

Net-Zero America - rhode island state report

2021-03-05

These data underlie graphs and tables presented in the Princeton Net-Zero America study:

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Notes

- These data are all data from the study available at https://netzeroamerica.prince-ton.edu.
- The Net-Zero America study describes five pathways to reach net-zero emissions and one "no new policies" reference scenario. In this document, state-level results are grouped by scenario. For some scenarios, the study generated national, but not statelevel results.
- Within results for a given scenario, data tables are organized into corresponding sections of the full net-zero study (e.g., Pillar 1, Pillar 2, etc.)
- For Pillar 6 (Land sinks), values shown are maximum carbon storage potentials.

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Table 1: E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	1,952	2,131	0	0	0	0
Sales of cooking units - Electric Resistance (%)	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Sales of space heating units - Electric Heat Pump (%)	2.71	10.5	38.5	72.1	77.6	77.9	78
Sales of space heating units - Electric Resistance (%)	1.36	4.58	16.4	21.3	22	22.1	22
Sales of space heating units - Fossil (%)	27.4	29.9	5.75	0.244	0	0	0
Sales of space heating units - Gas Furnace (%)	68.5	55	39.3	6.28	0.373	0	0
Sales of water heating units - Electric Heat Pump (%)	1.43	3.46	15.8	41.2	45.7	46	46
Sales of water heating units - Electric Resistance (%)	7.28	12.2	23.8	48	52.2	52.5	52.5
Sales of water heating units - Gas Furnace (%)	88.4	80.6	58.5	9.33	0.552	0	0
Sales of water heating units - Other (%)	2.9	3.75	1.86	1.55	1.53	1.53	1.55

Table 2: E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.337	0.347	1.19	1.3	1.08	1.15
Cumulative 5-yr (billion \$2018)							

Table 3: E+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	37.9	36	34.2	31.9	29.5	27.8	26.7
Final energy use - Industry (PJ)	7.41	7.1	7.08	7.12	7.25	7.42	7.63
Final energy use - Residential (PJ)	45.6	42.8	39.4	34.2	28.6	24.4	21.9
Final energy use - Transportation (PJ)	58.1	53.8	47.4	39.2	31.8	27.1	24.9

Table 4: E+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	0.886	0.975	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	55.1	64.6	94	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	44.9	35.4	6.05	0.305	0	0	0
Sales of space heating units - Electric	4.86	12.4	57.2	90.9	95.9	96.2	96.2
Heat Pump (%)							
Sales of space heating units - Electric	3.87	5.87	4.58	1.99	1.51	1.47	1.61
Resistance (%)							
Sales of space heating units - Fossil (%)	37.2	45.9	12.9	2.88	2.05	2.02	1.96
Sales of space heating units - Gas (%)	54.1	35.8	25.3	4.26	0.506	0.272	0.257
Sales of water heating units - Electric	0	1.46	13.8	34.6	38.2	38.4	38.4
Heat Pump (%)							
Sales of water heating units - Electric	22.1	39.5	47.7	59.4	61.4	61.5	61.5
Resistance (%)							
Sales of water heating units - Gas Furnace	65.5	51	36.9	5.9	0.348	0	0
(%)							
Sales of water heating units - Other (%)	12.4	7.96	1.57	0.146	0.084	0.085	0.085

Table 5: E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	167	429	695	1,053	1,145	1,092
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.024	0	0.247	0	1.08	0	1.74
units)							
Public EV charging plugs - L2 (1000 units)	0.374	0	5.92	0	25.9	0	41.8
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.21	1.51	1.13	0.357	0.069	0.013	0
Vehicle sales - Light-duty - EV (%)	5.05	18.7	51.6	83.8	96.6	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88	74	43.5	14.5	3.02	0.582	0
Vehicle sales - Light-duty - hybrid (%)	5.53	5.35	3.58	1.29	0.321	0.072	0
Vehicle sales - Light-duty - hydrogen FC	0.108	0.32	0.176	0.053	0.011	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.086	0.082	0.05	0.017	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 6: E+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Offshore Wind - Base (billion \$2018)	0	0	0.829	1.04	0.454	0	0
Capital invested - Offshore Wind - Constrained (billion \$2018)	0	2.08	0.546	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)	0	0	0.656	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	0.137	0.725	0	0	0	0
Capital invested - Wind - Base (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Wind - Constrained (billion \$2018)	0	0	0	0	0	0	0
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	268	681	906	906	906
Installed (cumulative) - Rooftop PV (MW)	152	264	310	362	422	489	563
Installed (cumulative) - Solar - Base land use assumptions (MW)	105	105	652	652	652	652	652
Installed (cumulative) - Wind - Base land use assumptions (MW)	91.4	91.4	91.4	91.4	91.4	91.4	91.4

