Documentation Of circularEEE v.1 prospective

Quick Links	All Variables	Variable Link Detail	Variable Types	Views	Groups	Units	Macros	Feedback Loops	Link Polarity	View Summary	View-Variable Profile

Model Assessment Results

Model Information	Result
Total Number Of Variables	224
Total Number Of State Variables	39 (17.4%)
Total Number Of Stocks	26 (11.6%)
Total Number Of Feedback Loops No IVV (Maximum Length: 30) [2, 29]	1,778 (899|879|0)
Total Number Of Feedback Loops With IVV (Maximum Length: 30) [0, 0]	0 (0|0|0)
Total Number Of Causal Links	446 (339|69|38)
Total Number of Rate-to-rate Links	42
Number Of Units Used In The Model (Basic/Combined)	12/10
Total Number Of Equations Using Macros	0 (0.0%)
Variables With Source Information	0 (0.0%)
Dimensionless Unit Variables	63 (28.1%)
Variables without Predefined Min or Max Values	220 (98.2%)
Function Sensitivity Parameters	0 (0.0%)
Data Lookup Tables	0 (0.0%)
Time Unit	year
Initial Time	1980
Final Time	2050
Reported Time Interval	TIME STEP
Time Step	0.125
Model Is Fully Formulated	Yes
Model Defined Groups	Yes

Warnings	Result
Number Of Undocumented Variables	1 (0.4%)
Equations With Embedded Data	27 (12.1%)
Variables Not In Any View	1 (0.4%)
Nonmonotonic Lookup Functions	0 (0.0%)
Cascading Lookup Functions	0 (0.0%)
Non-Zero End Sloped Lookup Functions	5 (2.2%)
Equations With If Then Else Functions	2 (0.9%)
Equations With Min Or Max Functions	10 (4.5%)
Equations With Step Pulse Or Related Functions	0 (0.0%)
Equations With Unit Errors Or Warnings	20 (8.9%)

Potential Omissions	Result
Unused Variables	26 (11.6%)
Supplementary Variables	0 (0.0%)
Supplementary Variables Being Used	0 (0.0%)
Complex Variable	35 (15.6%)
Complex Stock	12 (5.4%)

Variable Types

L: Level (26 / **26**)*	**SM**: Smooth (3 / **3**)*	**DE**: Delay (10 / **10**)*†	**LI**: Level Initial (9)	**I**: Initial (0 / **0**)
C: Constant (52 / **52**)	**F**: Flow (29 / **29**)	**A**: Auxiliary (151 / **151**)	**Sub**: Subscripts (0)	**D**: Data (0 / **0**)
G: Game (0 / **0**)	**T**: Lookup (5 / **5**)*††			

* (State Variables/Total Stocks) † Total Stocks Do Not Include Fixed Delay Variables. †† (Lookup Tables).

Views

View: 1. Technology adoption (31) Variables
View: 2. EEE and WEEE flows (54) Variables
View: 3. (de) Commissioning and restauration probabilit (46) Variables
View: 4. Ageing (26) Variables
View: 5. Calibration and tests (102) Variables
View: Depreciation (incomplete) (24) Variables

Groups

.CE mechanisms (19)	.EEE and WEEE flows (36)	.EEE obsolescence (38)	.Theil (39)	.depreciation (15)
.indicators (14)	.material supply (8)	.model checking (17)	.retrospective (14)	.technology adoption (19)
circularEEE v.1 prospective (1)				

Quick Links:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Top	(All) Variables (224 Variables)
Group	Type	*Variable Name And Description*
.Theil	#1 A	**1 - us (Dimensionless)** = 1 - us **Description:** One minus variance inequality proportion. Used to verify against UC **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#2 A	**actual adoption fraction (dmnl)** = EEE adopters / total households **Description:** Actual ratio of the population (household or inhabitant) that has adopted the technology. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.technology adoption	#3 DE,A	**additional purchases (unit/year)** = DELAY1(MAX (gap from EEE in use to desired, 0), time to realise additional need) **Description:** The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.material supply	#4 A	**adjustment for stock of Processed material (kg/year)** = (desired stock of processed material - Processed material)/stock adjustment time **Description:** Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction rate considering minimum stock Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.technology adoption	#5 A	**adoption purchases (unit/year)** = adoption rate * number of purchases when adopting **Description:** Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#6 F,A	**adoption rate (house/year)** = MAX (potential adoption fraction - actual adoption fraction, 0) * total households **Description:** Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.EEE and WEEE flows	#7 L	**Available used EEE (unit)** = $\int$((((first use decommissioning because faulty+first use decommissioning before broken)+second use decommissioning)-disposal of EEE as WEEE)-remanufacturing)-second use commissioning *dt* + initial stock of available used EEE **Description:** Stock of used EEE available after first and second use **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Total products in the system Counts the total stock of products in the system

		• average decommissioned EEE age Average age of the stock of decommissioned EEE • current stock of EEE Sum of all the stocks of EEE. • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,555 (87.5%) (+) 790 [4,28] (-) 765 [2,29]
.EEE obsolescence	#8 A	**average age of useful products (year/unit)** = ZIDZ ((average EEE age * First use EEE + average second use EEE age * Second use EEE) , (First use EEE + Second use EEE)) **Description:** Average age of the combination of the stocks of first use and second use EEE **Present In 1 View:** • 4. Ageing **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#9 A	**average decommissioned EEE age (year/unit)** = ZIDZ (Total age of available used EEE, Available used EEE) **Description:** Average age of the stock of decommissioned EEE **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • virtual age after reman Corresponds to the new average age of EEE products after remanufacturing. • virtual age after repair Corresponds to the new average age of EEE products after repairing. **Feedback Loops:** 1,705 (95.9%) (+) 868 [5,28] (-) 837 [3,29]
.EEE obsolescence	#10 A	**average EEE age (year/unit)** = ZIDZ (Total age of first use EEE , First use EEE) **Description:** Average age of the stock of first use EEE **Present In 3 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. • average EEE value Average monetary value of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,178 (66.3%) (+) 595 [4,28] (-) 583 [3,29]
.technology adoption	#11 A	**average EEE desired per adopter (unit/house)** = MIN (effect of normalised PPP on average number of EEE per adopter * normalised PPP,max EEE desired) **Description:** Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Present In 1 View:** • 1. Technology adoption **Used By** • desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#12 F,A	**average EEE value (USD/unit)** = EEE unit price - average EEE age * EEE depreciation ratio **Description:** Average monetary value of first use EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • Total historical first use EEE value Total historical value of first use EEE. • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#13 A	**average second use EEE age (year/unit)** = ZIDZ (Total time of second use EEE, Second use EEE) **Description:** Average age of the stock of second use EEE **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • average age of useful products Average age of the combination of the stocks of first use and second use EEE • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 891 (50.1%) (+) 461 [6,28] (-) 430 [3,29]
.EEE and WEEE flows	#14 A	**collection time (year)** = 2 * distribution time

		Description: Time to collect decommissioned EEE **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE not recycled Rate of WEEE which is not recycled • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#15 L	**count (Dimensionless)** = $\int$ pick/dt *dt* + 0.0 **Description:** Counter for # of points **Present In 1 View:** • 5. Calibration and tests **Used By** • M X Mean of x (sum x)/n • M Y Mean of y (sum y)/n • MX2 Mean of x^2 (sum x^2)/n • MY2 Mean of y^2 (sum y^2)/n • Mxy Mean of x*y (sum x*y)/n • RMSPE Root Mean Square Percent Error • mape Mean Absolute Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#16 A	**current stock of EEE (unit)** = First use EEE + Available used EEE + Second use EEE **Description:** Sum of all the stocks of EEE. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#17 A	**current stock of material (kg)** = Raw material + Processed material + Non recycled WEEE + WEEE before treatment **Description:** Sum of all the stocks of material. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#18 A	**decomissioned EEE outflows (unit/year)** = (WEEE not recycled + WEEE recycling) / EEE average unit weight + remanufacturing + second use commissioning **Description:** In unit per year equivalent **Present In 1 View:** • Depreciation (incomplete) **Used By** • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#19 A	**decommissioned EEE average outflow price (USD/unit)** = (WEEE average market value * ratio WEEE recycling from decomissioned EEE - WEEE costs for non recycling* ratio WEEE not being recycled from decomissioned EEE) * EEE average unit weight + remanufacturing contribution per unit * ratio remanufacturing from decommissioned EEE+ second use price* ratio second use comissioning from decommissioned EEE **Description:** Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#20 A	**decommissioning probability in the end of life for first use (dmnl)** = weibull shape / weibull scale * (average EEE age/weibull scale) ^ (weibull shape-1) **Description:** The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommissioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 880 (49.5%) (+) 440 [4,28] (-) 440 [6,29]
.EEE obsolescence	#21 A	**decommissioning probability in the end of life for second use (dmnl)** = EXP ((- (average second use EEE age / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^weibull shape)) **Description:** The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows

		• 3. (de) Commissioning and restauration probabilit **Used By** • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 785 (44.2%) (+) 408 [5,28] (-) 377 [4,29]
.EEE obsolescence	#22 F,A	**decrease in age of available used EEE (dmnl)** = second use commissioning * average decommissioned EEE age + disposal of EEE as WEEE * average decommissioned EEE age + remanufacturing * average decommissioned EEE age **Description:** Decrease rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 250 (14.1%) (+) 113 [8,26] (-) 137 [3,27]
.EEE obsolescence	#23 F,A	**decrease in age of first use EEE (dmnl)** = first use decommissioning because faulty * average EEE age + first use decommissioning before broken* expected lifetime for decommissioning before broken **Description:** Decrease rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 323 (18.2%) (+) 149 [5,28] (-) 174 [3,29]
.EEE obsolescence	#24 F,A	**decrease in age of second use EEE (dmnl)** = second use decommissioning * average second use EEE age **Description:** Decrease rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 65 (3.7%) (+) 30 [14,25] (-) 35 [3,26]
.technology adoption	#25 A	**desired EEE (unit)** = EEE adopters * average EEE desired per adopter **Description:** Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. **Present In 1 View:** • 1. Technology adoption **Used By** • gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#26 A	**desired extraction rate (kg/year)** = MAX (0, (expected EEE demand - expected material kept in the system)) **Description:** Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction rate considering minimum stock Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#27 C	**desired stock lenght of processed material (year)** = 1 **Description:** Coverage (in time equivalent) of the stock of processed material considering the actual EEE demand **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#28 SM,A	**desired stock of processed material (kg)** = SMOOTH(expected EEE demand * desired stock lenght of processed material, distribution time) **Description:** A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#29 A	**dif cov (Units*Units)** = 2*Sx*Sy*(1-r) **Description:** Difference of covariances **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • uc Covariance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#30	**dif mea (Units*Units)**

	A	= (M X-M Y)*(M X-M Y) **Description:** Difference of Means (bias) **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • um Bias inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#31 A	**dif var (Units*Units)** = (Sx-Sy)*(Sx-Sy) **Description:** Difference of variances **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • us Variance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE • material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Feedback Loops:** 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.EEE and WEEE flows	#33 A	**distribution time (year)** = TIME STEP **Description:** Time to distribute commissioned EEE.Is used in the model as a default process time value. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand. • collection time Time to collect decommissioned EEE • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • recycling time Time to recycle collected WEEE. • redistribution time Time to redistribute available used EEE. • reman time Time to remanufacture available used EEE. • time to extract Time to extract raw material into processed material. • time to make available Time to make obsolete products available for second use, remanufacturing or collection. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#34 F,A	**dt (Time Units)** = TIME STEP **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • count Counter for # of points **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#35 L	**EEE adopters (house)** $= \int$ adoption rate dt + initial adopters **Description:** Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology. • desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.retrospective	#36	**EEE average unit weight (kg/unit)**

	C,F	= EXTERNAL_DATA("EEE average unit weight") **Description:** Average unit weight of EEE. **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • Total materials in the system Counts the total stock of materials in the system • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#37 DE,F,A	**EEE commissioning (unit/year)** = DELAY1(EEE demand, distribution time) **Description:** Commissioning rate of processed material into EEE.Responds to EEE demand. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • EEE inflows Rate of all EEE inflows. • First use EEE Stock of EEE in first use • Processed material Stock of processed material available • material outflows Rate of all material outflows. • max value EEE commissioning Provides the historical maximum value of EEE commissioning. • simulated time series Dummy variable to id series • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 573 (32.2%) (+) 285 [7,28] (-) 288 [6,29]
.technology adoption	#38 A	**EEE demand (unit/year)** = adoption purchases + additional purchases + recurrent purchases to replace **Description:** Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Present In 2 Views:** • 1. Technology adoption • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,291 (72.6%) (+) 648 [7,28] (-) 643 [5,29]
.depreciation	#39 A	**EEE depreciation ratio (USD/year)** = ZIDZ ((EEE unit price - decommissioned EEE average outflow price) , average EEE age) **Description:** Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. **Present In 1 View:** • Depreciation (incomplete) **Used By** • average EEE value Average monetary value of first use EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#40 F,A	**EEE inflows (unit/year)** = EEE commissioning + first use decommissioning because faulty + first use decommissioning before broken+ second use commissioning + second use decommissioning + remanufacturing **Description:** Rate of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE inflows Sum of all EEE inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#41 F,A	**EEE outflows (unit/year)** = first use decommissioning because faulty + first use decommissioning before broken +second use commissioning + second use decommissioning + remanufacturing + disposal of EEE as WEEE **Description:** Rate of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE outflows Sum of all EEE outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#42 A	**EEE per household (unit/house)** = Total EEE in use / total households **Description:** Average number of stock in use (first and second use) per household **Present In 1 View:** • 5. Calibration and tests

		Used By **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#43 A	**EEE per inhabitant (unit/inhabitant)** = Total EEE in use / population **Description:** Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#44 C	**EEE unit price (USD/unit)** = EXTERNAL_DATA("EEE unit price") **Description:** Historial prices of flat panel television **Present In 1 View:** • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. • average EEE value Average monetary value of first use EEE • remanufacturing contribution per unit Remanufacturing contribution per unit of EEE • second use price Second use price per unit **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#45 C	**effect of normalised PPP on average number of EEE per adopter (unit/house)** = EXTERNAL_DATA("effect of normalised PPP on average number of EEE per adopter") **Description:** Defines the effect of the purchasing power parity per capta on the average number of EEE one adopter unit (household or inhabitant) need and can afford at the point in time. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#46 A	**error households adoption (house)** = EEE adopters + Potential EEE adopters - total households **Description:** This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#47 SM,A	**expected EEE demand (kg/year)** = SMOOTH (EEE demand * EEE average unit weight, distribution time) **Description:** Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#48 A	**expected lifetime for decommissioning before broken (year/unit)** = lifetime fraction for decommissioning before broken * mean lifetime **Description:** average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 3 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#49 A	**expected lifetime for second use (year/unit)** = mean lifetime * lifetime fraction for second use **Description:** Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#50 SM,A	**expected material kept in the system (kg/year)** = SMOOTH(remanufacturing * EEE average unit weight, reman time) + SMOOTH (WEEE recycling, recycling time)

		Description: Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#51 DE,F,A	**extraction (kg/year)** = DELAY1 (MAX (extraction rate considering minimum stock, 0) , time to extract) **Description:** Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • Raw material Stock of raw material available • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.material supply	#52 A	**extraction rate considering minimum stock (kg/year)** = adjustment for stock of Processed material + desired extraction rate **Description:** Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.Control	#53 C	**FINAL TIME (year)** = 2050 **Description:** The final time for the simulation. **Present In 0 Views:** **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#54 DE,F,A	**first use decommissioning because faulty (unit/year)** = DELAY1 (First use EEE * decommissioning probability in the end of life for first use* (1 - fraction of decomissioned before broken) , time to make available) **Description:** Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,146 (64.5%) (+) 568 [4,28] (-) 578 [2,29]
.EEE and WEEE flows	#55 DE,F,A	**first use decommissioning before broken (unit/year)** = DELAY1(First use EEE * fraction of decomissioned before broken , (expected lifetime for decommissioning before broken+time to make available)) **Description:** Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 610 (34.3%) (+) 305 [4,28] (-) 305 [2,29]
.EEE and WEEE flows	#56 L,F	**First use EEE (unit)** = $\int$((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken *dt* + initial stock of first use EEE **Description:** Stock of EEE in first use **Present In 5 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total historical first use EEE value Total historical value of first use EEE. • Total products in the system Counts the total stock of products in the system

		• average EEE age Average age of the stock of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • current stock of EEE Sum of all the stocks of EEE. • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]
.EEE obsolescence	#57 A	**fraction fit for reman (dmnl)** = EXP ((- ((virtual age after reman + lifetime expected for reman products) / weibull scale) ^ weibull shape) + ((virtual age after reman/ weibull scale) ^ weibull shape)) **Description:** Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Feedback Loops:** 381 (21.4%) (+) 190 [7,28] (-) 191 [6,27]
.EEE obsolescence	#58 A	**fraction fit for second use (dmnl)** = EXP ((- ((virtual age after repair + expected lifetime for second use) / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^ weibull shape)) **Description:** Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to second use market The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#59 A	**fraction introduced to reman market (dmnl)** = MIN (fraction fit for reman * reman market coverage, 1 - fraction introduced to second use market) **Description:** The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 762 (42.9%) (+) 381 [7,28] (-) 381 [6,29]
.EEE obsolescence	#60 A	**fraction introduced to second use market (dmnl)** = second hand market coverage * fraction fit for second use **Description:** The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#61 A	**fraction introduced to WEEE market (dmnl)** = 1 - (fraction introduced to second use market + fraction introduced to reman market) **Description:** The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 726 (40.8%) (+) 363 [7,28] (-) 363 [8,29]
.EEE and WEEE flows	#62 C	**fraction of decomissioned before broken (dmnl)** = 0 **Description:** Fraction of products that will be decommissioned for reasons other than functional obsolescence **Present In 1 View:** • 2. EEE and WEEE flows

		Used By • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#63 A	**fraction of WEEE formally collected (dmnl)** = fraction of WEEE formally collected_RSSDlookup(recycling infrastructure level) **Description:** Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • fraction of WEEE not formally collected Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#65 A	**fraction of WEEE not formally collected (dmnl)** = 1 - fraction of WEEE formally collected **Description:** Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • WEEE not recycled Rate of WEEE which is not recycled **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#66 A	**gap from EEE in use to desired (unit)** = desired EEE - Total EEE in use **Description:** Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Present In 1 View:** • 1. Technology adoption **Used By** • additional purchases The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.retrospective	#67 C	**historic disposal of EEE (unit/year)** = EXTERNAL_DATA("historic disposal of EEE") **Description:** Historical value of annual EEE disposal in a specific country.[obtained externally, drives the model] **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#68 C	**historic EEE put on market (unit/year)** = EXTERNAL_DATA("historic EEE put on market") **Description:** Historical value of EEE commisioned in specific country.[obtained externally] **Present In 1 View:** • 5. Calibration and tests **Used By** • historical time series Dummy variable to id series **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#69 A	**historical time series (Units)** = historic EEE put on market **Description:** Dummy variable to id series **Present In 1 View:** • 5. Calibration and tests **Used By** • Y Historical time series values **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#70 A	**household increase trend (1/year)** = TREND(total households, TIME STEP, 0.01) **Description:** Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. **Present In 1 View:** • 1. Technology adoption **Used By** • total households variation Variation of households considering the trend from historical values. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#71 F,A	**increase in age of available used EEE (dmnl)** = Available used EEE * rate of ageing + first use decommissioning because faulty * average EEE age+ first use decommissioning before broken* expected lifetime for decommissioning before broken + second use decommissioning * average second use EEE age **Description:** Increase rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 1,335 (75.1%) (+) 691 [6,28] (-) 644 [8,29]
.EEE	#72	**increase in age of first use EEE (dmnl)**

obsolescence	F,A	= First use EEE * rate of ageing + remanufacturing * virtual age after reman **Description:** Increase rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 596 (33.5%) (+) 311 [6,28] (-) 285 [7,29]
.EEE obsolescence	#73 F,A	**increase in age of second use EEE (dmnl)** = Second use EEE * rate of ageing + second use commissioning * virtual age after repair **Description:** Increase rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 660 (37.1%) (+) 344 [7,28] (-) 316 [6,29]
.CE mechanisms	#74 C	**infra development initial year (year)** = 2015 **Description:** Mechanism used to verify the implementation of increasing/decreasing infrastructure (initial year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level • repairing infrastructure level Defines the repairing infrastructure implementation level • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#75 LI,A	**initial adopters (house)** = initial adopters fraction * total households **Description:** Population number (household or inhabitant) that already adopted the technology at the initial time **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#76 C	**initial adopters fraction (dmnl)** = 0 **Description:** Population ratio (household or inhabitant) that already adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time • initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#77 LI,A	**initial potential adopters (house)** = (1 - initial adopters fraction) * total households **Description:** Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#78 LI,C	**initial stock of available used EEE (unit)** = 0 **Description:** Initial stock of available used EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#79 A	**initial stock of EEE (unit)** = initial stock of first use EEE + initial stock of available used EEE + initial stock of second use EEE **Description:** Sum of initial stocks of EEE. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#80 LI,C	**initial stock of first use EEE (unit)** = 0 **Description:** Initial stock of first use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • First use EEE Stock of EEE in first use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.model checking	#81 A	**initial stock of material (kg)** = initial stock of raw material + initial stock of processed material + initial stock of WEEE before treatment+ initial stock of non recycled WEEE **Description:** Sum of initial stocks of material. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#82 LI,C	**initial stock of non recycled WEEE (kg)** = 0 **Description:** Initial stock of non recycled WEEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#83 LI,C	**initial stock of processed material (kg)** = 0 **Description:** Initial stock of processed material. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#84 LI,C	**initial stock of raw material (kg)** = 1e+08 **Description:** Initial stock of raw material **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Raw material Stock of raw material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#85 LI,C	**initial stock of second use EEE (unit)** = 0 **Description:** Initial stock of second use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Second use EEE Stock of EEE in second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#86 LI,C	**initial stock of WEEE before treatment (kg)** = 0 **Description:** Initial stock of WEEE before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • WEEE before treatment Stock of WEEE available before treatment • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Control	#87 C	**INITIAL TIME (year)** = 1980 **Description:** The initial time for the simulation. **Present In 0 Views:** **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#88 A	**leakage of materials (1/year)** = ZIDZ (WEEE not recycled, Total materials in the system) **Description:** Indicator to check the ratio of materials leaving the system as WEEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#89 A	**leakage of products (1/year)** = ZIDZ(disposal of EEE as WEEE , Total products in the system) **Description:** Indicator to check the ratio of products leaving the system as WEEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE	#90	**lifetime expected for reman products (year/unit)**

obsolescence	A	= mean lifetime * lifetime fraction for reman products **Description:** Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#91 C	**lifetime fraction for decommissioning before broken (dmnl)** = 0.5 **Description:** Determines the fraction of the lifetime of an EEE that a user will keep the product before buying a new one for other reasons than functional obsolescence **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for decommissioning before broken average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#92 C	**lifetime fraction for reman products (dmnl)** = 0.8 **Description:** Determines the fraction of the lifetime of an EEE that a consumer expects for a remanufactured product **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • lifetime expected for reman products Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#93 C	**lifetime fraction for second use (dmnl)** = 0.5 **Description:** Determines the fraction of the lifetime of an EEE that a consumer expects for a product in second use **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for second use Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#94 C	**lifetime ratio (dmnl)** = 1 **Description:** Mechanism used to verify the design of EEE holding increased lifetimes **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • weibull scale The weibull scale defines the lifetime at which 63.2% of units will fail. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#95 A	**M X (Units)** = ZIDZ(Sum Xi,count) **Description:** Mean of x (sum x)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sx Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 • dif mea Difference of Means (bias) • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#96 A	**M Y (Units)** = ZIDZ(Sum Yi,count) **Description:** Mean of y (sum y)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sy Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 • dif mea Difference of Means (bias) • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#97 A	**mape (Dimensionless)** = ZIDZ(Sum APE,count) **Description:** Mean Absolute Percent Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#98 A	**mass balance EEE (unit)** = Sum of all EEE inflows + initial stock of EEE - Sum of all EEE outflows - current stock of EEE

		Description: Mass-balance check of EEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#99 A	**mass balance material (kg)** = Sum of all material inflows + initial stock of material - Sum of all material outflows- current stock of material **Description:** Mass balance check of material **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#100 F,A	**material inflows (kg/year)** = extraction + WEEE recycling + disposal of EEE as WEEE * EEE average unit weight + WEEE not recycled **Description:** Rate of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material inflows Sum of all material inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#101 F,A	**material outflows (kg/year)** = extraction + EEE commissioning * EEE average unit weight + WEEE not recycled + WEEE recycling **Description:** Rate of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material outflows Sum of all material outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#102 A	**max EEE desired (unit/house)** = GET DATA AT TIME (R EEE per adopter, 2015) **Description:** Represents the maximum EEE unities that one population unity (household or inhabitant) need and can historically afford. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#103 A	**max value EEE commissioning (unit/year)** = SAMPLE IF TRUE(EEE commissioning > max value EEE commissioning, EEE commissioning , EEE commissioning) **Description:** Provides the historical maximum value of EEE commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#104 A	**max value remanufacturing (unit/year)** = SAMPLE IF TRUE(remanufacturing > max value remanufacturing, remanufacturing , remanufacturing) **Description:** Provides the historical maximum value of remanufacturing. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#105 A	**max value second use commissioning (unit/year)** = SAMPLE IF TRUE(second use commissioning > max value second use commissioning, second use commissioning, second use commissioning) **Description:** Provides the historical maximum value of second use commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#106 A	**max value WEEE recycling (kg/year)** = SAMPLE IF TRUE(WEEE recycling > max value WEEE recycling, WEEE recycling , WEEE recycling) **Description:** Provides the historical maximum value of WEEE recycling. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#107 A	**mean lifetime (year/unit)** = EXP (GAMMA LN(1/weibull shape + 1)) * weibull scale **Description:** Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for decommissioning before broken average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs

		• expected lifetime for second use Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs • lifetime expected for reman products Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#108 A	**mse (Units*Units)** = dif mea + dif var + dif cov **Description:** Mean Square Error. The addition of the three components **Present In 1 View:** • 5. Calibration and tests **Used By** • rmse Root Mean Square Error • uc Covariance inequality proportion • um Bias inequality proportion • us Variance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#109 A	**MX2 (Units*Units)** = ZIDZ(SumX2,count) **Description:** Mean of x^2 (sum x^2)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sx Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#110 A	**Mxy (Units*Units)** = ZIDZ(SumXY,count) **Description:** Mean of x*y (sum x*y)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#111 A	**MY2 (Units*Units)** = ZIDZ(SumY2,count) **Description:** Mean of y^2 (sum y^2)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sy Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#113 F,A	**new potential adopters (house/year)** = total households variation **Description:** Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#114 L	**Non recycled WEEE (kg)** = $\int$ WEEE not recycled dt + initial stock of non recycled WEEE **Description:** Stock of non-recycled WEEE. Sink of the system. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#115 A	**non recycled WEEE because of recyclability (kg/year)** = WEEE recycling * (1-recyclability EEE) **Description:** Rate of WEEE which is formally collected but is not recycled because of EEE recyclability **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE not recycled Rate of WEEE which is not recycled **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.retrospective	#116 A	**normalised PPP (dmnl)** = purchasing power parity per capta / PPP 1980 **Description:** Normalised value of purchasing power parity considering the value at the initial time as reference. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#117 C	**number of purchases when adopting (unit/house)** = 1

		Description: Represents the average EEE unities that one population unity (household or inhabitant) buy when adopting the technology. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#118 F,A	**pick (Dimensionless)** = IF THEN ELSE(Y = NAREPLACEMENT :OR: X = NAREPLACEMENT, 0, 1) **Description:** Flag to id historical value available.Takes a value of one for every data point available **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • Yi Historical point entering calculations • count Counter for # of points • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#119 C	**population (inhabitant)** = EXTERNAL_DATA("population") **Description:** Total number of inhabitants at that moment[obtained externally, drives the model] **Present In 1 View:** • 5. Calibration and tests **Used By** • EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#120 C	**potential adoption fraction (dmnl)** = EXTERNAL_DATA("potential adoption fraction") **Description:** Potential ratio of the population (household or inhabitant) that are impeled to adopt the technology considering the price and their earnings. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#121 L	**Potential EEE adopters (house)** = $\int$new potential adopters-adoption rate *dt* + initial potential adopters **Description:** Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#122 A	**PPP 1980 (USD)** = GET DATA AT TIME(purchasing power parity per capta, 1980) **Description:** Reference value for purchasing power parity per capta. Value at initial time is used as reference. **Present In 1 View:** • 1. Technology adoption **Used By** • normalised PPP Normalised value of purchasing power parity considering the value at the initial time as reference. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#123 L	**Processed material (kg)** = $\int$(extraction+WEEE recycling)-(EEE commissioning*EEE average unit weight) *dt* + initial stock of processed material **Description:** Stock of processed material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. • current stock of material Sum of all the stocks of material. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.retrospective	#124 C	**purchasing power parity per capta (USD)** = EXTERNAL_DATA("purchasing power parity per capta") **Description:** Reference used to measure the real purchasing power in different regions.[obtained externally, drives the model] **Present In 1 View:** • 1. Technology adoption **Used By** • PPP 1980 Reference value for purchasing power parity per capta. Value at initial time is used as reference. • normalised PPP Normalised value of purchasing power parity considering the value at the initial time as reference. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#125 A	**r (Dimensionless)** = MIN(1,ZIDZ(Mxy-(M X*M Y),Sx*Sy))

		Description: Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • r2 Correlation coefficient squared **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#126 C	**R desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing repairing infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#127 C	**R desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing repairing infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
circularEEE v.1 prospective	#128 C	**R EEE in use (unit)** = EXTERNAL_DATA("R EEE in use") **Description:** Value of EEE in use obtained from the retrospective model.Equivalent to all EEE in a country. **Present In 0 Views:** **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#129 C	**R EEE per adopter (unit/house)** = EXTERNAL_DATA("R EEE per adopter") **Description:** Historical value of number of EEE unities per adopter[defined by the retrospective model] **Present In 1 View:** • 1. Technology adoption **Used By** • max EEE desired Represents the maximum EEE unities that one population unity (household or inhabitant) need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#130 C	**R initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial repairing infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#131 A	**r2 (Dimensionless)** = r*r **Description:** Correlation coefficient squared **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#132 C	**rate of ageing (year/(year*unit))** = 1 **Description:** Rate of age gain by EEE unit per year passed **Present In 1 View:** • 4. Ageing **Used By** • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#133 C	**ratio of EEE price for second use (dmnl)** = 0.3 **Description:** Fraction of the full price that customers are willing to pay for a second use product. **Present In 1 View:** • Depreciation (incomplete) **Used By** • second use price Second use price per unit **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#134 C	**ratio of reman contribution per unit (dmnl)** = 0.3 **Description:** Ratio of the contribution assumed for a remanufactured product in comparison to buying new. **Present In 1 View:** • Depreciation (incomplete) **Used By** • remanufacturing contribution per unit Remanufacturing contribution per unit of EEE

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#135 A	**ratio remanufacturing from decommissioned EEE (dmnl)** = ZIDZ (remanufacturing, decomissioned EEE outflows) **Description:** Ratio of available used EEE that flow into remanufacturing. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#136 A	**ratio second use comissioning from decommissioned EEE (dmnl)** = ZIDZ (second use commissioning, decomissioned EEE outflows) **Description:** Ratio of available used EEE that are commissioned for second use. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#137 A	**ratio WEEE not being recycled from decomissioned EEE (dmnl)** = ZIDZ (WEEE not recycled/EEE average unit weight, decomissioned EEE outflows) **Description:** Ratio of available used EEE that is not formally collected and, thus, not recycled. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#138 A	**ratio WEEE recycling from decomissioned EEE (dmnl)** = ZIDZ (WEEE recycling/EEE average unit weight, decomissioned EEE outflows) **Description:** Ratio of available used EEE that flow into recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#139 L	**Raw material (kg)** = $\int$-extraction *dt* + initial stock of raw material **Description:** Stock of raw material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#140 C	**RC desired level (dmnl)** = 4 **Description:** Mechanism used to verify the implementation of increasing/decreasing recycling infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#141 C	**RC desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing recycling infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#142 C	**RC initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial recycling infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#143 A	**recurrent purchases to replace (unit/year)** = disposal of EEE as WEEE **Description:** Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters.

		Feedback Loops: 710 (39.9%) (+) 355 [7,27] (-) 355 [5,26]
.EEE and WEEE flows	#144 C	**recyclability EEE (dmnl)** = 0.37 **Description:** Defines the ratio of products that, entering the recycling process, will be recycled.Considers the physical treatment and chemical recovery processes available. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#145 A	**recycling infrastructure level (dmnl)** = RC initial level + switch infra development * RAMP((RC desired level-RC initial level)/(RC desired year-infra development initial year), infra development initial year, RC desired year) **Description:** Defines the recycling infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction of WEEE formally collected Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#146 A	**recycling of EEE from remanufacturing process (kg/year)** = remanufacturing * (1 - remanufacturability EEE) / remanufacturability EEE * EEE average unit weight **Description:** Defines the recycling rate from the remanufacturing process **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#147 A	**recycling time (year)** = 2 * distribution time **Description:** Time to recycle collected WEEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#148 A	**redistribution time (year)** = 2 * distribution time **Description:** Time to redistribute available used EEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#149 A	**reman effectiveness (dmnl)** = reman effectiveness_RSSDlookup(remanufacturing infrastructure level) **Description:** The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • virtual age after reman Corresponds to the new average age of EEE products after remanufacturing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#151 A	**reman market coverage (dmnl)** = reman market coverage_RSSDlookup(remanufacturing infrastructure level) **Description:** The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#153 A	**reman time (year)** = 2 * distribution time **Description:** Time to remanufacture available used EEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By**

		• expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#154 C	**remanufacturability EEE (dmnl)** = 0.8 **Description:** Defines the ratio of products that, entering the remanufacturing process, will be remanufactured.Considers that some products (or parts thereof) will be recycled instead because these are broken beyond restauration, or will be broken during the process. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#155 DE,F,A	**remanufacturing (unit/year)** = MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • max value remanufacturing Provides the historical maximum value of remanufacturing. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]
.depreciation	#156 A	**remanufacturing contribution per unit (USD/unit)** = EEE unit price * ratio of reman contribution per unit **Description:** Remanufacturing contribution per unit of EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#157 A	**remanufacturing infrastructure level (dmnl)** = RM initial level + switch infra development * RAMP((RM desired level-RM initial level)/(RM desired year-infra development initial year), infra development initial year, RM desired year) **Description:** Defines the remanufacturing infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • reman effectiveness The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. • reman market coverage The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#158 A	**repair effectiveness (dmnl)** = repair effectiveness_RSSDlookup(repairing infrastructure level) **Description:** The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • virtual age after repair Corresponds to the new average age of EEE products after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#160 A	**repairing infrastructure level (dmnl)** = R initial level + switch infra development * RAMP((R desired level-R initial level)/(R desired year-infra development initial year), infra development initial year, R desired year) **Description:** Defines the repairing infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repair effectiveness The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.Theil	#161 A	**residuals (Units)** = IF THEN ELSE(pick,Xi-Yi,NAREPLACEMENT) **Description:** Errors **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#162 C	**RM desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing remanufacturing infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#163 C	**RM desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing remanufacturing infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#164 C	**RM initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial remanufacturing infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#165 A	**rmse (Units)** = SQRT(mse) **Description:** Root Mean Square Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#166 A	**RMSPE (Dimensionless)** = SQRT(ZIDZ(Sum SPE,count)) **Description:** Root Mean Square Percent Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Control	#167 A	**SAVEPER (year)** = TIME STEP **Description:** The frequency with which output is stored. **Present In 0 Views:** **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#168 A	**second hand market coverage (dmnl)** = second hand market coverage_RSSDlookup(second use infrastructure level) **Description:** The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to second use market The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#170 DE,F,A	**second use commissioning (unit/year)** = DELAY1(Available used EEE * fraction introduced to second use market , redistribution time) **Description:** Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • max value second use commissioning Provides the historical maximum value of second use commissioning.

		• ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]
.EEE and WEEE flows	#171 DE,F,A	**second use decommissioning (unit/year)** = DELAY1(Second use EEE * decommissioning probability in the end of life for second use, time to make available) **Description:** Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 949 (53.4%) (+) 492 [4,28] (-) 457 [2,29]
.EEE and WEEE flows	#172 L	**Second use EEE (unit)** = $\int$ second use commissioning-second use decommissioning dt + initial stock of second use EEE **Description:** Stock of EEE in second use **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total products in the system Counts the total stock of products in the system • average age of useful products Average age of the combination of the stocks of first use and second use EEE • average second use EEE age Average age of the stock of second use EEE • current stock of EEE Sum of all the stocks of EEE. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,061 (59.7%) (+) 541 [4,28] (-) 520 [2,29]
.CE mechanisms	#173 A	**second use infrastructure level (dmnl)** = SU initial level + switch infra development * RAMP((SU desired level-SU initial level)/(SU desired year-infra development initial year), infra development initial year, SU desired year) **Description:** Defines the second use infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second hand market coverage The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#174 A	**second use price (USD/unit)** = EEE unit price * ratio of EEE price for second use **Description:** Second use price per unit **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#175 A	**simulated time series (Units)** = EEE commissioning **Description:** Dummy variable to id series **Present In 1 View:** • 5. Calibration and tests **Used By** • X Simulated time series values **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#176 A	**SSE (Units*Units)** = Sum XmY2 **Description:** Sum of Square Errors (x-y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#177 C	**stock adjustment time (year)** = 1 **Description:** Time taken to adjust stock of processed material, i.e. every x year the stock is readjusted. **Present In 1 View:** • 2. EEE and WEEE flows **Used By**

		• adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#178 C	**SU desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing second use infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#179 C	**SU desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing second use infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#180 C	**SU initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial second use infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#181 L	**Sum APE (Dimensionless)** $= \int$(ABS((ZIDZ((Xi-Yi),Yi))))/dt *dt* + 0.0 **Description:** Sum of Absolute Percent Errors **Present In 1 View:** • 5. Calibration and tests **Used By** • mape Mean Absolute Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#182 L	**Sum of all EEE inflows (unit)** $= \int$EEE inflows *dt* + 0.0 **Description:** Sum of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#183 L	**Sum of all EEE outflows (unit)** $= \int$EEE outflows *dt* + 0.0 **Description:** Sum of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#184 L	**Sum of all material inflows (kg)** $= \int$material inflows *dt* + 0.0 **Description:** Sum of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#185 L	**Sum of all material outflows (kg)** $= \int$material outflows *dt* + 0.0 **Description:** Sum of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#186 L	**Sum SPE (Dimensionless)** $= \int$((ZIDZ((Xi-Yi),Yi))*(ZIDZ((Xi-Yi),Yi)))/dt *dt* + 0.0 **Description:** Sum of Square Percent Errors ((x-y)/y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** • RMSPE Root Mean Square Percent Error

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#187 L	**Sum Xi (Units)** = $\int$ Xi/dt *dt* + 0.0 **Description:** Sum of x's (simulated) **Present In 1 View:** • 5. Calibration and tests **Used By** • M X Mean of x (sum x)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#188 L	**Sum XmY2 (Units*Units)** = $\int$ ((Xi-Yi)*(Xi-Yi))/dt *dt* + 0.0 **Description:** Sum of Square Errors (x-y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** • SSE Sum of Square Errors (x-y)^2 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#189 L	**Sum Yi (Units)** = $\int$ Yi/dt *dt* + 0.0 **Description:** Sum of y's (historical) **Present In 1 View:** • 5. Calibration and tests **Used By** • M Y Mean of y (sum y)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#190 L	**SumX2 (Units*Units)** = $\int$ (Xi*Xi)/dt *dt* + 0.0 **Description:** Sum of x^2 (simulated) **Present In 1 View:** • 5. Calibration and tests **Used By** • MX2 Mean of x^2 (sum x^2)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#191 L	**SumXY (Units*Units)** = $\int$ (Xi*Yi)/dt *dt* + 0.0 **Description:** Sum of x*y **Present In 1 View:** • 5. Calibration and tests **Used By** • Mxy Mean of x*y (sum x*y)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#192 L	**SumY2 (Units*Units)** = $\int$ (Yi*Yi)/dt *dt* + 0.0 **Description:** Sum of y^2 (historical) **Present In 1 View:** • 5. Calibration and tests **Used By** • MY2 Mean of y^2 (sum y^2)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#193 C	**switch infra development (dmnl)** = 0 **Description:** Switch to turn on/off the bechanism to verify implementation of increasing/decreasing infrastructures **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level • repairing infrastructure level Defines the repairing infrastructure implementation level • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#194 A	**Sx (Units)** = SQRT(MAX(0,MX2-(M X*M X))) **Description:** Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • dif var Difference of variances • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#195 A	**Sy (Units)** = SQRT(MAX(0,MY2-(M Y*M Y))) **Description:** Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the

		mean.Sterman (1984), pg. 64 **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • dif var Difference of variances • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#197 A	**time max value commissioning** **(year)** = SAMPLE IF TRUE(EEE commissioning >= max value EEE commissioning, Time , Time) **Description:** Provides the year of the historical maximum value of EEE commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#198 A	**time max value recycling** **(year)** = SAMPLE IF TRUE(WEEE recycling >= max value WEEE recycling, Time, Time) **Description:** Provides the year of the historical maximum value of WEEE recycling. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#199 A	**time max value remanufacturing** **(year)** = SAMPLE IF TRUE(remanufacturing >= max value remanufacturing, Time , Time) **Description:** Provides the year of the historical maximum value of remanufacturing. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#200 A	**time max value second use commissioning** **(year)** = SAMPLE IF TRUE(second use commissioning >= max value second use commissioning, Time , Time) **Description:** Provides the year of the historical maximum value of second use commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Control	#201 C	**TIME STEP** **(year)** = 0.125 **Description:** Time step adopted for the simulation **Present In 3 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • SAVEPER The frequency with which output is stored. • distribution time Time to distribute commissioned EEE.Is used in the model as a default process time value. • dt • household increase trend Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. • time to realise additional need Average time taken by customers to realise they need additional EEE products **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#202 A	**time to extract** **(year)** = 2 * distribution time **Description:** Time to extract raw material into processed material. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#203 A	**time to make available** **(year)** = 1 * distribution time **Description:** Time to make obsolete products available for second use, remanufacturing or collection. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#204 A	**time to realise additional need** **(year)** = TIME STEP

		Description: Average time taken by customers to realise they need additional EEE products **Present In 1 View:** • 1. Technology adoption **Used By** • additional purchases The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#205 L	**Total age of available used EEE (year)** $= \int$ increase in age of available used EEE-decrease in age of available used EEE dt + 0.0 **Description:** Total age of the stock of available used EEE in years **Present In 1 View:** • 4. Ageing **Used By** • average decommissioned EEE age Average age of the stock of decommissioned EEE **Feedback Loops:** 1,585 (89.1%) (+) 804 [6,28] (-) 781 [3,29]
.EEE obsolescence	#206 L	**Total age of first use EEE (year)** $= \int$ increase in age of first use EEE-decrease in age of first use EEE dt + 0.0 **Description:** Total age of the stock of first use EEE in years **Present In 1 View:** • 4. Ageing **Used By** • average EEE age Average age of the stock of first use EEE **Feedback Loops:** 919 (51.7%) (+) 460 [5,28] (-) 459 [3,29]
.technology adoption	#207 A	**Total EEE in use (unit)** = First use EEE + Second use EEE **Description:** Total EEE in use considering stock in first and second use **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • EEE per household Average number of stock in use (first and second use) per household • EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ • gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.depreciation	#208 A	**total first use EEE value (USD)** = First use EEE * average EEE value **Description:** Total value of first use EEE at a given moment in time. **Present In 1 View:** • Depreciation (incomplete) **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#209 L	**Total historical first use EEE value (USD)** $= \int$ average EEE value*First use EEE dt + 0.0 **Description:** Total historical value of first use EEE. **Present In 1 View:** • Depreciation (incomplete) **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#210 C	**total households (house)** = EXTERNAL_DATA("total households") **Description:** Total number of households at that moment[obtained externally, drives the model] **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • EEE per household Average number of stock in use (first and second use) per household • actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology. • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. • household increase trend Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. • initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time • initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time. • total households variation Variation of households considering the trend from historical values. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#211 A	**total households variation (house/year)** = household increase trend * total households **Description:** Variation of households considering the trend from historical values. **Present In 1 View:** • 1. Technology adoption **Used By** • new potential adopters Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters.