Table 7: E+ scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

Table 7: E+ scenario - PILLAR 2: Clean Electricity - Generation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use	0	0	1,073	1,644	914	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	1,073	1,644	914	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	220	0	983	0	0	0	0
Solar - Constrained land use assumptions	0	0	1,788	0	0	0	0
(GWh)							
Wind - Base land use assumptions (GWh)	371	0	0	0	0	0	0
Wind - Constrained land use assumptions	371	0	0	0	0	0	0
(GWh)							

Table 8: E+ scenario - PILLAR 3: Clean fuels - Bioenergy

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	0	0	0	0	46.4
Conversion capital investment -	0	0	0	0	0	0	1,155
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

Table 9: E+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	1.48
Annual - BECCS (MMT)		0	0	0	0	0	1.48
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	0	1.48
Cumulative - BECCS (MMT)		0	0	0	0	0	1.48
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0

Table 10: E+ scenario - PILLAR 4: CCUS - CO2 pipelines

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	0	0	0	0	79.2
Cumulative investment - All (million \$2018)		0	0	0	0	0	59.3
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	59.3
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	79.2
Trunk (km)		0	0	0	0	0	0

Table 11: E+ scenario - PILLAR 4: CCUS - CO2 storage

	•						
Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	0	0	0	0
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)		0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)		0	0	0	0	0	0

Table 12: E+ scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-10.3
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-0.327
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-10.7
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-5.39
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-0.164
deployment - Permanent conservation							0
cover (1000 tC02e/y)							
Carbon sink potential - Moderate	+	+					-5.55
deployment - Total (1000 tC02e/y)							0.00
Land impacted for carbon sink -	+	+					0
Aggressive deployment - Corn-ethanol to							J
energy grasses (1000 hectares)							
Land impacted for carbon sink -	+	+					6.55
Aggressive deployment - Cropland							0.00
measures (1000 hectares)							
Land impacted for carbon sink -							0.595
Aggressive deployment - Permanent							0.373
conservation cover (1000 hectares)							
Land impacted for carbon sink -							7.15
Aggressive deployment - Total (1000							7.15
' '							
hectares) Land impacted for carbon sink - Moderate							0
							U
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							0.70
Land impacted for carbon sink - Moderate							3.43
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							0.298
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							3.72
deployment - Total (1000 hectares)							