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#212 A	**Total materials in the system (kg)** = Total products in the system * EEE average unit weight + WEEE before treatment **Description:** Counts the total stock of materials in the system **Present In 1 View:** • 5. Calibration and tests **Used By** • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#213 A	**Total products in the system (unit)** = Available used EEE + First use EEE + Second use EEE **Description:** Counts the total stock of products in the system **Present In 1 View:** • 5. Calibration and tests **Used By** • Total materials in the system Counts the total stock of materials in the system • leakage of products Indicator to check the ratio of products leaving the system as WEEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#214 L	**Total time of second use EEE (year)** $= \int$ increase in age of second use EEE-decrease in age of second use EEE $dt + 0.0$ **Description:** Total age of the stock of second use EEE in years **Present In 1 View:** • 4. Ageing **Used By** • average second use EEE age Average age of the stock of second use EEE **Feedback Loops:** 725 (40.8%) (+) 374 [7,28] (-) 351 [3,29]
.indicators	#215 A	**total value of Available WEEE (USD)** = WEEE before treatment * WEEE average market value **Description:** Total value of e-waste in the system at that moment **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#216 A	**uc (Dimensionless)** = ZIDZ(dif cov,mse) **Description:** Covariance inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#217 A	**um (Dimensionless)** = ZIDZ(dif mea,mse) **Description:** Bias inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#218 A	**us (Dimensionless)** = ZIDZ(dif var,mse) **Description:** Variance inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** • 1 - us One minus variance inequality proportion. Used to verify against UC **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#219 A	**virtual age after reman (year/unit)** = average decommissioned EEE age * (1 - reman effectiveness) **Description:** Corresponds to the new average age of EEE products after remanufacturing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE **Feedback Loops:** 436 (24.5%) (+) 220 [7,28] (-) 216 [6,27]
.EEE obsolescence	#220 A	**virtual age after repair (year/unit)** = average decommissioned EEE age * (1 - repair effectiveness) **Description:** Corresponds to the new average age of EEE products after repairing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population.

		• fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 1,268 (71.3%) (+) 648 [5,28] (-) 620 [6,29]
.indicators	#221 C	**WEEE average market value (USD/kg)** = 10 **Description:** Average market value of WEEE **Present In 2 Views:** • 5. Calibration and tests • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#222 L	**WEEE before treatment (kg)** = $\int$((disposal of EEE as WEEE*EEE average unit weight)-WEEE not recycled)-WEEE recycling *dt* + initial stock of WEEE before treatment **Description:** Stock of WEEE available before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Total materials in the system Counts the total stock of materials in the system • WEEE not recycled Rate of WEEE which is not recycled • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • current stock of material Sum of all the stocks of material. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 3 (0.2%) (+) 0 [0,0] (-) 3 [2,4]
.depreciation	#223 C	**WEEE costs for non recycling (USD/kg)** = 5 **Description:** Average sytemic costs assumed for note recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#224 F,A	**WEEE not recycled (kg/year)** = WEEE before treatment * fraction of WEEE not formally collected / collection time + non recycled WEEE because of recyclability **Description:** Rate of WEEE which is not recycled **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.EEE and WEEE flows	#225 DE,F,A	**WEEE recycling (kg/year)** = (DELAY1(WEEE before treatment * fraction of WEEE formally collected , recycling time) + recycling of EEE from remanufacturing process) * recyclability EEE **Description:** Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • max value WEEE recycling Provides the historical maximum value of WEEE recycling. • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.EEE obsolescence	#226 A	**weibull scale (dmnl)** = 11.75 * lifetime ratio

		Description: The weibull scale defines the lifetime at which 63.2% of units will fail. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • mean lifetime Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#227 C	**weibull shape (dmnl)** = 2.01 **Description:** The weibull shape parameter identifies the failure rate pattern through time. This parameter defines decreasing (β<1), constant (β=1), or increasing (β>1) failure rates over the product's lifetime **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • mean lifetime Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#228 A	**X (Units)** = simulated time series **Description:** Simulated time series values **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • pick Flag to id historical value available.Takes a value of one for every data point available **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#229 F,A	**Xi (Units)** = pick*X **Description:** Simulated point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#230 A	**Y (Units)** = historical time series **Description:** Historical time series values **Present In 1 View:** • 5. Calibration and tests **Used By** • Yi Historical point entering calculations • pick Flag to id historical value available.Takes a value of one for every data point available **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#231 F,A	**Yi (Units)** = pick*Y **Description:** Historical point entering calculations **Present In 1 View:** • 5. Calibration and tests

		Used By • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

(View) Not in View (1 Variables)

Top	(View) Not in View (1 Variables)	
Group	Type	*Variable Name And Description*
circularEEE v.1 prospective	#128 C	**R EEE in use (unit)** = EXTERNAL_DATA("R EEE in use") **Description:** Value of EEE in use obtained from the retrospective model.Equivalent to all EEE in a country. **Present In 0 Views:** **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

(View) 1. Technology adoption (31 Variables)

Top	(View) 1. Technology adoption (31 Variables)	
Group	Type	*Variable Name And Description*
.technology adoption	#2 A	**actual adoption fraction (dmnl)** = EEE adopters / total households **Description:** Actual ratio of the population (household or inhabitant) that has adopted the technology. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.technology adoption	#3 DE,A	**additional purchases (unit/year)** = DELAY1(MAX (gap from EEE in use to desired, 0), time to realise additional need) **Description:** The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.technology adoption	#5 A	**adoption purchases (unit/year)** = adoption rate * number of purchases when adopting **Description:** Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#6 F,A	**adoption rate (house/year)** = MAX (potential adoption fraction - actual adoption fraction, 0) * total households **Description:** Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.technology adoption	#11 A	**average EEE desired per adopter (unit/house)** = MIN (effect of normalised PPP on average number of EEE per adopter * normalised PPP,max EEE desired) **Description:** Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Present In 1 View:** • 1. Technology adoption **Used By** • desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#25 A	**desired EEE (unit)** = EEE adopters * average EEE desired per adopter **Description:** Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. **Present In 1 View:** • 1. Technology adoption

		Used By • gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE • material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. Feedback Loops: 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.technology adoption	#35 L	**EEE adopters (house)** = $\int$ adoption rate dt + initial adopters **Description:** Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology. • desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. Feedback Loops: 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.technology adoption	#38 A	**EEE demand (unit/year)** = adoption purchases + additional purchases + recurrent purchases to replace **Description:** Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Present In 2 Views:** • 1. Technology adoption • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). Feedback Loops: 1,291 (72.6%) (+) 648 [7,28] (-) 643 [5,29]
.retrospective	#45 C	**effect of normalised PPP on average number of EEE per adopter (unit/house)** = EXTERNAL_DATA("effect of normalised PPP on average number of EEE per adopter") **Description:** Defines the effect of the purchasing power parity per capta on the average number of EEE one adopter unit (household or inhabitant) need and can afford at the point in time. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#56 L,F	**First use EEE (unit)** = $\int$((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken dt + initial stock of first use EEE **Description:** Stock of EEE in first use **Present In 5 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total historical first use EEE value Total historical value of first use EEE. • Total products in the system Counts the total stock of products in the system • average EEE age Average age of the stock of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • current stock of EEE Sum of all the stocks of EEE. • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommissioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • total first use EEE value Total value of first use EEE at a given moment in time.

		Feedback Loops: 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]
.technology adoption	#66 A	**gap from EEE in use to desired (unit)** = desired EEE - Total EEE in use **Description:** Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Present In 1 View:** • 1. Technology adoption **Used By** • additional purchases The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.retrospective	#70 A	**household increase trend (1/year)** = TREND(total households, TIME STEP, 0.01) **Description:** Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. **Present In 1 View:** • 1. Technology adoption **Used By** • total households variation Variation of households considering the trend from historical values. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#75 LI,A	**initial adopters (house)** = initial adopters fraction * total households **Description:** Population number (household or inhabitant) that already adopted the technology at the initial time **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#76 C	**initial adopters fraction (dmnl)** = 0 **Description:** Population ratio (household or inhabitant) that already adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time • initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#77 LI,A	**initial potential adopters (house)** = (1 - initial adopters fraction) * total households **Description:** Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#102 A	**max EEE desired (unit/house)** = GET DATA AT TIME (R EEE per adopter, 2015) **Description:** Represents the maximum EEE unities that one population unity (household or inhabitant) need and can historically afford. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#113 F,A	**new potential adopters (house/year)** = total households variation **Description:** Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#116 A	**normalised PPP (dmnl)** = purchasing power parity per capta / PPP 1980 **Description:** Normalised value of purchasing power parity considering the value at the initial time as reference. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#117 C	**number of purchases when adopting (unit/house)** = 1 **Description:** Represents the average EEE unities that one population unity (household or inhabitant) buy when adopting the technology. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.retrospective	#120 C	**potential adoption fraction (dmnl)** = EXTERNAL_DATA("potential adoption fraction") **Description:** Potential ratio of the population (household or inhabitant) that are impeled to adopt the technology considering the price and their earnings. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#121 L	**Potential EEE adopters (house)** $= \int$ new potential adopters-adoption rate *dt* + initial potential adopters **Description:** Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#122 A	**PPP 1980 (USD)** = GET DATA AT TIME(purchasing power parity per capta, 1980) **Description:** Reference value for purchasing power parity per capta. Value at initial time is used as reference. **Present In 1 View:** • 1. Technology adoption **Used By** • normalised PPP Normalised value of purchasing power parity considering the value at the initial time as reference. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#124 C	**purchasing power parity per capta (USD)** = EXTERNAL_DATA("purchasing power parity per capta") **Description:** Reference used to measure the real purchasing power in different regions.[obtained externally, drives the model] **Present In 1 View:** • 1. Technology adoption **Used By** • PPP 1980 Reference value for purchasing power parity per capta. Value at initial time is used as reference. • normalised PPP Normalised value of purchasing power parity considering the value at the initial time as reference. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#129 C	**R EEE per adopter (unit/house)** = EXTERNAL_DATA("R EEE per adopter") **Description:** Historical value of number of EEE unities per adopter[defined by the retrospective model] **Present In 1 View:** • 1. Technology adoption **Used By** • max EEE desired Represents the maximum EEE unities that one population unity (household or inhabitant) need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#143 A	**recurrent purchases to replace (unit/year)** = disposal of EEE as WEEE **Description:** Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 710 (39.9%) (+) 355 [7,27] (-) 355 [5,26]
.EEE and WEEE flows	#172 L	**Second use EEE (unit)** $= \int$ second use commissioning-second use decommissioning *dt* + initial stock of second use EEE **Description:** Stock of EEE in second use **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total products in the system Counts the total stock of products in the system • average age of useful products Average age of the combination of the stocks of first use and second use EEE • average second use EEE age Average age of the stock of second use EEE • current stock of EEE Sum of all the stocks of EEE. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,061 (59.7%) (+) 541 [4,28] (-) 520 [2,29]
.technology adoption	#204 A	**time to realise additional need (year)** = TIME STEP **Description:** Average time taken by customers to realise they need additional EEE products **Present In 1 View:**

- 1. Technology adoption

Used By
- additional purchases The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative.

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.technology adoption | #207 A

Total EEE in use (unit)
= First use EEE + Second use EEE
Description: Total EEE in use considering stock in first and second use
Present In 2 Views:
- 1. Technology adoption
- 5. Calibration and tests

Used By
- EEE per household Average number of stock in use (first and second use) per household
- EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/
- gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time.

Feedback Loops: 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]

.retrospective | #210 C

total households (house)
= EXTERNAL_DATA("total households")
Description: Total number of households at that moment[obtained externally, drives the model]
Present In 2 Views:
- 1. Technology adoption
- 5. Calibration and tests

Used By
- EEE per household Average number of stock in use (first and second use) per household
- actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology.
- adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year).
- error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'.
- household increase trend Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'.
- initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time
- initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time.
- total households variation Variation of households considering the trend from historical values.

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.retrospective | #211 A

total households variation (house/year)
= household increase trend * total households
Description: Variation of households considering the trend from historical values.
Present In 1 View:
- 1. Technology adoption

Used By
- new potential adopters Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters.

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

(View) 2. EEE and WEEE flows (54 Variables)

Top

(View) 2. EEE and WEEE flows (54 Variables)

Group	Type	*Variable Name And Description*

.material supply | #4 A

adjustment for stock of Processed material (kg/year)
= (desired stock of processed material - Processed material)/stock adjustment time
Description: Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered.
Present In 1 View:
- 2. EEE and WEEE flows

Used By
- extraction rate considering minimum stock Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials.

Feedback Loops: 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]

.EEE and WEEE flows | #7 L

Available used EEE (unit)
= $\int$((((first use decommissioning because faulty+first use decommissioning before broken)+second use decommissioning)-disposal of EEE as WEEE)-remanufacturing)-second use commissioning *dt* + initial stock of available used EEE
Description: Stock of used EEE available after first and second use
Present In 3 Views:
- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests

Used By
- Total products in the system Counts the total stock of products in the system
- average decommissioned EEE age Average age of the stock of decommissioned EEE
- current stock of EEE Sum of all the stocks of EEE.
- disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate.
- increase in age of available used EEE Increase rate in the total age of the stock of available used EEE
- remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).
- second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).

		Feedback Loops: 1,555 (87.5%) (+) 790 [4,28] (-) 765 [2,29]
.EEE and WEEE flows	#14 A	**collection time (year)** = 2 * distribution time **Description:** Time to collect decommissioned EEE **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE not recycled Rate of WEEE which is not recycled • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#20 A	**decommissioning probability in the end of life for first use (dmnl)** = weibull shape / weibull scale * (average EEE age/weibull scale) ^ (weibull shape-1) **Description:** The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 880 (49.5%) (+) 440 [4,28] (-) 440 [6,29]
.EEE obsolescence	#21 A	**decommissioning probability in the end of life for second use (dmnl)** = EXP ((- (average second use EEE age / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^weibull shape)) **Description:** The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 785 (44.2%) (+) 408 [5,28] (-) 377 [4,29]
.material supply	#26 A	**desired extraction rate (kg/year)** = MAX (0, (expected EEE demand - expected material kept in the system)) **Description:** Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction rate considering minimum stock Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#27 C	**desired stock lenght of processed material (year)** = 1 **Description:** Coverage (in time equivalent) of the stock of processed material considering the actual EEE demand **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#28 SM,A	**desired stock of processed material (kg)** = SMOOTH(expected EEE demand * desired stock lenght of processed material, distribution time) **Description:** A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE

		• material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Feedback Loops:** 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.EEE and WEEE flows	#33 A	**distribution time (year)** = TIME STEP **Description:** Time to distribute commissioned EEE.Is used in the model as a default process time value. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand. • collection time Time to collect decommissioned EEE • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • recycling time Time to recycle collected WEEE. • redistribution time Time to redistribute available used EEE. • reman time Time to remanufacture available used EEE. • time to extract Time to extract raw material into processed material. • time to make available Time to make obsolete products available for second use, remanufacturing or collection. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#36 C,F	**EEE average unit weight (kg/unit)** = EXTERNAL_DATA("EEE average unit weight") **Description:** Average unit weight of EEE. **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • Total materials in the system Counts the total stock of materials in the system • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#37 DE,F,A	**EEE commissioning (unit/year)** = DELAY1(EEE demand, distribution time) **Description:** Commissioning rate of processed material into EEE.Responds to EEE demand. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • EEE inflows Rate of all EEE inflows. • First use EEE Stock of EEE in first use • Processed material Stock of processed material available • material outflows Rate of all material outflows. • max value EEE commissioning Provides the historical maximum value of EEE commissioning. • simulated time series Dummy variable to id series • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 573 (32.2%) (+) 285 [7,28] (-) 288 [6,29]
.technology adoption	#38 A	**EEE demand (unit/year)** = adoption purchases + additional purchases + recurrent purchases to replace **Description:** Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Present In 2 Views:** • 1. Technology adoption • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,291 (72.6%) (+) 648 [7,28] (-) 643 [5,29]
.material supply	#47 SM,A	**expected EEE demand (kg/year)** = SMOOTH (EEE demand * EEE average unit weight, distribution time) **Description:** Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative

		• desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#48 A	**expected lifetime for decommissioning before broken (year/unit)** = lifetime fraction for decommissioning before broken * mean lifetime **Description:** average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 3 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#50 SM,A	**expected material kept in the system (kg/year)** = SMOOTH(remanufacturing * EEE average unit weight, reman time) + SMOOTH (WEEE recycling, recycling time) **Description:** Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#51 DE,F,A	**extraction (kg/year)** = DELAY1 (MAX (extraction rate considering minimum stock, 0) , time to extract) **Description:** Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • Raw material Stock of raw material available • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.material supply	#52 A	**extraction rate considering minimum stock (kg/year)** = adjustment for stock of Processed material + desired extraction rate **Description:** Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#54 DE,F,A	**first use decommissioning because faulty (unit/year)** = DELAY1 (First use EEE * decommissioning probability in the end of life for first use* (1 - fraction of decomissioned before broken) , time to make available) **Description:** Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,146 (64.5%) (+) 568 [4,28] (-) 578 [2,29]
.EEE and WEEE flows	#55 DE,F,A	**first use decommissioning before broken (unit/year)** = DELAY1(First use EEE * fraction of decomissioned before broken , (expected lifetime for decommissioning before broken+time to make available)) **Description:** Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 610 (34.3%) (+) 305 [4,28] (-) 305 [2,29]
.EEE and	#56	**First use EEE (unit)**

WEEE flows	L,F	$= \int$((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken *dt* + initial stock of first use EEE **Description:** Stock of EEE in first use **Present In 5 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total historical first use EEE value Total historical value of first use EEE. • Total products in the system Counts the total stock of products in the system • average EEE age Average age of the stock of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • current stock of EEE Sum of all the stocks of EEE. • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]
.EEE obsolescence	#59 A	**fraction introduced to reman market (dmnl)** = MIN (fraction fit for reman * reman market coverage, 1 - fraction introduced to second use market) **Description:** The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 762 (42.9%) (+) 381 [7,28] (-) 381 [6,29]
.EEE obsolescence	#60 A	**fraction introduced to second use market (dmnl)** = second hand market coverage * fraction fit for second use **Description:** The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#61 A	**fraction introduced to WEEE market (dmnl)** = 1 - (fraction introduced to second use market + fraction introduced to reman market) **Description:** The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 726 (40.8%) (+) 363 [7,28] (-) 363 [8,29]
.EEE and WEEE flows	#62 C	**fraction of decomissioned before broken (dmnl)** = 0 **Description:** Fraction of products that will be decommissioned for reasons other than functional obsolescence **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#63 A	**fraction of WEEE formally collected (dmnl)** = fraction of WEEE formally collected_RSSDlookup(recycling infrastructure level) **Description:** Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit

		Used By • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • fraction of WEEE not formally collected Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#65 A	**fraction of WEEE not formally collected (dmnl)** = 1 - fraction of WEEE formally collected **Description:** Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • WEEE not recycled Rate of WEEE which is not recycled **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#78 LI,C	**initial stock of available used EEE (unit)** = 0 **Description:** Initial stock of available used EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#80 LI,C	**initial stock of first use EEE (unit)** = 0 **Description:** Initial stock of first use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • First use EEE Stock of EEE in first use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#82 LI,C	**initial stock of non recycled WEEE (kg)** = 0 **Description:** Initial stock of non recycled WEEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#83 LI,C	**initial stock of processed material (kg)** = 0 **Description:** Initial stock of processed material. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#84 LI,C	**initial stock of raw material (kg)** = 1e+08 **Description:** Initial stock of raw material **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Raw material Stock of raw material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#85 LI,C	**initial stock of second use EEE (unit)** = 0 **Description:** Initial stock of second use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Second use EEE Stock of EEE in second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#86 LI,C	**initial stock of WEEE before treatment (kg)** = 0 **Description:** Initial stock of WEEE before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests

		Used By • WEEE before treatment Stock of WEEE available before treatment • initial stock of material Sum of initial stocks of material. Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#114 L	**Non recycled WEEE (kg)** = $\int$WEEE not recycled *dt* + initial stock of non recycled WEEE **Description:** Stock of non-recycled WEEE. Sink of the system. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#115 A	**non recycled WEEE because of recyclability (kg/year)** = WEEE recycling * (1-recyclability EEE) **Description:** Rate of WEEE which is formally collected but is not recycled because of EEE recyclability **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE not recycled Rate of WEEE which is not recycled Feedback Loops: 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#123 L	**Processed material (kg)** = $\int$(extraction+WEEE recycling)-(EEE commissioning*EEE average unit weight) *dt* + initial stock of processed material **Description:** Stock of processed material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. • current stock of material Sum of all the stocks of material. Feedback Loops: 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#139 L	**Raw material (kg)** = $\int$-extraction *dt* + initial stock of raw material **Description:** Stock of raw material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#144 C	**recyclability EEE (dmnl)** = 0.37 **Description:** Defines the ratio of products that, entering the recycling process, will be recycled.Considers the physical treatment and chemical recovery processes available. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#146 A	**recycling of EEE from remanufacturing process (kg/year)** = remanufacturing * (1 - remanufacturability EEE) / remanufacturability EEE * EEE average unit weight **Description:** Defines the recycling rate from the remanufacturing process **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#147 A	**recycling time (year)** = 2 * distribution time **Description:** Time to recycle collected WEEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#148 A	**redistribution time (year)** = 2 * distribution time **Description:** Time to redistribute available used EEE. **Present In 1 View:**

		• 2. EEE and WEEE flows **Used By** • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#153 A	**reman time (year)** = 2 * distribution time **Description:** Time to remanufacture available used EEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • remanufacturing Remanufactung rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#154 C	**remanufacturability EEE (dmnl)** = 0.8 **Description:** Defines the ratio of products that, entering the remanufacturing process, will be remanufactured.Considers that some products (or parts thereof) will be recycled instead because these are broken beyond restauration, or will be broken during the process. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • remanufacturing Remanufactung rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#155 DE,F,A	**remanufacturing (unit/year)** = MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufactung rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • max value remanufacturing Provides the historical maximum value of remanufacturing. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]
.EEE and WEEE flows	#170 DE,F,A	**second use commissioning (unit/year)** = DELAY1(Available used EEE * fraction introduced to second use market , redistribution time) **Description:** Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • max value second use commissioning Provides the historical maximum value of second use commissioning. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]
.EEE and WEEE flows	#171 DE,F,A	**second use decommissioning (unit/year)** = DELAY1(Second use EEE * decommissioning probability in the end of life for second use, time to make available) **Description:** Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests

		Used By • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 949 (53.4%) (+) 492 [4,28] (-) 457 [2,29]
.EEE and WEEE flows	#172 L	**Second use EEE (unit)** = $\int$second use commissioning-second use decommissioning *dt* + initial stock of second use EEE **Description:** Stock of EEE in second use **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total products in the system Counts the total stock of products in the system • average age of useful products Average age of the combination of the stocks of first use and second use EEE • average second use EEE age Average age of the stock of second use EEE • current stock of EEE Sum of all the stocks of EEE. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,061 (59.7%) (+) 541 [4,28] (-) 520 [2,29]
.material supply	#177 C	**stock adjustment time (year)** = 1 **Description:** Time taken to adjust stock of processed material, i.e. every x year the stock is readjusted. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#202 A	**time to extract (year)** = 2 * distribution time **Description:** Time to extract raw material into processed material. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#203 A	**time to make available (year)** = 1 * distribution time **Description:** Time to make obsolete products available for second use, remanufacturing or collection. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#222 L	**WEEE before treatment (kg)** = $\int$((disposal of EEE as WEEE*EEE average unit weight)-WEEE not recycled)-WEEE recycling *dt* + initial stock of WEEE before treatment **Description:** Stock of WEEE available before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Total materials in the system Counts the total stock of materials in the system • WEEE not recycled Rate of WEEE which is not recycled • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • current stock of material Sum of all the stocks of material. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 3 (0.2%) (+) 0 [0,0] (-) 3 [2,4]
.EEE and WEEE flows	#224 F,A	**WEEE not recycled (kg/year)** = WEEE before treatment * fraction of WEEE not formally collected / collection time + non recycled WEEE because of recyclability **Description:** Rate of WEEE which is not recycled **Present In 3 Views:** • 2. EEE and WEEE flows

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5. Calibration and tests
Depreciation (incomplete)
Used By

Non recycled WEEE Stock of non-recycled WEEE. Sink of the system.
WEEE before treatment Stock of WEEE available before treatment
decomissioned EEE outflows In unit per year equivalent
leakage of materials Indicator to check the ratio of materials leaving the system as WEEE
material inflows Rate of all material inflows.
material outflows Rate of all material outflows.
ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled.

Feedback Loops: 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
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<tr><td>.EEE and WEEE flows</td><td>#225 DE,F,A</td><td>
WEEE recycling (kg/year)
= (DELAY1(WEEE before treatment * fraction of WEEE formally collected , recycling time) + recycling of EEE from remanufacturing process) * recyclability EEE
Description: Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year).
Present In 3 Views:
2. EEE and WEEE flows
5. Calibration and tests
Depreciation (incomplete)
Used By

Processed material Stock of processed material available
WEEE before treatment Stock of WEEE available before treatment
decomissioned EEE outflows In unit per year equivalent
expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered.
material inflows Rate of all material inflows.
material outflows Rate of all material outflows.
max value WEEE recycling Provides the historical maximum value of WEEE recycling.
non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability
ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling.
time max value recycling Provides the year of the historical maximum value of WEEE recycling.

Feedback Loops: 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
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(View) 3. (de) Commissioning and restauration probabilit (46 Variables)

<table>
<tr><td>Top</td><td colspan="2">(View) 3. (de) Commissioning and restauration probabilit (46 Variables)</td></tr>
<tr><td>Group</td><td>Type</td><td>Variable Name And Description</td></tr>
<tr><td>.EEE obsolescence</td><td>#9 A</td><td>
average decommissioned EEE age (year/unit)
= ZIDZ (Total age of available used EEE, Available used EEE)
Description: Average age of the stock of decommissioned EEE
Present In 2 Views:
3. (de) Commissioning and restauration probabilit
4. Ageing
Used By

decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE
virtual age after reman Corresponds to the new average age of EEE products after remanufacturing.
virtual age after repair Corresponds to the new average age of EEE products after repairing.

Feedback Loops: 1,705 (95.9%) (+) 868 [5,28] (-) 837 [3,29]
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<tr><td>.EEE obsolescence</td><td>#10 A</td><td>
average EEE age (year/unit)
= ZIDZ (Total age of first use EEE , First use EEE)
Description: Average age of the stock of first use EEE
Present In 3 Views:
3. (de) Commissioning and restauration probabilit
4. Ageing
Depreciation (incomplete)
Used By

EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it.
average EEE value Average monetary value of first use EEE
average age of useful products Average age of the combination of the stocks of first use and second use EEE
decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population.
decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE
increase in age of available used EEE Increase rate in the total age of the stock of available used EEE

Feedback Loops: 1,178 (66.3%) (+) 595 [4,28] (-) 583 [3,29]
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<tr><td>.EEE obsolescence</td><td>#13 A</td><td>
average second use EEE age (year/unit)
= ZIDZ (Total time of second use EEE, Second use EEE)
Description: Average age of the stock of second use EEE
Present In 2 Views:
3. (de) Commissioning and restauration probabilit
4. Ageing
Used By

average age of useful products Average age of the combination of the stocks of first use and second use EEE
decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population.
decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE
increase in age of available used EEE Increase rate in the total age of the stock of available used EEE

Feedback Loops: 891 (50.1%) (+) 461 [6,28] (-) 430 [3,29]
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<tr><td>.EEE obsolescence</td><td>#20 A</td><td>
decommissioning probability in the end of life for first use (dmnl)
= weibull shape / weibull scale * (average EEE age/weibull scale) ^ (weibull shape-1)
Description: The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age
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		of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 880 (49.5%) (+) 440 [4,28] (-) 440 [6,29]
.EEE obsolescence	#21 A	**decommissioning probability in the end of life for second use (dmnl)** = EXP ((- (average second use EEE age / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^weibull shape)) **Description:** The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 785 (44.2%) (+) 408 [5,28] (-) 377 [4,29]
.EEE obsolescence	#48 A	**expected lifetime for decommissioning before broken (year/unit)** = lifetime fraction for decommissioning before broken * mean lifetime **Description:** average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 3 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#49 A	**expected lifetime for second use (year/unit)** = mean lifetime * lifetime fraction for second use **Description:** Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#57 A	**fraction fit for reman (dmnl)** = EXP ((- ((virtual age after reman + lifetime expected for reman products) / weibull scale) ^ weibull shape) + ((virtual age after reman/ weibull scale) ^ weibull shape)) **Description:** Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Feedback Loops:** 381 (21.4%) (+) 190 [7,28] (-) 191 [6,27]
.EEE obsolescence	#58 A	**fraction fit for second use (dmnl)** = EXP ((- ((virtual age after repair + expected lifetime for second use) / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^ weibull shape)) **Description:** Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to second use market The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#59 A	**fraction introduced to reman market (dmnl)** = MIN (fraction fit for reman * reman market coverage, 1 - fraction introduced to second use market) **Description:** The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By**

		• fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 762 (42.9%) (+) 381 [7,28] (-) 381 [6,29]
.EEE obsolescence	#60 A	**fraction introduced to second use market (dmnl)** = second hand market coverage * fraction fit for second use **Description:** The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#61 A	**fraction introduced to WEEE market (dmnl)** = 1 - (fraction introduced to second use market + fraction introduced to reman market) **Description:** The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 726 (40.8%) (+) 363 [7,28] (-) 363 [8,29]
.EEE obsolescence	#63 A	**fraction of WEEE formally collected (dmnl)** = fraction of WEEE formally collected_RSSDlookup(recycling infrastructure level) **Description:** Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • fraction of WEEE not formally collected Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#65 A	**fraction of WEEE not formally collected (dmnl)** = 1 - fraction of WEEE formally collected **Description:** Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • WEEE not recycled Rate of WEEE which is not recycled **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#74 C	**infra development initial year (year)** = 2015 **Description:** Mechanism used to verify the implementation of increasing/decreasing infrastructure (initial year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level • repairing infrastructure level Defines the repairing infrastructure implementation level • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#90 A	**lifetime expected for reman products (year/unit)** = mean lifetime * lifetime fraction for reman products **Description:** Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#91 C	**lifetime fraction for decommissioning before broken (dmnl)** = 0.5 **Description:** Determines the fraction of the lifetime of an EEE that a user will keep the product before buying a new one for other reasons than functional obsolescence **Present In 1 View:**

		• 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for decommissioning before broken average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#92 C	**lifetime fraction for reman products (dmnl)** = 0.8 **Description:** Determines the fraction of the lifetime of an EEE that a consumer expects for a remanufactured product **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • lifetime expected for reman products Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#93 C	**lifetime fraction for second use (dmnl)** = 0.5 **Description:** Determines the fraction of the lifetime of an EEE that a consumer expects for a product in second use **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for second use Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#94 C	**lifetime ratio (dmnl)** = 1 **Description:** Mechanism used to verify the design of EEE holding increased lifetimes **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • weibull scale The weibull scale defines the lifetime at which 63.2% of units will fail. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#107 A	**mean lifetime (year/unit)** = EXP (GAMMA LN(1/weibull shape + 1)) * weibull scale **Description:** Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for decommissioning before broken average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs • expected lifetime for second use Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs • lifetime expected for reman products Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#126 C	**R desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing repairing infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#127 C	**R desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing repairing infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#130 C	**R initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial repairing infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#140 C	**RC desired level (dmnl)** = 4 **Description:** Mechanism used to verify the implementation of increasing/decreasing recycling infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#141 C	**RC desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing recycling infrastructure (final year of implementation) **Present In 1 View:**

		• 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#142 C	**RC initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial recycling infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#145 A	**recycling infrastructure level (dmnl)** = RC initial level + switch infra development * RAMP((RC desired level-RC initial level)/(RC desired year-infra development initial year), infra development initial year, RC desired year) **Description:** Defines the recycling infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction of WEEE formally collected Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#149 A	**reman effectiveness (dmnl)** = reman effectiveness_RSSDlookup(remanufacturing infrastructure level) **Description:** The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • virtual age after reman Corresponds to the new average age of EEE products after remanufacturing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#151 A	**reman market coverage (dmnl)** = reman market coverage_RSSDlookup(remanufacturing infrastructure level) **Description:** The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#157 A	**remanufacturing infrastructure level (dmnl)** = RM initial level + switch infra development * RAMP((RM desired level-RM initial level)/(RM desired year-infra development initial year), infra development initial year, RM desired year) **Description:** Defines the remanufacturing infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • reman effectiveness The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. • reman market coverage The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#158 A	**repair effectiveness (dmnl)** = repair effectiveness_RSSDlookup(repairing infrastructure level) **Description:** The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • virtual age after repair Corresponds to the new average age of EEE products after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#160 A	**repairing infrastructure level (dmnl)** = R initial level + switch infra development * RAMP((R desired level-R initial level)/(R desired year-infra development initial year), infra development initial year, R desired year) **Description:** Defines the repairing infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repair effectiveness The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#162 C	**RM desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing remanufacturing infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.CE mechanisms	#163 C	**RM desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing remanufacturing infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#164 C	**RM initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial remanufacturing infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#168 A	**second hand market coverage (dmnl)** = second hand market coverage_RSSDlookup(second use infrastructure level) **Description:** The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to second use market The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#173 A	**second use infrastructure level (dmnl)** = SU initial level + switch infra development * RAMP((SU desired level-SU initial level)/(SU desired year-infra development initial year), infra development initial year, SU desired year) **Description:** Defines the second use infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second hand market coverage The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#178 C	**SU desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing second use infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#179 C	**SU desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing second use infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#180 C	**SU initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial second use infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#193 C	**switch infra development (dmnl)** = 0 **Description:** Switch to turn on/off the bechanism to verify implementation of increasing/decreasing infrastructures **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level • repairing infrastructure level Defines the repairing infrastructure implementation level • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#219 A	**virtual age after reman (year/unit)** = average decommissioned EEE age * (1 - reman effectiveness) **Description:** Corresponds to the new average age of EEE products after remanufacturing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only

		those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE **Feedback Loops:** 436 (24.5%) (+) 220 [7,28] (-) 216 [6,27]
.EEE obsolescence	#220 A	**virtual age after repair (year/unit)** = average decommissioned EEE age * (1 - repair effectiveness) **Description:** Corresponds to the new average age of EEE products after repairing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 1,268 (71.3%) (+) 648 [5,28] (-) 620 [6,29]
.EEE obsolescence	#226 A	**weibull scale (dmnl)** = 11.75 * lifetime ratio **Description:** The weibull scale defines the lifetime at which 63.2% of units will fail. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • mean lifetime Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#227 C	**weibull shape (dmnl)** = 2.01 **Description:** The weibull shape parameter identifies the failure rate pattern through time. This parameter defines decreasing (β<1), constant (β=1), or increasing (β>1) failure rates over the product's lifetime **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • mean lifetime Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

(View) 4. Ageing (26 Variables)

Top	(View) 4. Ageing (26 Variables)	
Group	Type	*Variable Name And Description*
.EEE and WEEE flows	#7 L	**Available used EEE (unit)** = $\int$((((first use decommissioning because faulty+first use decommissioning before broken)+second use decommissioning)-disposal of EEE as WEEE)-remanufacturing)-second use commissioning *dt* + initial stock of available used EEE **Description:** Stock of used EEE available after first and second use **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By**

- Total products in the system Counts the total stock of products in the system
- average decommissioned EEE age Average age of the stock of decommissioned EEE
- current stock of EEE Sum of all the stocks of EEE.
- disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate.
- increase in age of available used EEE Increase rate in the total age of the stock of available used EEE
- remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).
- second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).

Feedback Loops: 1,555 (87.5%) (+) 790 [4,28] (-) 765 [2,29]

.EEE obsolescence | #8 A

average age of useful products (year/unit)
= ZIDZ ((average EEE age * First use EEE + average second use EEE age * Second use EEE) , (First use EEE + Second use EEE))
Description: Average age of the combination of the stocks of first use and second use EEE
Present In 1 View:
- 4. Ageing

Used By

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.EEE obsolescence | #9 A

average decommissioned EEE age (year/unit)
= ZIDZ (Total age of available used EEE, Available used EEE)
Description: Average age of the stock of decommissioned EEE
Present In 2 Views:
- 3. (de) Commissioning and restauration probabilit
- 4. Ageing

Used By
- decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE
- virtual age after reman Corresponds to the new average age of EEE products after remanufacturing.
- virtual age after repair Corresponds to the new average age of EEE products after repairing.

Feedback Loops: 1,705 (95.9%) (+) 868 [5,28] (-) 837 [3,29]

.EEE obsolescence | #10 A

average EEE age (year/unit)
= ZIDZ (Total age of first use EEE , First use EEE)
Description: Average age of the stock of first use EEE
Present In 3 Views:
- 3. (de) Commissioning and restauration probabilit
- 4. Ageing
- Depreciation (incomplete)

Used By
- EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it.
- average EEE value Average monetary value of first use EEE
- average age of useful products Average age of the combination of the stocks of first use and second use EEE
- decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population.
- decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE
- increase in age of available used EEE Increase rate in the total age of the stock of available used EEE

Feedback Loops: 1,178 (66.3%) (+) 595 [4,28] (-) 583 [3,29]

.EEE obsolescence | #13 A

average second use EEE age (year/unit)
= ZIDZ (Total time of second use EEE, Second use EEE)
Description: Average age of the stock of second use EEE
Present In 2 Views:
- 3. (de) Commissioning and restauration probabilit
- 4. Ageing

Used By
- average age of useful products Average age of the combination of the stocks of first use and second use EEE
- decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population.
- decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE
- increase in age of available used EEE Increase rate in the total age of the stock of available used EEE

Feedback Loops: 891 (50.1%) (+) 461 [6,28] (-) 430 [3,29]

.EEE obsolescence | #22 F,A

decrease in age of available used EEE (dmnl)
= second use commissioning * average decommissioned EEE age + disposal of EEE as WEEE * average decommissioned EEE age + remanufacturing * average decommissioned EEE age
Description: Decrease rate in the total age of the stock of available used EEE
Present In 1 View:
- 4. Ageing

Used By
- Total age of available used EEE Total age of the stock of available used EEE in years

Feedback Loops: 250 (14.1%) (+) 113 [8,26] (-) 137 [3,27]

.EEE obsolescence | #23 F,A

decrease in age of first use EEE (dmnl)
= first use decommissioning because faulty * average EEE age + first use decommissioning before broken* expected lifetime for decommissioning before broken
Description: Decrease rate in the total age of the stock of first use EEE
Present In 1 View:
- 4. Ageing

Used By
- Total age of first use EEE Total age of the stock of first use EEE in years

Feedback Loops: 323 (18.2%) (+) 149 [5,28] (-) 174 [3,29]

.EEE obsolescence | #24 F,A

decrease in age of second use EEE (dmnl)
= second use decommissioning * average second use EEE age

		Description: Decrease rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 65 (3.7%) (+) 30 [14,25] (-) 35 [3,26]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE • material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Feedback Loops:** 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.EEE obsolescence	#48 A	**expected lifetime for decommissioning before broken (year/unit)** = lifetime fraction for decommissioning before broken * mean lifetime **Description:** average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 3 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#54 DE,F,A	**first use decommissioning because faulty (unit/year)** = DELAY1 (First use EEE * decommissioning probability in the end of life for first use* (1 - fraction of decomissioned before broken) , time to make available) **Description:** Decommissioning rate of EEE because of functional obsolescence.Responds to the decommissioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,146 (64.5%) (+) 568 [4,28] (-) 578 [2,29]
.EEE and WEEE flows	#55 DE,F,A	**first use decommissioning before broken (unit/year)** = DELAY1(First use EEE * fraction of decomissioned before broken , (expected lifetime for decommissioning before broken+time to make available)) **Description:** Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommissioning probability because owner has bought a new product before the former was faulty or broken. **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 610 (34.3%) (+) 305 [4,28] (-) 305 [2,29]
.EEE and WEEE flows	#56 L,F	**First use EEE (unit)** = $\int$((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken *dt* + initial stock of first use EEE **Description:** Stock of EEE in first use **Present In 5 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total historical first use EEE value Total historical value of first use EEE.

		• Total products in the system Counts the total stock of products in the system • average EEE age Average age of the stock of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • current stock of EEE Sum of all the stocks of EEE. • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]
.EEE obsolescence	#71 F,A	**increase in age of available used EEE (dmnl)** = Available used EEE * rate of ageing + first use decommissioning because faulty * average EEE age+ first use decommissioning before broken* expected lifetime for decommissioning before broken + second use decommissioning * average second use EEE age **Description:** Increase rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 1,335 (75.1%) (+) 691 [6,28] (-) 644 [8,29]
.EEE obsolescence	#72 F,A	**increase in age of first use EEE (dmnl)** = First use EEE * rate of ageing + remanufacturing * virtual age after reman **Description:** Increase rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 596 (33.5%) (+) 311 [6,28] (-) 285 [7,29]
.EEE obsolescence	#73 F,A	**increase in age of second use EEE (dmnl)** = Second use EEE * rate of ageing + second use commissioning * virtual age after repair **Description:** Increase rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 660 (37.1%) (+) 344 [7,28] (-) 316 [6,29]
.EEE obsolescence	#132 C	**rate of ageing (year/(year*unit))** = 1 **Description:** Rate of age gain by EEE unit per year passed **Present In 1 View:** • 4. Ageing **Used By** • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#155 DE,F,A	**remanufacturing (unit/year)** = MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • max value remanufacturing Provides the historical maximum value of remanufacturing. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]
.EEE and WEEE flows	#170 DE,F,A	**second use commissioning (unit/year)** = DELAY1(Available used EEE * fraction introduced to second use market , redistribution time) **Description:** Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By**

		- Available used EEE Stock of used EEE available after first and second use - EEE inflows Rate of all EEE inflows. - EEE outflows Rate of all EEE outflows. - Second use EEE Stock of EEE in second use - decomissioned EEE outflows In unit per year equivalent - decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE - increase in age of second use EEE Increase rate in the total age of the stock of second use EEE - max value second use commissioning Provides the historical maximum value of second use commissioning. - ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. - time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]
.EEE and WEEE flows	#171 DE,F,A	**second use decommissioning (unit/year)** = DELAY1(Second use EEE * decommissioning probability in the end of life for second use, time to make available) **Description:** Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** - 2. EEE and WEEE flows - 4. Ageing - 5. Calibration and tests **Used By** - Available used EEE Stock of used EEE available after first and second use - EEE inflows Rate of all EEE inflows. - EEE outflows Rate of all EEE outflows. - Second use EEE Stock of EEE in second use - decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE - increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 949 (53.4%) (+) 492 [4,28] (-) 457 [2,29]
.EEE and WEEE flows	#172 L	**Second use EEE (unit)** $= \int$ second use commissioning-second use decommissioning dt + initial stock of second use EEE **Description:** Stock of EEE in second use **Present In 4 Views:** - 1. Technology adoption - 2. EEE and WEEE flows - 4. Ageing - 5. Calibration and tests **Used By** - Total EEE in use Total EEE in use considering stock in first and second use - Total products in the system Counts the total stock of products in the system - average age of useful products Average age of the combination of the stocks of first use and second use EEE - average second use EEE age Average age of the stock of second use EEE - current stock of EEE Sum of all the stocks of EEE. - increase in age of second use EEE Increase rate in the total age of the stock of second use EEE - second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,061 (59.7%) (+) 541 [4,28] (-) 520 [2,29]
.EEE obsolescence	#205 L	**Total age of available used EEE (year)** $= \int$ increase in age of available used EEE-decrease in age of available used EEE dt + 0.0 **Description:** Total age of the stock of available used EEE in years **Present In 1 View:** - 4. Ageing **Used By** - average decommissioned EEE age Average age of the stock of decommissioned EEE **Feedback Loops:** 1,585 (89.1%) (+) 804 [6,28] (-) 781 [3,29]
.EEE obsolescence	#206 L	**Total age of first use EEE (year)** $= \int$ increase in age of first use EEE-decrease in age of first use EEE dt + 0.0 **Description:** Total age of the stock of first use EEE in years **Present In 1 View:** - 4. Ageing **Used By** - average EEE age Average age of the stock of first use EEE **Feedback Loops:** 919 (51.7%) (+) 460 [5,28] (-) 459 [3,29]
.EEE obsolescence	#214 L	**Total time of second use EEE (year)** $= \int$ increase in age of second use EEE-decrease in age of second use EEE dt + 0.0 **Description:** Total age of the stock of second use EEE in years **Present In 1 View:** - 4. Ageing **Used By** - average second use EEE age Average age of the stock of second use EEE **Feedback Loops:** 725 (40.8%) (+) 374 [7,28] (-) 351 [3,29]
.EEE obsolescence	#219 A	**virtual age after reman (year/unit)** = average decommissioned EEE age * (1 - reman effectiveness) **Description:** Corresponds to the new average age of EEE products after remanufacturing. **Present In 2 Views:** - 3. (de) Commissioning and restauration probabilit - 4. Ageing **Used By** - fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when

		remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE **Feedback Loops:** 436 (24.5%) (+) 220 [7,28] (-) 216 [6,27]
.EEE obsolescence	#220 A	**virtual age after repair (year/unit)** = average decommissioned EEE age * (1 - repair effectiveness) **Description:** Corresponds to the new average age of EEE products after repairing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 1,268 (71.3%) (+) 648 [5,28] (-) 620 [6,29]

(View) 5. Calibration and tests (102 Variables)

Top	(View) 5. Calibration and tests (102 Variables)	
Group	Type	*Variable Name And Description*
.Theil	#1 A	**1 - us (Dimensionless)** = 1 - us **Description:** One minus variance inequality proportion. Used to verify against UC **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#7 L	**Available used EEE (unit)** $= \int$((((first use decommissioning because faulty+first use decommissioning before broken)+second use decommissioning)-disposal of EEE as WEEE)-remanufacturing)-second use commissioning *dt* + initial stock of available used EEE **Description:** Stock of used EEE available after first and second use **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Total products in the system Counts the total stock of products in the system • average decommissioned EEE age Average age of the stock of decommissioned EEE • current stock of EEE Sum of all the stocks of EEE. • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,555 (87.5%) (+) 790 [4,28] (-) 765 [2,29]
.Theil	#15 L	**count (Dimensionless)** $= \int$pick/dt *dt* + 0.0 **Description:** Counter for # of points **Present In 1 View:** • 5. Calibration and tests **Used By** • M X Mean of x (sum x)/n • M Y Mean of y (sum y)/n • MX2 Mean of x^2 (sum x^2)/n • MY2 Mean of y^2 (sum y^2)/n • Mxy Mean of x*y (sum x*y)/n • RMSPE Root Mean Square Percent Error • mape Mean Absolute Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#16 A	**current stock of EEE (unit)** = First use EEE + Available used EEE + Second use EEE **Description:** Sum of all the stocks of EEE. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#17 A	**current stock of material (kg)** = Raw material + Processed material + Non recycled WEEE + WEEE before treatment **Description:** Sum of all the stocks of material. **Present In 1 View:** • 5. Calibration and tests

		Used By • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#29 A	**dif cov (Units*Units)** = 2*Sx*Sy*(1-r) **Description:** Difference of covariances **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • uc Covariance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#30 A	**dif mea (Units*Units)** = (M X-M Y)*(M X-M Y) **Description:** Difference of Means (bias) **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • um Bias inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#31 A	**dif var (Units*Units)** = (Sx-Sy)*(Sx-Sy) **Description:** Difference of variances **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • us Variance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE • material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Feedback Loops:** 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.Theil	#34 F,A	**dt (Time Units)** = TIME STEP **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • count Counter for # of points **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#35 L	**EEE adopters (house)** = $\int$ adoption rate dt + initial adopters **Description:** Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology. • desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.retrospective	#36 C,F	**EEE average unit weight (kg/unit)** = EXTERNAL_DATA("EEE average unit weight") **Description:** Average unit weight of EEE. **Present In 3 Views:** • 2. EEE and WEEE flows

		• 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • Total materials in the system Counts the total stock of materials in the system • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#37 DE,F,A	**EEE commissioning (unit/year)** = DELAY1(EEE demand, distribution time) **Description:** Commissioning rate of processed material into EEE.Responds to EEE demand. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • EEE inflows Rate of all EEE inflows. • First use EEE Stock of EEE in first use • Processed material Stock of processed material available • material outflows Rate of all material outflows. • max value EEE commissioning Provides the historical maximum value of EEE commissioning. • simulated time series Dummy variable to id series • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 573 (32.2%) (+) 285 [7,28] (-) 288 [6,29]
.model checking	#40 F,A	**EEE inflows (unit/year)** = EEE commissioning + first use decommissioning because faulty + first use decommissioning before broken+ second use commissioning + second use decommissioning + remanufacturing **Description:** Rate of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE inflows Sum of all EEE inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#41 F,A	**EEE outflows (unit/year)** = first use decommissioning because faulty + first use decommissioning before broken +second use commissioning + second use decommissioning + remanufacturing + disposal of EEE as WEEE **Description:** Rate of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE outflows Sum of all EEE outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#42 A	**EEE per household (unit/house)** = Total EEE in use / total households **Description:** Average number of stock in use (first and second use) per household **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#43 A	**EEE per inhabitant (unit/inhabitant)** = Total EEE in use / population **Description:** Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#46 A	**error households adoption (house)** = EEE adopters + Potential EEE adopters - total households **Description:** This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#51 DE,F,A	**extraction (kg/year)** = DELAY1 (MAX (extraction rate considering minimum stock, 0) , time to extract) **Description:** Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Present In 2 Views:** • 2. EEE and WEEE flows

- 5. Calibration and tests

Used By
- Processed material Stock of processed material available
- Raw material Stock of raw material available
- material inflows Rate of all material inflows.
- material outflows Rate of all material outflows.