Table 13: E+ scenario - PILLAR 6: Land sinks - Forests

Item 2020 2025 2030 2035 2040 2040 2040 Carbon sink potential - High - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - High - Avoid	-617
regeneration (1000 tCO2e/y) Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - High - Avoid	
Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - High - Avoid	-617
counting overlap) (1000 tCO2e/y) Carbon sink potential - High - Avoid	-617
counting overlap) (1000 tCO2e/y) Carbon sink potential - High - Avoid	
Carbon sink potential - High - Avoid	
	-165
deforestation (1000 tC02e/y)	100
Carbon sink potential - High - Extend	-246
rotation length (1000 tC02e/y)	-240
Carbon sink potential - High - Improve	0
plantations (1000 tCO2e/y)	
Carbon sink potential - High - Increase	-54.9
retention of HWP (1000 tCO2e/y)	
Carbon sink potential - High - Increase	-28.5
trees outside forests (1000 tCO2e/y)	
Carbon sink potential - High - Reforest	0
cropland (1000 tCO2e/y)	
Carbon sink potential - High - Reforest	-50.3
pasture (1000 tC02e/y)	
Carbon sink potential - High - Restore	-63.9
productivity (1000 tC02e/y)	00.7
Carbon sink potential - Low - Accelerate	-4.07
regeneration (1000 tC02e/y)	-4.01
	100
Carbon sink potential - Low - All (not	-180
counting overlap) (1000 tCO2e/y)	
Carbon sink potential - Low - Avoid	-27.6
deforestation (1000 tC02e/y)	
Carbon sink potential - Low - Extend	-94.6
rotation length (1000 tC02e/y)	
Carbon sink potential - Low - Improve	0
plantations (1000 tCO2e/y)	
Carbon sink potential - Low - Increase	-18.3
retention of HWP (1000 tCO2e/y)	10.0
Carbon sink potential - Low - Increase	-9.99
trees outside forests (1000 tC02e/y)	-7.77
	0
Carbon sink potential - Low - Reforest	U
cropland (1000 tCO2e/y)	0.01
Carbon sink potential - Low - Reforest	-3.81
pasture (1000 tC02e/y)	
Carbon sink potential - Low - Restore	-21.5
productivity (1000 tCO2e/y)	
Carbon sink potential - Mid - Accelerate	-6.1
regeneration (1000 tCO2e/y)	
Carbon sink potential - Mid - All (not	-399
counting overlap) (1000 tC02e/y)	
Carbon sink potential - Mid - Avoid	-96.5
deforestation (1000 tC02e/y)	-70.5
	170
Carbon sink potential - Mid - Extend	-170
rotation length (1000 tCO2e/y)	
Carbon sink potential - Mid - Improve	0
plantations (1000 tCO2e/y)	
Carbon sink potential - Mid - Increase	-36.6
retention of HWP (1000 tCO2e/y)	
Carbon sink potential - Mid - Increase	-19.3
trees outside forests (1000 tC02e/y)	
Carbon sink potential - Mid - Reforest	0
cropland (1000 tCO2e/y)	
Carbon sink potential - Mid - Reforest	-27
pasture (1000 tC02e/y)	-21
Carbon sink potential - Mid - Restore	/07
	-42.7
productivity (1000 tC02e/y)	

Table 13: E+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1.33
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							22.4
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							126
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2.71
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.43
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							21.2
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							175
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.665
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							21
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							48.1
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							J
hectares)							
Land impacted for carbon sink potential -							1.43
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							·
Land impacted for carbon sink potential -							0.247
Low - Reforest pasture (1000 hectares)							0.2 11
Land impacted for carbon sink potential -							12.8
Low - Restore productivity (1000							12.0
hectares)							
Land impacted for carbon sink potential -							84.3
Low - Total impacted (over 30 years)							04.3
(1000 hectares)							
Land impacted for carbon sink potential -							0.997
Mid - Accelerate regeneration (1000							0.777
hectares)							
Hootal Goj							

Tahla 12. Fx	econario -	DILLAD 6.	Land sinks -	Enrecte	(continued)
Table 15. Et	SCEIIUI 10 -	PILLAK O.	LUIIU SIIIKS -	. คบา ยอเอา	COHUHUEUT

2020	2025	2030	2035	2040	2045	2050
						21.7
						86.8
						0
						0
						2.07
						0
						1.79
						25.8
						139
	2020	2020 2025	2020 2025 2030	2020 2025 2030 2035	2020 2025 2030 2035 2040	2020 2025 2030 2035 2040 2045

Table 14: E+ scenario - IMPACTS - Fossil fuel industries

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		78.8	66.4	53.3	40.1	25.2	17.5
Natural gas consumption - Cumulative		0	0	0	0	0	1,604
(tcf)							
Natural gas production - Annual (tcf)		0	0	0	0	0	0
Oil consumption - Annual (million bbls)		22.6	18.9	13.7	8.88	5.07	2.07
Oil consumption - Cumulative (million		0	0	0	0	0	426
bbls)							
Oil production - Annual (million bbls)		0	0	0	0	0	0

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		98.2	0.103	0.103	0.098	0.06	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)		57	28.2	19.5	23.7	14.7	8.71
Monetary damages from air pollution - Transportation (million 2019\$)		330	306	231	132	59.1	21.5
Premature deaths from air pollution - Coal (deaths)		11.1	0.012	0.012	0.011	0.007	0
Premature deaths from air pollution - Natural Gas (deaths)		6.43	3.18	2.2	2.68	1.66	0.983
Premature deaths from air pollution - Transportation (deaths)		37.1	34.4	26	14.9	6.64	2.42