Feedback Loops: 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]

.EEE and WEEE flows | #54 DE,F,A

first use decommissioning because faulty (unit/year)
= DELAY1 (First use EEE * decommissioning probability in the end of life for first use* (1 - fraction of decomissioned before broken) , time to make available)
Description: Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).
Present In 3 Views:
- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests

Used By
- Available used EEE Stock of used EEE available after first and second use
- EEE inflows Rate of all EEE inflows.
- EEE outflows Rate of all EEE outflows.
- First use EEE Stock of EEE in first use
- decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE
- increase in age of available used EEE Increase rate in the total age of the stock of available used EEE

Feedback Loops: 1,146 (64.5%) (+) 568 [4,28] (-) 578 [2,29]

.EEE and WEEE flows | #55 DE,F,A

first use decommissioning before broken (unit/year)
= DELAY1(First use EEE * fraction of decomissioned before broken , (expected lifetime for decommissioning before broken+time to make available))
Description: Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken.
Present In 3 Views:
- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests

Used By
- Available used EEE Stock of used EEE available after first and second use
- EEE inflows Rate of all EEE inflows.
- EEE outflows Rate of all EEE outflows.
- First use EEE Stock of EEE in first use
- decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE
- increase in age of available used EEE Increase rate in the total age of the stock of available used EEE

Feedback Loops: 610 (34.3%) (+) 305 [4,28] (-) 305 [2,29]

.EEE and WEEE flows | #56 L,F

First use EEE (unit)
= $\int$((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken *dt* + initial stock of first use EEE
Description: Stock of EEE in first use
Present In 5 Views:
- 1. Technology adoption
- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests
- Depreciation (incomplete)

Used By
- Total EEE in use Total EEE in use considering stock in first and second use
- Total historical first use EEE value Total historical value of first use EEE.
- Total products in the system Counts the total stock of products in the system
- average EEE age Average age of the stock of first use EEE
- average age of useful products Average age of the combination of the stocks of first use and second use EEE
- current stock of EEE Sum of all the stocks of EEE.
- first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).
- first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken.
- increase in age of first use EEE Increase rate in the total age of the stock of first use EEE
- total first use EEE value Total value of first use EEE at a given moment in time.

Feedback Loops: 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]

.retrospective | #67 C

historic disposal of EEE (unit/year)
= EXTERNAL_DATA("historic disposal of EEE")
Description: Historical value of annual EEE disposal in a specific country.[obtained externally, drives the model]
Present In 1 View:
- 5. Calibration and tests

Used By

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.retrospective | #68 C

historic EEE put on market (unit/year)
= EXTERNAL_DATA("historic EEE put on market")
Description: Historical value of EEE commisioned in specific country.[obtained externally]
Present In 1 View:
- 5. Calibration and tests

Used By
- historical time series Dummy variable to id series

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.Theil | #69 A

historical time series (Units)
= historic EEE put on market

		Description: Dummy variable to id series **Present In 1 View:** • 5. Calibration and tests **Used By** • Y Historical time series values **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#78 LI,C	**initial stock of available used EEE (unit)** = 0 **Description:** Initial stock of available used EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#79 A	**initial stock of EEE (unit)** = initial stock of first use EEE + initial stock of available used EEE + initial stock of second use EEE **Description:** Sum of initial stocks of EEE. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#80 LI,C	**initial stock of first use EEE (unit)** = 0 **Description:** Initial stock of first use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • First use EEE Stock of EEE in first use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#81 A	**initial stock of material (kg)** = initial stock of raw material + initial stock of processed material + initial stock of WEEE before treatment+ initial stock of non recycled WEEE **Description:** Sum of initial stocks of material. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#82 LI,C	**initial stock of non recycled WEEE (kg)** = 0 **Description:** Initial stock of non recycled WEEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#83 LI,C	**initial stock of processed material (kg)** = 0 **Description:** Initial stock of processed material. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#84 LI,C	**initial stock of raw material (kg)** = 1e+08 **Description:** Initial stock of raw material **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Raw material Stock of raw material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#85 LI,C	**initial stock of second use EEE (unit)** = 0 **Description:** Initial stock of second use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Second use EEE Stock of EEE in second use

		• initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#86 LI,C	**initial stock of WEEE before treatment (kg)** = 0 **Description:** Initial stock of WEEE before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • WEEE before treatment Stock of WEEE available before treatment • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#88 A	**leakage of materials (1/year)** = ZIDZ (WEEE not recycled, Total materials in the system) **Description:** Indicator to check the ratio of materials leaving the system as WEEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#89 A	**leakage of products (1/year)** = ZIDZ(disposal of EEE as WEEE , Total products in the system) **Description:** Indicator to check the ratio of products leaving the system as WEEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#95 A	**M X (Units)** = ZIDZ(Sum Xi,count) **Description:** Mean of x (sum x)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sx Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 • dif mea Difference of Means (bias) • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#96 A	**M Y (Units)** = ZIDZ(Sum Yi,count) **Description:** Mean of y (sum y)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sy Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 • dif mea Difference of Means (bias) • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#97 A	**mape (Dimensionless)** = ZIDZ(Sum APE,count) **Description:** Mean Absolute Percent Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#98 A	**mass balance EEE (unit)** = Sum of all EEE inflows + initial stock of EEE - Sum of all EEE outflows - current stock of EEE **Description:** Mass-balance check of EEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#99 A	**mass balance material (kg)** = Sum of all material inflows + initial stock of material - Sum of all material outflows- current stock of material **Description:** Mass balance check of material **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#100 F,A	**material inflows (kg/year)** = extraction + WEEE recycling + disposal of EEE as WEEE * EEE average unit weight + WEEE not recycled **Description:** Rate of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material inflows Sum of all material inflows.

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#101 F,A	**material outflows (kg/year)** = extraction + EEE commissioning * EEE average unit weight + WEEE not recycled + WEEE recycling **Description:** Rate of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material outflows Sum of all material outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#103 A	**max value EEE commissioning (unit/year)** = SAMPLE IF TRUE(EEE commissioning > max value EEE commissioning, EEE commissioning , EEE commissioning) **Description:** Provides the historical maximum value of EEE commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#104 A	**max value remanufacturing (unit/year)** = SAMPLE IF TRUE(remanufacturing > max value remanufacturing, remanufacturing , remanufacturing) **Description:** Provides the historical maximum value of remanufacturing. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#105 A	**max value second use commissioning (unit/year)** = SAMPLE IF TRUE(second use commissioning > max value second use commissioning, second use commissioning, second use commissioning) **Description:** Provides the historical maximum value of second use commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#106 A	**max value WEEE recycling (kg/year)** = SAMPLE IF TRUE(WEEE recycling > max value WEEE recycling, WEEE recycling , WEEE recycling) **Description:** Provides the historical maximum value of WEEE recycling. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#108 A	**mse (Units*Units)** = dif mea + dif var + dif cov **Description:** Mean Square Error. The addition of the three components **Present In 1 View:** • 5. Calibration and tests **Used By** • rmse Root Mean Square Error • uc Covariance inequality proportion • um Bias inequality proportion • us Variance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#109 A	**MX2 (Units*Units)** = ZIDZ(SumX2,count) **Description:** Mean of x^2 (sum x^2)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sx Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#110 A	**Mxy (Units*Units)** = ZIDZ(SumXY,count) **Description:** Mean of x*y (sum x*y)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#111 A	**MY2 (Units*Units)** = ZIDZ(SumY2,count) **Description:** Mean of y^2 (sum y^2)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sy Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.EEE and WEEE flows	#114 L	**Non recycled WEEE (kg)** = ∫WEEE not recycled *dt* + initial stock of non recycled WEEE **Description:** Stock of non-recycled WEEE. Sink of the system. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#118 F,A	**pick (Dimensionless)** = IF THEN ELSE(Y = NAREPLACEMENT :OR: X = NAREPLACEMENT, 0, 1) **Description:** Flag to id historical value available.Takes a value of one for every data point available **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • Yi Historical point entering calculations • count Counter for # of points • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#119 C	**population (inhabitant)** = EXTERNAL_DATA("population") **Description:** Total number of inhabitants at that moment[obtained externally, drives the model] **Present In 1 View:** • 5. Calibration and tests **Used By** • EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#121 L	**Potential EEE adopters (house)** = ∫new potential adopters-adoption rate *dt* + initial potential adopters **Description:** Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#123 L	**Processed material (kg)** = ∫(extraction+WEEE recycling)-(EEE commissioning*EEE average unit weight) *dt* + initial stock of processed material **Description:** Stock of processed material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. • current stock of material Sum of all the stocks of material. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.Theil	#125 A	**r (Dimensionless)** = MIN(1,ZIDZ(Mxy-(M X*M Y),Sx*Sy)) **Description:** Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • r2 Correlation coefficient squared **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#131 A	**r2 (Dimensionless)** = r*r **Description:** Correlation coefficient squared **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#139 L	**Raw material (kg)** = ∫-extraction *dt* + initial stock of raw material **Description:** Stock of raw material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and	#155	**remanufacturing (unit/year)**

WEEE flows	DE,F,A	= MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufacturing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • max value remanufacturing Provides the historical maximum value of remanufacturing. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]
.Theil	#161 A	**residuals (Units)** = IF THEN ELSE(pick,Xi-Yi,NAREPLACEMENT) **Description:** Errors **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#165 A	**rmse (Units)** = SQRT(mse) **Description:** Root Mean Square Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#166 A	**RMSPE (Dimensionless)** = SQRT(ZIDZ(Sum SPE,count)) **Description:** Root Mean Square Percent Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#170 DE,F,A	**second use commissioning (unit/year)** = DELAY1(Available used EEE * fraction introduced to second use market , redistribution time) **Description:** Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • max value second use commissioning Provides the historical maximum value of second use commissioning. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]
.EEE and WEEE flows	#171 DE,F,A	**second use decommissioning (unit/year)** = DELAY1(Second use EEE * decommissioning probability in the end of life for second use, time to make available) **Description:** Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 949 (53.4%) (+) 492 [4,28] (-) 457 [2,29]

.EEE and WEEE flows	#172 L	**Second use EEE (unit)** = ∫second use commissioning-second use decommissioning *dt* + initial stock of second use EEE **Description:** Stock of EEE in second use **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total products in the system Counts the total stock of products in the system • average age of useful products Average age of the combination of the stocks of first use and second use EEE • average second use EEE age Average age of the stock of second use EEE • current stock of EEE Sum of all the stocks of EEE. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,061 (59.7%) (+) 541 [4,28] (-) 520 [2,29]
.Theil	#175 A	**simulated time series (Units)** = EEE commissioning **Description:** Dummy variable to id series **Present In 1 View:** • 5. Calibration and tests **Used By** • X Simulated time series values **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#176 A	**SSE (Units*Units)** = Sum XmY2 **Description:** Sum of Square Errors (x-y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#181 L	**Sum APE (Dimensionless)** = ∫(ABS((ZIDZ((Xi-Yi),Yi))))/dt *dt* + 0.0 **Description:** Sum of Absolute Percent Errors **Present In 1 View:** • 5. Calibration and tests **Used By** • mape Mean Absolute Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#182 L	**Sum of all EEE inflows (unit)** = ∫EEE inflows *dt* + 0.0 **Description:** Sum of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#183 L	**Sum of all EEE outflows (unit)** = ∫EEE outflows *dt* + 0.0 **Description:** Sum of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#184 L	**Sum of all material inflows (kg)** = ∫material inflows *dt* + 0.0 **Description:** Sum of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#185 L	**Sum of all material outflows (kg)** = ∫material outflows *dt* + 0.0 **Description:** Sum of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#186	**Sum SPE (Dimensionless)**

	L	= ∫((ZIDZ((Xi-Yi),Yi))*(ZIDZ((Xi-Yi),Yi)))/dt *dt* + 0.0 **Description:** Sum of Square Percent Errors ((x-y)/y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** • RMSPE Root Mean Square Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#187 L	**Sum Xi (Units)** = ∫Xi/dt *dt* + 0.0 **Description:** Sum of x's (simulated) **Present In 1 View:** • 5. Calibration and tests **Used By** • M X Mean of x (sum x)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#188 L	**Sum XmY2 (Units*Units)** = ∫((Xi-Yi)*(Xi-Yi))/dt *dt* + 0.0 **Description:** Sum of Square Errors (x-y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** • SSE Sum of Square Errors (x-y)^2 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#189 L	**Sum Yi (Units)** = ∫Yi/dt *dt* + 0.0 **Description:** Sum of y's (historical) **Present In 1 View:** • 5. Calibration and tests **Used By** • M Y Mean of y (sum y)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#190 L	**SumX2 (Units*Units)** = ∫(Xi*Xi)/dt *dt* + 0.0 **Description:** Sum of x^2 (simulated) **Present In 1 View:** • 5. Calibration and tests **Used By** • MX2 Mean of x^2 (sum x^2)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#191 L	**SumXY (Units*Units)** = ∫(Xi*Yi)/dt *dt* + 0.0 **Description:** Sum of x*y **Present In 1 View:** • 5. Calibration and tests **Used By** • Mxy Mean of x*y (sum x*y)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#192 L	**SumY2 (Units*Units)** = ∫(Yi*Yi)/dt *dt* + 0.0 **Description:** Sum of y^2 (historical) **Present In 1 View:** • 5. Calibration and tests **Used By** • MY2 Mean of y^2 (sum y^2)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#194 A	**Sx (Units)** = SQRT(MAX(0,MX2-(M X*M X))) **Description:** Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • dif var Difference of variances • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#195 A	**Sy (Units)** = SQRT(MAX(0,MY2-(M Y*M Y))) **Description:** Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances

		• dif var Difference of variances • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#197 A	**time max value commissioning (year)** = SAMPLE IF TRUE(EEE commissioning >= max value EEE commissioning, Time , Time) **Description:** Provides the year of the historical maximum value of EEE commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#198 A	**time max value recycling (year)** = SAMPLE IF TRUE(WEEE recycling >= max value WEEE recycling, Time, Time) **Description:** Provides the year of the historical maximum value of WEEE recycling. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#199 A	**time max value remanufacturing (year)** = SAMPLE IF TRUE(remanufacturing >= max value remanufacturing, Time , Time) **Description:** Provides the year of the historical maximum value of remanufacturing. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#200 A	**time max value second use commissioning (year)** = SAMPLE IF TRUE(second use commissioning >= max value second use commissioning, Time , Time) **Description:** Provides the year of the historical maximum value of second use commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#207 A	**Total EEE in use (unit)** = First use EEE + Second use EEE **Description:** Total EEE in use considering stock in first and second use **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • EEE per household Average number of stock in use (first and second use) per household • EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ • gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.retrospective	#210 C	**total households (house)** = EXTERNAL_DATA("total households") **Description:** Total number of households at that moment[obtained externally, drives the model] **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • EEE per household Average number of stock in use (first and second use) per household • actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology. • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. • household increase trend Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. • initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time • initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time. • total households variation Variation of households considering the trend from historical values. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#212 A	**Total materials in the system (kg)** = Total products in the system * EEE average unit weight + WEEE before treatment **Description:** Counts the total stock of materials in the system **Present In 1 View:** • 5. Calibration and tests **Used By** • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#213 A	**Total products in the system (unit)** = Available used EEE + First use EEE + Second use EEE **Description:** Counts the total stock of products in the system **Present In 1 View:** • 5. Calibration and tests **Used By**

		• Total materials in the system Counts the total stock of materials in the system • leakage of products Indicator to check the ratio of products leaving the system as WEEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#215 A	**total value of Available WEEE (USD)** = WEEE before treatment * WEEE average market value **Description:** Total value of e-waste in the system at that moment **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#216 A	**uc (Dimensionless)** = ZIDZ(dif cov,mse) **Description:** Covariance inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#217 A	**um (Dimensionless)** = ZIDZ(dif mea,mse) **Description:** Bias inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#218 A	**us (Dimensionless)** = ZIDZ(dif var,mse) **Description:** Variance inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** • 1 - us One minus variance inequality proportion. Used to verify against UC **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#221 C	**WEEE average market value (USD/kg)** = 10 **Description:** Average market value of WEEE **Present In 2 Views:** • 5. Calibration and tests • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#222 L	**WEEE before treatment (kg)** = $\int$((disposal of EEE as WEEE*EEE average unit weight)-WEEE not recycled)-WEEE recycling *dt* + initial stock of WEEE before treatment **Description:** Stock of WEEE available before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Total materials in the system Counts the total stock of materials in the system • WEEE not recycled Rate of WEEE which is not recycled • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • current stock of material Sum of all the stocks of material. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 3 (0.2%) (+) 0 [0,0] (-) 3 [2,4]
.EEE and WEEE flows	#224 F,A	**WEEE not recycled (kg/year)** = WEEE before treatment * fraction of WEEE not formally collected / collection time + non recycled WEEE because of recyclability **Description:** Rate of WEEE which is not recycled **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.EEE and WEEE flows	#225 DE,F,A	**WEEE recycling (kg/year)** = (DELAY1(WEEE before treatment * fraction of WEEE formally collected , recycling time) + recycling of EEE from remanufacturing process) * recyclability EEE **Description:** Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). **Present In 3 Views:**

Group	Type	Variable Name And Description
		• [2. EEE and WEEE flows] • [5. Calibration and tests] • [Depreciation (incomplete)] **Used By** • Processed material Stock of processed material available • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • max value WEEE recycling Provides the historical maximum value of WEEE recycling. • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.Theil	#228 A	**X (Units)** = simulated time series **Description:** Simulated time series values **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • pick Flag to id historical value available.Takes a value of one for every data point available **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#229 F,A	**Xi (Units)** = pick*X **Description:** Simulated point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#230 A	**Y (Units)** = historical time series **Description:** Historical time series values **Present In 1 View:** • 5. Calibration and tests **Used By** • Yi Historical point entering calculations • pick Flag to id historical value available.Takes a value of one for every data point available **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#231 F,A	**Yi (Units)** = pick*Y **Description:** Historical point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

(View) Depreciation (incomplete) (24 Variables)

Top	(View) Depreciation (incomplete) (24 Variables)	
Group	Type	*Variable Name And Description*
.EEE obsolescence	#10 A	**average EEE age (year/unit)** = ZIDZ (Total age of first use EEE , First use EEE) **Description:** Average age of the stock of first use EEE **Present In 3 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. • average EEE value Average monetary value of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE

		Feedback Loops: 1,178 (66.3%) (+) 595 [4,28] (-) 583 [3,29]
.depreciation	#12 F,A	**average EEE value (USD/unit)** = EEE unit price - average EEE age * EEE depreciation ratio **Description:** Average monetary value of first use EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • Total historical first use EEE value Total historical value of first use EEE. • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#18 A	**decommissioned EEE outflows (unit/year)** = (WEEE not recycled + WEEE recycling) / EEE average unit weight + remanufacturing + second use commissioning **Description:** In unit per year equivalent **Present In 1 View:** • Depreciation (incomplete) **Used By** • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#19 A	**decommissioned EEE average outflow price (USD/unit)** = (WEEE average market value * ratio WEEE recycling from decomissioned EEE - WEEE costs for non recycling* ratio WEEE not being recycled from decomissioned EEE) * EEE average unit weight + remanufacturing contribution per unit * ratio remanufacturing from decommissioned EEE+ second use price* ratio second use comissioning from decommissioned EEE **Description:** Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#36 C,F	**EEE average unit weight (kg/unit)** = EXTERNAL_DATA("EEE average unit weight") **Description:** Average unit weight of EEE. **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • Total materials in the system Counts the total stock of materials in the system • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#39 A	**EEE depreciation ratio (USD/year)** = ZIDZ ((EEE unit price - decommissioned EEE average outflow price) , average EEE age) **Description:** Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. **Present In 1 View:** • Depreciation (incomplete) **Used By** • average EEE value Average monetary value of first use EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#44 C	**EEE unit price (USD/unit)** = EXTERNAL_DATA("EEE unit price") **Description:** Historical prices of flat panel television **Present In 1 View:** • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. • average EEE value Average monetary value of first use EEE • remanufacturing contribution per unit Remanufacturing contribution per unit of EEE • second use price Second use price per unit **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#56 L,F	**First use EEE (unit)** = $\int$((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken *dt* + initial stock of first use EEE **Description:** Stock of EEE in first use **Present In 5 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing

		• 5. Calibration and tests • Depreciation (incomplete) **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total historical first use EEE value Total historical value of first use EEE. • Total products in the system Counts the total stock of products in the system • average EEE age Average age of the stock of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • current stock of EEE Sum of all the stocks of EEE. • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]
.depreciation	#133 C	**ratio of EEE price for second use (dmnl)** = 0.3 **Description:** Fraction of the full price that customers are willing to pay for a second use product. **Present In 1 View:** • Depreciation (incomplete) **Used By** • second use price Second use price per unit **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#134 C	**ratio of reman contribution per unit (dmnl)** = 0.3 **Description:** Ratio of the contribution assumed for a remanufactured product in comparison to buying new. **Present In 1 View:** • Depreciation (incomplete) **Used By** • remanufacturing contribution per unit Remanufacturing contribution per unit of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#135 A	**ratio remanufacturing from decommissioned EEE (dmnl)** = ZIDZ (remanufacturing, decomissioned EEE outflows) **Description:** Ratio of available used EEE that flow into remanufacturing. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#136 A	**ratio second use comissioning from decommissioned EEE (dmnl)** = ZIDZ (second use commissioning, decomissioned EEE outflows) **Description:** Ratio of available used EEE that are commissioned for second use. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#137 A	**ratio WEEE not being recycled from decommissioned EEE (dmnl)** = ZIDZ (WEEE not recycled/EEE average unit weight, decomissioned EEE outflows) **Description:** Ratio of available used EEE that is not formally collected and, thus, not recycled. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#138 A	**ratio WEEE recycling from decomissioned EEE (dmnl)** = ZIDZ (WEEE recycling/EEE average unit weight, decomissioned EEE outflows) **Description:** Ratio of available used EEE that flow into recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#155 DE,F,A	**remanufacturing (unit/year)** = MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By**

		• Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • max value remanufacturing Provides the historical maximum value of remanufacturing. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]
.depreciation	#156 A	**remanufacturing contribution per unit (USD/unit)** = EEE unit price * ratio of reman contribution per unit **Description:** Remanufacturing contribution per unit of EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#170 DE,F,A	**second use commissioning (unit/year)** = DELAY1(Available used EEE * fraction introduced to second use market , redistribution time) **Description:** Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • max value second use commissioning Provides the historical maximum value of second use commissioning. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]
.depreciation	#174 A	**second use price (USD/unit)** = EEE unit price * ratio of EEE price for second use **Description:** Second use price per unit **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#208 A	**total first use EEE value (USD)** = First use EEE * average EEE value **Description:** Total value of first use EEE at a given moment in time. **Present In 1 View:** • Depreciation (incomplete) **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#209 L	**Total historical first use EEE value (USD)** $= \int$ average EEE value*First use EEE dt + 0.0 **Description:** Total historical value of first use EEE. **Present In 1 View:** • Depreciation (incomplete) **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#221 C	**WEEE average market value (USD/kg)** = 10 **Description:** Average market value of WEEE **Present In 2 Views:** • 5. Calibration and tests • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#223 C	**WEEE costs for non recycling (USD/kg)** = 5

Description: Average sytemic costs assumed for note recycling.
Present In 1 View:

- Depreciation (incomplete)

Used By

- decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling.

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.EEE and WEEE flows | #224 F,A

WEEE not recycled (kg/year)
= WEEE before treatment * fraction of WEEE not formally collected / collection time + non recycled WEEE because of recyclability
Description: Rate of WEEE which is not recycled
Present In 3 Views:

- 2. EEE and WEEE flows
- 5. Calibration and tests
- Depreciation (incomplete)

Used By

- Non recycled WEEE Stock of non-recycled WEEE. Sink of the system.
- WEEE before treatment Stock of WEEE available before treatment
- decomissioned EEE outflows In unit per year equivalent
- leakage of materials Indicator to check the ratio of materials leaving the system as WEEE
- material inflows Rate of all material inflows.
- material outflows Rate of all material outflows.
- ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled.

Feedback Loops: 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]

.EEE and WEEE flows | #225 DE,F,A

WEEE recycling (kg/year)
= (DELAY1(WEEE before treatment * fraction of WEEE formally collected , recycling time) + recycling of EEE from remanufacturing process) * recyclability EEE
Description: Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year).
Present In 3 Views:

- 2. EEE and WEEE flows
- 5. Calibration and tests
- Depreciation (incomplete)

Used By

- Processed material Stock of processed material available
- WEEE before treatment Stock of WEEE available before treatment
- decomissioned EEE outflows In unit per year equivalent
- expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered.
- material inflows Rate of all material inflows.
- material outflows Rate of all material outflows.
- max value WEEE recycling Provides the historical maximum value of WEEE recycling.
- non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability
- ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling.
- time max value recycling Provides the year of the historical maximum value of WEEE recycling.

Feedback Loops: 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]

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(Group) .CE mechanisms (19 Variables)

Group | Type | *Variable Name And Description*

.CE mechanisms | #74 C

infra development initial year (year)
= 2015
Description: Mechanism used to verify the implementation of increasing/decreasing infrastructure (initial year of implementation)
Present In 1 View:

- 3. (de) Commissioning and restauration probabilit

Used By

- recycling infrastructure level Defines the recycling infrastructure implementation level
- remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level
- repairing infrastructure level Defines the repairing infrastructure implementation level
- second use infrastructure level Defines the second use infrastructure implementation level

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.CE mechanisms | #94 C

lifetime ratio (dmnl)
= 1
Description: Mechanism used to verify the design of EEE holding increased lifetimes
Present In 1 View:

- 3. (de) Commissioning and restauration probabilit

Used By

- weibull scale The weibull scale defines the lifetime at which 63.2% of units will fail.

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.CE mechanisms | #126 C

R desired level (dmnl)
= 0
Description: Mechanism used to verify the implementation of increasing/decreasing repairing infrastructure (final level of implementation)
Present In 1 View:

- 3. (de) Commissioning and restauration probabilit

Used By

- repairing infrastructure level Defines the repairing infrastructure implementation level

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.CE mechanisms | #127 C

R desired year (year)
= 2030
Description: Mechanism used to verify the implementation of increasing/decreasing repairing infrastructure (final year of implementation)
Present In 1 View:

- 3. (de) Commissioning and restauration probabilit

Used By

- repairing infrastructure level Defines the repairing infrastructure implementation level

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#130 C	**R initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial repairing infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#140 C	**RC desired level (dmnl)** = 4 **Description:** Mechanism used to verify the implementation of increasing/decreasing recycling infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#141 C	**RC desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing recycling infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#142 C	**RC initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial recycling infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#145 A	**recycling infrastructure level (dmnl)** = RC initial level + switch infra development * RAMP((RC desired level-RC initial level)/(RC desired year-infra development initial year), infra development initial year, RC desired year) **Description:** Defines the recycling infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction of WEEE formally collected Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#157 A	**remanufacturing infrastructure level (dmnl)** = RM initial level + switch infra development * RAMP((RM desired level-RM initial level)/(RM desired year-infra development initial year), infra development initial year, RM desired year) **Description:** Defines the remanufacturing infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • reman effectiveness The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. • reman market coverage The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#160 A	**repairing infrastructure level (dmnl)** = R initial level + switch infra development * RAMP((R desired level-R initial level)/(R desired year-infra development initial year), infra development initial year, R desired year) **Description:** Defines the repairing infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repair effectiveness The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#162 C	**RM desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing remanufacturing infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#163 C	**RM desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing remanufacturing infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By**

		• remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#164 C	**RM initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial remanufacturing infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#173 A	**second use infrastructure level (dmnl)** = SU initial level + switch infra development * RAMP((SU desired level-SU initial level)/(SU desired year-infra development initial year), infra development initial year, SU desired year) **Description:** Defines the second use infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second hand market coverage The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#178 C	**SU desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing second use infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#179 C	**SU desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing second use infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#180 C	**SU initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial second use infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#193 C	**switch infra development (dmnl)** = 0 **Description:** Switch to turn on/off the bechanism to verify implementation of increasing/decreasing infrastructures **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level • repairing infrastructure level Defines the repairing infrastructure implementation level • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

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(Group) .EEE and WEEE flows (36 Variables)

Group	Type	*Variable Name And Description*
.EEE and WEEE flows	#7 L	**Available used EEE (unit)** = $\int$((((first use decommissioning because faulty+first use decommissioning before broken)+second use decommissioning)-disposal of EEE as WEEE)-remanufacturing)-second use commissioning *dt* + initial stock of available used EEE **Description:** Stock of used EEE available after first and second use **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Total products in the system Counts the total stock of products in the system • average decommissioned EEE age Average age of the stock of decommissioned EEE • current stock of EEE Sum of all the stocks of EEE. • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. • increase in age of available used EEE Increase rate in the total age of stock of available used EEE • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,555 (87.5%) (+) 790 [4,28] (-) 765 [2,29]
.EEE	#14	**collection time (year)**

and WEEE flows	A	= 2 * distribution time **Description:** Time to collect decommissioned EEE **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE not recycled Rate of WEEE which is not recycled • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE • material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Feedback Loops:** 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.EEE and WEEE flows	#33 A	**distribution time (year)** = TIME STEP **Description:** Time to distribute commissioned EEE.Is used in the model as a default process time value. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand. • collection time Time to collect decommissioned EEE • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • recycling time Time to recycle collected WEEE. • redistribution time Time to redistribute available used EEE. • reman time Time to remanufacture available used EEE. • time to extract Time to extract raw material into processed material. • time to make available Time to make obsolete products available for second use, remanufacturing or collection. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#37 DE,F,A	**EEE commissioning (unit/year)** = DELAY1(EEE demand, distribution time) **Description:** Commissioning rate of processed material into EEE.Responds to EEE demand. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • EEE inflows Rate of all EEE inflows. • First use EEE Stock of EEE in first use • Processed material Stock of processed material available • material outflows Rate of all material outflows. • max value EEE commissioning Provides the historical maximum value of EEE commissioning. • simulated time series Dummy variable to id series • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 573 (32.2%) (+) 285 [7,28] (-) 288 [6,29]
.EEE and WEEE flows	#51 DE,F,A	**extraction (kg/year)** = DELAY1 (MAX (extraction rate considering minimum stock, 0) , time to extract) **Description:** Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • Raw material Stock of raw material available • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#54 DE,F,A	**first use decommissioning because faulty (unit/year)** = DELAY1 (First use EEE * decommissioning probability in the end of life for first use* (1 - fraction of decomissioned before broken) , time to make available) **Description:** Decommissioning rate of EEE because of functional obsolescence.Responds to the decommissioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use

		• EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,146 (64.5%) (+) 568 [4,28] (-) 578 [2,29]
.EEE and WEEE flows	#55 DE,F,A	**first use decommissioning before broken (unit/year)** = DELAY1(First use EEE * fraction of decomissioned before broken , (expected lifetime for decommissioning before broken+time to make available)) **Description:** Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 610 (34.3%) (+) 305 [4,28] (-) 305 [2,29]
.EEE and WEEE flows	#56 L,F	**First use EEE (unit)** = $\int$((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken *dt* + initial stock of first use EEE **Description:** Stock of EEE in first use **Present In 5 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total historical first use EEE value Total historical value of first use EEE. • Total products in the system Counts the total stock of products in the system • average EEE age Average age of the stock of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • current stock of EEE Sum of all the stocks of EEE. • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]
.EEE and WEEE flows	#62 C	**fraction of decomissioned before broken (dmnl)** = 0 **Description:** Fraction of products that will be decommissioned for reasons other than functional obsolescence **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#78 LI,C	**initial stock of available used EEE (unit)** = 0 **Description:** Initial stock of available used EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#80 LI,C	**initial stock of first use EEE (unit)** = 0 **Description:** Initial stock of first use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • First use EEE Stock of EEE in first use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#82 LI,C	**initial stock of non recycled WEEE (kg)** = 0 **Description:** Initial stock of non recycled WEEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests

		Used By • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#83 LI,C	**initial stock of processed material (kg)** = 0 **Description:** Initial stock of processed material. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#84 LI,C	**initial stock of raw material (kg)** = 1e+08 **Description:** Initial stock of raw material **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Raw material Stock of raw material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#85 LI,C	**initial stock of second use EEE (unit)** = 0 **Description:** Initial stock of second use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Second use EEE Stock of EEE in second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#86 LI,C	**initial stock of WEEE before treatment (kg)** = 0 **Description:** Initial stock of WEEE before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • WEEE before treatment Stock of WEEE available before treatment • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#114 L	**Non recycled WEEE (kg)** = $\int$ WEEE not recycled *dt* + initial stock of non recycled WEEE **Description:** Stock of non-recycled WEEE. Sink of the system. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#115 A	**non recycled WEEE because of recyclability (kg/year)** = WEEE recycling * (1-recyclability EEE) **Description:** Rate of WEEE which is formally collected but is not recycled because of EEE recyclability **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE not recycled Rate of WEEE which is not recycled **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#123 L	**Processed material (kg)** = $\int$ (extraction+WEEE recycling)-(EEE commissioning*EEE average unit weight) *dt* + initial stock of processed material **Description:** Stock of processed material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. • current stock of material Sum of all the stocks of material. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#139 L	**Raw material (kg)** = $\int$ -extraction *dt* + initial stock of raw material **Description:** Stock of raw material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests

		Used By • current stock of material Sum of all the stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#144 C	**recyclability EEE (dmnl)** = 0.37 **Description:** Defines the ratio of products that, entering the recycling process, will be recycled.Considers the physical treatment and chemical recovery processes available. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#146 A	**recycling of EEE from remanufacturing process (kg/year)** = remanufacturing * (1 - remanufacturability EEE) / remanufacturability EEE * EEE average unit weight **Description:** Defines the recycling rate from the remanufacturing process **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#147 A	**recycling time (year)** = 2 * distribution time **Description:** Time to recycle collected WEEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#148 A	**redistribution time (year)** = 2 * distribution time **Description:** Time to redistribute available used EEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#153 A	**reman time (year)** = 2 * distribution time **Description:** Time to remanufacture available used EEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#154 C	**remanufacturability EEE (dmnl)** = 0.8 **Description:** Defines the ratio of products that, entering the remanufacturing process, will be remanufactured.Considers that some products (or parts thereof) will be recycled instead because these are broken beyond restauration, or will be broken during the process. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#155 DE,F,A	**remanufacturing (unit/year)** = MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By**

- Available used EEE Stock of used EEE available after first and second use
- EEE inflows Rate of all EEE inflows.
- EEE outflows Rate of all EEE outflows.
- First use EEE Stock of EEE in first use
- decomissioned EEE outflows In unit per year equivalent
- decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE
- expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered.
- increase in age of first use EEE Increase rate in the total age of the stock of first use EEE
- max value remanufacturing Provides the historical maximum value of remanufacturing.
- ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing.
- recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process
- time max value remanufacturing Provides the year of the historical maximum value of remanufacturing.

Feedback Loops: 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]

.EEE and WEEE flows | #170 DE,F,A

second use commissioning (unit/year)
= DELAY1(Available used EEE * fraction introduced to second use market , redistribution time)
Description: Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).
Present In 4 Views:

- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests
- Depreciation (incomplete)

Used By

- Available used EEE Stock of used EEE available after first and second use
- EEE inflows Rate of all EEE inflows.
- EEE outflows Rate of all EEE outflows.
- Second use EEE Stock of EEE in second use
- decomissioned EEE outflows In unit per year equivalent
- decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE
- increase in age of second use EEE Increase rate in the total age of the stock of second use EEE
- max value second use commissioning Provides the historical maximum value of second use commissioning.
- ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use.
- time max value second use commissioning Provides the year of the historical maximum value of second use commissioning.

Feedback Loops: 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]

.EEE and WEEE flows | #171 DE,F,A

second use decommissioning (unit/year)
= DELAY1(Second use EEE * decommissioning probability in the end of life for second use, time to make available)
Description: Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).
Present In 3 Views:

- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests

Used By

- Available used EEE Stock of used EEE available after first and second use
- EEE inflows Rate of all EEE inflows.
- EEE outflows Rate of all EEE outflows.
- Second use EEE Stock of EEE in second use
- decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE
- increase in age of available used EEE Increase rate in the total age of the stock of available used EEE

Feedback Loops: 949 (53.4%) (+) 492 [4,28] (-) 457 [2,29]

.EEE and WEEE flows | #172 L

Second use EEE (unit)
= $\int$ second use commissioning-second use decommissioning *dt* + initial stock of second use EEE
Description: Stock of EEE in second use
Present In 4 Views:

- 1. Technology adoption
- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests

Used By

- Total EEE in use Total EEE in use considering stock in first and second use
- Total products in the system Counts the total stock of products in the system
- average age of useful products Average age of the combination of the stocks of first use and second use EEE
- average second use EEE age Average age of the stock of second use EEE
- current stock of EEE Sum of all the stocks of EEE.
- increase in age of second use EEE Increase rate in the total age of the stock of second use EEE
- second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).

Feedback Loops: 1,061 (59.7%) (+) 541 [4,28] (-) 520 [2,29]

.EEE and WEEE flows | #202 A

time to extract (year)
= 2 * distribution time
Description: Time to extract raw material into processed material.
Present In 1 View:

- 2. EEE and WEEE flows

Used By

- extraction Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered.

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.EEE and WEEE flows | #203 A

time to make available (year)
= 1 * distribution time
Description: Time to make obsolete products available for second use, remanufacturing or collection.
Present In 1 View:

- 2. EEE and WEEE flows

		Used By • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#222 L	**WEEE before treatment (kg)** = $\int$((disposal of EEE as WEEE*EEE average unit weight)-WEEE not recycled)-WEEE recycling *dt* + initial stock of WEEE before treatment **Description:** Stock of WEEE available before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Total materials in the system Counts the total stock of materials in the system • WEEE not recycled Rate of WEEE which is not recycled • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • current stock of material Sum of all the stocks of material. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 3 (0.2%) (+) 0 [0,0] (-) 3 [2,4]
.EEE and WEEE flows	#224 F,A	**WEEE not recycled (kg/year)** = WEEE before treatment * fraction of WEEE not formally collected / collection time + non recycled WEEE because of recyclability **Description:** Rate of WEEE which is not recycled **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.EEE and WEEE flows	#225 DE,F,A	**WEEE recycling (kg/year)** = (DELAY1(WEEE before treatment * fraction of WEEE formally collected , recycling time) + recycling of EEE from remanufacturing process) * recyclability EEE **Description:** Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • max value WEEE recycling Provides the historical maximum value of WEEE recycling. • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]

Top	(Group) .EEE obsolescence (38 Variables)	
Group	Type	*Variable Name And Description*
.EEE obsolescence	#8 A	**average age of useful products (year/unit)** = ZIDZ ((average EEE age * First use EEE + average second use EEE age * Second use EEE) , (First use EEE + Second use EEE)) **Description:** Average age of the combination of the stocks of first use and second use EEE **Present In 1 View:** • 4. Ageing **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#9 A	**average decommissioned EEE age (year/unit)** = ZIDZ (Total age of available used EEE, Available used EEE) **Description:** Average age of the stock of decommissioned EEE **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • virtual age after reman Corresponds to the new average age of EEE products after remanufacturing. • virtual age after repair Corresponds to the new average age of EEE products after repairing. **Feedback Loops:** 1,705 (95.9%) (+) 868 [5,28] (-) 837 [3,29]
.EEE obsolescence	#10 A	**average EEE age (year/unit)** = ZIDZ (Total age of first use EEE , First use EEE)

		Description: Average age of the stock of first use EEE **Present In 3 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. • average EEE value Average monetary value of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,178 (66.3%) (+) 595 [4,28] (-) 583 [3,29]
.EEE obsolescence	#13 A	**average second use EEE age (year/unit)** = ZIDZ (Total time of second use EEE, Second use EEE) **Description:** Average age of the stock of second use EEE **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • average age of useful products Average age of the combination of the stocks of first use and second use EEE • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 891 (50.1%) (+) 461 [6,28] (-) 430 [3,29]
.EEE obsolescence	#20 A	**decommissioning probability in the end of life for first use (dmnl)** = weibull shape / weibull scale * (average EEE age/weibull scale) ^ (weibull shape-1) **Description:** The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 880 (49.5%) (+) 440 [4,28] (-) 440 [6,29]
.EEE obsolescence	#21 A	**decommissioning probability in the end of life for second use (dmnl)** = EXP ((- (average second use EEE age / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^weibull shape)) **Description:** The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 785 (44.2%) (+) 408 [5,28] (-) 377 [4,29]
.EEE obsolescence	#22 F,A	**decrease in age of available used EEE (dmnl)** = second use commissioning * average decommissioned EEE age + disposal of EEE as WEEE * average decommissioned EEE age + remanufacturing * average decommissioned EEE age **Description:** Decrease rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 250 (14.1%) (+) 113 [8,26] (-) 137 [3,27]
.EEE obsolescence	#23 F,A	**decrease in age of first use EEE (dmnl)** = first use decommissioning because faulty * average EEE age + first use decommissioning before broken* expected lifetime for decommissioning before broken **Description:** Decrease rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 323 (18.2%) (+) 149 [5,28] (-) 174 [3,29]
.EEE obsolescence	#24 F,A	**decrease in age of second use EEE (dmnl)** = second use decommissioning * average second use EEE age **Description:** Decrease rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 65 (3.7%) (+) 30 [14,25] (-) 35 [3,26]

.EEE obsolescence	#48 A	**expected lifetime for decommissioning before broken (year/unit)** = lifetime fraction for decommissioning before broken * mean lifetime **Description:** average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 3 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#49 A	**expected lifetime for second use (year/unit)** = mean lifetime * lifetime fraction for second use **Description:** Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#57 A	**fraction fit for reman (dmnl)** = EXP ((- ((virtual age after reman + lifetime expected for reman products) / weibull scale) ^ weibull shape) + ((virtual age after reman/ weibull scale) ^ weibull shape)) **Description:** Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Feedback Loops:** 381 (21.4%) (+) 190 [7,28] (-) 191 [6,27]
.EEE obsolescence	#58 A	**fraction fit for second use (dmnl)** = EXP ((- ((virtual age after repair + expected lifetime for second use) / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^ weibull shape)) **Description:** Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to second use market The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#59 A	**fraction introduced to reman market (dmnl)** = MIN (fraction fit for reman * reman market coverage, 1 - fraction introduced to second use market) **Description:** The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 762 (42.9%) (+) 381 [7,28] (-) 381 [6,29]
.EEE obsolescence	#60 A	**fraction introduced to second use market (dmnl)** = second hand market coverage * fraction fit for second use **Description:** The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#61 A	**fraction introduced to WEEE market (dmnl)** = 1 - (fraction introduced to second use market + fraction introduced to reman market) **Description:** The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets

		for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 726 (40.8%) (+) 363 [7,28] (-) 363 [8,29]
.EEE obsolescence	#63 A	**fraction of WEEE formally collected (dmnl)** = fraction of WEEE formally collected_RSSDlookup(recycling infrastructure level) **Description:** Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • fraction of WEEE not formally collected Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#65 A	**fraction of WEEE not formally collected (dmnl)** = 1 - fraction of WEEE formally collected **Description:** Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • WEEE not recycled Rate of WEEE which is not recycled **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#71 F,A	**increase in age of available used EEE (dmnl)** = Available used EEE * rate of ageing + first use decommissioning because faulty * average EEE age+ first use decommissioning before broken* expected lifetime for decommissioning before broken + second use decommissioning * average second use EEE age **Description:** Increase rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 1,335 (75.1%) (+) 691 [6,28] (-) 644 [8,29]
.EEE obsolescence	#72 F,A	**increase in age of first use EEE (dmnl)** = First use EEE * rate of ageing + remanufacturing * virtual age after reman **Description:** Increase rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 596 (33.5%) (+) 311 [6,28] (-) 285 [7,29]
.EEE obsolescence	#73 F,A	**increase in age of second use EEE (dmnl)** = Second use EEE * rate of ageing + second use commissioning * virtual age after repair **Description:** Increase rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 660 (37.1%) (+) 344 [7,28] (-) 316 [6,29]
.EEE obsolescence	#90 A	**lifetime expected for reman products (year/unit)** = mean lifetime * lifetime fraction for reman products **Description:** Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#91 C	**lifetime fraction for decommissioning before broken (dmnl)** = 0.5 **Description:** Determines the fraction of the lifetime of an EEE that a user will keep the product before buying a new one for other reasons than functional obsolescence **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for decommissioning before broken average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#92 C	**lifetime fraction for reman products (dmnl)** = 0.8

		Description: Determines the fraction of the lifetime of an EEE that a consumer expects for a remanufactured product **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • lifetime expected for reman products Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#93 C	**lifetime fraction for second use (dmnl)** = 0.5 **Description:** Determines the fraction of the lifetime of an EEE that a consumer expects for a product in second use **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for second use Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#107 A	**mean lifetime (year/unit)** = EXP (GAMMA LN(1/weibull shape + 1)) * weibull scale **Description:** Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for decommissioning before broken average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs • expected lifetime for second use Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs • lifetime expected for reman products Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#132 C	**rate of ageing (year/(year*unit))** = 1 **Description:** Rate of age gain by EEE unit per year passed **Present In 1 View:** • 4. Ageing **Used By** • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#149 A	**reman effectiveness (dmnl)** = reman effectiveness_RSSDlookup(remanufacturing infrastructure level) **Description:** The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • virtual age after reman Corresponds to the new average age of EEE products after remanufacturing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#151 A	**reman market coverage (dmnl)** = reman market coverage_RSSDlookup(remanufacturing infrastructure level) **Description:** The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#158 A	**repair effectiveness (dmnl)** = repair effectiveness_RSSDlookup(repairing infrastructure level) **Description:** The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • virtual age after repair Corresponds to the new average age of EEE products after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#168 A	**second hand market coverage (dmnl)** = second hand market coverage_RSSDlookup(second use infrastructure level) **Description:** The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to second use market The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#205 L	**Total age of available used EEE (year)** = $\int$ increase in age of available used EEE-decrease in age of available used EEE dt + 0.0 **Description:** Total age of the stock of available used EEE in years **Present In 1 View:** • 4. Ageing

		Used By • average decommissioned EEE age Average age of the stock of decommissioned EEE **Feedback Loops:** 1,585 (89.1%) (+) 804 [6,28] (-) 781 [3,29]
.EEE obsolescence	#206 L	**Total age of first use EEE (year)** = $\int$increase in age of first use EEE-decrease in age of first use EEE *dt* + 0.0 **Description:** Total age of the stock of first use EEE in years **Present In 1 View:** • 4. Ageing **Used By** • average EEE age Average age of the stock of first use EEE **Feedback Loops:** 919 (51.7%) (+) 460 [5,28] (-) 459 [3,29]
.EEE obsolescence	#214 L	**Total time of second use EEE (year)** = $\int$increase in age of second use EEE-decrease in age of second use EEE *dt* + 0.0 **Description:** Total age of the stock of second use EEE in years **Present In 1 View:** • 4. Ageing **Used By** • average second use EEE age Average age of the stock of second use EEE **Feedback Loops:** 725 (40.8%) (+) 374 [7,28] (-) 351 [3,29]
.EEE obsolescence	#219 A	**virtual age after reman (year/unit)** = average decommissioned EEE age * (1 - reman effectiveness) **Description:** Corresponds to the new average age of EEE products after remanufacturing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE **Feedback Loops:** 436 (24.5%) (+) 220 [7,28] (-) 216 [6,27]
.EEE obsolescence	#220 A	**virtual age after repair (year/unit)** = average decommissioned EEE age * (1 - repair effectiveness) **Description:** Corresponds to the new average age of EEE products after repairing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 1,268 (71.3%) (+) 648 [5,28] (-) 620 [6,29]
.EEE obsolescence	#226 A	**weibull scale (dmnl)** = 11.75 * lifetime ratio **Description:** The weibull scale defines the lifetime at which 63.2% of units will fail. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • mean lifetime Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#227 C	**weibull shape (dmnl)** = 2.01 **Description:** The weibull shape parameter identifies the failure rate pattern through time. This parameter defines decreasing (β<1), constant (β=1), or increasing (β>1) failure rates over the product's lifetime **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By**

- decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population.
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Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

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(Group) .Theil (39 Variables)

Group	Type	*Variable Name And Description*
.Theil	#1 A	**1 - us (Dimensionless)** = 1 - us **Description:** One minus variance inequality proportion. Used to verify against UC **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#15 L	**count (Dimensionless)** = $\int$ pick/dt dt + 0.0 **Description:** Counter for # of points **Present In 1 View:** • 5. Calibration and tests **Used By** • M X Mean of x (sum x)/n • M Y Mean of y (sum y)/n • MX2 Mean of x^2 (sum x^2)/n • MY2 Mean of y^2 (sum y^2)/n • Mxy Mean of x*y (sum x*y)/n • RMSPE Root Mean Square Percent Error • mape Mean Absolute Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#29 A	**dif cov (Units*Units)** = 2*Sx*Sy*(1-r) **Description:** Difference of covariances **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • uc Covariance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#30 A	**dif mea (Units*Units)** = (M X-M Y)*(M X-M Y) **Description:** Difference of Means (bias) **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • um Bias inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#31 A	**dif var (Units*Units)** = (Sx-Sy)*(Sx-Sy) **Description:** Difference of variances **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • us Variance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#34 F,A	**dt (Time Units)** = TIME STEP **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • count Counter for # of points

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#69 A	**historical time series (Units)** = historic EEE put on market **Description:** Dummy variable to id series **Present In 1 View:** • 5. Calibration and tests **Used By** • Y Historical time series values **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#95 A	**M X (Units)** = ZIDZ(Sum Xi,count) **Description:** Mean of x (sum x)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sx Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 • dif mea Difference of Means (bias) • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#96 A	**M Y (Units)** = ZIDZ(Sum Yi,count) **Description:** Mean of y (sum y)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sy Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 • dif mea Difference of Means (bias) • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#97 A	**mape (Dimensionless)** = ZIDZ(Sum APE,count) **Description:** Mean Absolute Percent Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#108 A	**mse (Units*Units)** = dif mea + dif var + dif cov **Description:** Mean Square Error. The addition of the three components **Present In 1 View:** • 5. Calibration and tests **Used By** • rmse Root Mean Square Error • uc Covariance inequality proportion • um Bias inequality proportion • us Variance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#109 A	**MX2 (Units*Units)** = ZIDZ(SumX2,count) **Description:** Mean of x^2 (sum x^2)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sx Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#110 A	**Mxy (Units*Units)** = ZIDZ(SumXY,count) **Description:** Mean of x*y (sum x*y)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#111 A	**MY2 (Units*Units)** = ZIDZ(SumY2,count) **Description:** Mean of y^2 (sum y^2)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sy Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#118 F,A	**pick (Dimensionless)** = IF THEN ELSE(Y = NAREPLACEMENT :OR: X = NAREPLACEMENT, 0, 1)

		Description: Flag to id historical value available.Takes a value of one for every data point available **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • Yi Historical point entering calculations • count Counter for # of points • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#125 A	**r (Dimensionless)** = MIN(1,ZIDZ(Mxy-(M X*M Y),Sx*Sy)) **Description:** Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • r2 Correlation coefficient squared **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#131 A	**r2 (Dimensionless)** = r*r **Description:** Correlation coefficient squared **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#161 A	**residuals (Units)** = IF THEN ELSE(pick,Xi-Yi,NAREPLACEMENT) **Description:** Errors **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#165 A	**rmse (Units)** = SQRT(mse) **Description:** Root Mean Square Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#166 A	**RMSPE (Dimensionless)** = SQRT(ZIDZ(Sum SPE,count)) **Description:** Root Mean Square Percent Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#175 A	**simulated time series (Units)** = EEE commissioning **Description:** Dummy variable to id series **Present In 1 View:** • 5. Calibration and tests **Used By** • X Simulated time series values **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#176 A	**SSE (Units*Units)** = Sum XmY2 **Description:** Sum of Square Errors (x-y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#181 L	**Sum APE (Dimensionless)** = ∫(ABS((ZIDZ((Xi-Yi),Yi))))/dt dt + 0.0 **Description:** Sum of Absolute Percent Errors **Present In 1 View:** • 5. Calibration and tests **Used By** • mape Mean Absolute Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#186 L	**Sum SPE (Dimensionless)** = ∫((ZIDZ((Xi-Yi),Yi))*(ZIDZ((Xi-Yi),Yi)))/dt dt + 0.0 **Description:** Sum of Square Percent Errors ((x-y)/y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By**

		• RMSPE Root Mean Square Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#187 L	**Sum Xi (Units)** = ∫Xi/dt dt + 0.0 **Description:** Sum of x's (simulated) **Present In 1 View:** • 5. Calibration and tests **Used By** • M X Mean of x (sum x)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#188 L	**Sum XmY2 (Units*Units)** = ∫((Xi-Yi)*(Xi-Yi))/dt dt + 0.0 **Description:** Sum of Square Errors (x-y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** • SSE Sum of Square Errors (x-y)^2 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#189 L	**Sum Yi (Units)** = ∫Yi/dt dt + 0.0 **Description:** Sum of y's (historical) **Present In 1 View:** • 5. Calibration and tests **Used By** • M Y Mean of y (sum y)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#190 L	**SumX2 (Units*Units)** = ∫(Xi*Xi)/dt dt + 0.0 **Description:** Sum of x^2 (simulated) **Present In 1 View:** • 5. Calibration and tests **Used By** • MX2 Mean of x^2 (sum x^2)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#191 L	**SumXY (Units*Units)** = ∫(Xi*Yi)/dt dt + 0.0 **Description:** Sum of x*y **Present In 1 View:** • 5. Calibration and tests **Used By** • Mxy Mean of x*y (sum x*y)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#192 L	**SumY2 (Units*Units)** = ∫(Yi*Yi)/dt dt + 0.0 **Description:** Sum of y^2 (historical) **Present In 1 View:** • 5. Calibration and tests **Used By** • MY2 Mean of y^2 (sum y^2)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#194 A	**Sx (Units)** = SQRT(MAX(0,MX2-(M X*M X))) **Description:** Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • dif var Difference of variances • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#195 A	**Sy (Units)** = SQRT(MAX(0,MY2-(M Y*M Y))) **Description:** Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • dif var Difference of variances • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#216	**uc (Dimensionless)**

	A	= ZIDZ(dif cov,mse) **Description:** Covariance inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#217 A	**um (Dimensionless)** = ZIDZ(dif mea,mse) **Description:** Bias inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#218 A	**us (Dimensionless)** = ZIDZ(dif var,mse) **Description:** Variance inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** • 1 - us One minus variance inequality proportion. Used to verify against UC **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#228 A	**X (Units)** = simulated time series **Description:** Simulated time series values **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • pick Flag to id historical value available.Takes a value of one for every data point available **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#229 F,A	**Xi (Units)** = pick*X **Description:** Simulated point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#230 A	**Y (Units)** = historical time series **Description:** Historical time series values **Present In 1 View:** • 5. Calibration and tests **Used By** • Yi Historical point entering calculations • pick Flag to id historical value available.Takes a value of one for every data point available **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#231 F,A	**Yi (Units)** = pick*Y **Description:** Historical point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Group) .depreciation (15 Variables)
Group	Type	*Variable Name And Description*
.depreciation	#12 F,A	**average EEE value (USD/unit)** = EEE unit price - average EEE age * EEE depreciation ratio **Description:** Average monetary value of first use EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • Total historical first use EEE value Total historical value of first use EEE. • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#18 A	**decomissioned EEE outflows (unit/year)** = (WEEE not recycled + WEEE recycling) / EEE average unit weight + remanufacturing + second use commissioning

		Description: In unit per year equivalent **Present In 1 View:** • Depreciation (incomplete) **Used By** • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#19 A	**decommissioned EEE average outflow price (USD/unit)** = (WEEE average market value * ratio WEEE recycling from decomissioned EEE - WEEE costs for non recycling* ratio WEEE not being recycled from decomissioned EEE) * EEE average unit weight + remanufacturing contribution per unit * ratio remanufacturing from decommissioned EEE+ second use price* ratio second use comissioning from decommissioned EEE **Description:** Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#39 A	**EEE depreciation ratio (USD/year)** = ZIDZ ((EEE unit price - decommissioned EEE average outflow price) , average EEE age) **Description:** Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. **Present In 1 View:** • Depreciation (incomplete) **Used By** • average EEE value Average monetary value of first use EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#133 C	**ratio of EEE price for second use (dmnl)** = 0.3 **Description:** Fraction of the full price that customers are willing to pay for a second use product. **Present In 1 View:** • Depreciation (incomplete) **Used By** • second use price Second use price per unit **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#134 C	**ratio of reman contribution per unit (dmnl)** = 0.3 **Description:** Ratio of the contribution assumed for a remanufactured product in comparison to buying new. **Present In 1 View:** • Depreciation (incomplete) **Used By** • remanufacturing contribution per unit Remanufacturing contribution per unit of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#135 A	**ratio remanufacturing from decommissioned EEE (dmnl)** = ZIDZ (remanufacturing, decomissioned EEE outflows) **Description:** Ratio of available used EEE that flow into remanufacturing. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#136 A	**ratio second use comissioning from decommissioned EEE (dmnl)** = ZIDZ (second use commissioning, decomissioned EEE outflows) **Description:** Ratio of available used EEE that are commissioned for second use. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#137 A	**ratio WEEE not being recycled from decomissioned EEE (dmnl)** = ZIDZ (WEEE not recycled/EEE average unit weight, decomissioned EEE outflows) **Description:** Ratio of available used EEE that is not formally collected and, thus, not recycled. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#138 A	**ratio WEEE recycling from decomissioned EEE (dmnl)** = ZIDZ (WEEE recycling/EEE average unit weight, decomissioned EEE outflows) **Description:** Ratio of available used EEE that flow into recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling.

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#156 A	**remanufacturing contribution per unit (USD/unit)** = EEE unit price * ratio of reman contribution per unit **Description:** Remanufacturing contribution per unit of EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#174 A	**second use price (USD/unit)** = EEE unit price * ratio of EEE price for second use **Description:** Second use price per unit **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#208 A	**total first use EEE value (USD)** = First use EEE * average EEE value **Description:** Total value of first use EEE at a given moment in time. **Present In 1 View:** • Depreciation (incomplete) **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#209 L	**Total historical first use EEE value (USD)** = $\int$ average EEE value*First use EEE dt + 0.0 **Description:** Total historical value of first use EEE. **Present In 1 View:** • Depreciation (incomplete) **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#223 C	**WEEE costs for non recycling (USD/kg)** = 5 **Description:** Average sytemic costs assumed for note recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Group) .indicators (14 Variables)	
Group	Type	*Variable Name And Description*
.indicators	#88 A	**leakage of materials (1/year)** = ZIDZ (WEEE not recycled, Total materials in the system) **Description:** Indicator to check the ratio of materials leaving the system as WEEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#89 A	**leakage of products (1/year)** = ZIDZ(disposal of EEE as WEEE , Total products in the system) **Description:** Indicator to check the ratio of products leaving the system as WEEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#103 A	**max value EEE commissioning (unit/year)** = SAMPLE IF TRUE(EEE commissioning > max value EEE commissioning, EEE commissioning , EEE commissioning) **Description:** Provides the historical maximum value of EEE commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#104 A	**max value remanufacturing (unit/year)** = SAMPLE IF TRUE(remanufacturing > max value remanufacturing, remanufacturing , remanufacturing) **Description:** Provides the historical maximum value of remanufacturing. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#105 A	**max value second use commissioning (unit/year)** = SAMPLE IF TRUE(second use commissioning > max value second use commissioning, second use commissioning, second use commissioning)

		Description: Provides the historical maximum value of second use commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#106 A	**max value WEEE recycling (kg/year)** = SAMPLE IF TRUE(WEEE recycling > max value WEEE recycling, WEEE recycling , WEEE recycling) **Description:** Provides the historical maximum value of WEEE recycling. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#197 A	**time max value commissioning (year)** = SAMPLE IF TRUE(EEE commissioning >= max value EEE commissioning, Time , Time) **Description:** Provides the year of the historical maximum value of EEE commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#198 A	**time max value recycling (year)** = SAMPLE IF TRUE(WEEE recycling >= max value WEEE recycling, Time, Time) **Description:** Provides the year of the historical maximum value of WEEE recycling. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#199 A	**time max value remanufacturing (year)** = SAMPLE IF TRUE(remanufacturing >= max value remanufacturing, Time , Time) **Description:** Provides the year of the historical maximum value of remanufacturing. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#200 A	**time max value second use commissioning (year)** = SAMPLE IF TRUE(second use commissioning >= max value second use commissioning, Time , Time) **Description:** Provides the year of the historical maximum value of second use commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#212 A	**Total materials in the system (kg)** = Total products in the system * EEE average unit weight + WEEE before treatment **Description:** Counts the total stock of materials in the system **Present In 1 View:** • 5. Calibration and tests **Used By** • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#213 A	**Total products in the system (unit)** = Available used EEE + First use EEE + Second use EEE **Description:** Counts the total stock of products in the system **Present In 1 View:** • 5. Calibration and tests **Used By** • Total materials in the system Counts the total stock of materials in the system • leakage of products Indicator to check the ratio of products leaving the system as WEEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#215 A	**total value of Available WEEE (USD)** = WEEE before treatment * WEEE average market value **Description:** Total value of e-waste in the system at that moment **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#221 C	**WEEE average market value (USD/kg)** = 10 **Description:** Average market value of WEEE **Present In 2 Views:** • 5. Calibration and tests • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Group) .material supply (8 Variables)	
Group	Type	*Variable Name And Description*
.material supply	#4 A	**adjustment for stock of Processed material (kg/year)** = (desired stock of processed material - Processed material)/stock adjustment time **Description:** Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction rate considering minimum stock Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.material supply	#26 A	**desired extraction rate (kg/year)** = MAX (0, (expected EEE demand - expected material kept in the system)) **Description:** Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction rate considering minimum stock Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#27 C	**desired stock lenght of processed material (year)** = 1 **Description:** Coverage (in time equivalent) of the stock of processed material considering the actual EEE demand **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#28 SM,A	**desired stock of processed material (kg)** = SMOOTH(expected EEE demand * desired stock lenght of processed material, distribution time) **Description:** A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#47 SM,A	**expected EEE demand (kg/year)** = SMOOTH (EEE demand * EEE average unit weight, distribution time) **Description:** Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#50 SM,A	**expected material kept in the system (kg/year)** = SMOOTH(remanufacturing * EEE average unit weight, reman time) + SMOOTH (WEEE recycling, recycling time) **Description:** Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#52 A	**extraction rate considering minimum stock (kg/year)** = adjustment for stock of Processed material + desired extraction rate **Description:** Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.material supply	#177 C	**stock adjustment time (year)** = 1 **Description:** Time taken to adjust stock of processed material, i.e. every x year the stock is readjusted. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered.

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
Top	(Group) .model checking (17 Variables)	
Group	Type	*Variable Name And Description*
.model checking	#16 A	**current stock of EEE (unit)** = First use EEE + Available used EEE + Second use EEE **Description:** Sum of all the stocks of EEE. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#17 A	**current stock of material (kg)** = Raw material + Processed material + Non recycled WEEE + WEEE before treatment **Description:** Sum of all the stocks of material. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#40 F,A	**EEE inflows (unit/year)** = EEE commissioning + first use decommissioning because faulty + first use decommissioning before broken+ second use commissioning + second use decommissioning + remanufacturing **Description:** Rate of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE inflows Sum of all EEE inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#41 F,A	**EEE outflows (unit/year)** = first use decommissioning because faulty + first use decommissioning before broken +second use commissioning + second use decommissioning + remanufacturing + disposal of EEE as WEEE **Description:** Rate of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE outflows Sum of all EEE outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#42 A	**EEE per household (unit/house)** = Total EEE in use / total households **Description:** Average number of stock in use (first and second use) per household **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#43 A	**EEE per inhabitant (unit/inhabitant)** = Total EEE in use / population **Description:** Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#46 A	**error households adoption (house)** = EEE adopters + Potential EEE adopters - total households **Description:** This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#79 A	**initial stock of EEE (unit)** = initial stock of first use EEE + initial stock of available used EEE + initial stock of second use EEE **Description:** Sum of initial stocks of EEE. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#81 A	**initial stock of material (kg)** = initial stock of raw material + initial stock of processed material + initial stock of WEEE before treatment+ initial stock of non recycled WEEE **Description:** Sum of initial stocks of material. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model	#98	**mass balance EEE (unit)**

checking	A	= Sum of all EEE inflows + initial stock of EEE - Sum of all EEE outflows - current stock of EEE **Description:** Mass-balance check of EEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#99 A	**mass balance material (kg)** = Sum of all material inflows + initial stock of material - Sum of all material outflows- current stock of material **Description:** Mass balance check of material **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#100 F,A	**material inflows (kg/year)** = extraction + WEEE recycling + disposal of EEE as WEEE * EEE average unit weight + WEEE not recycled **Description:** Rate of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material inflows Sum of all material inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#101 F,A	**material outflows (kg/year)** = extraction + EEE commissioning * EEE average unit weight + WEEE not recycled + WEEE recycling **Description:** Rate of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material outflows Sum of all material outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#182 L	**Sum of all EEE inflows (unit)** $= \int \text{EEE inflows}\, dt + 0.0$ **Description:** Sum of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#183 L	**Sum of all EEE outflows (unit)** $= \int \text{EEE outflows}\, dt + 0.0$ **Description:** Sum of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#184 L	**Sum of all material inflows (kg)** $= \int \text{material inflows}\, dt + 0.0$ **Description:** Sum of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#185 L	**Sum of all material outflows (kg)** $= \int \text{material outflows}\, dt + 0.0$ **Description:** Sum of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Group) .retrospective (14 Variables)	
Group	Type	*Variable Name And Description*
.retrospective	#36 C,F	**EEE average unit weight (kg/unit)** = EXTERNAL_DATA("EEE average unit weight") **Description:** Average unit weight of EEE. **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • Total materials in the system Counts the total stock of materials in the system • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent

		• decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#44 C	**EEE unit price (USD/unit)** = EXTERNAL_DATA("EEE unit price") **Description:** Historial prices of flat panel television **Present In 1 View:** • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. • average EEE value Average monetary value of first use EEE • remanufacturing contribution per unit Remanufacturing contribution per unit of EEE • second use price Second use price per unit **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#45 C	**effect of normalised PPP on average number of EEE per adopter (unit/house)** = EXTERNAL_DATA("effect of normalised PPP on average number of EEE per adopter") **Description:** Defines the effect of the purchasing power parity per capta on the average number of EEE one adopter unit (household or inhabitant) need and can afford at the point in time. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#67 C	**historic disposal of EEE (unit/year)** = EXTERNAL_DATA("historic disposal of EEE") **Description:** Historical value of annual EEE disposal in a specific country.[obtained externally, drives the model] **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#68 C	**historic EEE put on market (unit/year)** = EXTERNAL_DATA("historic EEE put on market") **Description:** Historical value of EEE commisioned in specific country.[obtained externally] **Present In 1 View:** • 5. Calibration and tests **Used By** • historical time series Dummy variable to id series **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#70 A	**household increase trend (1/year)** = TREND(total households, TIME STEP, 0.01) **Description:** Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. **Present In 1 View:** • 1. Technology adoption **Used By** • total households variation Variation of households considering the trend from historical values. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#116 A	**normalised PPP (dmnl)** = purchasing power parity per capta / PPP 1980 **Description:** Normalised value of purchasing power parity considering the value at the initial time as reference. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#119 C	**population (inhabitant)** = EXTERNAL_DATA("population") **Description:** Total number of inhabitants at that moment[obtained externally, drives the model] **Present In 1 View:** • 5. Calibration and tests **Used By** • EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#120 C	**potential adoption fraction (dmnl)** = EXTERNAL_DATA("potential adoption fraction") **Description:** Potential ratio of the population (household or inhabitant) that are impeled to adopt the technology considering the price and their earnings. **Present In 1 View:** • 1. Technology adoption

		Used By • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#122 A	**PPP 1980 (USD)** = GET DATA AT TIME(purchasing power parity per capta, 1980) **Description:** Reference value for purchasing power parity per capta. Value at initial time is used as reference. **Present In 1 View:** • 1. Technology adoption **Used By** • normalised PPP Normalised value of purchasing power parity considering the value at the initial time as reference. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#124 C	**purchasing power parity per capta (USD)** = EXTERNAL_DATA("purchasing power parity per capta") **Description:** Reference used to measure the real purchasing power in different regions.[obtained externally, drives the model] **Present In 1 View:** • 1. Technology adoption **Used By** • PPP 1980 Reference value for purchasing power parity per capta. Value at initial time is used as reference. • normalised PPP Normalised value of purchasing power parity considering the value at the initial time as reference. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#129 C	**R EEE per adopter (unit/house)** = EXTERNAL_DATA("R EEE per adopter") **Description:** Historical value of number of EEE unities per adopter[defined by the retrospective model] **Present In 1 View:** • 1. Technology adoption **Used By** • max EEE desired Represents the maximum EEE unities that one population unity (household or inhabitant) need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#210 C	**total households (house)** = EXTERNAL_DATA("total households") **Description:** Total number of households at that moment[obtained externally, drives the model] **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • EEE per household Average number of stock in use (first and second use) per household • actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology. • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. • household increase trend Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. • initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time • initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time. • total households variation Variation of households considering the trend from historical values. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#211 A	**total households variation (house/year)** = household increase trend * total households **Description:** Variation of households considering the trend from historical values. **Present In 1 View:** • 1. Technology adoption **Used By** • new potential adopters Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Group) .technology adoption (19 Variables)	
Group	Type	*Variable Name And Description*
.technology adoption	#2 A	**actual adoption fraction (dmnl)** = EEE adopters / total households **Description:** Actual ratio of the population (household or inhabitant) that has adopted the technology. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.technology adoption	#3 DE,A	**additional purchases (unit/year)** = DELAY1(MAX (gap from EEE in use to desired, 0), time to realise additional need) **Description:** The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Present In 1 View:** • 1. Technology adoption **Used By**

		• EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.technology adoption	#5 A	**adoption purchases (unit/year)** = adoption rate * number of purchases when adopting **Description:** Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#6 F,A	**adoption rate (house/year)** = MAX (potential adoption fraction - actual adoption fraction, 0) * total households **Description:** Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.technology adoption	#11 A	**average EEE desired per adopter (unit/house)** = MIN (effect of normalised PPP on average number of EEE per adopter * normalised PPP,max EEE desired) **Description:** Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Present In 1 View:** • 1. Technology adoption **Used By** • desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#25 A	**desired EEE (unit)** = EEE adopters * average EEE desired per adopter **Description:** Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. **Present In 1 View:** • 1. Technology adoption **Used By** • gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#35 L	**EEE adopters (house)** $= \int$ adoption rate dt + initial adopters **Description:** Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology. • desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.technology adoption	#38 A	**EEE demand (unit/year)** = adoption purchases + additional purchases + recurrent purchases to replace **Description:** Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Present In 2 Views:** • 1. Technology adoption • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,291 (72.6%) (+) 648 [7,28] (-) 643 [5,29]
.technology adoption	#66 A	**gap from EEE in use to desired (unit)** = desired EEE - Total EEE in use **Description:** Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Present In 1 View:** • 1. Technology adoption **Used By** • additional purchases The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.technology	#75	**initial adopters (house)**

adoption	LI,A	= initial adopters fraction * total households **Description:** Population number (household or inhabitant) that already adopted the technology at the initial time **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#76 C	**initial adopters fraction (dmnl)** = 0 **Description:** Population ratio (household or inhabitant) that already adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time • initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#77 LI,A	**initial potential adopters (house)** = (1 - initial adopters fraction) * total households **Description:** Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#102 A	**max EEE desired (unit/house)** = GET DATA AT TIME (R EEE per adopter, 2015) **Description:** Represents the maximum EEE unities that one population unity (household or inhabitant) need and can historically afford. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#113 F,A	**new potential adopters (house/year)** = total households variation **Description:** Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#117 C	**number of purchases when adopting (unit/house)** = 1 **Description:** Represents the average EEE unities that one population unity (household or inhabitant) buy when adopting the technology. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#121 L	**Potential EEE adopters (house)** = $\int$ new potential adopters-adoption rate *dt* + initial potential adopters **Description:** Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#143 A	**recurrent purchases to replace (unit/year)** = disposal of EEE as WEEE **Description:** Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 710 (39.9%) (+) 355 [7,27] (-) 355 [5,26]
.technology adoption	#204 A	**time to realise additional need (year)** = TIME STEP **Description:** Average time taken by customers to realise they need additional EEE products **Present In 1 View:** • 1. Technology adoption **Used By** • additional purchases The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative.

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.technology adoption | #207 A

Total EEE in use (unit)
= First use EEE + Second use EEE
Description: Total EEE in use considering stock in first and second use
Present In 2 Views:

- 1. Technology adoption
- 5. Calibration and tests

Used By

- EEE per household Average number of stock in use (first and second use) per household
- EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/
- gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time.

Feedback Loops: 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]

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(Group) circularEEE v.1 prospective (1 Variables)

Group	Type	*Variable Name And Description*
circularEEE v.1 prospective	#128 C	**R EEE in use (unit)**

= EXTERNAL_DATA("R EEE in use")
Description: Value of EEE in use obtained from the retrospective model.Equivalent to all EEE in a country.
Present In 0 Views:

Used By

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

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(Type) Level (26 Variables)

Group	Type	*Variable Name And Description*
.EEE and WEEE flows	#7 L	**Available used EEE (unit)**

$= \int$ ((((first use decommissioning because faulty+first use decommissioning before broken)+second use decommissioning)-disposal of EEE as WEEE)-remanufacturing)-second use commissioning *dt* + initial stock of available used EEE
Description: Stock of used EEE available after first and second use
Present In 3 Views:

- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests

Used By

- Total products in the system Counts the total stock of products in the system
- average decommissioned EEE age Average age of the stock of decommissioned EEE
- current stock of EEE Sum of all the stocks of EEE.
- disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate.
- increase in age of available used EEE Increase rate in the total age of the stock of available used EEE
- remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).
- second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).

Feedback Loops: 1,555 (87.5%) (+) 790 [4,28] (-) 765 [2,29]

.Theil | #15 L

count (Dimensionless)
$= \int$ pick/dt *dt* + 0.0
Description: Counter for # of points
Present In 1 View:

- 5. Calibration and tests

Used By

- M X Mean of x (sum x)/n
- M Y Mean of y (sum y)/n
- MX2 Mean of x^2 (sum x^2)/n
- MY2 Mean of y^2 (sum y^2)/n
- Mxy Mean of x*y (sum x*y)/n
- RMSPE Root Mean Square Percent Error
- mape Mean Absolute Percent Error

Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.technology adoption | #35 L

EEE adopters (house)
$= \int$ adoption rate *dt* + initial adopters
Description: Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology.
Present In 2 Views:

- 1. Technology adoption
- 5. Calibration and tests

Used By

- actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology.
- desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time.
- error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'.

Feedback Loops: 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]

.EEE and WEEE flows | #56 L,F

First use EEE (unit)
$= \int$ ((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken *dt* + initial stock of first use EEE
Description: Stock of EEE in first use
Present In 5 Views:

- 1. Technology adoption
- 2. EEE and WEEE flows
- 4. Ageing
- 5. Calibration and tests
- Depreciation (incomplete)

		Used By • Total EEE in use Total EEE in use considering stock in first and second use • Total historical first use EEE value Total historical value of first use EEE. • Total products in the system Counts the total stock of products in the system • average EEE age Average age of the stock of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • current stock of EEE Sum of all the stocks of EEE. • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]
.EEE and WEEE flows	#114 L	**Non recycled WEEE (kg)** $= \int$ WEEE not recycled dt + initial stock of non recycled WEEE **Description:** Stock of non-recycled WEEE. Sink of the system. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#121 L	**Potential EEE adopters (house)** $= \int$ new potential adopters-adoption rate dt + initial potential adopters **Description:** Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#123 L	**Processed material (kg)** $= \int$ (extraction+WEEE recycling)-(EEE commissioning*EEE average unit weight) dt + initial stock of processed material **Description:** Stock of processed material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. • current stock of material Sum of all the stocks of material. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#139 L	**Raw material (kg)** $= \int$ -extraction dt + initial stock of raw material **Description:** Stock of raw material available **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • current stock of material Sum of all the stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#172 L	**Second use EEE (unit)** $= \int$ second use commissioning-second use decommissioning dt + initial stock of second use EEE **Description:** Stock of EEE in second use **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total products in the system Counts the total stock of products in the system • average age of useful products Average age of the combination of the stocks of first use and second use EEE • average second use EEE age Average age of the stock of second use EEE • current stock of EEE Sum of all the stocks of EEE. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,061 (59.7%) (+) 541 [4,28] (-) 520 [2,29]
.Theil	#181 L	**Sum APE (Dimensionless)** $= \int$ (ABS((ZIDZ((Xi-Yi),Yi))))/dt dt + 0.0 **Description:** Sum of Absolute Percent Errors **Present In 1 View:** • 5. Calibration and tests

		Used By • mape Mean Absolute Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#182 L	**Sum of all EEE inflows (unit)** $= \int$ EEE inflows dt + 0.0 **Description:** Sum of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#183 L	**Sum of all EEE outflows (unit)** $= \int$ EEE outflows dt + 0.0 **Description:** Sum of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#184 L	**Sum of all material inflows (kg)** $= \int$ material inflows dt + 0.0 **Description:** Sum of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#185 L	**Sum of all material outflows (kg)** $= \int$ material outflows dt + 0.0 **Description:** Sum of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#186 L	**Sum SPE (Dimensionless)** $= \int$ ((ZIDZ((Xi-Yi),Yi))*(ZIDZ((Xi-Yi),Yi)))/dt dt + 0.0 **Description:** Sum of Square Percent Errors ((x-y)/y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** • RMSPE Root Mean Square Percent Error **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#187 L	**Sum Xi (Units)** $= \int$ Xi/dt dt + 0.0 **Description:** Sum of x's (simulated) **Present In 1 View:** • 5. Calibration and tests **Used By** • M X Mean of x (sum x)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#188 L	**Sum XmY2 (Units*Units)** $= \int$ ((Xi-Yi)*(Xi-Yi))/dt dt + 0.0 **Description:** Sum of Square Errors (x-y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** • SSE Sum of Square Errors (x-y)^2 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#189 L	**Sum Yi (Units)** $= \int$ Yi/dt dt + 0.0 **Description:** Sum of y's (historical) **Present In 1 View:** • 5. Calibration and tests **Used By** • M Y Mean of y (sum y)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#190 L	**SumX2 (Units*Units)** $= \int$ (Xi*Xi)/dt dt + 0.0 **Description:** Sum of x^2 (simulated) **Present In 1 View:** • 5. Calibration and tests

		Used By • MX2 Mean of x^2 (sum x^2)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#191 L	**SumXY (Units*Units)** = $\int$(Xi*Yi)/dt *dt* + 0.0 **Description:** Sum of x*y **Present In 1 View:** • 5. Calibration and tests **Used By** • Mxy Mean of x*y (sum x*y)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#192 L	**SumY2 (Units*Units)** = $\int$(Yi*Yi)/dt *dt* + 0.0 **Description:** Sum of y^2 (historical) **Present In 1 View:** • 5. Calibration and tests **Used By** • MY2 Mean of y^2 (sum y^2)/n **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#205 L	**Total age of available used EEE (year)** = $\int$increase in age of available used EEE-decrease in age of available used EEE *dt* + 0.0 **Description:** Total age of the stock of available used EEE in years **Present In 1 View:** • 4. Ageing **Used By** • average decommissioned EEE age Average age of the stock of decommissioned EEE **Feedback Loops:** 1,585 (89.1%) (+) 804 [6,28] (-) 781 [3,29]
.EEE obsolescence	#206 L	**Total age of first use EEE (year)** = $\int$increase in age of first use EEE-decrease in age of first use EEE *dt* + 0.0 **Description:** Total age of the stock of first use EEE in years **Present In 1 View:** • 4. Ageing **Used By** • average EEE age Average age of the stock of first use EEE **Feedback Loops:** 919 (51.7%) (+) 460 [5,28] (-) 459 [3,29]
.depreciation	#209 L	**Total historical first use EEE value (USD)** = $\int$average EEE value*First use EEE *dt* + 0.0 **Description:** Total historical value of first use EEE. **Present In 1 View:** • Depreciation (incomplete) **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#214 L	**Total time of second use EEE (year)** = $\int$increase in age of second use EEE-decrease in age of second use EEE *dt* + 0.0 **Description:** Total age of the stock of second use EEE in years **Present In 1 View:** • 4. Ageing **Used By** • average second use EEE age Average age of the stock of second use EEE **Feedback Loops:** 725 (40.8%) (+) 374 [7,28] (-) 351 [3,29]
.EEE and WEEE flows	#222 L	**WEEE before treatment (kg)** = $\int$((disposal of EEE as WEEE*EEE average unit weight)-WEEE not recycled)-WEEE recycling *dt* + initial stock of WEEE before treatment **Description:** Stock of WEEE available before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Total materials in the system Counts the total stock of materials in the system • WEEE not recycled Rate of WEEE which is not recycled • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • current stock of material Sum of all the stocks of material. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 3 (0.2%) (+) 0 [0,0] (-) 3 [2,4]

Top	(Type) Smooth (3 Variables)	
Group	Type	*Variable Name And Description*
.material supply	#28 SM,A	**desired stock of processed material (kg)** = SMOOTH(expected EEE demand * desired stock lenght of processed material, distribution time) **Description:** A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By**

		• adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#47 SM,A	**expected EEE demand (kg/year)** = SMOOTH (EEE demand * EEE average unit weight, distribution time) **Description:** Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#50 SM,A	**expected material kept in the system (kg/year)** = SMOOTH(remanufacturing * EEE average unit weight, reman time) + SMOOTH (WEEE recycling, recycling time) **Description:** Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Type) Delay (10 Variables)	
Group	Type	*Variable Name And Description*
.technology adoption	#3 DE,A	**additional purchases (unit/year)** = DELAY1(MAX (gap from EEE in use to desired, 0), time to realise additional need) **Description:** The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE • material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Feedback Loops:** 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.EEE and WEEE flows	#37 DE,F,A	**EEE commissioning (unit/year)** = DELAY1(EEE demand, distribution time) **Description:** Commissioning rate of processed material into EEE.Responds to EEE demand. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • EEE inflows Rate of all EEE inflows. • First use EEE Stock of EEE in first use • Processed material Stock of processed material available • material outflows Rate of all material outflows. • max value EEE commissioning Provides the historical maximum value of EEE commissioning. • simulated time series Dummy variable to id series • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 573 (32.2%) (+) 285 [7,28] (-) 288 [6,29]
.EEE and WEEE flows	#51 DE,F,A	**extraction (kg/year)** = DELAY1 (MAX (extraction rate considering minimum stock, 0) , time to extract) **Description:** Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • Raw material Stock of raw material available • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]

.EEE and WEEE flows	#54 DE,F,A	**first use decommissioning because faulty** (unit/year) = DELAY1 (First use EEE * decommissioning probability in the end of life for first use* (1 - fraction of decomissioned before broken) , time to make available) **Description:** Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,146 (64.5%) (+) 568 [4,28] (-) 578 [2,29]
.EEE and WEEE flows	#55 DE,F,A	**first use decommissioning before broken** (unit/year) = DELAY1(First use EEE * fraction of decomissioned before broken , (expected lifetime for decommissioning before broken+time to make available)) **Description:** Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 610 (34.3%) (+) 305 [4,28] (-) 305 [2,29]
.EEE and WEEE flows	#155 DE,F,A	**remanufacturing** (unit/year) = MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • max value remanufacturing Provides the historical maximum value of remanufacturing. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]
.EEE and WEEE flows	#170 DE,F,A	**second use commissioning** (unit/year) = DELAY1(Available used EEE * fraction introduced to second use market , redistribution time) **Description:** Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • max value second use commissioning Provides the historical maximum value of second use commissioning. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]
.EEE and WEEE flows	#171 DE,F,A	**second use decommissioning** (unit/year) = DELAY1(Second use EEE * decommissioning probability in the end of life for second use, time to make available) **Description:** Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows

		• 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 949 (53.4%) (+) 492 [4,28] (-) 457 [2,29]
.EEE and WEEE flows	#225 DE,F,A	**WEEE recycling (kg/year)** = (DELAY1(WEEE before treatment * fraction of WEEE formally collected , recycling time) + recycling of EEE from remanufacturing process) * recyclability EEE **Description:** Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • max value WEEE recycling Provides the historical maximum value of WEEE recycling. • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]

Top		(Type) Level Initial (9 Variables)
Group	Type	***Variable Name And Description***
.technology adoption	#75 LI,A	**initial adopters (house)** = initial adopters fraction * total households **Description:** Population number (household or inhabitant) that already adopted the technology at the initial time **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#77 LI,A	**initial potential adopters (house)** = (1 - initial adopters fraction) * total households **Description:** Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#78 LI,C	**initial stock of available used EEE (unit)** = 0 **Description:** Initial stock of available used EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#80 LI,C	**initial stock of first use EEE (unit)** = 0 **Description:** Initial stock of first use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • First use EEE Stock of EEE in first use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#82 LI,C	**initial stock of non recycled WEEE (kg)** = 0 **Description:** Initial stock of non recycled WEEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE	#83	**initial stock of processed material (kg)**

flows	LI,C	= 0 **Description:** Initial stock of processed material. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#84 LI,C	**initial stock of raw material (kg)** = 1e+08 **Description:** Initial stock of raw material **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Raw material Stock of raw material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#85 LI,C	**initial stock of second use EEE (unit)** = 0 **Description:** Initial stock of second use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Second use EEE Stock of EEE in second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#86 LI,C	**initial stock of WEEE before treatment (kg)** = 0 **Description:** Initial stock of WEEE before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • WEEE before treatment Stock of WEEE available before treatment • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Type) Initial (0 Variables)	
Group	Type	*Variable Name And Description*