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		14.1	28.6	10.9	8.49	6.24	78
By economic sector - Construction (jobs)		1,127	1,360	1,278	1,702	1,559	2,007
By economic sector - Manufacturing		607	920	878	1,035	1,292	1,856
(jobs)							
By economic sector - Mining (jobs)		428	300	186	105	51.4	21.4

Table 16: E+ scenario - IMPACTS - Jobs (continued)

Table 16: E+ Scending - IMPAG13 - Jobs (Co	mulliueuj						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		130	186	143	190	191	320
By economic sector - Pipeline (jobs)		101	85	65.4	46.5	28.2	27.1
By economic sector - Professional (jobs)		465	575	581	825	756	1,076
By economic sector - Trade (jobs)		434	457	406	509	464	641
By economic sector - Utilities (jobs)		797	823	1,169	2,041	1,835	2,093
By education level - All sectors -		1,282	1,487	1,510	2,113	2,020	2,624
Associates degree or some college (jobs)		057	055	0/0	1.077	1.01/	1.50/
By education level - All sectors -		856	955	943	1,277	1,214	1,594
Bachelors degree (jobs) By education level - All sectors - Doctoral		28.4	32.1	30.6	41	37.6	51.8
degree (jobs)		20.4	32.1	30.6	41	31.6	51.6
By education level - All sectors - High		1,736	2,035	2,009	2,720	2,620	3,465
school diploma or less (jobs)		1,130	2,000	2,007	2,120	2,020	3,403
By education level - All sectors - Masters		201	225	225	311	291	384
or professional degree (jobs)		201	220	220	011	271	304
By resource sector - Biomass (jobs)		60.5	79	31.2	25.6	22.8	333
By resource sector - CO2 (jobs)		0	0	0	0	0	84.7
By resource sector - Grid (jobs)		558	1,107	1,940	3,132	3,110	3,649
By resource sector - Natural Gas (jobs)		1,212	685	545	1,083	684	568
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		1,004	772	517	310	166	63.6
By resource sector - Solar (jobs)		1,177	1,605	870	1,004	1,331	2,086
By resource sector - Wind (jobs)		92.2	486	814	908	870	1,334
Median wages - Annual - All (\$2019 per		67,361	67,136	69,084	70,830	71,152	71,296
job)		,		,	,	, -	,
On-Site or In-Plant Training - Total jobs - 1		671	773	781	1,086	1,033	1,335
to 4 years (jobs)						,	
On-Site or In-Plant Training - Total jobs - 4		284	317	324	460	423	535
to 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		665	772	757	1,030	989	1,315
None (jobs)							
On-Site or In-Plant Training - Total jobs -		34.6	40	41.7	59.8	56.4	72.3
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		2,448	2,832	2,814	3,827	3,681	4,862
Up to 1 year (jobs)							
On-the-Job Training - All sectors - 1 to 4		864	991	1,007	1,408	1,335	1,719
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		275	311	319	457	420	531
years (jobs)							
On-the-Job Training - All sectors - None		227	260	250	334	319	427
(jobs)							
On-the-Job Training - All sectors - Over 10		41.4	48.8	46.2	60.7	59.5	79.1
years (jobs)				2.221			
On-the-Job Training - All sectors - Up to 1		2,696	3,123	3,096	4,203	4,049	5,363
year (jobs)		1 / 0 /	1 (07	1.05	0.007	0.015	0.005
Related work experience - All sectors - 1		1,484	1,697	1,695	2,324	2,215	2,895
to 4 years (jobs)		0/1	1.005	1100	1.50/	1//0	1.070
Related work experience - All sectors - 4		961	1,095	1,102	1,524	1,448	1,878
to 10 years (jobs) Related work experience - All sectors -		595	(0/	(0)	945	900	1,181
None (jobs)		595	684	684	945	900	1,101
Related work experience - All sectors -		254	293	294	402	389	507
Over 10 years (jobs)		204	273	274	402	307	301
Related work experience - All sectors - Up		810	965	943	1,268	1,232	1,658
to 1 year (jobs)		010	700	740	1,200	1,232	1,000
Wage income - All (million \$2019)		276	318	326	458	440	579
go moomo /m (mmon 4201/)		210	310	020	700	7-10	017