Top	(Type) Constant (49 Variables)	
Group	Type	*Variable Name And Description*
.material supply	#27 C	**desired stock lenght of processed material (year)** = 1 **Description:** Coverage (in time equivalent) of the stock of processed material considering the actual EEE demand **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#36 C,F	**EEE average unit weight (kg/unit)** = EXTERNAL_DATA("EEE average unit weight") **Description:** Average unit weight of EEE. **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • Total materials in the system Counts the total stock of materials in the system • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#44 C	**EEE unit price (USD/unit)** = EXTERNAL_DATA("EEE unit price") **Description:** Historial prices of flat panel television **Present In 1 View:** • Depreciation (incomplete) **Used By**

		• EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. • average EEE value Average monetary value of first use EEE • remanufacturing contribution per unit Remanufacturing contribution per unit of EEE • second use price Second use price per unit **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#45 C	**effect of normalised PPP on average number of EEE per adopter (unit/house)** = EXTERNAL_DATA("effect of normalised PPP on average number of EEE per adopter") **Description:** Defines the effect of the purchasing power parity per capta on the average number of EEE one adopter unit (household or inhabitant) need and can afford at the point in time. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#62 C	**fraction of decomissioned before broken (dmnl)** = 0 **Description:** Fraction of products that will be decommissioned for reasons other than functional obsolescence **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#67 C	**historic disposal of EEE (unit/year)** = EXTERNAL_DATA("historic disposal of EEE") **Description:** Historical value of annual EEE disposal in a specific country.[obtained externally, drives the model] **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#68 C	**historic EEE put on market (unit/year)** = EXTERNAL_DATA("historic EEE put on market") **Description:** Historical value of EEE commisioned in specific country.[obtained externally] **Present In 1 View:** • 5. Calibration and tests **Used By** • historical time series Dummy variable to id series **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#74 C	**infra development initial year (year)** = 2015 **Description:** Mechanism used to verify the implementation of increasing/decreasing infrastructure (initial year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level • repairing infrastructure level Defines the repairing infrastructure implementation level • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#76 C	**initial adopters fraction (dmnl)** = 0 **Description:** Population ratio (household or inhabitant) that already adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time • initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#78 LI,C	**initial stock of available used EEE (unit)** = 0 **Description:** Initial stock of available used EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#80 LI,C	**initial stock of first use EEE (unit)** = 0 **Description:** Initial stock of first use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests

		Used By • First use EEE Stock of EEE in first use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#82 LI,C	**initial stock of non recycled WEEE (kg)** = 0 **Description:** Initial stock of non recycled WEEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#83 LI,C	**initial stock of processed material (kg)** = 0 **Description:** Initial stock of processed material. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#84 LI,C	**initial stock of raw material (kg)** = 1e+08 **Description:** Initial stock of raw material **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Raw material Stock of raw material available • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#85 LI,C	**initial stock of second use EEE (unit)** = 0 **Description:** Initial stock of second use EEE **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Second use EEE Stock of EEE in second use • initial stock of EEE Sum of initial stocks of EEE. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#86 LI,C	**initial stock of WEEE before treatment (kg)** = 0 **Description:** Initial stock of WEEE before treatment **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • WEEE before treatment Stock of WEEE available before treatment • initial stock of material Sum of initial stocks of material. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#91 C	**lifetime fraction for decommissioning before broken (dmnl)** = 0.5 **Description:** Determines the fraction of the lifetime of an EEE that a user will keep the product before buying a new one for other reasons than functional obsolescence **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for decommissioning before broken average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#92 C	**lifetime fraction for reman products (dmnl)** = 0.8 **Description:** Determines the fraction of the lifetime of an EEE that a consumer expects for a remanufactured product **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • lifetime expected for reman products Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#93 C	**lifetime fraction for second use (dmnl)** = 0.5 **Description:** Determines the fraction of the lifetime of an EEE that a consumer expects for a product in second use **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for second use Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#94 C	**lifetime ratio (dmnl)** = 1 **Description:** Mechanism used to verify the design of EEE holding increased lifetimes **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • weibull scale The weibull scale defines the lifetime at which 63.2% of units will fail. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#117 C	**number of purchases when adopting (unit/house)** = 1 **Description:** Represents the average EEE unities that one population unity (household or inhabitant) buy when adopting the technology. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#119 C	**population (inhabitant)** = EXTERNAL_DATA("population") **Description:** Total number of inhabitants at that moment[obtained externally, drives the model] **Present In 1 View:** • 5. Calibration and tests **Used By** • EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#120 C	**potential adoption fraction (dmnl)** = EXTERNAL_DATA("potential adoption fraction") **Description:** Potential ratio of the population (household or inhabitant) that are impeled to adopt the technology considering the price and their earnings. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#124 C	**purchasing power parity per capta (USD)** = EXTERNAL_DATA("purchasing power parity per capta") **Description:** Reference used to measure the real purchasing power in different regions.[obtained externally, drives the model] **Present In 1 View:** • 1. Technology adoption **Used By** • PPP 1980 Reference value for purchasing power parity per capta. Value at initial time is used as reference. • normalised PPP Normalised value of purchasing power parity considering the value at the initial time as reference. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#126 C	**R desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing repairing infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#127 C	**R desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing repairing infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
circularEEE v.1 prospective	#128 C	**R EEE in use (unit)** = EXTERNAL_DATA("R EEE in use") **Description:** Value of EEE in use obtained from the retrospective model.Equivalent to all EEE in a country. **Present In 0 Views:** **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#129 C	**R EEE per adopter (unit/house)** = EXTERNAL_DATA("R EEE per adopter") **Description:** Historical value of number of EEE unities per adopter[defined by the retrospective model] **Present In 1 View:** • 1. Technology adoption **Used By** • max EEE desired Represents the maximum EEE unities that one population unity (household or inhabitant) need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#130 C	**R initial level (dmnl)** = 0

		Description: Mechanism used to verify the implementation of different levels of initial repairing infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repairing infrastructure level Defines the repairing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#132 C	**rate of ageing (year/(year*unit))** = 1 **Description:** Rate of age gain by EEE unit per year passed **Present In 1 View:** • 4. Ageing **Used By** • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#133 C	**ratio of EEE price for second use (dmnl)** = 0.3 **Description:** Fraction of the full price that customers are willing to pay for a second use product. **Present In 1 View:** • Depreciation (incomplete) **Used By** • second use price Second use price per unit **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#134 C	**ratio of reman contribution per unit (dmnl)** = 0.3 **Description:** Ratio of the contribution assumed for a remanufactured product in comparison to buying new. **Present In 1 View:** • Depreciation (incomplete) **Used By** • remanufacturing contribution per unit Remanufacturing contribution per unit of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#140 C	**RC desired level (dmnl)** = 4 **Description:** Mechanism used to verify the implementation of increasing/decreasing recycling infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#141 C	**RC desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing recycling infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#142 C	**RC initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial recycling infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#144 C	**recyclability EEE (dmnl)** = 0.37 **Description:** Defines the ratio of products that, entering the recycling process, will be recycled.Considers the physical treatment and chemical recovery processes available. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#154 C	**remanufacturability EEE (dmnl)** = 0.8 **Description:** Defines the ratio of products that, entering the remanufacturing process, will be remanufactured.Considers that some products (or parts thereof) will be recycled instead because these are broken beyond restauration, or will be broken during the process. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year).

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#162 C	**RM desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing remanufacturing infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#163 C	**RM desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing remanufacturing infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#164 C	**RM initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial remanufacturing infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#177 C	**stock adjustment time (year)** = 1 **Description:** Time taken to adjust stock of processed material, i.e. every x year the stock is readjusted. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#178 C	**SU desired level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of increasing/decreasing second use infrastructure (final level of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#179 C	**SU desired year (year)** = 2030 **Description:** Mechanism used to verify the implementation of increasing/decreasing second use infrastructure (final year of implementation) **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#180 C	**SU initial level (dmnl)** = 0 **Description:** Mechanism used to verify the implementation of different levels of initial second use infrastructure **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#193 C	**switch infra development (dmnl)** = 0 **Description:** Switch to turn on/off the bechanism to verify implementation of increasing/decreasing infrastructures **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • recycling infrastructure level Defines the recycling infrastructure implementation level • remanufacturing infrastructure level Defines the remanufacturing infrastructure implementation level • repairing infrastructure level Defines the repairing infrastructure implementation level • second use infrastructure level Defines the second use infrastructure implementation level **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#210 C	**total households (house)** = EXTERNAL_DATA("total households") **Description:** Total number of households at that moment[obtained externally, drives the model] **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • EEE per household Average number of stock in use (first and second use) per household • actual adoption fraction Actual ratio of the population (household or inhabitant) that has adopted the technology.

		• adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). • error households adoption This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. • household increase trend Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. • initial adopters Population number (household or inhabitant) that already adopted the technology at the initial time • initial potential adopters Population number (household or inhabitant) that has not yet adopted the technology at the initial time. • total households variation Variation of households considering the trend from historical values. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#221 C	**WEEE average market value (USD/kg)** = 10 **Description:** Average market value of WEEE **Present In 2 Views:** • 5. Calibration and tests • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • total value of Available WEEE Total value of e-waste in the system at that moment **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#223 C	**WEEE costs for non recycling (USD/kg)** = 5 **Description:** Average sytemic costs assumed for note recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#227 C	**weibull shape (dmnl)** = 2.01 **Description:** The weibull shape parameter identifies the failure rate pattern through time. This parameter defines decreasing (β<1), constant (β=1), or increasing (β>1) failure rates over the product's lifetime **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • mean lifetime Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Type) Flow (29 Variables)	
Group	Type	*Variable Name And Description*
.technology adoption	#6 F,A	**adoption rate (house/year)** = MAX (potential adoption fraction - actual adoption fraction, 0) * total households **Description:** Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchases when one adopts. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.depreciation	#12 F,A	**average EEE value (USD/unit)** = EEE unit price - average EEE age * EEE depreciation ratio **Description:** Average monetary value of first use EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • Total historical first use EEE value Total historical value of first use EEE. • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.EEE obsolescence	#22 F,A	**decrease in age of available used EEE (dmnl)** = second use commissioning * average decommissioned EEE age + disposal of EEE as WEEE * average decommissioned EEE age + remanufacturing * average decommissioned EEE age **Description:** Decrease rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 250 (14.1%) (+) 113 [8,26] (-) 137 [3,27]
.EEE obsolescence	#23 F,A	**decrease in age of first use EEE (dmnl)** = first use decommissioning because faulty * average EEE age + first use decommissioning before broken* expected lifetime for decommissioning before broken **Description:** Decrease rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 323 (18.2%) (+) 149 [5,28] (-) 174 [3,29]
.EEE obsolescence	#24 F,A	**decrease in age of second use EEE (dmnl)** = second use decommissioning * average second use EEE age **Description:** Decrease rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 65 (3.7%) (+) 30 [14,25] (-) 35 [3,26]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE • material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Feedback Loops:** 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.Theil	#34 F,A	**dt (Time Units)** = TIME STEP **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • count Counter for # of points **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#36 C,F	**EEE average unit weight (kg/unit)** = EXTERNAL_DATA("EEE average unit weight") **Description:** Average unit weight of EEE. **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • Total materials in the system Counts the total stock of materials in the system • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and	#37	**EEE commissioning (unit/year)**

WEEE flows	DE,F,A	= DELAY1(EEE demand, distribution time) **Description:** Commissioning rate of processed material into EEE.Responds to EEE demand. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • EEE inflows Rate of all EEE inflows. • First use EEE Stock of EEE in first use • Processed material Stock of processed material available • material outflows Rate of all material outflows. • max value EEE commissioning Provides the historical maximum value of EEE commissioning. • simulated time series Dummy variable to id series • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 573 (32.2%) (+) 285 [7,28] (-) 288 [6,29]
.model checking	#40 F,A	**EEE inflows (unit/year)** = EEE commissioning + first use decommissioning because faulty + first use decommissioning before broken+ second use commissioning + second use decommissioning + remanufacturing **Description:** Rate of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE inflows Sum of all EEE inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#41 F,A	**EEE outflows (unit/year)** = first use decommissioning because faulty + first use decommissioning before broken +second use commissioning + second use decommissioning + remanufacturing + disposal of EEE as WEEE **Description:** Rate of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE outflows Sum of all EEE outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#51 DE,F,A	**extraction (kg/year)** = DELAY1 (MAX (extraction rate considering minimum stock, 0) , time to extract) **Description:** Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • Raw material Stock of raw material available • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#54 DE,F,A	**first use decommissioning because faulty (unit/year)** = DELAY1 (First use EEE * decommissioning probability in the end of life for first use* (1 - fraction of decomissioned before broken) , time to make available) **Description:** Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,146 (64.5%) (+) 568 [4,28] (-) 578 [2,29]
.EEE and WEEE flows	#55 DE,F,A	**first use decommissioning before broken (unit/year)** = DELAY1(First use EEE * fraction of decomissioned before broken , (expected lifetime for decommissioning before broken+time to make available)) **Description:** Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 610 (34.3%) (+) 305 [4,28] (-) 305 [2,29]
.EEE and WEEE flows	#56 L,F	**First use EEE (unit)** = $\int$((EEE commissioning+remanufacturing)-first use decommissioning because faulty)-first use decommissioning before broken *dt* + initial stock of first use EEE **Description:** Stock of EEE in first use **Present In 5 Views:** • 1. Technology adoption

		• 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Total EEE in use Total EEE in use considering stock in first and second use • Total historical first use EEE value Total historical value of first use EEE. • Total products in the system Counts the total stock of products in the system • average EEE age Average age of the stock of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • current stock of EEE Sum of all the stocks of EEE. • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 1,410 (79.3%) (+) 713 [4,28] (-) 697 [2,29]
.EEE obsolescence	#71 F,A	**increase in age of available used EEE (dmnl)** = Available used EEE * rate of ageing + first use decommissioning because faulty * average EEE age+ first use decommissioning before broken* expected lifetime for decommissioning before broken + second use decommissioning * average second use EEE age **Description:** Increase rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 1,335 (75.1%) (+) 691 [6,28] (-) 644 [8,29]
.EEE obsolescence	#72 F,A	**increase in age of first use EEE (dmnl)** = First use EEE * rate of ageing + remanufacturing * virtual age after reman **Description:** Increase rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 596 (33.5%) (+) 311 [6,28] (-) 285 [7,29]
.EEE obsolescence	#73 F,A	**increase in age of second use EEE (dmnl)** = Second use EEE * rate of ageing + second use commissioning * virtual age after repair **Description:** Increase rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 660 (37.1%) (+) 344 [7,28] (-) 316 [6,29]
.model checking	#100 F,A	**material inflows (kg/year)** = extraction + WEEE recycling + disposal of EEE as WEEE * EEE average unit weight + WEEE not recycled **Description:** Rate of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material inflows Sum of all material inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#101 F,A	**material outflows (kg/year)** = extraction + EEE commissioning * EEE average unit weight + WEEE not recycled + WEEE recycling **Description:** Rate of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material outflows Sum of all material outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#113 F,A	**new potential adopters (house/year)** = total households variation **Description:** Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#118 F,A	**pick (Dimensionless)** = IF THEN ELSE(Y = NAREPLACEMENT :OR: X = NAREPLACEMENT, 0, 1) **Description:** Flag to id historical value available.Takes a value of one for every data point available **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • Yi Historical point entering calculations • count Counter for # of points • residuals Errors

		Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#155 DE,F,A	**remanufacturing (unit/year)** = MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • max value remanufacturing Provides the historical maximum value of remanufacturing. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]
.EEE and WEEE flows	#170 DE,F,A	**second use commissioning (unit/year)** = DELAY1(Available used EEE * fraction introduced to second use market , redistribution time) **Description:** Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • max value second use commissioning Provides the historical maximum value of second use commissioning. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]
.EEE and WEEE flows	#171 DE,F,A	**second use decommissioning (unit/year)** = DELAY1(Second use EEE * decommissioning probability in the end of life for second use, time to make available) **Description:** Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 949 (53.4%) (+) 492 [4,28] (-) 457 [2,29]
.EEE and WEEE flows	#224 F,A	**WEEE not recycled (kg/year)** = WEEE before treatment * fraction of WEEE not formally collected / collection time + non recycled WEEE because of recyclability **Description:** Rate of WEEE which is not recycled **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decommissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.EEE and WEEE flows	#225 DE,F,A	**WEEE recycling (kg/year)** = (DELAY1(WEEE before treatment * fraction of WEEE formally collected , recycling time) + recycling of EEE from remanufacturing process) * recyclability EEE **Description:** Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through

		time (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • max value WEEE recycling Provides the historical maximum value of WEEE recycling. • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.Theil	#229 F,A	**Xi (Units)** = pick*X **Description:** Simulated point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#231 F,A	**Yi (Units)** = pick*Y **Description:** Historical point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top (Type) Auxiliary (145 Variables)

Group	Type	*Variable Name And Description*
.Theil	#1 A	**1 - us (Dimensionless)** = 1 - us **Description:** One minus variance inequality proportion. Used to verify against UC **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#2 A	**actual adoption fraction (dmnl)** = EEE adopters / total households **Description:** Actual ratio of the population (household or inhabitant) that has adopted the technology. **Present In 1 View:** • 1. Technology adoption **Used By** • adoption rate Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.technology adoption	#3 DE,A	**additional purchases (unit/year)** = DELAY1(MAX (gap from EEE in use to desired, 0), time to realise additional need) **Description:** The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.material supply	#4 A	**adjustment for stock of Processed material (kg/year)** = (desired stock of processed material - Processed material)/stock adjustment time **Description:** Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By**

		• extraction rate considering minimum stock Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.technology adoption	#5 A	**adoption purchases (unit/year)** = adoption rate * number of purchases when adopting **Description:** Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#6 F,A	**adoption rate (house/year)** = MAX (potential adoption fraction - actual adoption fraction, 0) * total households **Description:** Ratio of adoption to the technology. Relies on the difference among the potential adoption fraction and the actual adoption fraction multiplied by the total population (households or individuals)† Units inconsistency due to the structure set to drive the technology adoption model. The comparison among the potential adoption fraction (dmnl) obtained from the retrospective model and the actual adoption (dmnl) fraction multiplied by the total households (house) defines the adoption rate at that moment in time (house/year). **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. • adoption purchases Adoption purchases happen at the moment that a fraction of the population (households or inhabitants) adopt the technology. Relies on the number of adopters and the average number of purchages when one adopts. **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [3,3]
.EEE obsolescence	#8 A	**average age of useful products (year/unit)** = ZIDZ ((average EEE age * First use EEE + average second use EEE age * Second use EEE) , (First use EEE + Second use EEE)) **Description:** Average age of the combination of the stocks of first use and second use EEE **Present In 1 View:** • 4. Ageing **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#9 A	**average decommissioned EEE age (year/unit)** = ZIDZ (Total age of available used EEE, Available used EEE) **Description:** Average age of the stock of decommissioned EEE **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • virtual age after reman Corresponds to the new average age of EEE products after remanufacturing. • virtual age after repair Corresponds to the new average age of EEE products after repairing. **Feedback Loops:** 1,705 (95.9%) (+) 868 [5,28] (-) 837 [3,29]
.EEE obsolescence	#10 A	**average EEE age (year/unit)** = ZIDZ (Total age of first use EEE , First use EEE) **Description:** Average age of the stock of first use EEE **Present In 3 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. • average EEE value Average monetary value of first use EEE • average age of useful products Average age of the combination of the stocks of first use and second use EEE • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 1,178 (66.3%) (+) 595 [4,28] (-) 583 [3,29]
.technology adoption	#11 A	**average EEE desired per adopter (unit/house)** = MIN (effect of normalised PPP on average number of EEE per adopter * normalised PPP,max EEE desired) **Description:** Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Present In 1 View:** • 1. Technology adoption **Used By** • desired EEE Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#12 F,A	**average EEE value (USD/unit)** = EEE unit price - average EEE age * EEE depreciation ratio **Description:** Average monetary value of first use EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • Total historical first use EEE value Total historical value of first use EEE. • total first use EEE value Total value of first use EEE at a given moment in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.EEE obsolescence	#13 A	**average second use EEE age (year/unit)** = ZIDZ (Total time of second use EEE, Second use EEE) **Description:** Average age of the stock of second use EEE **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • average age of useful products Average age of the combination of the stocks of first use and second use EEE • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 891 (50.1%) (+) 461 [6,28] (-) 430 [3,29]
.EEE and WEEE flows	#14 A	**collection time (year)** = 2 * distribution time **Description:** Time to collect decommissioned EEE **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE not recycled Rate of WEEE which is not recycled • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#16 A	**current stock of EEE (unit)** = First use EEE + Available used EEE + Second use EEE **Description:** Sum of all the stocks of EEE. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#17 A	**current stock of material (kg)** = Raw material + Processed material + Non recycled WEEE + WEEE before treatment **Description:** Sum of all the stocks of material. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#18 A	**decomissioned EEE outflows (unit/year)** = (WEEE not recycled + WEEE recycling) / EEE average unit weight + remanufacturing + second use commissioning **Description:** In unit per year equivalent **Present In 1 View:** • Depreciation (incomplete) **Used By** • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#19 A	**decommissioned EEE average outflow price (USD/unit)** = (WEEE average market value * ratio WEEE recycling from decomissioned EEE - WEEE costs for non recycling* ratio WEEE not being recycled from decomissioned EEE) * EEE average unit weight + remanufacturing contribution per unit * ratio remanufacturing from decommissioned EEE+ second use price* ratio second use comissioning from decommissioned EEE **Description:** Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • EEE depreciation ratio Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#20 A	**decommissioning probability in the end of life for first use (dmnl)** = weibull shape / weibull scale * (average EEE age/weibull scale) ^ (weibull shape-1) **Description:** The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 880 (49.5%) (+) 440 [4,28] (-) 440 [6,29]
.EEE obsolescence	#21 A	**decommissioning probability in the end of life for second use (dmnl)** = EXP ((- (average second use EEE age / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^weibull shape)) **Description:** The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 2 Views:**

		• 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 785 (44.2%) (+) 408 [5,28] (-) 377 [4,29]
.EEE obsolescence	#22 F,A	**decrease in age of available used EEE (dmnl)** = second use commissioning * average decommissioned EEE age + disposal of EEE as WEEE * average decommissioned EEE age + remanufacturing * average decommissioned EEE age **Description:** Decrease rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 250 (14.1%) (+) 113 [8,26] (-) 137 [3,27]
.EEE obsolescence	#23 F,A	**decrease in age of first use EEE (dmnl)** = first use decommissioning because faulty * average EEE age + first use decommissioning before broken* expected lifetime for decommissioning before broken **Description:** Decrease rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 323 (18.2%) (+) 149 [5,28] (-) 174 [3,29]
.EEE obsolescence	#24 F,A	**decrease in age of second use EEE (dmnl)** = second use decommissioning * average second use EEE age **Description:** Decrease rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 65 (3.7%) (+) 30 [14,25] (-) 35 [3,26]
.technology adoption	#25 A	**desired EEE (unit)** = EEE adopters * average EEE desired per adopter **Description:** Represents the total EEE unities needed by the population (household or inhabitant) at the point in time. **Present In 1 View:** • 1. Technology adoption **Used By** • gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#26 A	**desired extraction rate (kg/year)** = MAX (0, (expected EEE demand - expected material kept in the system)) **Description:** Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction rate considering minimum stock Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#28 SM,A	**desired stock of processed material (kg)** = SMOOTH(expected EEE demand * desired stock lenght of processed material, distribution time) **Description:** A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • adjustment for stock of Processed material Represents the adjustment of the stock comparing the desired stock to the actual stock of processed materials available.An information lag consistent to the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#29 A	**dif cov (Units*Units)** = 2*Sx*Sy*(1-r) **Description:** Difference of covariances **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • uc Covariance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#30 A	**dif mea (Units*Units)** = (M X-M Y)*(M X-M Y) **Description:** Difference of Means (bias) **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • um Bias inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.Theil	#31 A	**dif var (Units*Units)** = (Sx-Sy)*(Sx-Sy) **Description:** Difference of variances **Present In 1 View:** • 5. Calibration and tests **Used By** • mse Mean Square Error. The addition of the three components • us Variance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#32 DE,F,A	**disposal of EEE as WEEE (unit/year)** = DELAY1(Available used EEE * fraction introduced to WEEE market , collection time) **Description:** Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Present In 4 Views:** • 1. Technology adoption • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE outflows Rate of all EEE outflows. • WEEE before treatment Stock of WEEE available before treatment • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • leakage of products Indicator to check the ratio of products leaving the system as WEEE • material inflows Rate of all material inflows. • recurrent purchases to replace Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Feedback Loops:** 996 (56.0%) (+) 498 [7,28] (-) 498 [2,29]
.EEE and WEEE flows	#33 A	**distribution time (year)** = TIME STEP **Description:** Time to distribute commissioned EEE.Is used in the model as a default process time value. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand. • collection time Time to collect decommissioned EEE • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. • expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • recycling time Time to recycle collected WEEE. • redistribution time Time to redistribute available used EEE. • reman time Time to remanufacture available used EEE. • time to extract Time to extract raw material into processed material. • time to make available Time to make obsolete products available for second use, remanufacturing or collection. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#34 F,A	**dt (Time Units)** = TIME STEP **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated) • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • count Counter for # of points **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#37 DE,F,A	**EEE commissioning (unit/year)** = DELAY1(EEE demand, distribution time) **Description:** Commissioning rate of processed material into EEE.Responds to EEE demand. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • EEE inflows Rate of all EEE inflows. • First use EEE Stock of EEE in first use • Processed material Stock of processed material available • material outflows Rate of all material outflows. • max value EEE commissioning Provides the historical maximum value of EEE commissioning. • simulated time series Dummy variable to id series • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 573 (32.2%) (+) 285 [7,28] (-) 288 [6,29]
.technology adoption	#38 A	**EEE demand (unit/year)** = adoption purchases + additional purchases + recurrent purchases to replace **Description:** Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Present In 2 Views:** • 1. Technology adoption • 2. EEE and WEEE flows **Used By** • EEE commissioning Commissioning rate of processed material into EEE.Responds to EEE demand.

		• expected EEE demand Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 1,291 (72.6%) (+) 648 [7,28] (-) 643 [5,29]
.depreciation	#39 A	**EEE depreciation ratio (USD/year)** = ZIDZ ((EEE unit price - decommissioned EEE average outflow price) , average EEE age) **Description:** Annual decrease in value of first use assets considering the possibilities for restauration and costs of not recycling when customers decommission it. **Present In 1 View:** • Depreciation (incomplete) **Used By** • average EEE value Average monetary value of first use EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#40 F,A	**EEE inflows (unit/year)** = EEE commissioning + first use decommissioning because faulty + first use decommissioning before broken+ second use commissioning + second use decommissioning + remanufacturing **Description:** Rate of all EEE inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE inflows Sum of all EEE inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#41 F,A	**EEE outflows (unit/year)** = first use decommissioning because faulty + first use decommissioning before broken +second use commissioning + second use decommissioning + remanufacturing + disposal of EEE as WEEE **Description:** Rate of all EEE outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all EEE outflows Sum of all EEE outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#42 A	**EEE per household (unit/house)** = Total EEE in use / total households **Description:** Average number of stock in use (first and second use) per household **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#43 A	**EEE per inhabitant (unit/inhabitant)** = Total EEE in use / population **Description:** Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#46 A	**error households adoption (house)** = EEE adopters + Potential EEE adopters - total households **Description:** This variable represents the error on the adoption submodel comparing to the total population.As the adoption submodel comprises two stocks ('EEE adopters' and 'Potential EEE adopters'), these should sum equal to 'total households' during the whole simulation.Error is due to the use of the TREND function in the 'household increase trend' to define 'households variation'. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#47 SM,A	**expected EEE demand (kg/year)** = SMOOTH (EEE demand * EEE average unit weight, distribution time) **Description:** Represents the EEE demand rate. Actors obtain information from market prospects.An information lag consistent to the average time for distribution of products is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative • desired stock of processed material A desired stock of processed material consistent to EEE demand and considering a defined desired lenght of material is kept.An information lag consistent to the distribution time is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#48 A	**expected lifetime for decommissioning before broken (year/unit)** = lifetime fraction for decommissioning before broken * mean lifetime **Description:** average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 3 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommissioning probability because owner has bought a new product before the former was faulty or broken.

		• increase in age of available used EEE Increase rate in the total age of the stock of available used EEE Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#49 A	**expected lifetime for second use (year/unit)** = mean lifetime * lifetime fraction for second use **Description:** Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.material supply	#50 SM,A	**expected material kept in the system (kg/year)** = SMOOTH(remanufacturing * EEE average unit weight, reman time) + SMOOTH (WEEE recycling, recycling time) **Description:** Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • desired extraction rate Represents the rate at which the industry intends to extract material, sufficient to attend EEE demand considering the material which is kept in the system through restauration processes.Extraction rate cannot be negative Feedback Loops: 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#51 DE,F,A	**extraction (kg/year)** = DELAY1 (MAX (extraction rate considering minimum stock, 0) , time to extract) **Description:** Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Present In 2 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests **Used By** • Processed material Stock of processed material available • Raw material Stock of raw material available • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. Feedback Loops: 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.material supply	#52 A	**extraction rate considering minimum stock (kg/year)** = adjustment for stock of Processed material + desired extraction rate **Description:** Represents the rate at which the industry intends to extract material considering a minimum stock of processed materials. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. Feedback Loops: 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.EEE and WEEE flows	#54 DE,F,A	**first use decommissioning because faulty (unit/year)** = DELAY1 (First use EEE * decommissioning probability in the end of life for first use* (1 - fraction of decomissioned before broken) , time to make available) **Description:** Decommissioning rate of EEE because of functional obsolescence.Responds to the decommissioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE Feedback Loops: 1,146 (64.5%) (+) 568 [4,28] (-) 578 [2,29]
.EEE and WEEE flows	#55 DE,F,A	**first use decommissioning before broken (unit/year)** = DELAY1(First use EEE * fraction of decomissioned before broken , (expected lifetime for decommissioning before broken+time to make available)) **Description:** Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decrease in age of first use EEE Decrease rate in the total age of the stock of first use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE Feedback Loops: 610 (34.3%) (+) 305 [4,28] (-) 305 [2,29]
.EEE obsolescence	#57 A	**fraction fit for reman (dmnl)** = EXP ((- ((virtual age after reman + lifetime expected for reman products) / weibull scale) ^ weibull shape) + ((virtual age after reman/ weibull scale) ^ weibull shape)) **Description:** Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function

		defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Feedback Loops:** 381 (21.4%) (+) 190 [7,28] (-) 191 [6,27]
.EEE obsolescence	#58 A	**fraction fit for second use (dmnl)** = EXP ((- ((virtual age after repair + expected lifetime for second use) / weibull scale) ^ weibull shape) + ((virtual age after repair/ weibull scale) ^ weibull shape)) **Description:** Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to second use market The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#59 A	**fraction introduced to reman market (dmnl)** = MIN (fraction fit for reman * reman market coverage, 1 - fraction introduced to second use market) **Description:** The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 762 (42.9%) (+) 381 [7,28] (-) 381 [6,29]
.EEE obsolescence	#60 A	**fraction introduced to second use market (dmnl)** = second hand market coverage * fraction fit for second use **Description:** The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to WEEE market The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 960 (54.0%) (+) 489 [7,28] (-) 471 [6,29]
.EEE obsolescence	#61 A	**fraction introduced to WEEE market (dmnl)** = 1 - (fraction introduced to second use market + fraction introduced to reman market) **Description:** The fraction of decommissioned EEE that will be introduced to the WEEE market depends on the existence of second-use and remanufacturing markets for those products. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • disposal of EEE as WEEE Rate of disposal of EEE as WEEE.† Units inconsistency due to the mechanism created to limit the disposal of EEE as WEEE considering second use and remanufacturing. This fraction defines the probability for the total stock to flow through this rate. **Feedback Loops:** 726 (40.8%) (+) 363 [7,28] (-) 363 [8,29]
.EEE obsolescence	#63 A	**fraction of WEEE formally collected (dmnl)** = fraction of WEEE formally collected_RSSDlookup(recycling infrastructure level) **Description:** Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • fraction of WEEE not formally collected Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#65 A	**fraction of WEEE not formally collected (dmnl)** = 1 - fraction of WEEE formally collected **Description:** Represents the ratio of WEEE that will not be formally collected for recycling because of insufficient information. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By**

		• WEEE not recycled Rate of WEEE which is not recycled **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#66 A	**gap from EEE in use to desired (unit)** = desired EEE - Total EEE in use **Description:** Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Present In 1 View:** • 1. Technology adoption **Used By** • additional purchases The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.Theil	#69 A	**historical time series (Units)** = historic EEE put on market **Description:** Dummy variable to id series **Present In 1 View:** • 5. Calibration and tests **Used By** • Y Historical time series values **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#70 A	**household increase trend (1/year)** = TREND(total households, TIME STEP, 0.01) **Description:** Trend estimate of households through time.† Units inconsistency due to the use of TIME STEP to verify the growth rate, emulating the derivative of households in at a given point in time. This justifies the use of '1/year' instead of 'house/year'. **Present In 1 View:** • 1. Technology adoption **Used By** • total households variation Variation of households considering the trend from historical values. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#71 F,A	**increase in age of available used EEE (dmnl)** = Available used EEE * rate of ageing + first use decommissioning because faulty * average EEE age+ first use decommissioning before broken* expected lifetime for decommissioning before broken + second use decommissioning * average second use EEE age **Description:** Increase rate in the total age of the stock of available used EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of available used EEE Total age of the stock of available used EEE in years **Feedback Loops:** 1,335 (75.1%) (+) 691 [6,28] (-) 644 [8,29]
.EEE obsolescence	#72 F,A	**increase in age of first use EEE (dmnl)** = First use EEE * rate of ageing + remanufacturing * virtual age after reman **Description:** Increase rate in the total age of the stock of first use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total age of first use EEE Total age of the stock of first use EEE in years **Feedback Loops:** 596 (33.5%) (+) 311 [6,28] (-) 285 [7,29]
.EEE obsolescence	#73 F,A	**increase in age of second use EEE (dmnl)** = Second use EEE * rate of ageing + second use commissioning * virtual age after repair **Description:** Increase rate in the total age of the stock of second use EEE **Present In 1 View:** • 4. Ageing **Used By** • Total time of second use EEE Total age of the stock of second use EEE in years **Feedback Loops:** 660 (37.1%) (+) 344 [7,28] (-) 316 [6,29]
.technology adoption	#75 LI,A	**initial adopters (house)** = initial adopters fraction * total households **Description:** Population number (household or inhabitant) that already adopted the technology at the initial time **Present In 1 View:** • 1. Technology adoption **Used By** • EEE adopters Stock of adopters. Relies on the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#77 LI,A	**initial potential adopters (house)** = (1 - initial adopters fraction) * total households **Description:** Population number (household or inhabitant) that has not yet adopted the technology at the initial time. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#79 A	**initial stock of EEE (unit)** = initial stock of first use EEE + initial stock of available used EEE + initial stock of second use EEE **Description:** Sum of initial stocks of EEE. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance EEE Mass-balance check of EEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#81 A	**initial stock of material (kg)** = initial stock of raw material + initial stock of processed material + initial stock of WEEE before treatment+ initial stock of non recycled WEEE

		Description: Sum of initial stocks of material. **Present In 1 View:** • 5. Calibration and tests **Used By** • mass balance material Mass balance check of material **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#88 A	**leakage of materials (1/year)** = ZIDZ (WEEE not recycled, Total materials in the system) **Description:** Indicator to check the ratio of materials leaving the system as WEEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#89 A	**leakage of products (1/year)** = ZIDZ(disposal of EEE as WEEE , Total products in the system) **Description:** Indicator to check the ratio of products leaving the system as WEEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#90 A	**lifetime expected for reman products (year/unit)** = mean lifetime * lifetime fraction for reman products **Description:** Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#95 A	**M X (Units)** = ZIDZ(Sum Xi,count) **Description:** Mean of x (sum x)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sx Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 • dif mea Difference of Means (bias) • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#96 A	**M Y (Units)** = ZIDZ(Sum Yi,count) **Description:** Mean of y (sum y)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sy Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 • dif mea Difference of Means (bias) • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#97 A	**mape (Dimensionless)** = ZIDZ(Sum APE,count) **Description:** Mean Absolute Percent Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#98 A	**mass balance EEE (unit)** = Sum of all EEE inflows + initial stock of EEE - Sum of all EEE outflows - current stock of EEE **Description:** Mass-balance check of EEE **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#99 A	**mass balance material (kg)** = Sum of all material inflows + initial stock of material - Sum of all material outflows- current stock of material **Description:** Mass balance check of material **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#100 F,A	**material inflows (kg/year)** = extraction + WEEE recycling + disposal of EEE as WEEE * EEE average unit weight + WEEE not recycled

		Description: Rate of all material inflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material inflows Sum of all material inflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.model checking	#101 F,A	**material outflows (kg/year)** = extraction + EEE commissioning * EEE average unit weight + WEEE not recycled + WEEE recycling **Description:** Rate of all material outflows. **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum of all material outflows Sum of all material outflows. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#102 A	**max EEE desired (unit/house)** = GET DATA AT TIME (R EEE per adopter, 2015) **Description:** Represents the maximum EEE unities that one population unity (household or inhabitant) need and can historically afford. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#103 A	**max value EEE commissioning (unit/year)** = SAMPLE IF TRUE(EEE commissioning > max value EEE commissioning, EEE commissioning , EEE commissioning) **Description:** Provides the historical maximum value of EEE commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value commissioning Provides the year of the historical maximum value of EEE commissioning. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#104 A	**max value remanufacturing (unit/year)** = SAMPLE IF TRUE(remanufacturing > max value remanufacturing, remanufacturing , remanufacturing) **Description:** Provides the historical maximum value of remanufacturing. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#105 A	**max value second use commissioning (unit/year)** = SAMPLE IF TRUE(second use commissioning > max value second use commissioning, second use commissioning, second use commissioning) **Description:** Provides the historical maximum value of second use commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#106 A	**max value WEEE recycling (kg/year)** = SAMPLE IF TRUE(WEEE recycling > max value WEEE recycling, WEEE recycling , WEEE recycling) **Description:** Provides the historical maximum value of WEEE recycling. **Present In 1 View:** • 5. Calibration and tests **Used By** • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#107 A	**mean lifetime (year/unit)** = EXP (GAMMA LN(1/weibull shape + 1)) * weibull scale **Description:** Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • expected lifetime for decommissioning before broken average EEE age when decommissioned before brokenRepresents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs • expected lifetime for second use Represents how many years a new customer expects a second use EEE will function based on the mean lifetime of EEEs • lifetime expected for reman products Represents how many years a new customer expects a remanufactured EEE will function based on the mean lifetime of EEEs **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#108 A	**mse (Units*Units)** = dif mea + dif var + dif cov **Description:** Mean Square Error. The addition of the three components **Present In 1 View:** • 5. Calibration and tests **Used By** • rmse Root Mean Square Error • uc Covariance inequality proportion • um Bias inequality proportion • us Variance inequality proportion **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

.Theil	#109 A	**MX2 (Units*Units)** = ZIDZ(SumX2,count) **Description:** Mean of x^2 (sum x^2)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sx Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#110 A	**Mxy (Units*Units)** = ZIDZ(SumXY,count) **Description:** Mean of x*y (sum x*y)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#111 A	**MY2 (Units*Units)** = ZIDZ(SumY2,count) **Description:** Mean of y^2 (sum y^2)/n **Present In 1 View:** • 5. Calibration and tests **Used By** • Sy Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#113 F,A	**new potential adopters (house/year)** = total households variation **Description:** Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters. **Present In 1 View:** • 1. Technology adoption **Used By** • Potential EEE adopters Stock of potential adopters. Relies on new potential adopters minus the ones (households or inhabitants) that adopted the technology. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#115 A	**non recycled WEEE because of recyclability (kg/year)** = WEEE recycling * (1-recyclability EEE) **Description:** Rate of WEEE which is formally collected but is not recycled because of EEE recyclability **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE not recycled Rate of WEEE which is not recycled **Feedback Loops:** 1 (0.1%) (+) 0 [0,0] (-) 1 [4,4]
.retrospective	#116 A	**normalised PPP (dmnl)** = purchasing power parity per capta / PPP 1980 **Description:** Normalised value of purchasing power parity considering the value at the initial time as reference. **Present In 1 View:** • 1. Technology adoption **Used By** • average EEE desired per adopter Represents the average EEE unities that one population unity (household or inhabitant) need and can afford at the point in time.The value is limited by the maximum EEE unities one need and can historically afford. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#118 F,A	**pick (Dimensionless)** = IF THEN ELSE(Y = NAREPLACEMENT :OR: X = NAREPLACEMENT, 0, 1) **Description:** Flag to id historical value available.Takes a value of one for every data point available **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • Yi Historical point entering calculations • count Counter for # of points • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#122 A	**PPP 1980 (USD)** = GET DATA AT TIME(purchasing power parity per capta, 1980) **Description:** Reference value for purchasing power parity per capta. Value at initial time is used as reference. **Present In 1 View:** • 1. Technology adoption **Used By** • normalised PPP Normalised value of purchasing power parity considering the value at the initial time as reference. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#125 A	**r (Dimensionless)** = MIN(1,ZIDZ(Mxy-(M X*M Y),Sx*Sy)) **Description:** Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances

		• r2 Correlation coefficient squared **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#131 A	**r2 (Dimensionless)** = r*r **Description:** Correlation coefficient squared **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#135 A	**ratio remanufacturing from decommissioned EEE (dmnl)** = ZIDZ (remanufacturing, decomissioned EEE outflows) **Description:** Ratio of available used EEE that flow into remanufacturing. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#136 A	**ratio second use comissioning from decommissioned EEE (dmnl)** = ZIDZ (second use commissioning, decomissioned EEE outflows) **Description:** Ratio of available used EEE that are commissioned for second use. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#137 A	**ratio WEEE not being recycled from decomissioned EEE (dmnl)** = ZIDZ (WEEE not recycled/EEE average unit weight, decomissioned EEE outflows) **Description:** Ratio of available used EEE that is not formally collected and, thus, not recycled. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#138 A	**ratio WEEE recycling from decomissioned EEE (dmnl)** = ZIDZ (WEEE recycling/EEE average unit weight, decomissioned EEE outflows) **Description:** Ratio of available used EEE that flow into recycling. **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#143 A	**recurrent purchases to replace (unit/year)** = disposal of EEE as WEEE **Description:** Recurrent purchases to replace stem from the EEE that leave the system as WEEE. The ones that (re-)enter in second use or that are remanufactured are, thus, not considered. **Present In 1 View:** • 1. Technology adoption **Used By** • EEE demand Total EEE demand stems from the initial purchases when the population adopt the given technology and the additional and replacing purchases from adopters. **Feedback Loops:** 710 (39.9%) (+) 355 [7,27] (-) 355 [5,26]
.CE mechanisms	#145 A	**recycling infrastructure level (dmnl)** = RC initial level + switch infra development * RAMP((RC desired level-RC initial level)/(RC desired year-infra development initial year), infra development initial year, RC desired year) **Description:** Defines the recycling infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction of WEEE formally collected Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#146 A	**recycling of EEE from remanufacturing process (kg/year)** = remanufacturing * (1 - remanufacturability EEE) / remanufacturability EEE * EEE average unit weight **Description:** Defines the recycling rate from the remanufacturing process **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#147 A	**recycling time (year)** = 2 * distribution time **Description:** Time to recycle collected WEEE. **Present In 1 View:** • 2. EEE and WEEE flows

		Used By • WEEE recycling Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#148 A	**redistribution time (year)** = 2 * distribution time **Description:** Time to redistribute available used EEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • second use commissioning Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#149 A	**reman effectiveness (dmnl)** = reman effectiveness_RSSDlookup(remanufacturing infrastructure level) **Description:** The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • virtual age after reman Corresponds to the new average age of EEE products after remanufacturing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#151 A	**reman market coverage (dmnl)** = reman market coverage_RSSDlookup(remanufacturing infrastructure level) **Description:** The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to reman market The fraction of decommissioned EEE that will be introduced to the reman market depends on the reman market coverage and the fit of EEEs for remanufacturing. It also depends on the existence of second-use market for those products. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#153 A	**reman time (year)** = 2 * distribution time **Description:** Time to remanufacture available used EEE. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • remanufacturing Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#155 DE,F,A	**remanufacturing (unit/year)** = MIN(DELAY1(Available used EEE * fraction introduced to reman market * remanufacturability EEE, reman time), EEE demand) **Description:** Remanufactuing rate of available used EEE.Relies on the EEE introduced to reman market that is in fact remanufactured.Responds to EEE demand first than assembling.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • First use EEE Stock of EEE in first use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE • max value remanufacturing Provides the historical maximum value of remanufacturing. • ratio remanufacturing from decommissioned EEE Ratio of available used EEE that flow into remanufacturing. • recycling of EEE from remanufacturing process Defines the recycling rate from the remanufacturing process • time max value remanufacturing Provides the year of the historical maximum value of remanufacturing. **Feedback Loops:** 1,193 (67.1%) (+) 603 [4,28] (-) 590 [2,29]
.depreciation	#156 A	**remanufacturing contribution per unit (USD/unit)** = EEE unit price * ratio of reman contribution per unit **Description:** Remanufacturing contribution per unit of EEE **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE	#157	**remanufacturing infrastructure level (dmnl)**

mechanisms	A	= RM initial level + switch infra development * RAMP((RM desired level-RM initial level)/(RM desired year-infra development initial year), infra development initial year, RM desired year) **Description:** Defines the remanufacturing infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • reman effectiveness The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. • reman market coverage The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#158 A	**repair effectiveness (dmnl)** = repair effectiveness_RSSDlookup(repairing infrastructure level) **Description:** The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • virtual age after repair Corresponds to the new average age of EEE products after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.CE mechanisms	#160 A	**repairing infrastructure level (dmnl)** = R initial level + switch infra development * RAMP((R desired level-R initial level)/(R desired year-infra development initial year), infra development initial year, R desired year) **Description:** Defines the repairing infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repair effectiveness The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#161 A	**residuals (Units)** = IF THEN ELSE(pick,Xi-Yi,NAREPLACEMENT) **Description:** Errors **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#165 A	**rmse (Units)** = SQRT(mse) **Description:** Root Mean Square Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#166 A	**RMSPE (Dimensionless)** = SQRT(ZIDZ(Sum SPE,count)) **Description:** Root Mean Square Percent Error **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#168 A	**second hand market coverage (dmnl)** = second hand market coverage_RSSDlookup(second use infrastructure level) **Description:** The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • fraction introduced to second use market The fraction of decommissioned EEE that will be introduced to the second use market depends on the second use market coverage and fit of EEEs for second use **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#170 DE,F,A	**second use commissioning (unit/year)** = DELAY1(Available used EEE * fraction introduced to second use market , redistribution time) **Description:** Commissioning rate of used EEE into a new life† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 4 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decomissioned EEE outflows In unit per year equivalent • decrease in age of available used EEE Decrease rate in the total age of the stock of available used EEE • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE • max value second use commissioning Provides the historical maximum value of second use commissioning. • ratio second use comissioning from decommissioned EEE Ratio of available used EEE that are commissioned for second use.

		• time max value second use commissioning Provides the year of the historical maximum value of second use commissioning. **Feedback Loops:** 1,185 (66.6%) (+) 603 [4,28] (-) 582 [2,29]
.EEE and WEEE flows	#171 DE,F,A	**second use decommissioning (unit/year)** = DELAY1(Second use EEE * decommissioning probability in the end of life for second use, time to make available) **Description:** Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommissioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 4. Ageing • 5. Calibration and tests **Used By** • Available used EEE Stock of used EEE available after first and second use • EEE inflows Rate of all EEE inflows. • EEE outflows Rate of all EEE outflows. • Second use EEE Stock of EEE in second use • decrease in age of second use EEE Decrease rate in the total age of the stock of second use EEE • increase in age of available used EEE Increase rate in the total age of the stock of available used EEE **Feedback Loops:** 949 (53.4%) (+) 492 [4,28] (-) 457 [2,29]
.CE mechanisms	#173 A	**second use infrastructure level (dmnl)** = SU initial level + switch infra development * RAMP((SU desired level-SU initial level)/(SU desired year-infra development initial year), infra development initial year, SU desired year) **Description:** Defines the second use infrastructure implementation level **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second hand market coverage The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.depreciation	#174 A	**second use price (USD/unit)** = EEE unit price * ratio of EEE price for second use **Description:** Second use price per unit **Present In 1 View:** • Depreciation (incomplete) **Used By** • decommissioned EEE average outflow price Average outflow price of available used EEE considering the possibilities for second use, remanufacturing, recycling, and not-recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#175 A	**simulated time series (Units)** = EEE commissioning **Description:** Dummy variable to id series **Present In 1 View:** • 5. Calibration and tests **Used By** • X Simulated time series values **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#176 A	**SSE (Units*Units)** = Sum XmY2 **Description:** Sum of Square Errors (x-y)^2 **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#194 A	**Sx (Units)** = SQRT(MAX(0,MX2-(M X*M X))) **Description:** Standard Deviation of x. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • dif var Difference of variances • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#195 A	**Sy (Units)** = SQRT(MAX(0,MY2-(M Y*M Y))) **Description:** Standard Deviation of y. Calculated using the 'hand computation' formulato calculate the standard deviation without prior knowledge of the mean.Sterman (1984), pg. 64 **Present In 1 View:** • 5. Calibration and tests **Used By** • dif cov Difference of covariances • dif var Difference of variances • r Correlation coefficient. Calculated through the 'hand computation'.Sterman (1984) pg. 63MAX prevents numerical issues due to numerical precision; perhaps there is a better way to do this. -TF **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#197 A	**time max value commissioning (year)** = SAMPLE IF TRUE(EEE commissioning >= max value EEE commissioning, Time , Time) **Description:** Provides the year of the historical maximum value of EEE commissioning. **Present In 1 View:**

		• 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#198 A	**time max value recycling (year)** = SAMPLE IF TRUE(WEEE recycling >= max value WEEE recycling, Time, Time) **Description:** Provides the year of the historical maximum value of WEEE recycling. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#199 A	**time max value remanufacturing (year)** = SAMPLE IF TRUE(remanufacturing >= max value remanufacturing, Time , Time) **Description:** Provides the year of the historical maximum value of remanufacturing. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#200 A	**time max value second use commissioning (year)** = SAMPLE IF TRUE(second use commissioning >= max value second use commissioning, Time , Time) **Description:** Provides the year of the historical maximum value of second use commissioning. **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#202 A	**time to extract (year)** = 2 * distribution time **Description:** Time to extract raw material into processed material. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • extraction Extraction rate of raw material into processed material.Responds to the extraction rate considering minimum stock. A material delay of the time to extract is considered. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE and WEEE flows	#203 A	**time to make available (year)** = 1 * distribution time **Description:** Time to make obsolete products available for second use, remanufacturing or collection. **Present In 1 View:** • 2. EEE and WEEE flows **Used By** • first use decommissioning because faulty Decommissioning rate of EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). • first use decommissioning before broken Decommissioning rate of EEE because of psychological obsolescence.Responds to the decommisioning probability because owner has bought a new product before the former was faulty or broken. • second use decommissioning Decommissioning rate of used EEE because of functional obsolescence.Responds to the decommisioning probability because product has achieved the end of its functional life.† Units inconsistency due to probabilty unit (dmnl) obtained from the Weibull function used. The average probability (dmnl) for that given population (unit) at that moment in time defines the quantity of unities of the total stock flowing through this rate (unit/year). **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#204 A	**time to realise additional need (year)** = TIME STEP **Description:** Average time taken by customers to realise they need additional EEE products **Present In 1 View:** • 1. Technology adoption **Used By** • additional purchases The 'gap from EEE in use to desired' defines additional purchases from adopters. Purchases cannot be negative. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.technology adoption	#207 A	**Total EEE in use (unit)** = First use EEE + Second use EEE **Description:** Total EEE in use considering stock in first and second use **Present In 2 Views:** • 1. Technology adoption • 5. Calibration and tests **Used By** • EEE per household Average number of stock in use (first and second use) per household • EEE per inhabitant Average number of stock in use (first and second use) per inhabitant.Can be used to verify against: https://statistics-netherlands.shinyapps.io/sales_and_waste/ • gap from EEE in use to desired Represents the difference of EEE needed and in use by the population (households or inhabitants) at that moment in time. **Feedback Loops:** 581 (32.7%) (+) 293 [8,28] (-) 288 [6,29]
.depreciation	#208 A	**total first use EEE value (USD)** = First use EEE * average EEE value **Description:** Total value of first use EEE at a given moment in time. **Present In 1 View:** • Depreciation (incomplete) **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.retrospective	#211 A	**total households variation (house/year)** = household increase trend * total households

		Description: Variation of households considering the trend from historical values. **Present In 1 View:** • 1. Technology adoption **Used By** • new potential adopters Ratio of new potential adopters to the technology. Relies on the variation of the population (variation of households or inhabitants). Additional households or inhabitants start as potential adopters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#212 A	**Total materials in the system (kg)** = Total products in the system * EEE average unit weight + WEEE before treatment **Description:** Counts the total stock of materials in the system **Present In 1 View:** • 5. Calibration and tests **Used By** • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#213 A	**Total products in the system (unit)** = Available used EEE + First use EEE + Second use EEE **Description:** Counts the total stock of products in the system **Present In 1 View:** • 5. Calibration and tests **Used By** • Total materials in the system Counts the total stock of materials in the system • leakage of products Indicator to check the ratio of products leaving the system as WEEE **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.indicators	#215 A	**total value of Available WEEE (USD)** = WEEE before treatment * WEEE average market value **Description:** Total value of e-waste in the system at that moment **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#216 A	**uc (Dimensionless)** = ZIDZ(dif cov,mse) **Description:** Covariance inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#217 A	**um (Dimensionless)** = ZIDZ(dif mea,mse) **Description:** Bias inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#218 A	**us (Dimensionless)** = ZIDZ(dif var,mse) **Description:** Variance inequality proportion **Present In 1 View:** • 5. Calibration and tests **Used By** • 1 - us One minus variance inequality proportion. Used to verify against UC **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#219 A	**virtual age after reman (year/unit)** = average decommissioned EEE age * (1 - reman effectiveness) **Description:** Corresponds to the new average age of EEE products after remanufacturing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of first use EEE Increase rate in the total age of the stock of first use EEE **Feedback Loops:** 436 (24.5%) (+) 220 [7,28] (-) 216 [6,27]
.EEE obsolescence	#220 A	**virtual age after repair (year/unit)** = average decommissioned EEE age * (1 - repair effectiveness) **Description:** Corresponds to the new average age of EEE products after repairing. **Present In 2 Views:** • 3. (de) Commissioning and restauration probabilit • 4. Ageing **Used By** • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a

		probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • increase in age of second use EEE Increase rate in the total age of the stock of second use EEE **Feedback Loops:** 1,268 (71.3%) (+) 648 [5,28] (-) 620 [6,29]
.EEE and WEEE flows	#224 F,A	**WEEE not recycled (kg/year)** = WEEE before treatment * fraction of WEEE not formally collected / collection time + non recycled WEEE because of recyclability **Description:** Rate of WEEE which is not recycled **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Non recycled WEEE Stock of non-recycled WEEE. Sink of the system. • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • leakage of materials Indicator to check the ratio of materials leaving the system as WEEE • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • ratio WEEE not being recycled from decomissioned EEE Ratio of available used EEE that is not formally collected and, thus, not recycled. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.EEE and WEEE flows	#225 DE,F,A	**WEEE recycling (kg/year)** = (DELAY1(WEEE before treatment * fraction of WEEE formally collected , recycling time) + recycling of EEE from remanufacturing process) * recyclability EEE **Description:** Recycling rate of WEEERelies on the WEEE introduced to the recycling market that is in fact recycled.Units inconsistency due to the mechanisms created to determine the recycling potential of the system. This fraction (dmnl) defines the probability for the total stock (unit) to flow through this rate through time (unit/year). **Present In 3 Views:** • 2. EEE and WEEE flows • 5. Calibration and tests • Depreciation (incomplete) **Used By** • Processed material Stock of processed material available • WEEE before treatment Stock of WEEE available before treatment • decomissioned EEE outflows In unit per year equivalent • expected material kept in the system Represents the rate at which material is restored in the system. Actors obtain information from the remanufacturing and recycling processes.An information lag consistent to the average time of such processes is considered. • material inflows Rate of all material inflows. • material outflows Rate of all material outflows. • max value WEEE recycling Provides the historical maximum value of WEEE recycling. • non recycled WEEE because of recyclability Rate of WEEE which is formally collected but is not recycled because of EEE recyclability • ratio WEEE recycling from decomissioned EEE Ratio of available used EEE that flow into recycling. • time max value recycling Provides the year of the historical maximum value of WEEE recycling. **Feedback Loops:** 2 (0.1%) (+) 0 [0,0] (-) 2 [2,4]
.EEE obsolescence	#226 A	**weibull scale (dmnl)** = 11.75 * lifetime ratio **Description:** The weibull scale defines the lifetime at which 63.2% of units will fail. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • decommissioning probability in the end of life for first use The Weibull failure rate equation defines the decommissioning probability for first use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • decommissioning probability in the end of life for second use The Weibull failure rate equation defines the decommissioning probability for second use in the EEE end of life† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for reman Makes use of a conditional reliability function to determine fraction of EEE products fit for remanufacturing.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when remanufactured.Only those that meet the condition will be, in fact, remanufactured.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • fraction fit for second use Makes use of a conditional reliability function to determine the fraction of EEE products fit for second use.The conditional reliability function defines the probability of operating for a minimal lifetime expected by customers considering the conditions of the product when repaired.Only those prodcts that meet the condition will be, in fact, repaired.† Units inconsistency due to the use of the Weibull equation. It provides a probabilty (dmnl) based on the age of an asset (year/unit), and stablished parameters (dmnl). In this case, we are using the average age of a population, leading to the average probability for that given population. • mean lifetime Represents the average time that the EEE units in the population are expected to operate before failure.† Units inconsistency due to the use of the Weibull equation. It provides the mean lifetime of a given product (year/unit) based on the scale (dmnl) and shape (dmnl) parameters. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#228 A	**X (Units)** = simulated time series **Description:** Simulated time series values **Present In 1 View:** • 5. Calibration and tests **Used By** • Xi Simulated point entering calculations • pick Flag to id historical value available.Takes a value of one for every data point available **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#229 F,A	**Xi (Units)** = pick*X **Description:** Simulated point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum Xi Sum of x's (simulated)

		• Sum XmY2 Sum of Square Errors (x-y)^2 • SumX2 Sum of x^2 (simulated) • SumXY Sum of x*y • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#230 A	**Y (Units)** = historical time series **Description:** Historical time series values **Present In 1 View:** • 5. Calibration and tests **Used By** • Yi Historical point entering calculations • pick Flag to id historical value available.Takes a value of one for every data point available **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.Theil	#231 F,A	**Yi (Units)** = pick*Y **Description:** Historical point entering calculations **Present In 1 View:** • 5. Calibration and tests **Used By** • Sum APE Sum of Absolute Percent Errors • Sum SPE Sum of Square Percent Errors ((x-y)/y)^2 • Sum XmY2 Sum of Square Errors (x-y)^2 • Sum Yi Sum of y's (historical) • SumXY Sum of x*y • SumY2 Sum of y^2 (historical) • residuals Errors **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

Top	(Type) Subscripts (0 Variables)	
Group	Type	***Variable Name And Description***

Top	(Type) Data (0 Variables)	
Group	Type	***Variable Name And Description***

Top	(Type) Game (0 Variables)	
Group	Type	***Variable Name And Description***

Top	(Type) Lookup (5 Variables)	
Group	Type	***Variable Name And Description***
.EEE obsolescence	#64 A,T	**fraction of WEEE formally collected_RSSDlookup (dmnl)** fraction of WEEE formally collected_RSSDlookup([(0,0)-(4,1)],(0,0),(1,0.2),(2,0.4),(3,0.5),(4,0.8)) **Description:** Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Present In 2 Views:** • 2. EEE and WEEE flows • 3. (de) Commissioning and restauration probabilit **Used By** • fraction of WEEE formally collected Defines the recycling market coverage based on the 0-4 infrastructure level.The coverage defines the ratio of WEEE that will be formally collected for recycling. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#150 A,T	**reman effectiveness_RSSDlookup (dmnl)** reman effectiveness_RSSDlookup([(0,0)-(4,1)],(0,0),(1,0.3),(2,0.5),(3,0.7),(4,0.9)) **Description:** The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • reman effectiveness The reman effectiveness correspondent to the 0-4 infrastructure level.The reman effectiveness determines the restauration ratio of the repairing processes. For instance, if the average reman effectiveness is 0.8 (80%), the product will rejuvenate to 20% of its actual age after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#152 A,T	**reman market coverage_RSSDlookup (dmnl)** reman market coverage_RSSDlookup([(0,0)-(4,1)],(0,0),(1,0.2),(2,0.4),(3,0.6),(4,0.8)) **Description:** The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • reman market coverage The remanufacturing market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the reman market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE obsolescence	#159 A,T	**repair effectiveness_RSSDlookup (dmnl)** repair effectiveness_RSSDlookup([(0,0)-(4,1)],(0,0),(1,0.1),(2,0.2),(3,0.3),(4,0.4)) **Description:** The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • repair effectiveness The repair effectiveness correspondent to the 0-4 infrastructure level.The repair effectiveness determines the restauration ratio of the repairing processes. For instance, if the average repair effectiveness is 0.2 (20%), the product will rejuvenate to 80% of its actual age after repairing. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]
.EEE	#169	**second hand market coverage_RSSDlookup (dmnl)**

obsolescence	A,T	second hand market coverage_RSSDlookup([(0,0)-(4,1)],(0,0),(1,0.2),(2,0.4),(3,0.6),(4,0.8)) **Description:** The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Present In 1 View:** • 3. (de) Commissioning and restauration probabilit **Used By** • second hand market coverage The second hand market coverage correspondent the 0-4 infrastructure level.The coverage defines the ratio of EEE that will reach the second hand market. **Feedback Loops:** 0 (0.0%) (+) 0 [0,0] (-) 0 [0,0]

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All Variables (224)

Group	Type	Variable
.Theil	A	1 - us (Dimensionless)
.technology adoption	A	actual adoption fraction (dmnl)
.technology adoption	DE,A	additional purchases (unit/year)
.material supply	A	adjustment for stock of Processed material (kg/year)
.technology adoption	A	adoption purchases (unit/year)
.technology adoption	F,A	adoption rate (house/year)
.EEE and WEEE flows	L	Available used EEE (unit)
.EEE obsolescence	A	average age of useful products (year/unit)
.EEE obsolescence	A	average decommissioned EEE age (year/unit)
.EEE obsolescence	A	average EEE age (year/unit)
.technology adoption	A	average EEE desired per adopter (unit/house)
.depreciation	F,A	average EEE value (USD/unit)
.EEE obsolescence	A	average second use EEE age (year/unit)
.EEE and WEEE flows	A	collection time (year)
.Theil	L	count (Dimensionless)
.model checking	A	current stock of EEE (unit)
.model checking	A	current stock of material (kg)
.depreciation	A	decomissioned EEE outflows (unit/year)
.depreciation	A	decommissioned EEE average outflow price (USD/unit)
.EEE obsolescence	A	decommissioning probability in the end of life for first use (dmnl)
.EEE obsolescence	A	decommissioning probability in the end of life for second use (dmnl)
.EEE obsolescence	F,A	decrease in age of available used EEE (dmnl)
.EEE obsolescence	F,A	decrease in age of first use EEE (dmnl)
.EEE obsolescence	F,A	decrease in age of second use EEE (dmnl)
.technology adoption	A	desired EEE (unit)
.material supply	A	desired extraction rate (kg/year)
.material supply	C	desired stock lenght of processed material (year)
.material supply	SM,A	desired stock of processed material (kg)
.Theil	A	dif cov (Units*Units)
.Theil	A	dif mea (Units*Units)
.Theil	A	dif var (Units*Units)
.EEE and WEEE flows	DE,F,A	disposal of EEE as WEEE (unit/year)
.EEE and WEEE flows	A	distribution time (year)
.Theil	F,A	dt (Time Units)
.technology adoption	L	EEE adopters (house)
.retrospective	C,F	EEE average unit weight (kg/unit)
.EEE and WEEE flows	DE,F,A	EEE commissioning (unit/year)
.technology adoption	A	EEE demand (unit/year)
.depreciation	A	EEE depreciation ratio (USD/year)
.model checking	F,A	EEE inflows (unit/year)
.model checking	F,A	EEE outflows (unit/year)
.model checking	A	EEE per household (unit/house)
.model checking	A	EEE per inhabitant (unit/inhabitant)
.retrospective	C	EEE unit price (USD/unit)
.retrospective	C	effect of normalised PPP on average number of EEE per adopter (unit/house)
.model checking	A	error households adoption (house)
.material supply	SM,A	expected EEE demand (kg/year)
.EEE obsolescence	A	expected lifetime for decommissioning before broken (year/unit)
.EEE obsolescence	A	expected lifetime for second use (year/unit)
.material supply	SM,A	expected material kept in the system (kg/year)
.EEE and WEEE flows	DE,F,A	extraction (kg/year)
.material supply	A	extraction rate considering minimum stock (kg/year)
.Control	C	FINAL TIME (year)
.EEE and WEEE flows	DE,F,A	first use decommissioning because faulty (unit/year)
.EEE and WEEE flows	DE,F,A	first use decommissioning before broken (unit/year)
.EEE and WEEE flows	L,F	First use EEE (unit)
.EEE obsolescence	A	fraction fit for reman (dmnl)
.EEE obsolescence	A	fraction fit for second use (dmnl)
.EEE obsolescence	A	fraction introduced to reman market (dmnl)
.EEE obsolescence	A	fraction introduced to second use market (dmnl)
.EEE obsolescence	A	fraction introduced to WEEE market (dmnl)
.EEE and WEEE flows	C	fraction of decomissioned before broken (dmnl)
.EEE obsolescence	A	fraction of WEEE formally collected (dmnl)
.EEE obsolescence	A	fraction of WEEE not formally collected (dmnl)
.technology adoption	A	gap from EEE in use to desired (unit)
.retrospective	C	historic disposal of EEE (unit/year)
.retrospective	C	historic EEE put on market (unit/year)

.Theil	A	historical time series (Units)
.retrospective	A	household increase trend (1/year)
.EEE obsolescence	F,A	increase in age of available used EEE (dmnl)
.EEE obsolescence	F,A	increase in age of first use EEE (dmnl)
.EEE obsolescence	F,A	increase in age of second use EEE (dmnl)
.CE mechanisms	C	infra development initial year (year)
.technology adoption	LI,A	initial adopters (house)
.technology adoption	C	initial adopters fraction (dmnl)
.technology adoption	LI,A	initial potential adopters (house)
.EEE and WEEE flows	LI,C	initial stock of available used EEE (unit)
.model checking	A	initial stock of EEE (unit)
.EEE and WEEE flows	LI,C	initial stock of first use EEE (unit)
.model checking	A	initial stock of material (kg)
.EEE and WEEE flows	LI,C	initial stock of non recycled WEEE (kg)
.EEE and WEEE flows	LI,C	initial stock of processed material (kg)
.EEE and WEEE flows	LI,C	initial stock of raw material (kg)
.EEE and WEEE flows	LI,C	initial stock of second use EEE (unit)
.EEE and WEEE flows	LI,C	initial stock of WEEE before treatment (kg)
.Control	C	INITIAL TIME (year)
.indicators	A	leakage of materials (1/year)
.indicators	A	leakage of products (1/year)
.EEE obsolescence	A	lifetime expected for reman products (year/unit)
.EEE obsolescence	C	lifetime fraction for decommissioning before broken (dmnl)
.EEE obsolescence	C	lifetime fraction for reman products (dmnl)
.EEE obsolescence	C	lifetime fraction for second use (dmnl)
.CE mechanisms	C	lifetime ratio (dmnl)
.Theil	A	M X (Units)
.Theil	A	M Y (Units)
.Theil	A	mape (Dimensionless)
.model checking	A	mass balance EEE (unit)
.model checking	A	mass balance material (kg)
.model checking	F,A	material inflows (kg/year)
.model checking	F,A	material outflows (kg/year)
.technology adoption	A	max EEE desired (unit/house)
.indicators	A	max value EEE commissioning (unit/year)
.indicators	A	max value remanufacturing (unit/year)
.indicators	A	max value second use commissioning (unit/year)
.indicators	A	max value WEEE recycling (kg/year)
.EEE obsolescence	A	mean lifetime (year/unit)
.Theil	A	mse (Units*Units)
.Theil	A	MX2 (Units*Units)
.Theil	A	Mxy (Units*Units)
.Theil	A	MY2 (Units*Units)
.technology adoption	F,A	new potential adopters (house/year)
.EEE and WEEE flows	L	Non recycled WEEE (kg)
.EEE and WEEE flows	A	non recycled WEEE because of recyclability (kg/year)
.retrospective	A	normalised PPP (dmnl)
.technology adoption	C	number of purchases when adopting (unit/house)
.Theil	F,A	pick (Dimensionless)
.retrospective	C	population (inhabitant)
.retrospective	C	potential adoption fraction (dmnl)
.technology adoption	L	Potential EEE adopters (house)
.retrospective	A	PPP 1980 (USD)
.EEE and WEEE flows	L	Processed material (kg)
.retrospective	C	purchasing power parity per capta (USD)
.Theil	A	r (Dimensionless)
.CE mechanisms	C	R desired level (dmnl)
.CE mechanisms	C	R desired year (year)
circularEEE v.1 prospective	C	R EEE in use (unit)
.retrospective	C	R EEE per adopter (unit/house)
.CE mechanisms	C	R initial level (dmnl)
.Theil	A	r2 (Dimensionless)
.EEE obsolescence	C	rate of ageing (year/(year*unit))
.depreciation	C	ratio of EEE price for second use (dmnl)
.depreciation	C	ratio of reman contribution per unit (dmnl)
.depreciation	A	ratio remanufacturing from decommissioned EEE (dmnl)
.depreciation	A	ratio second use comissioning from decommissioned EEE (dmnl)
.depreciation	A	ratio WEEE not being recycled from decomissioned EEE (dmnl)
.depreciation	A	ratio WEEE recycling from decomissioned EEE (dmnl)
.EEE and WEEE flows	L	Raw material (kg)
.CE mechanisms	C	RC desired level (dmnl)
.CE mechanisms	C	RC desired year (year)
.CE mechanisms	C	RC initial level (dmnl)
.technology adoption	A	recurrent purchases to replace (unit/year)
.EEE and WEEE flows	C	recyclability EEE (dmnl)
.CE mechanisms	A	recycling infrastructure level (dmnl)
.EEE and WEEE flows	A	recycling of EEE from remanufacturing process (kg/year)
.EEE and WEEE flows	A	recycling time (year)
.EEE and WEEE flows	A	redistribution time (year)
.EEE obsolescence	A	reman effectiveness (dmnl)
.EEE obsolescence	A	reman market coverage (dmnl)
.EEE and WEEE flows	A	reman time (year)
.EEE and WEEE flows	C	remanufacturability EEE (dmnl)
.EEE and WEEE flows	DE,F,A	remanufacturing (unit/year)
.depreciation	A	remanufacturing contribution per unit (USD/unit)
.CE mechanisms	A	remanufacturing infrastructure level (dmnl)
.EEE obsolescence	A	repair effectiveness (dmnl)
.CE mechanisms	A	repairing infrastructure level (dmnl)
.Theil	A	residuals (Units)

.CE mechanisms	C	RM desired level (dmnl)
.CE mechanisms	C	RM desired year (year)
.CE mechanisms	C	RM initial level (dmnl)
.Theil	A	rmse (Units)
.Theil	A	RMSPE (Dimensionless)
.Control	A	SAVEPER (year)
.EEE obsolescence	A	second hand market coverage (dmnl)
.EEE and WEEE flows	DE,F,A	second use commissioning (unit/year)
.EEE and WEEE flows	DE,F,A	second use decommissioning (unit/year)
.EEE and WEEE flows	L	Second use EEE (unit)
.CE mechanisms	A	second use infrastructure level (dmnl)
.depreciation	A	second use price (USD/unit)
.Theil	A	simulated time series (Units)
.Theil	A	SSE (Units*Units)
.material supply	C	stock adjustment time (year)
.CE mechanisms	C	SU desired level (dmnl)
.CE mechanisms	C	SU desired year (year)
.CE mechanisms	C	SU initial level (dmnl)
.Theil	L	Sum APE (Dimensionless)
.model checking	L	Sum of all EEE inflows (unit)
.model checking	L	Sum of all EEE outflows (unit)
.model checking	L	Sum of all material inflows (kg)
.model checking	L	Sum of all material outflows (kg)
.Theil	L	Sum SPE (Dimensionless)
.Theil	L	Sum Xi (Units)
.Theil	L	Sum XmY2 (Units*Units)
.Theil	L	Sum Yi (Units)
.Theil	L	SumX2 (Units*Units)
.Theil	L	SumXY (Units*Units)
.Theil	L	SumY2 (Units*Units)
.CE mechanisms	C	switch infra development (dmnl)
.Theil	A	Sx (Units)
.Theil	A	Sy (Units)
.indicators	A	time max value commissioning (year)
.indicators	A	time max value recycling (year)
.indicators	A	time max value remanufacturing (year)
.indicators	A	time max value second use commissioning (year)
.Control	C	TIME STEP (year)
.EEE and WEEE flows	A	time to extract (year)
.EEE and WEEE flows	A	time to make available (year)
.technology adoption	A	time to realise additional need (year)
.EEE obsolescence	L	Total age of available used EEE (year)
.EEE obsolescence	L	Total age of first use EEE (year)
.technology adoption	A	Total EEE in use (unit)
.depreciation	A	total first use EEE value (USD)
.depreciation	L	Total historical first use EEE value (USD)
.retrospective	C	total households (house)
.retrospective	A	total households variation (house/year)
.indicators	A	Total materials in the system (kg)
.indicators	A	Total products in the system (unit)
.EEE obsolescence	L	Total time of second use EEE (year)
.indicators	A	total value of Available WEEE (USD)
.Theil	A	uc (Dimensionless)
.Theil	A	um (Dimensionless)
.Theil	A	us (Dimensionless)
.EEE obsolescence	A	virtual age after reman (year/unit)
.EEE obsolescence	A	virtual age after repair (year/unit)
.indicators	C	WEEE average market value (USD/kg)
.EEE and WEEE flows	L	WEEE before treatment (kg)
.depreciation	C	WEEE costs for non recycling (USD/kg)
.EEE and WEEE flows	F,A	WEEE not recycled (kg/year)
.EEE and WEEE flows	DE,F,A	WEEE recycling (kg/year)
.EEE obsolescence	A	weibull scale (dmnl)
.EEE obsolescence	C	weibull shape (dmnl)
.Theil	A	X (Units)
.Theil	F,A	Xi (Units)
.Theil	A	Y (Units)
.Theil	F,A	Yi (Units)

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Variable Link Detail (224)

Group	Type	Variable	In/Out Counts	In/Out Ratio	In Links by Polarity	Out Links by Polarity
.EEE and WEEE flows	DE,F,A	remanufacturing (unit/year)	5 | 12	0.42	5| 0| 0	9| 1| 2
.EEE and WEEE flows	DE,F,A	WEEE recycling (kg/year)	5 | 10	0.50	5| 0| 0	7| 1| 2
.EEE and WEEE flows	L,F	First use EEE (unit)	5 | 10	0.50	3| 2| 0	10| 0| 0
.EEE and WEEE flows	L	Available used EEE (unit)	7 | 7	1.00	4| 3| 0	7| 0| 0
.EEE and WEEE flows	DE,F,A	second use commissioning (unit/year)	3 | 10	0.30	3| 0| 0	7| 1| 2
.retrospective	C,F	EEE average unit weight (kg/unit)	0 | 12	0.00	0| 0| 0	7| 5| 0
.EEE and WEEE flows	F,A	WEEE not recycled (kg/year)	4 | 7	0.57	3| 1| 0	6| 1| 0
.EEE and WEEE flows	L	WEEE before treatment (kg)	5 | 5	1.00	3| 2| 0	5| 0| 0
.EEE and WEEE flows	L	Second use EEE (unit)	3 | 7	0.43	2| 1| 0	7| 0| 0
.EEE and WEEE flows	DE,F,A	first use decommissioning before broken (unit/year)	4 | 6	0.67	4| 0| 0	5| 1| 0
.EEE and WEEE flows	DE,F,A	first use decommissioning because faulty (unit/year)	4 | 6	0.67	3| 1| 0	5| 1| 0

.Theil	F,A	dt (Time Units)	1	9	0.11	1	0	0	0	9	0
.EEE and WEEE flows	A	distribution time (year)	1	9	0.11	1	0	0	9	0	0
.EEE and WEEE flows	DE,F,A	disposal of EEE as WEEE (unit/year)	3	7	0.43	3	0	0	6	1	0
.depreciation	A	decommissioned EEE average outflow price (USD/unit)	9	1	9.00	6	3	0	0	1	0
.Theil	F,A	Yi (Units)	2	7	0.29	2	0	0	4	1	2
.Theil	F,A	Xi (Units)	2	7	0.29	2	0	0	7	0	0
.EEE and WEEE flows	DE,F,A	second use decommissioning (unit/year)	3	6	0.50	3	0	0	5	1	0
.EEE obsolescence	F,A	increase in age of available used EEE (dmnl)	8	1	8.00	8	0	0	1	0	0
.EEE and WEEE flows	DE,F,A	EEE commissioning (unit/year)	2	7	0.29	2	0	0	4	1	2
.depreciation	A	decomissioned EEE outflows (unit/year)	5	4	1.25	4	1	0	4	0	0
.Theil	L	count (Dimensionless)	2	7	0.29	1	1	0	7	0	0
.retrospective	C	total households (house)	0	8	0.00	0	0	0	4	4	0
.EEE obsolescence	A	average EEE age (year/unit)	2	6	0.33	2	0	0	4	2	0
.CE mechanisms	A	remanufacturing infrastructure level (dmnl)	5	2	2.50	4	0	1	2	0	0
.Theil	A	r (Dimensionless)	5	2	2.50	3	2	0	1	1	0
.EEE and WEEE flows	L	Processed material (kg)	5	2	2.50	3	2	0	1	1	0
.Theil	F,A	pick (Dimensionless)	3	4	0.75	0	0	3	3	0	1
.Theil	A	mse (Units*Units)	3	4	0.75	3	0	0	4	0	0
.model checking	F,A	EEE outflows (unit/year)	6	1	6.00	6	0	0	1	0	0
.model checking	F,A	EEE inflows (unit/year)	6	1	6.00	6	0	0	1	0	0
.EEE obsolescence	A	weibull scale (dmnl)	1	5	0.20	1	0	0	3	1	1
.CE mechanisms	A	second use infrastructure level (dmnl)	5	1	5.00	3	2	0	1	0	0
.CE mechanisms	A	repairing infrastructure level (dmnl)	5	1	5.00	1	0	4	1	0	0
.CE mechanisms	A	recycling infrastructure level (dmnl)	5	1	5.00	1	0	4	1	0	0
.model checking	F,A	material outflows (kg/year)	5	1	5.00	5	0	0	1	0	0
.model checking	F,A	material inflows (kg/year)	5	1	5.00	5	0	0	1	0	0
.EEE and WEEE flows	DE,F,A	extraction (kg/year)	2	4	0.50	2	0	0	3	1	0
.material supply	SM,A	expected material kept in the system (kg/year)	5	1	5.00	5	0	0	0	1	0
.technology adoption	A	EEE demand (unit/year)	3	3	1.00	3	0	0	3	0	0
.EEE obsolescence	A	average second use EEE age (year/unit)	2	4	0.50	2	0	0	4	0	0
.technology adoption	F,A	adoption rate (house/year)	3	3	1.00	1	2	0	2	1	0
.EEE obsolescence	C	weibull shape (dmnl)	0	5	0.00	0	0	0	4	0	1
.EEE obsolescence	A	virtual age after repair (year/unit)	2	3	0.67	1	1	0	3	0	0
.indicators	A	Total products in the system (unit)	3	2	1.50	3	0	0	2	0	0
.technology adoption	A	Total EEE in use (unit)	2	3	0.67	2	0	0	2	1	0
.Control	C	TIME STEP (year)	0	5	0.00	0	0	0	5	0	0
.Theil	A	Sy (Units)	2	3	0.67	1	1	0	2	0	1
.Theil	A	Sx (Units)	2	3	0.67	1	1	0	3	0	0
.EEE obsolescence	A	mean lifetime (year/unit)	2	3	0.67	0	0	2	3	0	0
.Theil	A	M Y (Units)	2	3	0.67	2	0	0	0	2	1
.Theil	A	M X (Units)	2	3	0.67	2	0	0	0	2	1
.model checking	A	initial stock of material (kg)	4	1	4.00	4	0	0	1	0	0
.EEE obsolescence	F,A	increase in age of second use EEE (dmnl)	4	1	4.00	4	0	0	1	0	0
.EEE obsolescence	F,A	increase in age of first use EEE (dmnl)	4	1	4.00	4	0	0	1	0	0
.EEE obsolescence	A	fraction introduced to second use market (dmnl)	2	3	0.67	2	0	0	1	2	0
.EEE obsolescence	A	fraction introduced to reman market (dmnl)	3	2	1.50	2	1	0	1	1	0
.EEE obsolescence	A	fraction fit for second use (dmnl)	4	1	4.00	4	0	0	1	0	0
.EEE obsolescence	A	fraction fit for reman (dmnl)	4	1	4.00	4	0	0	1	0	0
.EEE obsolescence	A	expected lifetime for decommissioning before broken (year/unit)	2	3	0.67	2	0	0	3	0	0
.material supply	SM,A	expected EEE demand (kg/year)	3	2	1.50	3	0	0	2	0	0
.technology adoption	L	EEE adopters (house)	2	3	0.67	2	0	0	3	0	0
.Theil	A	dif cov (Units*Units)	3	2	1.50	2	1	0	2	0	0
.EEE obsolescence	F,A	decrease in age of first use EEE (dmnl)	4	1	4.00	4	0	0	0	1	0
.EEE obsolescence	F,A	decrease in age of available used EEE (dmnl)	4	1	4.00	4	0	0	0	1	0
.EEE obsolescence	A	decommissioning probability in the end of life for second use (dmnl)	4	1	4.00	4	0	0	1	0	0
.model checking	A	current stock of material (kg)	4	1	4.00	4	0	0	0	1	0
.depreciation	F,A	average EEE value (USD/unit)	3	2	1.50	1	2	0	2	0	0
.EEE obsolescence	A	average decommissioned EEE age (year/unit)	2	3	0.67	2	0	0	3	0	0
.EEE obsolescence	A	virtual age after reman (year/unit)	2	2	1.00	1	1	0	2	0	0
.indicators	A	Total materials in the system (kg)	3	1	3.00	3	0	0	1	0	0
.EEE and WEEE flows	A	time to make available (year)	1	3	0.33	1	0	0	3	0	0
.CE mechanisms	C	switch infra development (dmnl)	0	4	0.00	0	0	0	2	0	2
.Theil	L	SumXY (Units*Units)	3	1	3.00	2	1	0	1	0	0
.Theil	L	Sum XmY2 (Units*Units)	3	1	3.00	1	1	1	1	0	0
.Theil	L	Sum SPE (Dimensionless)	3	1	3.00	1	1	1	1	0	0
.Theil	L	Sum APE (Dimensionless)	3	1	3.00	2	1	0	1	0	0
.Theil	A	residuals (Units)	4	0	∞	2	1	1	0	0	0
.EEE and WEEE flows	A	recycling of EEE from remanufacturing process (kg/year)	3	1	3.00	2	1	0	1	0	0
.depreciation	A	ratio WEEE recycling from decomissioned EEE (dmnl)	3	1	3.00	2	1	0	1	0	0
.depreciation	A	ratio WEEE not being recycled from decomissioned EEE (dmnl)	3	1	3.00	2	1	0	0	1	0
.technology adoption	L	Potential EEE adopters (house)	3	1	3.00	2	1	0	1	0	0
.model checking	A	mass balance material (kg)	4	0	∞	2	2	0	0	0	0
.model checking	A	mass balance EEE (unit)	4	0	∞	2	2	0	0	0	0
.model checking	A	initial stock of EEE (unit)	3	1	3.00	3	0	0	1	0	0
.CE mechanisms	C	infra development initial year (year)	0	4	0.00	0	0	0	2	0	2
.EEE obsolescence	A	fraction of WEEE formally collected (dmnl)	2	2	1.00	2	0	0	1	1	0
.retrospective	C	EEE unit price (USD/unit)	0	4	0.00	0	0	0	4	0	0
.depreciation	A	EEE depreciation ratio (USD/year)	3	1	3.00	2	1	0	0	1	0
.Theil	A	dif var (Units*Units)	2	2	1.00	1	0	1	2	0	0
.Theil	A	dif mea (Units*Units)	2	2	1.00	0	0	2	2	0	0
.material supply	SM,A	desired stock of processed material (kg)	3	1	3.00	3	0	0	1	0	0
.EEE obsolescence	A	decommissioning probability in the end of life for first use (dmnl)	3	1	3.00	1	2	0	1	0	0
.model checking	A	current stock of EEE (unit)	3	1	3.00	3	0	0	0	1	0
.technology adoption	A	average EEE desired per adopter (unit/house)	3	1	3.00	3	0	0	1	0	0
.EEE obsolescence	A	average age of useful products (year/unit)	4	0	∞	4	0	0	0	0	0
.material supply	A	adjustment for stock of Processed material (kg/year)	3	1	3.00	2	1	0	1	0	0
.Theil	A	Y (Units)	1	2	0.50	1	0	0	1	0	1
.Theil	A	X (Units)	1	2	0.50	1	0	0	1	0	1
.Theil	A	us (Dimensionless)	2	1	2.00	2	0	0	0	1	0