Table 17: E- scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	1,952	2,132	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	40.7	44.7	56.5	72.7	82.9	86.4
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	59.3	55.3	43.5	27.3	17.1	13.6
Sales of space heating units - Electric	2.71	7.42	10.6	20.5	40.4	61.4	72.8
Heat Pump (%)							
Sales of space heating units - Electric	1.36	2.46	3.76	7.72	14.3	19.2	21.2
Resistance (%)							
Sales of space heating units - Fossil (%)	27.4	34.6	32.4	24.5	11.9	3.78	0.991
Sales of space heating units - Gas Furnace	68.5	55.5	53.2	47.3	33.4	15.6	5.09
(%)							
Sales of water heating units - Electric	1.43	2.87	4.27	8.98	20.1	34	42.1
Heat Pump (%)							
Sales of water heating units - Electric	7.28	11.6	12.8	17.4	28	41.1	48.8
Resistance (%)							
Sales of water heating units - Gas Furnace	88.4	81.4	79.2	70.3	49.5	23.1	7.55
(%)							
Sales of water heating units - Other (%)	2.9	4.09	3.79	3.25	2.39	1.79	1.62

Table 18: E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.246	0.245	0.466	0.491	0.969	1.05
Cumulative 5-yr (billion \$2018)							

Table 19: E- scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	37.9	36	35	34.2	33.1	31.9	30.6
Final energy use - Industry (PJ)	7.41	7.1	7.11	7.23	7.42	7.57	7.74
Final energy use - Residential (PJ)	45.6	43	41.1	39.3	36.3	32.3	28
Final energy use - Transportation (PJ)	58.2	54.4	49.9	45.9	42.7	38.8	34.4

Table 20: E- scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	0.888	1.03	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	54.9	56.1	60.2	71.1	86.2	95.6	98.8
Resistance (%)							
Sales of cooking units - Gas (%)	45.1	43.9	39.8	28.9	13.8	4.45	1.2
Sales of space heating units - Electric	4.86	5.74	10.9	26.2	53.8	78.8	90.8
Heat Pump (%)							
Sales of space heating units - Electric	3.87	5.91	5.68	5.25	4.15	2.68	1.92
Resistance (%)							
Sales of space heating units - Fossil (%)	37.2	52.1	48.5	37.5	20.3	8.33	3.72
Sales of space heating units - Gas (%)	54.1	36.3	34.9	31	21.7	10.2	3.52
Sales of water heating units - Electric	0	0.513	1.93	6.5	16.6	28.5	35.2
Heat Pump (%)							
Sales of water heating units - Electric	22.1	38.7	39.7	42.7	48.9	55.9	59.7
Resistance (%)							
Sales of water heating units - Gas Furnace	65.5	51.6	49.9	44.4	31.3	14.6	4.75
(%)							
Sales of water heating units - Other (%)	12.4	9.19	8.47	6.4	3.18	1.08	0.344

 ${\bf Table~21:}~{\it E-scenario-PILLAR~1:}~{\it Efficiency/Electrification-Transportation}$

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	27.1	56.8	192	604	880
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.024	0	0.077	0	0.4	0	1.12
units)							
Public EV charging plugs - L2 (1000 units)	0.374	0	1.84	0	9.6	0	26.8
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC	0.332	0.969	2.74	7.17	15.7	26.3	34
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.22	1.69	2	1.57	0.98	0.498	0.214
Vehicle sales - Light-duty - EV (%)	2.29	5.57	13.6	28.7	51.4	74	88.4
Vehicle sales - Light-duty - gasoline (%)	90.5	85.8	76.9	63.1	42.8	22.8	10.1
Vehicle sales - Light-duty - hybrid (%)	5.76	6.51	7.15	6.34	4.59	2.61	1.24
Vehicle sales - Light-duty - hydrogen FC	0.112	0.37	0.307	0.227	0.157	0.086	0.04
(%)							
Vehicle sales - Light-duty - other (%)	0.088	0.091	0.082	0.07	0.05	0.027	0.012
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 22: E- scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-10.3
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-0.327
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-10.7
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-5.39
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-0.164
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-5.55
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							6.55
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							0.595
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							

Table 22: E- scenario - PILLAR 6: Land sinks - Agriculture (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							7.15
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3.43
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							0.298
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							3.72
deployment - Total (1000 hectares)							