.EEE obsolescence	L	Total time of second use EEE (year)	2 | 1	2.00	1| 1| 0	1| 0| 0
.retrospective	A	total households variation (house/year)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE obsolescence	L	Total age of first use EEE (year)	2 | 1	2.00	1| 1| 0	1| 0| 0
.EEE obsolescence	L	Total age of available used EEE (year)	2 | 1	2.00	1| 1| 0	1| 0| 0
.indicators	A	time max value second use commissioning (year)	3 | 0	∞	0| 0| 3	0| 0| 0
.indicators	A	time max value remanufacturing (year)	3 | 0	∞	0| 0| 3	0| 0| 0
.indicators	A	time max value recycling (year)	3 | 0	∞	0| 0| 3	0| 0| 0
.indicators	A	time max value commissioning (year)	3 | 0	∞	0| 0| 3	0| 0| 0
.Theil	L	SumY2 (Units*Units)	2 | 1	2.00	1| 1| 0	1| 0| 0
.Theil	L	SumX2 (Units*Units)	2 | 1	2.00	1| 1| 0	1| 0| 0
.Theil	L	Sum Yi (Units)	2 | 1	2.00	1| 1| 0	1| 0| 0
.Theil	L	Sum Xi (Units)	2 | 1	2.00	1| 1| 0	1| 0| 0
.depreciation	A	second use price (USD/unit)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE obsolescence	A	second hand market coverage (dmnl)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE obsolescence	A	repair effectiveness (dmnl)	2 | 1	2.00	2| 0| 0	0| 1| 0
.depreciation	A	remanufacturing contribution per unit (USD/unit)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE and WEEE flows	A	reman time (year)	1 | 2	0.50	1| 0| 0	2| 0| 0
.EEE obsolescence	A	reman market coverage (dmnl)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE obsolescence	A	reman effectiveness (dmnl)	2 | 1	2.00	2| 0| 0	0| 1| 0
.EEE and WEEE flows	A	recycling time (year)	1 | 2	0.50	1| 0| 0	2| 0| 0
.EEE and WEEE flows	L	Raw material (kg)	2 | 1	2.00	1| 1| 0	1| 0| 0
.depreciation	A	ratio second use comissioning from decommissioned EEE (dmnl)	2 | 1	2.00	2| 0| 0	1| 0| 0
.depreciation	A	ratio remanufacturing from decommissioned EEE (dmnl)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE obsolescence	C	rate of ageing (year/(year*unit))	0 | 3	0.00	0| 0| 0	3| 0| 0
.retrospective	A	normalised PPP (dmnl)	2 | 1	2.00	1| 1| 0	1| 0| 0
.EEE and WEEE flows	A	non recycled WEEE because of recyclability (kg/year)	2 | 1	2.00	1| 1| 0	1| 0| 0
.EEE and WEEE flows	L	Non recycled WEEE (kg)	2 | 1	2.00	2| 0| 0	1| 0| 0
.Theil	A	MY2 (Units*Units)	2 | 1	2.00	2| 0| 0	1| 0| 0
.Theil	A	Mxy (Units*Units)	2 | 1	2.00	2| 0| 0	1| 0| 0
.Theil	A	MX2 (Units*Units)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE obsolescence	A	lifetime expected for reman products (year/unit)	2 | 1	2.00	2| 0| 0	1| 0| 0
.technology adoption	LI,A	initial potential adopters (house)	2 | 1	2.00	1| 1| 0	1| 0| 0
.technology adoption	LI,A	initial adopters (house)	2 | 1	2.00	2| 0| 0	1| 0| 0
.retrospective	A	household increase trend (1/year)	2 | 1	2.00	2| 0| 0	1| 0| 0
.technology adoption	A	gap from EEE in use to desired (unit)	2 | 1	2.00	1| 1| 0	1| 0| 0
.EEE obsolescence	A	fraction introduced to WEEE market (dmnl)	2 | 1	2.00	0| 2| 0	1| 0| 0
.material supply	A	extraction rate considering minimum stock (kg/year)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE obsolescence	A	expected lifetime for second use (year/unit)	2 | 1	2.00	2| 0| 0	1| 0| 0
.model checking	A	error households adoption (house)	3 | 0	∞	2| 1| 0	0| 0| 0
.material supply	A	desired extraction rate (kg/year)	2 | 1	2.00	1| 1| 0	1| 0| 0
.technology adoption	A	desired EEE (unit)	2 | 1	2.00	2| 0| 0	1| 0| 0
.EEE obsolescence	F,A	decrease in age of second use EEE (dmnl)	2 | 1	2.00	2| 0| 0	0| 1| 0
.EEE and WEEE flows	A	collection time (year)	1 | 2	0.50	1| 0| 0	1| 1| 0
.technology adoption	A	adoption purchases (unit/year)	2 | 1	2.00	2| 0| 0	1| 0| 0
.technology adoption	DE,A	additional purchases (unit/year)	2 | 1	2.00	2| 0| 0	1| 0| 0
.technology adoption	A	actual adoption fraction (dmnl)	2 | 1	2.00	1| 1| 0	0| 1| 0
.indicators	C	WEEE average market value (USD/kg)	0 | 2	0.00	0| 0| 0	2| 0| 0
.Theil	A	um (Dimensionless)	2 | 0	∞	2| 0| 0	0| 0| 0
.Theil	A	uc (Dimensionless)	2 | 0	∞	2| 0| 0	0| 0| 0
.indicators	A	total value of Available WEEE (USD)	2 | 0	∞	2| 0| 0	0| 0| 0
.depreciation	L	Total historical first use EEE value (USD)	2 | 0	∞	2| 0| 0	0| 0| 0
.depreciation	A	total first use EEE value (USD)	2 | 0	∞	2| 0| 0	0| 0| 0
.technology adoption	A	time to realise additional need (year)	1 | 1	1.00	1| 0| 0	1| 0| 0
.EEE and WEEE flows	A	time to extract (year)	1 | 1	1.00	1| 0| 0	1| 0| 0
.model checking	L	Sum of all material outflows (kg)	1 | 1	1.00	1| 0| 0	0| 1| 0
.model checking	L	Sum of all material inflows (kg)	1 | 1	1.00	1| 0| 0	1| 0| 0
.model checking	L	Sum of all EEE outflows (unit)	1 | 1	1.00	1| 0| 0	0| 1| 0
.model checking	L	Sum of all EEE inflows (unit)	1 | 1	1.00	1| 0| 0	1| 0| 0
.Theil	A	simulated time series (Units)	1 | 1	1.00	1| 0| 0	1| 0| 0
.Theil	A	RMSPE (Dimensionless)	2 | 0	∞	2| 0| 0	0| 0| 0
.EEE and WEEE flows	C	remanufacturability EEE (dmnl)	0 | 2	0.00	0| 0| 0	1| 1| 0
.EEE and WEEE flows	A	redistribution time (year)	1 | 1	1.00	1| 0| 0	1| 0| 0
.EEE and WEEE flows	C	recyclability EEE (dmnl)	0 | 2	0.00	0| 0| 0	1| 1| 0
.technology adoption	A	recurrent purchases to replace (unit/year)	1 | 1	1.00	1| 0| 0	1| 0| 0
.retrospective	C	purchasing power parity per capta (USD)	0 | 2	0.00	0| 0| 0	1| 0| 1
.retrospective	A	PPP 1980 (USD)	1 | 1	1.00	0| 0| 1	0| 1| 0
.technology adoption	F,A	new potential adopters (house/year)	1 | 1	1.00	1| 0| 0	1| 0| 0
.indicators	A	max value WEEE recycling (kg/year)	1 | 1	1.00	0| 0| 1	0| 0| 1
.indicators	A	max value second use commissioning (unit/year)	1 | 1	1.00	0| 0| 1	0| 0| 1
.indicators	A	max value remanufacturing (unit/year)	1 | 1	1.00	0| 0| 1	0| 0| 1
.indicators	A	max value EEE commissioning (unit/year)	1 | 1	1.00	0| 0| 1	0| 0| 1
.technology adoption	A	max EEE desired (unit/house)	1 | 1	1.00	0| 0| 1	1| 0| 0
.Theil	A	mape (Dimensionless)	2 | 0	∞	2| 0| 0	0| 0| 0
.indicators	A	leakage of products (1/year)	2 | 0	∞	2| 0| 0	0| 0| 0
.indicators	A	leakage of materials (1/year)	2 | 0	∞	2| 0| 0	0| 0| 0
.EEE and WEEE flows	LI,C	initial stock of WEEE before treatment (kg)	0 | 2	0.00	0| 0| 0	2| 0| 0
.EEE and WEEE flows	LI,C	initial stock of second use EEE (unit)	0 | 2	0.00	0| 0| 0	2| 0| 0
.EEE and WEEE flows	LI,C	initial stock of raw material (kg)	0 | 2	0.00	0| 0| 0	2| 0| 0
.EEE and WEEE flows	LI,C	initial stock of processed material (kg)	0 | 2	0.00	0| 0| 0	2| 0| 0
.EEE and WEEE flows	LI,C	initial stock of non recycled WEEE (kg)	0 | 2	0.00	0| 0| 0	2| 0| 0
.EEE and WEEE flows	LI,C	initial stock of first use EEE (unit)	0 | 2	0.00	0| 0| 0	2| 0| 0
.EEE and WEEE flows	LI,C	initial stock of available used EEE (unit)	0 | 2	0.00	0| 0| 0	2| 0| 0
.technology adoption	C	initial adopters fraction (dmnl)	0 | 2	0.00	0| 0| 0	1| 1| 0
.Theil	A	historical time series (Units)	1 | 1	1.00	1| 0| 0	1| 0| 0
.EEE obsolescence	A	fraction of WEEE not formally collected (dmnl)	1 | 1	1.00	0| 1| 0	1| 0| 0
.EEE and WEEE flows	C	fraction of decomissioned before broken (dmnl)	0 | 2	0.00	0| 0| 0	1| 1| 0
.model checking	A	EEE per inhabitant (unit/inhabitant)	2 | 0	∞	1| 1| 0	0| 0| 0
.model checking	A	EEE per household (unit/house)	2 | 0	∞	1| 1| 0	0| 0| 0
.depreciation	C	WEEE costs for non recycling (USD/kg)	0 | 1	0.00	0| 0| 0	0| 1| 0

.CE mechanisms	C	SU initial level (dmnl)	0	1	0.00	0	0	0	1	0	0
.CE mechanisms	C	SU desired year (year)	0	1	0.00	0	0	0	0	1	0
.CE mechanisms	C	SU desired level (dmnl)	0	1	0.00	0	0	0	0	1	0
.material supply	C	stock adjustment time (year)	0	1	0.00	0	0	0	1	0	0
.Theil	A	SSE (Units*Units)	1	0	∞	1	0	0	0	0	0
.Control	A	SAVEPER (year)	1	0	∞	1	0	0	0	0	0
.Theil	A	rmse (Units)	1	0	∞	1	0	0	0	0	0
.CE mechanisms	C	RM initial level (dmnl)	0	1	0.00	0	0	0	1	0	0
.CE mechanisms	C	RM desired year (year)	0	1	0.00	0	0	0	0	0	1
.CE mechanisms	C	RM desired level (dmnl)	0	1	0.00	0	0	0	1	0	0
.CE mechanisms	C	RC initial level (dmnl)	0	1	0.00	0	0	0	0	0	1
.CE mechanisms	C	RC desired year (year)	0	1	0.00	0	0	0	0	0	1
.CE mechanisms	C	RC desired level (dmnl)	0	1	0.00	0	0	0	1	0	0
.depreciation	C	ratio of reman contribution per unit (dmnl)	0	1	0.00	0	0	0	1	0	0
.depreciation	C	ratio of EEE price for second use (dmnl)	0	1	0.00	0	0	0	1	0	0
.Theil	A	r2 (Dimensionless)	1	0	∞	1	0	0	0	0	0
.CE mechanisms	C	R initial level (dmnl)	0	1	0.00	0	0	0	0	0	1
.retrospective	C	R EEE per adopter (unit/house)	0	1	0.00	0	0	0	0	0	1
.CE mechanisms	C	R desired year (year)	0	1	0.00	0	0	0	0	0	1
.CE mechanisms	C	R desired level (dmnl)	0	1	0.00	0	0	0	1	0	0
.retrospective	C	potential adoption fraction (dmnl)	0	1	0.00	0	0	0	1	0	0
.retrospective	C	population (inhabitant)	0	1	0.00	0	0	0	0	1	0
.technology adoption	C	number of purchases when adopting (unit/house)	0	1	0.00	0	0	0	1	0	0
.CE mechanisms	C	lifetime ratio (dmnl)	0	1	0.00	0	0	0	1	0	0
.EEE obsolescence	C	lifetime fraction for second use (dmnl)	0	1	0.00	0	0	0	1	0	0
.EEE obsolescence	C	lifetime fraction for reman products (dmnl)	0	1	0.00	0	0	0	1	0	0
.EEE obsolescence	C	lifetime fraction for decommissioning before broken (dmnl)	0	1	0.00	0	0	0	1	0	0
.retrospective	C	historic EEE put on market (unit/year)	0	1	0.00	0	0	0	1	0	0
.retrospective	C	effect of normalised PPP on average number of EEE per adopter (unit/house)	0	1	0.00	0	0	0	1	0	0
.material supply	C	desired stock lenght of processed material (year)	0	1	0.00	0	0	0	1	0	0
.Theil	A	1 - us (Dimensionless)	1	0	∞	0	1	0	0	0	0
circularEEE v.1 prospective	C	R EEE in use (unit)	(0	0)	∞	0	0	0	0	0	0
.Control	C	INITIAL TIME (year)	(0	0)	∞	0	0	0	0	0	0
.retrospective	C	historic disposal of EEE (unit/year)	(0	0)	∞	0	0	0	0	0	0
.Control	C	FINAL TIME (year)	(0	0)	∞	0	0	0	0	0	0

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Supplementary Variables (0)

Group	Type	Variable

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Supplementary Variables Being Used (0)

Group	Type	Variable

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Unused Variables (26)

Group	Type	Variable
.Theil	A	1 - us (Dimensionless)
.EEE obsolescence	A	average age of useful products (year/unit)
.model checking	A	EEE per household (unit/house)
.model checking	A	EEE per inhabitant (unit/inhabitant)
.model checking	A	error households adoption (house)
.retrospective	C	historic disposal of EEE (unit/year)
.indicators	A	leakage of materials (1/year)
.indicators	A	leakage of products (1/year)
.Theil	A	mape (Dimensionless)
.model checking	A	mass balance EEE (unit)
.model checking	A	mass balance material (kg)
circularEEE v.1 prospective	C	R EEE in use (unit)
.Theil	A	r2 (Dimensionless)
.Theil	A	residuals (Units)
.Theil	A	rmse (Units)
.Theil	A	RMSPE (Dimensionless)
.Theil	A	SSE (Units*Units)
.indicators	A	time max value commissioning (year)
.indicators	A	time max value recycling (year)
.indicators	A	time max value remanufacturing (year)
.indicators	A	time max value second use commissioning (year)
.depreciation	A	total first use EEE value (USD)
.depreciation	L	Total historical first use EEE value (USD)

.indicators	A	total value of Available WEEE (USD)
.Theil	A	uc (Dimensionless)
.Theil	A	um (Dimensionless)

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Equations With Embedded Data (27)

Group	Type	Variable
.EEE and WEEE flows	A	collection time (year)
.Theil	L	count (Dimensionless)
.Theil	A	dif cov (Units*Units)
.retrospective	A	household increase trend (1/year)
.technology adoption	A	max EEE desired (unit/house)
.retrospective	A	PPP 1980 (USD)
.EEE and WEEE flows	A	recycling time (year)
.EEE and WEEE flows	A	redistribution time (year)
.EEE and WEEE flows	A	reman time (year)
.Theil	L	Sum APE (Dimensionless)
.model checking	L	Sum of all EEE inflows (unit)
.model checking	L	Sum of all EEE outflows (unit)
.model checking	L	Sum of all material inflows (kg)
.model checking	L	Sum of all material outflows (kg)
.Theil	L	Sum SPE (Dimensionless)
.Theil	L	Sum Xi (Units)
.Theil	L	Sum XmY2 (Units*Units)
.Theil	L	Sum Yi (Units)
.Theil	L	SumX2 (Units*Units)
.Theil	L	SumXY (Units*Units)
.Theil	L	SumY2 (Units*Units)
.EEE and WEEE flows	A	time to extract (year)
.EEE obsolescence	L	Total age of available used EEE (year)
.EEE obsolescence	L	Total age of first use EEE (year)
.depreciation	L	Total historical first use EEE value (USD)
.EEE obsolescence	L	Total time of second use EEE (year)
.EEE obsolescence	A	weibull scale (dmnl)

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Nonmonotonic Lookup Functions (0)

Group	Type	Variable

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Non-Zero End Sloped Lookup Functions (5)

Group	Type	Variable	Non-Zero
.EEE obsolescence	A,T	fraction of WEEE formally collected_RSSDlookup (dmnl)	Both
.EEE obsolescence	A,T	reman effectiveness_RSSDlookup (dmnl)	Both
.EEE obsolescence	A,T	reman market coverage_RSSDlookup (dmnl)	Both
.EEE obsolescence	A,T	repair effectiveness_RSSDlookup (dmnl)	Both
.EEE obsolescence	A,T	second hand market coverage_RSSDlookup (dmnl)	Both

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Cascading Lookup Functions (0)

Group	Type	Variable

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Equations With Step Pulse Or Related Functions (0)

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Equations With If Then Else Functions (2)

Group	Type	Variable
.Theil	F,A	pick (Dimensionless)
.Theil	A	residuals (Units)

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Equations With Min Or Max Functions (10)

Group	Type	Variable
.technology adoption	DE,A	additional purchases (unit/year)
.technology adoption	F,A	adoption rate (house/year)
.technology adoption	A	average EEE desired per adopter (unit/house)
.material supply	A	desired extraction rate (kg/year)
.EEE and WEEE flows	DE,F,A	extraction (kg/year)
.EEE obsolescence	A	fraction introduced to reman market (dmnl)
.Theil	A	r (Dimensionless)
.EEE and WEEE flows	DE,F,A	remanufacturing (unit/year)
.Theil	A	Sx (Units)
.Theil	A	Sy (Units)

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Complex Variable (Richardson's Rule Threshold = 3) (35)

Group	Type	Variable	Complexity
.EEE obsolescence	A	average age of useful products (year/unit)	4
.model checking	A	current stock of material (kg)	4
.EEE obsolescence	A	decommissioning probability in the end of life for second use (dmnl)	4
.EEE obsolescence	F,A	decrease in age of available used EEE (dmnl)	4
.EEE obsolescence	F,A	decrease in age of first use EEE (dmnl)	4
.EEE and WEEE flows	DE,F,A	first use decommissioning because faulty (unit/year)	4
.EEE and WEEE flows	DE,F,A	first use decommissioning before broken (unit/year)	4
.EEE obsolescence	A	fraction fit for reman (dmnl)	4
.EEE obsolescence	A	fraction fit for second use (dmnl)	4
.EEE obsolescence	F,A	increase in age of first use EEE (dmnl)	4
.EEE obsolescence	F,A	increase in age of second use EEE (dmnl)	4
.model checking	A	initial stock of material (kg)	4
.model checking	A	mass balance EEE (unit)	4
.model checking	A	mass balance material (kg)	4
.Theil	A	residuals (Units)	4
.EEE and WEEE flows	F,A	WEEE not recycled (kg/year)	4
.depreciation	A	decomissioned EEE outflows (unit/year)	5
.material supply	SM,A	expected material kept in the system (kg/year)	5
.EEE and WEEE flows	L,F	First use EEE (unit)	5
.model checking	F,A	material inflows (kg/year)	5
.model checking	F,A	material outflows (kg/year)	5
.EEE and WEEE flows	L	Processed material (kg)	5
.Theil	A	r (Dimensionless)	5
.CE mechanisms	A	recycling infrastructure level (dmnl)	5
.EEE and WEEE flows	DE,F,A	remanufacturing (unit/year)	5
.CE mechanisms	A	remanufacturing infrastructure level (dmnl)	5
.CE mechanisms	A	repairing infrastructure level (dmnl)	5
.CE mechanisms	A	second use infrastructure level (dmnl)	5
.EEE and WEEE flows	L	WEEE before treatment (kg)	5
.EEE and WEEE flows	DE,F,A	WEEE recycling (kg/year)	5
.model checking	F,A	EEE inflows (unit/year)	6
.model checking	F,A	EEE outflows (unit/year)	6
.EEE and WEEE flows	L	Available used EEE (unit)	7
.EEE obsolescence	F,A	increase in age of available used EEE (dmnl)	8
.depreciation	A	decommissioned EEE average outflow price (USD/unit)	9

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Complex Stock (12)

Group	Type	Variable
.Theil	L	count (Dimensionless)
.EEE and WEEE flows	L	Processed material (kg)
.Theil	L	Sum APE (Dimensionless)
.Theil	L	Sum SPE (Dimensionless)
.Theil	L	Sum Xi (Units)
.Theil	L	Sum XmY2 (Units*Units)
.Theil	L	Sum Yi (Units)

.Theil	L	SumX2 (Units*Units)
.Theil	L	SumXY (Units*Units)
.Theil	L	SumY2 (Units*Units)
.depreciation	L	Total historical first use EEE value (USD)
.EEE and WEEE flows	L	WEEE before treatment (kg)

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Variables With Source Information (0)

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Variables With Dimensionless Units (63)

Group	Type	Variable
.Theil	A	1 - us (Dimensionless)
.technology adoption	A	actual adoption fraction (dmnl)
.Theil	L	count (Dimensionless)
.EEE obsolescence	A	decommissioning probability in the end of life for first use (dmnl)
.EEE obsolescence	A	decommissioning probability in the end of life for second use (dmnl)
.EEE obsolescence	F,A	decrease in age of available used EEE (dmnl)
.EEE obsolescence	F,A	decrease in age of first use EEE (dmnl)
.EEE obsolescence	F,A	decrease in age of second use EEE (dmnl)
.EEE obsolescence	A	fraction fit for reman (dmnl)
.EEE obsolescence	A	fraction fit for second use (dmnl)
.EEE obsolescence	A	fraction introduced to reman market (dmnl)
.EEE obsolescence	A	fraction introduced to second use market (dmnl)
.EEE obsolescence	A	fraction introduced to WEEE market (dmnl)
.EEE and WEEE flows	C	fraction of decomissioned before broken (dmnl)
.EEE obsolescence	A	fraction of WEEE formally collected (dmnl)
.EEE obsolescence	A	fraction of WEEE not formally collected (dmnl)
.EEE obsolescence	F,A	increase in age of available used EEE (dmnl)
.EEE obsolescence	F,A	increase in age of first use EEE (dmnl)
.EEE obsolescence	F,A	increase in age of second use EEE (dmnl)
.technology adoption	C	initial adopters fraction (dmnl)
.EEE obsolescence	C	lifetime fraction for decommissioning before broken (dmnl)
.EEE obsolescence	C	lifetime fraction for reman products (dmnl)
.EEE obsolescence	C	lifetime fraction for second use (dmnl)
.CE mechanisms	C	lifetime ratio (dmnl)
.Theil	A	mape (Dimensionless)
.retrospective	A	normalised PPP (dmnl)
.Theil	F,A	pick (Dimensionless)
.retrospective	C	potential adoption fraction (dmnl)
.Theil	A	r (Dimensionless)
.CE mechanisms	C	R desired level (dmnl)
.CE mechanisms	C	R initial level (dmnl)
.Theil	A	r2 (Dimensionless)
.depreciation	C	ratio of EEE price for second use (dmnl)
.depreciation	C	ratio of reman contribution per unit (dmnl)
.depreciation	A	ratio remanufacturing from decommissioned EEE (dmnl)
.depreciation	A	ratio second use comissioning from decommissioned EEE (dmnl)
.depreciation	A	ratio WEEE not being recycled from decomissioned EEE (dmnl)
.depreciation	A	ratio WEEE recycling from decomissioned EEE (dmnl)
.CE mechanisms	C	RC desired level (dmnl)
.CE mechanisms	C	RC initial level (dmnl)
.EEE and WEEE flows	C	recyclability EEE (dmnl)
.CE mechanisms	A	recycling infrastructure level (dmnl)
.EEE obsolescence	A	reman effectiveness (dmnl)
.EEE obsolescence	A	reman market coverage (dmnl)
.EEE and WEEE flows	C	remanufacturability EEE (dmnl)
.CE mechanisms	A	remanufacturing infrastructure level (dmnl)
.EEE obsolescence	A	repair effectiveness (dmnl)
.CE mechanisms	A	repairing infrastructure level (dmnl)
.CE mechanisms	C	RM desired level (dmnl)
.CE mechanisms	C	RM initial level (dmnl)
.Theil	A	RMSPE (Dimensionless)
.EEE obsolescence	A	second hand market coverage (dmnl)
.CE mechanisms	A	second use infrastructure level (dmnl)
.CE mechanisms	C	SU desired level (dmnl)
.CE mechanisms	C	SU initial level (dmnl)
.Theil	L	Sum APE (Dimensionless)
.Theil	L	Sum SPE (Dimensionless)
.CE mechanisms	C	switch infra development (dmnl)
.Theil	A	uc (Dimensionless)
.Theil	A	um (Dimensionless)
.Theil	A	us (Dimensionless)
.EEE obsolescence	A	weibull scale (dmnl)
.EEE obsolescence	C	weibull shape (dmnl)

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Variables without Predefined Min or Max Values (220)

Group	Type	Variable
.Theil	A	1 - us (Dimensionless)
.technology adoption	A	actual adoption fraction (dmnl)
.technology adoption	DE,A	additional purchases (unit/year)
.material supply	A	adjustment for stock of Processed material (kg/year)
.technology adoption	A	adoption purchases (unit/year)
.technology adoption	F,A	adoption rate (house/year)
.EEE and WEEE flows	L	Available used EEE (unit)
.EEE obsolescence	A	average age of useful products (year/unit)
.EEE obsolescence	A	average decommissioned EEE age (year/unit)
.EEE obsolescence	A	average EEE age (year/unit)
.technology adoption	A	average EEE desired per adopter (unit/house)
.depreciation	F,A	average EEE value (USD/unit)
.EEE obsolescence	A	average second use EEE age (year/unit)
.EEE and WEEE flows	A	collection time (year)
.Theil	L	count (Dimensionless)
.model checking	A	current stock of EEE (unit)
.model checking	A	current stock of material (kg)
.depreciation	A	decomissioned EEE outflows (unit/year)
.depreciation	A	decommissioned EEE average outflow price (USD/unit)
.EEE obsolescence	A	decommissioning probability in the end of life for first use (dmnl)
.EEE obsolescence	A	decommissioning probability in the end of life for second use (dmnl)
.EEE obsolescence	F,A	decrease in age of available used EEE (dmnl)
.EEE obsolescence	F,A	decrease in age of first use EEE (dmnl)
.EEE obsolescence	F,A	decrease in age of second use EEE (dmnl)
.technology adoption	A	desired EEE (unit)
.material supply	A	desired extraction rate (kg/year)
.material supply	C	desired stock lenght of processed material (year)
.material supply	SM,A	desired stock of processed material (kg)
.Theil	A	dif cov (Units*Units)
.Theil	A	dif mea (Units*Units)
.Theil	A	dif var (Units*Units)
.EEE and WEEE flows	DE,F,A	disposal of EEE as WEEE (unit/year)
.EEE and WEEE flows	A	distribution time (year)
.Theil	F,A	dt (Time Units)
.technology adoption	L	EEE adopters (house)
.retrospective	C,F	EEE average unit weight (kg/unit)
.EEE and WEEE flows	DE,F,A	EEE commissioning (unit/year)
.technology adoption	A	EEE demand (unit/year)
.depreciation	A	EEE depreciation ratio (USD/year)
.model checking	F,A	EEE inflows (unit/year)
.model checking	F,A	EEE outflows (unit/year)
.model checking	A	EEE per household (unit/house)
.model checking	A	EEE per inhabitant (unit/inhabitant)
.retrospective	C	EEE unit price (USD/unit)
.retrospective	C	effect of normalised PPP on average number of EEE per adopter (unit/house)
.model checking	A	error households adoption (house)
.material supply	SM,A	expected EEE demand (kg/year)
.EEE obsolescence	A	expected lifetime for decommissioning before broken (year/unit)
.EEE obsolescence	A	expected lifetime for second use (year/unit)
.material supply	SM,A	expected material kept in the system (kg/year)
.EEE and WEEE flows	DE,F,A	extraction (kg/year)
.material supply	A	extraction rate considering minimum stock (kg/year)
.EEE and WEEE flows	DE,F,A	first use decommissioning because faulty (unit/year)
.EEE and WEEE flows	DE,F,A	first use decommissioning before broken (unit/year)
.EEE and WEEE flows	L,F	First use EEE (unit)
.EEE obsolescence	A	fraction fit for reman (dmnl)
.EEE obsolescence	A	fraction fit for second use (dmnl)
.EEE obsolescence	A	fraction introduced to reman market (dmnl)
.EEE obsolescence	A	fraction introduced to second use market (dmnl)
.EEE obsolescence	A	fraction introduced to WEEE market (dmnl)
.EEE and WEEE flows	C	fraction of decomissioned before broken (dmnl)
.EEE obsolescence	A	fraction of WEEE formally collected (dmnl)
.EEE obsolescence	A	fraction of WEEE not formally collected (dmnl)
.technology adoption	A	gap from EEE in use to desired (unit)
.retrospective	C	historic disposal of EEE (unit/year)
.retrospective	C	historic EEE put on market (unit/year)
.Theil	A	historical time series (Units)
.retrospective	A	household increase trend (1/year)
.EEE obsolescence	F,A	increase in age of available used EEE (dmnl)
.EEE obsolescence	F,A	increase in age of first use EEE (dmnl)
.EEE obsolescence	F,A	increase in age of second use EEE (dmnl)
.CE mechanisms	C	infra development initial year (year)
.technology adoption	LI,A	initial adopters (house)
.technology adoption	C	initial adopters fraction (dmnl)
.technology adoption	LI,A	initial potential adopters (house)
.EEE and WEEE flows	LI,C	initial stock of available used EEE (unit)
.model checking	A	initial stock of EEE (unit)

.EEE and WEEE flows	LI,C	initial stock of first use EEE (unit)
.model checking	A	initial stock of material (kg)
.EEE and WEEE flows	LI,C	initial stock of non recycled WEEE (kg)
.EEE and WEEE flows	LI,C	initial stock of processed material (kg)
.EEE and WEEE flows	LI,C	initial stock of raw material (kg)
.EEE and WEEE flows	LI,C	initial stock of second use EEE (unit)
.EEE and WEEE flows	LI,C	initial stock of WEEE before treatment (kg)
.indicators	A	leakage of materials (1/year)
.indicators	A	leakage of products (1/year)
.EEE obsolescence	A	lifetime expected for reman products (year/unit)
.EEE obsolescence	C	lifetime fraction for decommissioning before broken (dmnl)
.EEE obsolescence	C	lifetime fraction for reman products (dmnl)
.EEE obsolescence	C	lifetime fraction for second use (dmnl)
.CE mechanisms	C	lifetime ratio (dmnl)
.Theil	A	M X (Units)
.Theil	A	M Y (Units)
.Theil	A	mape (Dimensionless)
.model checking	A	mass balance EEE (unit)
.model checking	A	mass balance material (kg)
.model checking	F,A	material inflows (kg/year)
.model checking	F,A	material outflows (kg/year)
.technology adoption	A	max EEE desired (unit/house)
.indicators	A	max value EEE commissioning (unit/year)
.indicators	A	max value remanufacturing (unit/year)
.indicators	A	max value second use commissioning (unit/year)
.indicators	A	max value WEEE recycling (kg/year)
.EEE obsolescence	A	mean lifetime (year/unit)
.Theil	A	mse (Units*Units)
.Theil	A	MX2 (Units*Units)
.Theil	A	Mxy (Units*Units)
.Theil	A	MY2 (Units*Units)
.technology adoption	F,A	new potential adopters (house/year)
.EEE and WEEE flows	L	Non recycled WEEE (kg)
.EEE and WEEE flows	A	non recycled WEEE because of recyclability (kg/year)
.retrospective	A	normalised PPP (dmnl)
.technology adoption	C	number of purchases when adopting (unit/house)
.Theil	F,A	pick (Dimensionless)
.retrospective	C	population (inhabitant)
.retrospective	C	potential adoption fraction (dmnl)
.technology adoption	L	Potential EEE adopters (house)
.retrospective	A	PPP 1980 (USD)
.EEE and WEEE flows	L	Processed material (kg)
.retrospective	C	purchasing power parity per capta (USD)
.Theil	A	r (Dimensionless)
.CE mechanisms	C	R desired level (dmnl)
.CE mechanisms	C	R desired year (year)
circularEEE v.1 prospective	C	R EEE in use (unit)
.retrospective	C	R EEE per adopter (unit/house)
.CE mechanisms	C	R initial level (dmnl)
.Theil	A	r2 (Dimensionless)
.EEE obsolescence	C	rate of ageing (year/(year*unit))
.depreciation	C	ratio of EEE price for second use (dmnl)
.depreciation	C	ratio of reman contribution per unit (dmnl)
.depreciation	A	ratio remanufacturing from decommissioned EEE (dmnl)
.depreciation	A	ratio second use comissioning from decommissioned EEE (dmnl)
.depreciation	A	ratio WEEE not being recycled from decomissioned EEE (dmnl)
.depreciation	A	ratio WEEE recycling from decomissioned EEE (dmnl)
.EEE and WEEE flows	L	Raw material (kg)
.CE mechanisms	C	RC desired level (dmnl)
.CE mechanisms	C	RC desired year (year)
.CE mechanisms	C	RC initial level (dmnl)
.technology adoption	A	recurrent purchases to replace (unit/year)
.EEE and WEEE flows	C	recyclability EEE (dmnl)
.CE mechanisms	A	recycling infrastructure level (dmnl)
.EEE and WEEE flows	A	recycling of EEE from remanufacturing process (kg/year)
.EEE and WEEE flows	A	recycling time (year)
.EEE and WEEE flows	A	redistribution time (year)
.EEE obsolescence	A	reman effectiveness (dmnl)
.EEE obsolescence	A	reman market coverage (dmnl)
.EEE and WEEE flows	A	reman time (year)
.EEE and WEEE flows	C	remanufacturability EEE (dmnl)
.EEE and WEEE flows	DE,F,A	remanufacturing (unit/year)
.depreciation	A	remanufacturing contribution per unit (USD/unit)
.CE mechanisms	A	remanufacturing infrastructure level (dmnl)
.EEE obsolescence	A	repair effectiveness (dmnl)
.CE mechanisms	A	repairing infrastructure level (dmnl)
.Theil	A	residuals (Units)
.CE mechanisms	C	RM desired level (dmnl)
.CE mechanisms	C	RM desired year (year)
.CE mechanisms	C	RM initial level (dmnl)
.Theil	A	rmse (Units)
.Theil	A	RMSPE (Dimensionless)
.EEE obsolescence	A	second hand market coverage (dmnl)
.EEE and WEEE flows	DE,F,A	second use commissioning (unit/year)
.EEE and WEEE flows	DE,F,A	second use decommissioning (unit/year)
.EEE and WEEE flows	L	Second use EEE (unit)
.CE mechanisms	A	second use infrastructure level (dmnl)
.depreciation	A	second use price (USD/unit)
.Theil	A	simulated time series (Units)

.Theil	A	SSE (Units*Units)
.material supply	C	stock adjustment time (year)
.CE mechanisms	C	SU desired level (dmnl)
.CE mechanisms	C	SU desired year (year)
.CE mechanisms	C	SU initial level (dmnl)
.Theil	L	Sum APE (Dimensionless)
.model checking	L	Sum of all EEE inflows (unit)
.model checking	L	Sum of all EEE outflows (unit)
.model checking	L	Sum of all material inflows (kg)
.model checking	L	Sum of all material outflows (kg)
.Theil	L	Sum SPE (Dimensionless)
.Theil	L	Sum Xi (Units)
.Theil	L	Sum XmY2 (Units*Units)
.Theil	L	Sum Yi (Units)
.Theil	L	SumX2 (Units*Units)
.Theil	L	SumXY (Units*Units)
.Theil	L	SumY2 (Units*Units)
.CE mechanisms	C	switch infra development (dmnl)
.Theil	A	Sx (Units)
.Theil	A	Sy (Units)
.indicators	A	time max value commissioning (year)
.indicators	A	time max value recycling (year)
.indicators	A	time max value remanufacturing (year)
.indicators	A	time max value second use commissioning (year)
.EEE and WEEE flows	A	time to extract (year)
.EEE and WEEE flows	A	time to make available (year)
.technology adoption	A	time to realise additional need (year)
.EEE obsolescence	L	Total age of available used EEE (year)
.EEE obsolescence	L	Total age of first use EEE (year)
.technology adoption	A	Total EEE in use (unit)
.depreciation	A	total first use EEE value (USD)
.depreciation	L	Total historical first use EEE value (USD)
.retrospective	C	total households (house)
.retrospective	A	total households variation (house/year)
.indicators	A	Total materials in the system (kg)
.indicators	A	Total products in the system (unit)
.EEE obsolescence	L	Total time of second use EEE (year)
.indicators	A	total value of Available WEEE (USD)
.Theil	A	uc (Dimensionless)
.Theil	A	um (Dimensionless)
.Theil	A	us (Dimensionless)
.EEE obsolescence	A	virtual age after reman (year/unit)
.EEE obsolescence	A	virtual age after repair (year/unit)
.indicators	C	WEEE average market value (USD/kg)
.EEE and WEEE flows	L	WEEE before treatment (kg)
.depreciation	C	WEEE costs for non recycling (USD/kg)
.EEE and WEEE flows	F,A	WEEE not recycled (kg/year)
.EEE and WEEE flows	DE,F,A	WEEE recycling (kg/year)
.EEE obsolescence	A	weibull scale (dmnl)
.EEE obsolescence	C	weibull shape (dmnl)
.Theil	A	X (Units)
.Theil	F,A	Xi (Units)
.Theil	A	Y (Units)
.Theil	F,A	Yi (Units)

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Function Sensitivity Parameters (0)

Group	Type	Variable

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Data Lookup Tables (0)

Group	Type	Variable

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Variables Not In Any View (1)

Group	Type	Variable
circularEEE v.1 prospective	C	R EEE in use (unit)

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Equations With Unit Errors Or Warnings (20)

Group	Type	Variable	Units
.technology adoption	F,A	adoption rate (house/year)	LHS Units: (house/year) RHS Units: (house) Complete RHS Units: (MAX ((Dmnl - Dmnl) , constant) * house)
.EEE obsolescence	A	decommissioning probability in the end of life for first use (dmnl)	LHS Units: (Dmnl) RHS Units: (year/unit) Complete RHS Units: ((Dmnl / Dmnl) * ((year/unit / Dmnl) ^ (Dmnl - constant)))
.EEE obsolescence	A	decommissioning probability in the end of life for second use (dmnl)	LHS Units: (Dmnl) RHS Units: Improper units for function argument 1 < (year/unit) > Complete RHS Units: EXP (((((year/unit / Dmnl) _) ^ Dmnl) + ((year/unit / Dmnl) ^ Dmnl)))
.EEE and WEEE flows	DE,F,A	disposal of EEE as WEEE (unit/year)	LHS Units: (unit/year) RHS Units: (unit) Complete RHS Units: DELAY1 ((unit * Dmnl) , year)
.Theil	F,A	dt (Time Units)	LHS Units: (Time Units) RHS Units: (year) Complete RHS Units: year
.EEE and WEEE flows	DE,F,A	first use decommissioning because faulty (unit/year)	LHS Units: (unit/year) RHS Units: (unit) Complete RHS Units: DELAY1 (((unit * Dmnl) * (constant - Dmnl)) , year)
.EEE and WEEE flows	DE,F,A	first use decommissioning before broken (unit/year)	LHS Units: (unit/year) RHS Units: DELAY1 ((unit) , (ERROR >>> (year/unit) + (year) <<< ERROR)) Complete RHS Units: DELAY1 ((unit * Dmnl) , (year/unit + year))
.EEE obsolescence	A	fraction fit for reman (dmnl)	LHS Units: (Dmnl) RHS Units: Improper units for function argument 1 < (year/unit) > Complete RHS Units: EXP ((((((year/unit + year/unit) / Dmnl) _) ^ Dmnl) + ((year/unit / Dmnl) ^ Dmnl)))
.EEE obsolescence	A	fraction fit for second use (dmnl)	LHS Units: (Dmnl) RHS Units: Improper units for function argument 1 < (year/unit) > Complete RHS Units: EXP ((((((year/unit + year/unit) / Dmnl) _) ^ Dmnl) + ((year/unit / Dmnl) ^ Dmnl)))
.Theil	A	historical time series (Units)	LHS Units: (Units) RHS Units: (unit/year) Complete RHS Units: unit/year
.retrospective	A	household increase trend (1/year)	LHS Units: (1/year) RHS Units: (house/year) Complete RHS Units: TREND (house , year , constant)
.EEE obsolescence	A	mean lifetime (year/unit)	LHS Units: (year/unit) RHS Units: (Dmnl) Complete RHS Units: (EXP (GAMMALN (((constant / Dmnl) + constant))) * Dmnl)
.EEE and WEEE flows	DE,F,A	remanufacturing (unit/year)	LHS Units: (unit/year) RHS Units: ERROR >>> Mismatched units in function call <<< ERROR Complete RHS Units: MIN (DELAY1 (((unit * Dmnl) * Dmnl) , year) , unit/year)
.Theil	A	rmse (Units)	LHS Units: (Units) RHS Units: (Units*Units) Complete RHS Units: SQRT (Units*Units)
.EEE and WEEE flows	DE,F,A	second use commissioning (unit/year)	LHS Units: (unit/year) RHS Units: (unit) Complete RHS Units: DELAY1 ((unit * Dmnl) , year)
.EEE and WEEE flows	DE,F,A	second use decommissioning (unit/year)	LHS Units: (unit/year) RHS Units: (unit) Complete RHS Units: DELAY1 ((unit * Dmnl) , year)
.Theil	A	simulated time series (Units)	LHS Units: (Units) RHS Units: (unit/year) Complete RHS Units: unit/year
.Theil	A	Sx (Units)	LHS Units: (Units) RHS Units: (Units*Units) Complete RHS Units: SQRT (MAX (constant , (Units*Units - (Units * Units))))
.Theil	A	Sy (Units)	LHS Units: (Units) RHS Units: (Units*Units) Complete RHS Units: SQRT (MAX (constant , (Units*Units - (Units * Units))))
.EEE and WEEE flows	DE,F,A	WEEE recycling (kg/year)	LHS Units: (kg/year) RHS Units: ((ERROR >>> (kg) + (kg/year) <<< ERROR) * (Dmnl)) Complete RHS Units: ((DELAY1 ((kg * Dmnl) , year) + kg/year) * Dmnl)

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Units (12/10)

Units	Type	Alternates
1/unit	Basic	[year/(year*unit)]
1/year	Basic	
Dmnl	Basic	[Dimensionless, dmnl]
house	Basic	
inhabitant	Basic	
kg	Basic	
Time Units	Basic	
unit	Basic	
Units	Basic	
Units*Units	Basic	
USD	Basic	
year	Basic	
house/year	Combined	
kg/unit	Combined	
kg/year	Combined	
unit/house	Combined	
unit/inhabitant	Combined	

unit/year	Combined	
USD/kg	Combined	
USD/unit	Combined	
USD/year	Combined	
year/unit	Combined	

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Feedback Loops (1,778|0 Maximum Length: 30 [2,29] | [0,0])

Group	Type	Variable	Loops	+	-	+/- Ratio	?	Loops (IVV)	+	-	+/- Ratio	?
.EEE obsolescence	A	average decommissioned EEE age (year/unit)	1,705 (95.9%)	868 [5,28]	837 [3,29]	1.04	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	L	Total age of available used EEE (year)	1,585 (89.1%)	804 [6,28]	781 [3,29]	1.03	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	L	Available used EEE (unit)	1,555 (87.5%)	790 [4,28]	765 [2,29]	1.03	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	L,F	First use EEE (unit)	1,410 (79.3%)	713 [4,28]	697 [2,29]	1.02	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	F,A	increase in age of available used EEE (dmnl)	1,335 (75.1%)	691 [6,28]	644 [8,29]	1.07	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	EEE demand (unit/year)	1,291 (72.6%)	648 [7,28]	643 [5,29]	1.01	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	virtual age after repair (year/unit)	1,268 (71.3%)	648 [5,28]	620 [6,29]	1.05	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	remanufacturing (unit/year)	1,193 (67.1%)	603 [4,28]	590 [2,29]	1.02	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	second use commissioning (unit/year)	1,185 (66.6%)	603 [4,28]	582 [2,29]	1.04	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	average EEE age (year/unit)	1,178 (66.3%)	595 [4,28]	583 [3,29]	1.02	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	first use decommissioning because faulty (unit/year)	1,146 (64.5%)	568 [4,28]	578 [2,29]	0.98	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	L	Second use EEE (unit)	1,061 (59.7%)	541 [4,28]	520 [2,29]	1.04	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	disposal of EEE as WEEE (unit/year)	996 (56.0%)	498 [7,28]	498 [2,29]	1.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	fraction fit for second use (dmnl)	960 (54.0%)	489 [7,28]	471 [6,29]	1.04	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	fraction introduced to second use market (dmnl)	960 (54.0%)	489 [7,28]	471 [6,29]	1.04	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	second use decommissioning (unit/year)	949 (53.4%)	492 [4,28]	457 [2,29]	1.08	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	L	Total age of first use EEE (year)	919 (51.7%)	460 [5,28]	459 [3,29]	1.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	average second use EEE age (year/unit)	891 (50.1%)	461 [6,28]	430 [3,29]	1.07	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	decommissioning probability in the end of life for first use (dmnl)	880 (49.5%)	440 [4,28]	440 [6,29]	1.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	decommissioning probability in the end of life for second use (dmnl)	785 (44.2%)	408 [5,28]	377 [4,29]	1.08	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	fraction introduced to reman market (dmnl)	762 (42.9%)	381 [7,28]	381 [6,29]	1.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	fraction introduced to WEEE market (dmnl)	726 (40.8%)	363 [7,28]	363 [8,29]	1.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	L	Total time of second use EEE (year)	725 (40.8%)	374 [7,28]	351 [3,29]	1.07	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	recurrent purchases to replace (unit/year)	710 (39.9%)	355 [7,27]	355 [5,26]	1.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	F,A	increase in age of second use EEE (dmnl)	660 (37.1%)	344 [7,28]	316 [6,29]	1.09	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	first use decommissioning before broken (unit/year)	610 (34.3%)	305 [4,28]	305 [2,29]	1.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	F,A	increase in age of first use EEE (dmnl)	596 (33.5%)	311 [6,28]	285 [7,29]	1.09	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	DE,A	additional purchases (unit/year)	581 (32.7%)	293 [8,28]	288 [6,29]	1.02	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]

.technology adoption	A	gap from EEE in use to desired (unit)	581 (32.7%)	293 [8,28]	288 [6,29]	1.02	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	Total EEE in use (unit)	581 (32.7%)	293 [8,28]	288 [6,29]	1.02	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	EEE commissioning (unit/year)	573 (32.2%)	285 [7,28]	288 [6,29]	0.99	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	virtual age after reman (year/unit)	436 (24.5%)	220 [7,28]	216 [6,27]	1.02	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	fraction fit for reman (dmnl)	381 (21.4%)	190 [7,28]	191 [6,27]	0.99	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	F,A	decrease in age of first use EEE (dmnl)	323 (18.2%)	149 [5,28]	174 [3,29]	0.86	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	F,A	decrease in age of available used EEE (dmnl)	250 (14.1%)	113 [8,26]	137 [3,27]	0.82	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	F,A	decrease in age of second use EEE (dmnl)	65 (3.7%)	30 [14,25]	35 [3,26]	0.86	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	L	WEEE before treatment (kg)	3 (0.2%)	0 [0, 0]	3 [2, 4]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	F,A	WEEE not recycled (kg/year)	2 (0.1%)	0 [0, 0]	2 [2, 4]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	WEEE recycling (kg/year)	2 (0.1%)	0 [0, 0]	2 [2, 4]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	actual adoption fraction (dmnl)	1 (0.1%)	0 [0, 0]	1 [3, 3]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.material supply	A	adjustment for stock of Processed material (kg/year)	1 (0.1%)	0 [0, 0]	1 [4, 4]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	F,A	adoption rate (house/year)	1 (0.1%)	0 [0, 0]	1 [3, 3]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	L	EEE adopters (house)	1 (0.1%)	0 [0, 0]	1 [3, 3]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	DE,F,A	extraction (kg/year)	1 (0.1%)	0 [0, 0]	1 [4, 4]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.material supply	A	extraction rate considering minimum stock (kg/year)	1 (0.1%)	0 [0, 0]	1 [4, 4]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	A	non recycled WEEE because of recyclability (kg/year)	1 (0.1%)	0 [0, 0]	1 [4, 4]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	L	Processed material (kg)	1 (0.1%)	0 [0, 0]	1 [4, 4]	0.00	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	1 - us (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	adoption purchases (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	average age of useful products (year/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	average EEE desired per adopter (unit/house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	F,A	average EEE value (USD/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	A	collection time (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	count (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	current stock of EEE (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	current stock of material (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	decomissioned EEE outflows (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	decommissioned EEE average outflow price (USD/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	desired EEE (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.material supply	A	desired extraction rate (kg/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.material supply	C	desired stock lenght of processed material (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.material supply	SM,A	desired stock of processed material (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	dif cov (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	dif mea (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	dif var (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and	A	distribution time	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]

WEEE flows		(year)										
.Theil	F,A	dt (Time Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C,F	EEE average unit weight (kg/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	EEE depreciation ratio (USD/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	F,A	EEE inflows (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	F,A	EEE outflows (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	EEE per household (unit/house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	EEE per inhabitant (unit/inhabitant)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	EEE unit price (USD/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	effect of normalised PPP on average number of EEE per adopter (unit/house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	error households adoption (house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.material supply	SM,A	expected EEE demand (kg/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	expected lifetime for decommissioning before broken (year/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	expected lifetime for second use (year/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.material supply	SM,A	expected material kept in the system (kg/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Control	C	FINAL TIME (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	C	fraction of decomissioned before broken (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	fraction of WEEE formally collected (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	fraction of WEEE not formally collected (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	historic disposal of EEE (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	historic EEE put on market (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	historical time series (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	A	household increase trend (1/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	infra development initial year (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	LI,A	initial adopters (house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	C	initial adopters fraction (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	LI,A	initial potential adopters (house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	LI,C	initial stock of available used EEE (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	initial stock of EEE (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	LI,C	initial stock of first use EEE (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	initial stock of material (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	LI,C	initial stock of non recycled WEEE (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	LI,C	initial stock of processed material (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	LI,C	initial stock of raw material (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	LI,C	initial stock of second use EEE (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	LI,C	initial stock of WEEE before treatment (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Control	C	INITIAL TIME (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	leakage of materials (1/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	leakage of products	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]

		(1/year)										
.EEE obsolescence	A	lifetime expected for reman products (year/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	C	lifetime fraction for decommissioning before broken (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	C	lifetime fraction for reman products (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	C	lifetime fraction for second use (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	lifetime ratio (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	M X (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	M Y (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	mape (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	mass balance EEE (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	A	mass balance material (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	F,A	material inflows (kg/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	F,A	material outflows (kg/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	max EEE desired (unit/house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	max value EEE commissioning (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	max value remanufacturing (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	max value second use commissioning (unit/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	max value WEEE recycling (kg/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	mean lifetime (year/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	mse (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	MX2 (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	Mxy (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	MY2 (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	F,A	new potential adopters (house/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	L	Non recycled WEEE (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	A	normalised PPP (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	C	number of purchases when adopting (unit/house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	F,A	pick (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	population (inhabitant)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	potential adoption fraction (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	L	Potential EEE adopters (house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	A	PPP 1980 (USD)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	purchasing power parity per capta (USD)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	r (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	R desired level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	R desired year (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
circularEEE v.1 prospective	C	R EEE in use (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	R EEE per adopter (unit/house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	R initial level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	r2 (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	C	rate of ageing (year/(year*unit))	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	C	ratio of EEE price for second use (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	C	ratio of reman contribution per unit (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	ratio remanufacturing	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]

		from decommissioned EEE (dmnl)										
.depreciation	A	ratio second use comissioning from decommissioned EEE (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	ratio WEEE not being recycled from decomissioned EEE (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	ratio WEEE recycling from decomissioned EEE (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	L	Raw material (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	RC desired level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	RC desired year (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	RC initial level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	C	recyclability EEE (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	A	recycling infrastructure level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	A	recycling of EEE from remanufacturing process (kg/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	A	recycling time (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	A	redistribution time (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	reman effectiveness (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	reman market coverage (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	A	reman time (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	C	remanufacturability EEE (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	remanufacturing contribution per unit (USD/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	A	remanufacturing infrastructure level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	repair effectiveness (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	A	repairing infrastructure level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	residuals (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	RM desired level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	RM desired year (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	RM initial level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	rmse (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	RMSPE (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Control	A	SAVEPER (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	second hand market coverage (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	A	second use infrastructure level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	second use price (USD/unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	simulated time series (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	SSE (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.material supply	C	stock adjustment time (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	SU desired level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	SU desired year (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	SU initial level (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	Sum APE (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	L	Sum of all EEE inflows (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	L	Sum of all EEE outflows (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]

.model checking	L	Sum of all material inflows (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.model checking	L	Sum of all material outflows (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	Sum SPE (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	Sum Xi (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	Sum XmY2 (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	Sum Yi (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	SumX2 (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	SumXY (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	L	SumY2 (Units*Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.CE mechanisms	C	switch infra development (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	Sx (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	Sy (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	time max value commissioning (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	time max value recycling (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	time max value remanufacturing (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	time max value second use commissioning (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Control	C	TIME STEP (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	A	time to extract (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE and WEEE flows	A	time to make available (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.technology adoption	A	time to realise additional need (year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	A	total first use EEE value (USD)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	L	Total historical first use EEE value (USD)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	C	total households (house)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.retrospective	A	total households variation (house/year)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	Total materials in the system (kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	Total products in the system (unit)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	A	total value of Available WEEE (USD)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	uc (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	um (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	us (Dimensionless)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.indicators	C	WEEE average market value (USD/kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.depreciation	C	WEEE costs for non recycling (USD/kg)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	A	weibull scale (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.EEE obsolescence	C	weibull shape (dmnl)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	X (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	F,A	Xi (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	A	Y (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]
.Theil	F,A	Yi (Units)	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]	0 (0%)	0 [0, 0]	0 [0, 0]	NA	0 [0, 0]

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Macros (0)

Name	Macro Definition	Expanded Macro Definition

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Quick Links: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Positive Polarity Causal Links (339)

Cause	Effect	Polarity
additional purchases	EEE demand	+
adjustment for stock of Processed material	extraction rate considering minimum stock	+
adoption purchases	EEE demand	+
adoption rate	adoption purchases	+
adoption rate	EEE adopters	+
Available used EEE	average decommissioned EEE age	+
Available used EEE	current stock of EEE	+
Available used EEE	disposal of EEE as WEEE	+
Available used EEE	increase in age of available used EEE	+
Available used EEE	remanufacturing	+
Available used EEE	second use commissioning	+
Available used EEE	Total products in the system	+
average decommissioned EEE age	decrease in age of available used EEE	+
average decommissioned EEE age	virtual age after reman	+
average decommissioned EEE age	virtual age after repair	+
average EEE age	average age of useful products	+
average EEE age	decrease in age of first use EEE	+
average EEE age	EEE depreciation ratio	+
average EEE age	increase in age of available used EEE	+
average EEE desired per adopter	desired EEE	+
average EEE value	total first use EEE value	+
average EEE value	Total historical first use EEE value	+
average second use EEE age	average age of useful products	+
average second use EEE age	decommissioning probability in the end of life for second use	+
average second use EEE age	decrease in age of second use EEE	+
average second use EEE age	increase in age of available used EEE	+
collection time	disposal of EEE as WEEE	+
count	M X	+
count	M Y	+
count	mape	+
count	MX2	+
count	Mxy	+
count	MY2	+
count	RMSPE	+
decomissioned EEE outflows	ratio remanufacturing from decommissioned EEE	+
decomissioned EEE outflows	ratio second use comissioning from decommissioned EEE	+
decomissioned EEE outflows	ratio WEEE not being recycled from decomissioned EEE	+
decomissioned EEE outflows	ratio WEEE recycling from decomissioned EEE	+
decommissioning probability in the end of life for first use	first use decommissioning because faulty	+
decommissioning probability in the end of life for second use	second use decommissioning	+
desired EEE	gap from EEE in use to desired	+
desired extraction rate	extraction rate considering minimum stock	+
desired stock lenght of processed material	desired stock of processed material	+
desired stock of processed material	adjustment for stock of Processed material	+
dif cov	mse	+
dif cov	uc	+
dif mea	mse	+
dif mea	um	+
dif var	mse	+
dif var	us	+
disposal of EEE as WEEE	decrease in age of available used EEE	+
disposal of EEE as WEEE	EEE outflows	+
disposal of EEE as WEEE	leakage of products	+
disposal of EEE as WEEE	material inflows	+
disposal of EEE as WEEE	recurrent purchases to replace	+
disposal of EEE as WEEE	WEEE before treatment	+
distribution time	collection time	+
distribution time	desired stock of processed material	+
distribution time	EEE commissioning	+
distribution time	expected EEE demand	+
distribution time	recycling time	+
distribution time	redistribution time	+
distribution time	reman time	+
distribution time	time to extract	+
distribution time	time to make available	+
EEE adopters	actual adoption fraction	+
EEE adopters	desired EEE	+
EEE adopters	error households adoption	+
EEE average unit weight	expected EEE demand	+
EEE average unit weight	expected material kept in the system	+
EEE average unit weight	material inflows	+
EEE average unit weight	material outflows	+
EEE average unit weight	recycling of EEE from remanufacturing process	+
EEE average unit weight	Total materials in the system	+
EEE average unit weight	WEEE before treatment	+
EEE commissioning	EEE inflows	+
EEE commissioning	First use EEE	+
EEE commissioning	material outflows	+
EEE commissioning	simulated time series	+
EEE demand	EEE commissioning	+
EEE demand	expected EEE demand	+
EEE demand	remanufacturing	+
EEE inflows	Sum of all EEE inflows	+
EEE outflows	Sum of all EEE outflows	+
EEE unit price	average EEE value	+

EEE unit price	EEE depreciation ratio	+
EEE unit price	remanufacturing contribution per unit	+
EEE unit price	second use price	+
effect of normalised PPP on average number of EEE per adopter	average EEE desired per adopter	+
expected EEE demand	desired extraction rate	+
expected EEE demand	desired stock of processed material	+
expected lifetime for decommissioning before broken	decrease in age of first use EEE	+
expected lifetime for decommissioning before broken	first use decommissioning before broken	+
expected lifetime for decommissioning before broken	increase in age of available used EEE	+
expected lifetime for second use	fraction fit for second use	+
extraction	material inflows	+
extraction	material outflows	+
extraction	Processed material	+
extraction rate considering minimum stock	extraction	+
first use decommissioning because faulty	Available used EEE	+
first use decommissioning because faulty	decrease in age of first use EEE	+
first use decommissioning because faulty	EEE inflows	+
first use decommissioning because faulty	EEE outflows	+
first use decommissioning because faulty	increase in age of available used EEE	+
first use decommissioning before broken	Available used EEE	+
first use decommissioning before broken	decrease in age of first use EEE	+
first use decommissioning before broken	EEE inflows	+
first use decommissioning before broken	EEE outflows	+
first use decommissioning before broken	increase in age of available used EEE	+
First use EEE	average age of useful products	+
First use EEE	average EEE age	+
First use EEE	current stock of EEE	+
First use EEE	first use decommissioning because faulty	+
First use EEE	first use decommissioning before broken	+
First use EEE	increase in age of first use EEE	+
First use EEE	Total EEE in use	+
First use EEE	total first use EEE value	+
First use EEE	Total historical first use EEE value	+
First use EEE	Total products in the system	+
fraction fit for reman	fraction introduced to reman market	+
fraction fit for second use	fraction introduced to second use market	+
fraction introduced to reman market	remanufacturing	+
fraction introduced to second use market	second use commissioning	+
fraction introduced to WEEE market	disposal of EEE as WEEE	+
fraction of decomissioned before broken	first use decommissioning before broken	+
fraction of WEEE formally collected	WEEE recycling	+
fraction of WEEE formally collected_RSSDlookup	fraction of WEEE formally collected	+
fraction of WEEE not formally collected	WEEE not recycled	+
gap from EEE in use to desired	additional purchases	+
historic EEE put on market	historical time series	+
historical time series	Y	+
household increase trend	total households variation	+
increase in age of available used EEE	Total age of available used EEE	+
increase in age of first use EEE	Total age of first use EEE	+
increase in age of second use EEE	Total time of second use EEE	+
infra development initial year	remanufacturing infrastructure level	+
infra development initial year	second use infrastructure level	+
initial adopters	EEE adopters	+
initial adopters fraction	initial adopters	+
initial potential adopters	Potential EEE adopters	+
initial stock of available used EEE	Available used EEE	+
initial stock of available used EEE	initial stock of EEE	+
initial stock of EEE	mass balance EEE	+
initial stock of first use EEE	First use EEE	+
initial stock of first use EEE	initial stock of EEE	+
initial stock of material	mass balance material	+
initial stock of non recycled WEEE	initial stock of material	+
initial stock of non recycled WEEE	Non recycled WEEE	+
initial stock of processed material	initial stock of material	+
initial stock of processed material	Processed material	+
initial stock of raw material	initial stock of material	+
initial stock of raw material	Raw material	+
initial stock of second use EEE	initial stock of EEE	+
initial stock of second use EEE	Second use EEE	+
initial stock of WEEE before treatment	initial stock of material	+
initial stock of WEEE before treatment	WEEE before treatment	+
lifetime expected for reman products	fraction fit for reman	+
lifetime fraction for decommissioning before broken	expected lifetime for decommissioning before broken	+
lifetime fraction for reman products	lifetime expected for reman products	+
lifetime fraction for second use	expected lifetime for second use	+
lifetime ratio	weibull scale	+
material inflows	Sum of all material inflows	+
material outflows	Sum of all material outflows	+
max EEE desired	average EEE desired per adopter	+
mean lifetime	expected lifetime for decommissioning before broken	+
mean lifetime	expected lifetime for second use	+
mean lifetime	lifetime expected for reman products	+
mse	rmse	+
mse	uc	+
mse	um	+
mse	us	+
MX2	Sx	+
Mxy	r	+
MY2	Sy	+

NAREPLACEMENT	residuals	+
new potential adopters	Potential EEE adopters	+
Non recycled WEEE	current stock of material	+
non recycled WEEE because of recyclability	WEEE not recycled	+
normalised PPP	average EEE desired per adopter	+
number of purchases when adopting	adoption purchases	+
pick	count	+
pick	Xi	+
pick	Yi	+
potential adoption fraction	adoption rate	+
Potential EEE adopters	error households adoption	+
Processed material	current stock of material	+
purchasing power parity per capta	normalised PPP	+
r	r2	+
R desired level	repairing infrastructure level	+
rate of ageing	increase in age of available used EEE	+
rate of ageing	increase in age of first use EEE	+
rate of ageing	increase in age of second use EEE	+
ratio of EEE price for second use	second use price	+
ratio of reman contribution per unit	remanufacturing contribution per unit	+
ratio remanufacturing from decommissioned EEE	decommissioned EEE average outflow price	+
ratio second use comissioning from decommissioned EEE	decommissioned EEE average outflow price	+
ratio WEEE recycling from decomissioned EEE	decommissioned EEE average outflow price	+
Raw material	current stock of material	+
RC desired level	recycling infrastructure level	+
recurrent purchases to replace	EEE demand	+
recyclability EEE	WEEE recycling	+
recycling infrastructure level	fraction of WEEE formally collected	+
recycling of EEE from remanufacturing process	WEEE recycling	+
recycling time	expected material kept in the system	+
recycling time	WEEE recycling	+
redistribution time	second use commissioning	+
reman effectiveness_RSSDlookup	reman effectiveness	+
reman market coverage	fraction introduced to reman market	+
reman market coverage_RSSDlookup	reman market coverage	+
reman time	expected material kept in the system	+
reman time	remanufacturing	+
remanufacturability EEE	remanufacturing	+
remanufacturing	decomissioned EEE outflows	+
remanufacturing	decrease in age of available used EEE	+
remanufacturing	EEE inflows	+
remanufacturing	EEE outflows	+
remanufacturing	expected material kept in the system	+
remanufacturing	First use EEE	+
remanufacturing	increase in age of first use EEE	+
remanufacturing	ratio remanufacturing from decommissioned EEE	+
remanufacturing	recycling of EEE from remanufacturing process	+
remanufacturing contribution per unit	decommissioned EEE average outflow price	+
remanufacturing infrastructure level	reman effectiveness	+
remanufacturing infrastructure level	reman market coverage	+
repair effectiveness_RSSDlookup	repair effectiveness	+
repairing infrastructure level	repair effectiveness	+
RM desired level	remanufacturing infrastructure level	+
RM initial level	remanufacturing infrastructure level	+
second hand market coverage	fraction introduced to second use market	+
second hand market coverage_RSSDlookup	second hand market coverage	+
second use commissioning	decomissioned EEE outflows	+
second use commissioning	decrease in age of available used EEE	+
second use commissioning	EEE inflows	+
second use commissioning	EEE outflows	+
second use commissioning	increase in age of second use EEE	+
second use commissioning	ratio second use comissioning from decommissioned EEE	+
second use commissioning	Second use EEE	+
second use decommissioning	Available used EEE	+
second use decommissioning	decrease in age of second use EEE	+
second use decommissioning	EEE inflows	+
second use decommissioning	EEE outflows	+
second use decommissioning	increase in age of available used EEE	+
Second use EEE	average age of useful products	+
Second use EEE	average second use EEE age	+
Second use EEE	current stock of EEE	+
Second use EEE	increase in age of second use EEE	+
Second use EEE	second use decommissioning	+
Second use EEE	Total EEE in use	+
Second use EEE	Total products in the system	+
second use infrastructure level	second hand market coverage	+
second use price	decommissioned EEE average outflow price	+
simulated time series	X	+
stock adjustment time	adjustment for stock of Processed material	+
SU initial level	second use infrastructure level	+
Sum APE	mape	+
Sum of all EEE inflows	mass balance EEE	+
Sum of all material inflows	mass balance material	+
Sum SPE	RMSPE	+
Sum Xi	M X	+
Sum XmY2	SSE	+
Sum Yi	M Y	+
SumX2	MX2	+
SumXY	Mxy	+

SumY2	MY2	+
switch infra development	remanufacturing infrastructure level	+
switch infra development	second use infrastructure level	+
Sx	dif cov	+
Sx	dif var	+
Sx	r	+
Sy	dif cov	+
Sy	r	+
TIME STEP	distribution time	+
TIME STEP	dt	+
TIME STEP	household increase trend	+
TIME STEP	SAVEPER	+
TIME STEP	time to realise additional need	+
time to extract	extraction	+
time to make available	first use decommissioning because faulty	+
time to make available	first use decommissioning before broken	+
time to make available	second use decommissioning	+
time to realise additional need	additional purchases	+
Total age of available used EEE	average decommissioned EEE age	+
Total age of first use EEE	average EEE age	+
Total EEE in use	EEE per household	+
Total EEE in use	EEE per inhabitant	+
total households	household increase trend	+
total households	initial adopters	+
total households	initial potential adopters	+
total households	total households variation	+
total households variation	new potential adopters	+
Total materials in the system	leakage of materials	+
Total products in the system	leakage of products	+
Total products in the system	Total materials in the system	+
Total time of second use EEE	average second use EEE age	+
virtual age after reman	fraction fit for reman	+
virtual age after reman	increase in age of first use EEE	+
virtual age after repair	decommissioning probability in the end of life for second use	+
virtual age after repair	fraction fit for second use	+
virtual age after repair	increase in age of second use EEE	+
WEEE average market value	decommissioned EEE average outflow price	+
WEEE average market value	total value of Available WEEE	+
WEEE before treatment	current stock of material	+
WEEE before treatment	Total materials in the system	+
WEEE before treatment	total value of Available WEEE	+
WEEE before treatment	WEEE not recycled	+
WEEE before treatment	WEEE recycling	+
WEEE not recycled	decomissioned EEE outflows	+
WEEE not recycled	leakage of materials	+
WEEE not recycled	material inflows	+
WEEE not recycled	material outflows	+
WEEE not recycled	Non recycled WEEE	+
WEEE not recycled	ratio WEEE not being recycled from decomissioned EEE	+
WEEE recycling	decomissioned EEE outflows	+
WEEE recycling	expected material kept in the system	+
WEEE recycling	material inflows	+
WEEE recycling	material outflows	+
WEEE recycling	non recycled WEEE because of recyclability	+
WEEE recycling	Processed material	+
WEEE recycling	ratio WEEE recycling from decomissioned EEE	+
weibull scale	decommissioning probability in the end of life for second use	+
weibull scale	fraction fit for reman	+
weibull scale	fraction fit for second use	+
weibull shape	decommissioning probability in the end of life for first use	+
weibull shape	decommissioning probability in the end of life for second use	+
weibull shape	fraction fit for reman	+
weibull shape	fraction fit for second use	+
X	Xi	+
Xi	residuals	+
Xi	Sum APE	+
Xi	Sum SPE	+
Xi	Sum Xi	+
Xi	Sum XmY2	+
Xi	SumX2	+
Xi	SumXY	+
Y	Yi	+
Yi	Sum APE	+
Yi	Sum Yi	+
Yi	SumXY	+
Yi	SumY2	+

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Negative Polarity Causal Links (69)

Cause	Effect	**Polarity**
actual adoption fraction	adoption rate	-

adoption rate	Potential EEE adopters	-
average EEE age	average EEE value	-
average EEE age	decommissioning probability in the end of life for first use	-
collection time	WEEE not recycled	-
current stock of EEE	mass balance EEE	-
current stock of material	mass balance material	-
decommissioned EEE average outflow price	EEE depreciation ratio	-
decrease in age of available used EEE	Total age of available used EEE	-
decrease in age of first use EEE	Total age of first use EEE	-
decrease in age of second use EEE	Total time of second use EEE	-
disposal of EEE as WEEE	Available used EEE	-
dt	count	-
dt	Sum APE	-
dt	Sum SPE	-
dt	Sum Xi	-
dt	Sum XmY2	-
dt	Sum Yi	-
dt	SumX2	-
dt	SumXY	-
dt	SumY2	-
EEE average unit weight	decomissioned EEE outflows	-
EEE average unit weight	decommissioned EEE average outflow price	-
EEE average unit weight	Processed material	-
EEE average unit weight	ratio WEEE not being recycled from decomissioned EEE	-
EEE average unit weight	ratio WEEE recycling from decomissioned EEE	-
EEE commissioning	Processed material	-
EEE depreciation ratio	average EEE value	-
expected material kept in the system	desired extraction rate	-
extraction	Raw material	-
first use decommissioning because faulty	First use EEE	-
first use decommissioning before broken	First use EEE	-
fraction introduced to reman market	fraction introduced to WEEE market	-
fraction introduced to second use market	fraction introduced to reman market	-
fraction introduced to second use market	fraction introduced to WEEE market	-
fraction of decomissioned before broken	first use decommissioning because faulty	-
fraction of WEEE formally collected	fraction of WEEE not formally collected	-
initial adopters fraction	initial potential adopters	-
M X	r	-
M X	Sx	-
M Y	r	-
M Y	Sy	-
population	EEE per inhabitant	-
PPP 1980	normalised PPP	-
Processed material	adjustment for stock of Processed material	-
r	dif cov	-
ratio WEEE not being recycled from decomissioned EEE	decommissioned EEE average outflow price	-
recyclability EEE	non recycled WEEE because of recyclability	-
reman effectiveness	virtual age after reman	-
remanufacturability EEE	recycling of EEE from remanufacturing process	-
remanufacturing	Available used EEE	-
repair effectiveness	virtual age after repair	-
second use commissioning	Available used EEE	-
second use decommissioning	Second use EEE	-
SU desired level	second use infrastructure level	-
SU desired year	second use infrastructure level	-
Sum of all EEE outflows	mass balance EEE	-
Sum of all material outflows	mass balance material	-
Total EEE in use	gap from EEE in use to desired	-
total households	actual adoption fraction	-
total households	adoption rate	-
total households	EEE per household	-
total households	error households adoption	-
us	1 - us	-
WEEE costs for non recycling	decommissioned EEE average outflow price	-
WEEE not recycled	WEEE before treatment	-
WEEE recycling	WEEE before treatment	-
weibull scale	decommissioning probability in the end of life for first use	-
Yi	residuals	-

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Function-based Polarity Causal Links (38)

Cause	Effect	Polarity
EEE commissioning	max value EEE commissioning	Function[SAMPLEIFTRUE]
EEE commissioning	time max value commissioning	Function[SAMPLEIFTRUE]
infra development initial year	recycling infrastructure level	Inconsistent
infra development initial year	repairing infrastructure level	Inconsistent
M X	dif mea	Inconsistent
M Y	dif mea	Inconsistent
max value EEE commissioning	time max value commissioning	Function[SAMPLEIFTRUE]
max value remanufacturing	time max value remanufacturing	Function[SAMPLEIFTRUE]
max value second use commissioning	time max value second use commissioning	Function[SAMPLEIFTRUE]

max value WEEE recycling	time max value recycling	Function[SAMPLEIFTRUE]
NAREPLACEMENT	pick	If Then Else Switch
pick	residuals	If Then Else Switch
purchasing power parity per capta	PPP 1980	Function[GETDATAATTIME]
R desired year	repairing infrastructure level	Inconsistent
R EEE per adopter	max EEE desired	Function[GETDATAATTIME]
R initial level	repairing infrastructure level	Inconsistent
RC desired year	recycling infrastructure level	Inconsistent
RC initial level	recycling infrastructure level	Inconsistent
remanufacturing	max value remanufacturing	Function[SAMPLEIFTRUE]
remanufacturing	time max value remanufacturing	Function[SAMPLEIFTRUE]
RM desired year	remanufacturing infrastructure level	Inconsistent
second use commissioning	max value second use commissioning	Function[SAMPLEIFTRUE]
second use commissioning	time max value second use commissioning	Function[SAMPLEIFTRUE]
switch infra development	recycling infrastructure level	Inconsistent
switch infra development	repairing infrastructure level	Inconsistent
Sy	dif var	Inconsistent
Time	time max value commissioning	Function[SAMPLEIFTRUE]
Time	time max value recycling	Function[SAMPLEIFTRUE]
Time	time max value remanufacturing	Function[SAMPLEIFTRUE]
Time	time max value second use commissioning	Function[SAMPLEIFTRUE]
WEEE recycling	max value WEEE recycling	Function[SAMPLEIFTRUE]
WEEE recycling	time max value recycling	Function[SAMPLEIFTRUE]
weibull scale	mean lifetime	Function[EXP,GAMMALN]
weibull shape	mean lifetime	Function[EXP,GAMMALN]
X	pick	If Then Else Switch
Y	pick	If Then Else Switch
Yi	Sum SPE	Inconsistent
Yi	Sum XmY2	Inconsistent

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Rate-to-rate Links (42)

Cause	Effect
EEE average unit weight	material inflows
EEE average unit weight	material outflows
EEE commissioning	EEE inflows
EEE commissioning	First use EEE
EEE commissioning	material outflows
First use EEE	first use decommissioning because faulty
First use EEE	first use decommissioning before broken
First use EEE	increase in age of first use EEE
WEEE not recycled	material inflows
WEEE not recycled	material outflows
WEEE recycling	material inflows
WEEE recycling	material outflows
disposal of EEE as WEEE	EEE outflows
disposal of EEE as WEEE	decrease in age of available used EEE
disposal of EEE as WEEE	material inflows
extraction	material inflows
extraction	material outflows
first use decommissioning because faulty	EEE inflows
first use decommissioning because faulty	EEE outflows
first use decommissioning because faulty	First use EEE
first use decommissioning because faulty	decrease in age of first use EEE
first use decommissioning because faulty	increase in age of available used EEE
first use decommissioning before broken	EEE inflows
first use decommissioning before broken	EEE outflows
first use decommissioning before broken	First use EEE
first use decommissioning before broken	decrease in age of first use EEE
first use decommissioning before broken	increase in age of available used EEE
pick	Xi
pick	Yi
remanufacturing	EEE inflows
remanufacturing	EEE outflows
remanufacturing	First use EEE
remanufacturing	decrease in age of available used EEE
remanufacturing	increase in age of first use EEE
second use commissioning	EEE inflows
second use commissioning	EEE outflows
second use commissioning	decrease in age of available used EEE
second use commissioning	increase in age of second use EEE
second use decommissioning	EEE inflows
second use decommissioning	EEE outflows
second use decommissioning	decrease in age of second use EEE
second use decommissioning	increase in age of available used EEE

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View-Variable Profile

View	View-Variable Profile

Not in View	1 vars (0.4%)
1. Technology adoption	31 vars (13.4%)
2. EEE and WEEE flows	54 vars (23.4%)
3. (de) Commissioning and restauration probabilit	46 vars (19.9%)
4. Ageing	26 vars (11.3%)
5. Calibration and tests	102 vars (44.2%)
Depreciation (incomplete)	24 vars (10.4%)

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List Of 7 views and their 220 Variables

	Not in View	1. Technology adoption	2. EEE and WEEE flows	3. (de) Commissioning and restauration probabilit	4. Ageing	5. Calibration and tests	Depreciation (incomplete)	
Total:	**1**	**31**	**54**	**46**	**26**	**102**	**24**	**Total:**
r2 (In 1 View)								r2 (In 1 View)
Sum Yi (In 1 View)								Sum Yi (In 1 View)
WEEE recycling (In 3 Views)								WEEE recycling (In 3 Views)
MY2 (In 1 View)								MY2 (In 1 View)
Mxy (In 1 View)								Mxy (In 1 View)
current stock of EEE (In 1 View)								current stock of EEE (In 1 View)
Xi (In 1 View)								Xi (In 1 View)
Processed material (In 2 Views)								Processed material (In 2 Views)
pick (In 1 View)								pick (In 1 View)
leakage of products (In 1 View)								leakage of products (In 1 View)
second use commissioning (In 4 Views)								second use commissioning (In 4 Views)
first use decommissioning because faulty (In 3 Views)								first use decommissioning because faulty (In 3 Views)
material inflows (In 1 View)								material inflows (In 1 View)
leakage of materials (In 1 View)								leakage of materials (In 1 View)
initial stock of WEEE before treatment (In 2 Views)								initial stock of WEEE before treatment (In 2 Views)
Raw material (In 2 Views)								Raw material (In 2 Views)
extraction (In 2 Views)								extraction (In 2 Views)
population (In 1 View)								population (In 1 View)
current stock of material (In 1 View)								current stock of material (In 1 View)
Yi (In 1 View)								Yi (In 1 View)
Sum of all material outflows (In 1 View)								Sum of all material outflows (In 1 View)
historic disposal of EEE (In 1 View)								historic disposal of EEE (In 1 View)
Non recycled WEEE (In 2 Views)								Non recycled WEEE (In 2 Views)
EEE adopters (In 2 Views)								EEE adopters (In 2 Views)
First use EEE (In 5 Views)								First use EEE (In 5 Views)
Sum of all material inflows (In 1 View)								Sum of all material inflows (In 1 View)
historical time series (In 1 View)								historical time series (In 1 View)
initial stock of non recycled WEEE (In 2 Views)								initial stock of non recycled WEEE (In 2 Views)
M X (In 1 View)								M X (In 1 View)
WEEE average market value (In 2 Views)								WEEE average market value (In 2 Views)
M Y (In 1 View)								M Y (In 1 View)
error households adoption (In 1 View)								error households adoption (In 1 View)
initial stock of available used EEE (In 2 Views)								initial stock of available used EEE (In 2 Views)
Available used EEE (In 3 Views)								Available used EEE (In 3 Views)
Sum SPE (In 1 View)								Sum SPE (In 1 View)
X (In 1 View)								X (In 1 View)
Y (In 1 View)								Y (In 1 View)
WEEE not recycled (In 3 Views)								WEEE not recycled (In 3 Views)
disposal of EEE as WEEE (In 4 Views)								disposal of EEE as WEEE (In 4 Views)
WEEE before treatment (In 2 Views)								WEEE before treatment (In 2 Views)
second use decommissioning (In 3 Views)								second use decommissioning (In 3 Views)
dif mea (In 1 View)								dif mea (In 1 View)
Sum Xi (In 1 View)								Sum Xi (In 1 View)
EEE per household (In 1 View)								EEE per household (In 1 View)
Sum of all EEE outflows (In 1 View)								Sum of all EEE outflows (In 1 View)
EEE per inhabitant (In 1 View)								EEE per inhabitant (In 1 View)
r (In 1 View)								r (In 1 View)
1 - us (In 1 View)								1 - us (In 1 View)
Total materials in the system (In 1 View)								Total materials in the system (In 1 View)
mse (In 1 View)								mse (In 1 View)
EEE inflows (In 1 View)								EEE inflows (In 1 View)
Sum XmY2 (In 1 View)								Sum XmY2 (In 1 View)
Sx (In 1 View)								Sx (In 1 View)
mass balance material (In 1 View)								mass balance material (In 1 View)
initial stock of EEE (In 1 View)								initial stock of EEE (In 1 View)
Sy (In 1 View)								Sy (In 1 View)
SumX2 (In 1 View)								SumX2 (In 1 View)
uc (In 1 View)								uc (In 1 View)
dt (In 1 View)								dt (In 1 View)
Potential EEE adopters (In 2 Views)								Potential EEE adopters (In 2 Views)
initial stock of second use EEE (In 2 Views)								initial stock of second use EEE (In 2 Views)
um (In 1 View)								um (In 1 View)
initial stock of processed material (In 2 Views)								initial stock of processed material (In 2 Views)

max value remanufacturing (In 1 View)							max value remanufacturing (In 1 View)
us (In 1 View)							us (In 1 View)
Sum of all EEE inflows (In 1 View)							Sum of all EEE inflows (In 1 View)
initial stock of first use EEE (In 2 Views)							initial stock of first use EEE (In 2 Views)
dif cov (In 1 View)							dif cov (In 1 View)
SumXY (In 1 View)							SumXY (In 1 View)
EEE average unit weight (In 3 Views)							EEE average unit weight (In 3 Views)
count (In 1 View)							count (In 1 View)
time max value remanufacturing (In 1 View)							time max value remanufacturing (In 1 View)
SumY2 (In 1 View)							SumY2 (In 1 View)
max value EEE commissioning (In 1 View)							max value EEE commissioning (In 1 View)
EEE commissioning (In 2 Views)							EEE commissioning (In 2 Views)
Total products in the system (In 1 View)							Total products in the system (In 1 View)
remanufacturing (In 4 Views)							remanufacturing (In 4 Views)
mape (In 1 View)							mape (In 1 View)
dif var (In 1 View)							dif var (In 1 View)
max value WEEE recycling (In 1 View)							max value WEEE recycling (In 1 View)
time max value commissioning (In 1 View)							time max value commissioning (In 1 View)
initial stock of material (In 1 View)							initial stock of material (In 1 View)
RMSPE (In 1 View)							RMSPE (In 1 View)
mass balance EEE (In 1 View)							mass balance EEE (In 1 View)
Total EEE in use (In 2 Views)							Total EEE in use (In 2 Views)
first use decommissioning before broken (In 3 Views)							first use decommissioning before broken (In 3 Views)
time max value recycling (In 1 View)							time max value recycling (In 1 View)
total households (In 2 Views)							total households (In 2 Views)
Sum APE (In 1 View)							Sum APE (In 1 View)
material outflows (In 1 View)							material outflows (In 1 View)
simulated time series (In 1 View)							simulated time series (In 1 View)
total value of Available WEEE (In 1 View)							total value of Available WEEE (In 1 View)
SSE (In 1 View)							SSE (In 1 View)
MX2 (In 1 View)							MX2 (In 1 View)
time max value second use commissioning (In 1 View)							time max value second use commissioning (In 1 View)
EEE outflows (In 1 View)							EEE outflows (In 1 View)
residuals (In 1 View)							residuals (In 1 View)
initial stock of raw material (In 2 Views)							initial stock of raw material (In 2 Views)
max value second use commissioning (In 1 View)							max value second use commissioning (In 1 View)
rmse (In 1 View)							rmse (In 1 View)
historic EEE put on market (In 1 View)							historic EEE put on market (In 1 View)
Second use EEE (In 4 Views)							Second use EEE (In 4 Views)
lifetime fraction for second use (In 1 View)							lifetime fraction for second use (In 1 View)
reman effectiveness (In 1 View)							reman effectiveness (In 1 View)
RM desired year (In 1 View)							RM desired year (In 1 View)
weibull shape (In 1 View)							weibull shape (In 1 View)
second use infrastructure level (In 1 View)							second use infrastructure level (In 1 View)
fraction fit for reman (In 1 View)							fraction fit for reman (In 1 View)
R desired year (In 1 View)							R desired year (In 1 View)
fraction fit for second use (In 1 View)							fraction fit for second use (In 1 View)
RC desired year (In 1 View)							RC desired year (In 1 View)
switch infra development (In 1 View)							switch infra development (In 1 View)
fraction introduced to reman market (In 2 Views)							fraction introduced to reman market (In 2 Views)
fraction of WEEE not formally collected (In 2 Views)							fraction of WEEE not formally collected (In 2 Views)
SU desired year (In 1 View)							SU desired year (In 1 View)
RM desired level (In 1 View)							RM desired level (In 1 View)
fraction of WEEE formally collected (In 2 Views)							fraction of WEEE formally collected (In 2 Views)
decommissioning probability in the end of life for second use (In 2 Views)							decommissioning probability in the end of life for second use (In 2 Views)
infra development initial year (In 1 View)							infra development initial year (In 1 View)
lifetime fraction for reman products (In 1 View)							lifetime fraction for reman products (In 1 View)
virtual age after reman (In 2 Views)							virtual age after reman (In 2 Views)
RM initial level (In 1 View)							RM initial level (In 1 View)
reman market coverage (In 1 View)							reman market coverage (In 1 View)
lifetime ratio (In 1 View)							lifetime ratio (In 1 View)
mean lifetime (In 1 View)							mean lifetime (In 1 View)
average second use EEE age (In 2 Views)							average second use EEE age (In 2 Views)
remanufacturing infrastructure level (In 1 View)							remanufacturing infrastructure level (In 1 View)
fraction introduced to WEEE market (In 2 Views)							fraction introduced to WEEE market (In 2 Views)
expected lifetime for second use (In 1 View)							expected lifetime for second use (In 1 View)
average decommissioned EEE age (In 2 Views)							average decommissioned EEE age (In 2 Views)
lifetime fraction for decommissioning							lifetime fraction for decommissioning

before broken (In 1 View)								before broken (In 1 View)
lifetime expected for reman products (In 1 View)								lifetime expected for reman products (In 1 View)
SU initial level (In 1 View)								SU initial level (In 1 View)
average EEE age (In 3 Views)								average EEE age (In 3 Views)
R desired level (In 1 View)								R desired level (In 1 View)
second hand market coverage (In 1 View)								second hand market coverage (In 1 View)
repair effectiveness (In 1 View)								repair effectiveness (In 1 View)
fraction introduced to second use market (In 2 Views)								fraction introduced to second use market (In 2 Views)
virtual age after repair (In 2 Views)								virtual age after repair (In 2 Views)
expected lifetime for decommissioning before broken (In 3 Views)								expected lifetime for decommissioning before broken (In 3 Views)
R initial level (In 1 View)								R initial level (In 1 View)
RC desired level (In 1 View)								RC desired level (In 1 View)
weibull scale (In 1 View)								weibull scale (In 1 View)
repairing infrastructure level (In 1 View)								repairing infrastructure level (In 1 View)
decommissioning probability in the end of life for first use (In 2 Views)								decommissioning probability in the end of life for first use (In 2 Views)
SU desired level (In 1 View)								SU desired level (In 1 View)
recycling infrastructure level (In 1 View)								recycling infrastructure level (In 1 View)
RC initial level (In 1 View)								RC initial level (In 1 View)
stock adjustment time (In 1 View)								stock adjustment time (In 1 View)
expected EEE demand (In 1 View)								expected EEE demand (In 1 View)
distribution time (In 1 View)								distribution time (In 1 View)
desired stock of processed material (In 1 View)								desired stock of processed material (In 1 View)
time to make available (In 1 View)								time to make available (In 1 View)
time to extract (In 1 View)								time to extract (In 1 View)
collection time (In 1 View)								collection time (In 1 View)
recyclability EEE (In 1 View)								recyclability EEE (In 1 View)
EEE demand (In 2 Views)								EEE demand (In 2 Views)
non recycled WEEE because of recyclability (In 1 View)								non recycled WEEE because of recyclability (In 1 View)
fraction of decomissioned before broken (In 1 View)								fraction of decomissioned before broken (In 1 View)
redistribution time (In 1 View)								redistribution time (In 1 View)
recycling of EEE from remanufacturing process (In 1 View)								recycling of EEE from remanufacturing process (In 1 View)
adjustment for stock of Processed material (In 1 View)								adjustment for stock of Processed material (In 1 View)
recycling time (In 1 View)								recycling time (In 1 View)
desired extraction rate (In 1 View)								desired extraction rate (In 1 View)
remanufacturability EEE (In 1 View)								remanufacturability EEE (In 1 View)
expected material kept in the system (In 1 View)								expected material kept in the system (In 1 View)
extraction rate considering minimum stock (In 1 View)								extraction rate considering minimum stock (In 1 View)
reman time (In 1 View)								reman time (In 1 View)
desired stock lenght of processed material (In 1 View)								desired stock lenght of processed material (In 1 View)
decomissioned EEE outflows (In 1 View)								decomissioned EEE outflows (In 1 View)
total first use EEE value (In 1 View)								total first use EEE value (In 1 View)
decommissioned EEE average outflow price (In 1 View)								decommissioned EEE average outflow price (In 1 View)
ratio second use comissioning from decommissioned EEE (In 1 View)								ratio second use comissioning from decommissioned EEE (In 1 View)
Total historical first use EEE value (In 1 View)								Total historical first use EEE value (In 1 View)
second use price (In 1 View)								second use price (In 1 View)
ratio remanufacturing from decommissioned EEE (In 1 View)								ratio remanufacturing from decommissioned EEE (In 1 View)
ratio WEEE recycling from decomissioned EEE (In 1 View)								ratio WEEE recycling from decomissioned EEE (In 1 View)
EEE depreciation ratio (In 1 View)								EEE depreciation ratio (In 1 View)
ratio of reman contribution per unit (In 1 View)								ratio of reman contribution per unit (In 1 View)
ratio of EEE price for second use (In 1 View)								ratio of EEE price for second use (In 1 View)
EEE unit price (In 1 View)								EEE unit price (In 1 View)
ratio WEEE not being recycled from decomissioned EEE (In 1 View)								ratio WEEE not being recycled from decomissioned EEE (In 1 View)
remanufacturing contribution per unit (In 1 View)								remanufacturing contribution per unit (In 1 View)
average EEE value (In 1 View)								average EEE value (In 1 View)
WEEE costs for non recycling (In 1 View)								WEEE costs for non recycling (In 1 View)
R EEE in use (In 1 View)								R EEE in use (In 1 View)
average age of useful products (In 1 View)								average age of useful products (In 1 View)
increase in age of first use EEE (In 1 View)								increase in age of first use EEE (In 1 View)
Total time of second use EEE (In 1 View)								Total time of second use EEE (In 1 View)
increase in age of available used EEE (In 1 View)								increase in age of available used EEE (In 1 View)
decrease in age of second use EEE (In 1								decrease in age of second use EEE (In 1

View)								View)
decrease in age of first use EEE (In 1 View)								decrease in age of first use EEE (In 1 View)
decrease in age of available used EEE (In 1 View)								decrease in age of available used EEE (In 1 View)
Total age of available used EEE (In 1 View)								Total age of available used EEE (In 1 View)
Total age of first use EEE (In 1 View)								Total age of first use EEE (In 1 View)
increase in age of second use EEE (In 1 View)								increase in age of second use EEE (In 1 View)
rate of ageing (In 1 View)								rate of ageing (In 1 View)
number of purchases when adopting (In 1 View)								number of purchases when adopting (In 1 View)
new potential adopters (In 1 View)								new potential adopters (In 1 View)
desired EEE (In 1 View)								desired EEE (In 1 View)
adoption purchases (In 1 View)								adoption purchases (In 1 View)
max EEE desired (In 1 View)								max EEE desired (In 1 View)
average EEE desired per adopter (In 1 View)								average EEE desired per adopter (In 1 View)
purchasing power parity per capta (In 1 View)								purchasing power parity per capta (In 1 View)
actual adoption fraction (In 1 View)								actual adoption fraction (In 1 View)
adoption rate (In 1 View)								adoption rate (In 1 View)
effect of normalised PPP on average number of EEE per adopter (In 1 View)								effect of normalised PPP on average number of EEE per adopter (In 1 View)
normalised PPP (In 1 View)								normalised PPP (In 1 View)
PPP 1980 (In 1 View)								PPP 1980 (In 1 View)
additional purchases (In 1 View)								additional purchases (In 1 View)
initial adopters (In 1 View)								initial adopters (In 1 View)
total households variation (In 1 View)								total households variation (In 1 View)
initial potential adopters (In 1 View)								initial potential adopters (In 1 View)
household increase trend (In 1 View)								household increase trend (In 1 View)
gap from EEE in use to desired (In 1 View)								gap from EEE in use to desired (In 1 View)
recurrent purchases to replace (In 1 View)								recurrent purchases to replace (In 1 View)
initial adopters fraction (In 1 View)								initial adopters fraction (In 1 View)
potential adoption fraction (In 1 View)								potential adoption fraction (In 1 View)
R EEE per adopter (In 1 View)								R EEE per adopter (In 1 View)
time to realise additional need (In 1 View)								time to realise additional need (In 1 View)
Total:	**1**	**31**	**54**	**46**	**26**	**102**	**24**	**Total:**
	Not in View	1. Technology adoption	2. EEE and WEEE flows	3. (de) Commissioning and restauration probabilit	4. Ageing	5. Calibration and tests	Depreciation (incomplete)	

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