Table 23: E- scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-8.13
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-617
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-165
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-246
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-54.9
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-28.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-50.3
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-63.9
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-4.07
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-180
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-27.6
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-94.6
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-18.3
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-9.99
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-3.81
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-21.5
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-6.1
regeneration (1000 tCO2e/y)							

Table 23: E- scenario - PILLAR 6: Land sinks - Forests (continued)

Item Carbon sink potential - Mid - All (not	2020	2025	2030	2035	2040	2045	2050 -399
counting overlap) (1000 tCO2e/y)							-39
Carbon sink potential - Mid - Avoid							-96.
deforestation (1000 tC02e/y)							-90.
Carbon sink potential - Mid - Extend							-17(
rotation length (1000 tC02e/y)							-171
= -							
Carbon sink potential - Mid - Improve							(
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-36.
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-19.:
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							(
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-42.
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							1.3
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							22.4
High - Avoid deforestation (over 30 years)							22.
(1000 hectares)							
Land impacted for carbon sink potential -							120
High - Extend rotation length (1000							120
hectares)							
Land impacted for carbon sink potential -							
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2.7
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							(
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.4
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							21.
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							17
High - Total impacted (over 30 years)							
(1000 hectares)							
•							0 / /
Land impacted for carbon sink potential -							0.66
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							2
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							48
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
Low - Increase retention of HWP (1000							,
hectares)							

Table 23: E- scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1.43
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.247
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							12.8
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							84.3
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.997
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							21.7
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							86.8
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2.07
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.79
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							25.8
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							139
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Table 24. L Scenario Init Acro Ticulti							
Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		98.2	0.103	0.103	0.098	0.06	0.003
Coal (million 2019\$)							
Monetary damages from air pollution -		56	22	8.27	3.44	1.06	2.17
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		336	338	327	292	231	157
Transportation (million 2019\$)							
Premature deaths from air pollution -		11.1	0.012	0.012	0.011	0.007	0
Coal (deaths)							
Premature deaths from air pollution -		6.32	2.49	0.933	0.388	0.119	0.245
Natural Gas (deaths)							
Premature deaths from air pollution -		37.8	38	36.8	32.9	26	17.7
Transportation (deaths)							

Table 25: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	1,952	2,131	0	0	0	0
Cumulative 5-yr (million \$2018)		,					
Sales of cooking units - Electric	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Sales of space heating units - Electric	2.71	10.5	38.5	72.1	77.6	77.9	78
Heat Pump (%)							
Sales of space heating units - Electric	1.36	4.58	16.4	21.3	22	22.1	22
Resistance (%)							
Sales of space heating units - Fossil (%)	27.4	29.9	5.75	0.244	0	0	0
Sales of space heating units - Gas Furnace	68.5	55	39.3	6.28	0.373	0	0
(%)							
Sales of water heating units - Electric	1.43	3.46	15.8	41.2	45.7	46	46
Heat Pump (%)							
Sales of water heating units - Electric	7.28	12.2	23.8	48	52.2	52.5	52.5
Resistance (%)							
Sales of water heating units - Gas Furnace	88.4	80.6	58.5	9.33	0.552	0	0
(%)							
Sales of water heating units - Other (%)	2.9	3.75	1.86	1.55	1.53	1.53	1.55

Table 26: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.337	0.347	1.19	1.3	1.08	1.15
Cumulative 5-yr (billion \$2018)							

Table 27: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview

11										
Item	2020	2025	2030	2035	2040	2045	2050			
Final energy use - Commercial (PJ)	37.9	36	34.2	31.9	29.5	27.8	26.7			
Final energy use - Industry (PJ)	7.41	7.1	7.08	7.12	7.25	7.42	7.63			
Final energy use - Residential (PJ)	45.6	42.8	39.4	34.2	28.6	24.4	21.9			
Final energy use - Transportation (PJ)	58.1	53.8	47.4	39.2	31.8	27.1	24.9			

Table 28: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	0.886	0.975	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	55.1	64.6	94	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	44.9	35.4	6.05	0.305	0	0	0
Sales of space heating units - Electric	4.86	12.4	57.2	90.9	95.9	96.2	96.2
Heat Pump (%)							
Sales of space heating units - Electric	3.87	5.87	4.58	1.99	1.51	1.47	1.61
Resistance (%)							
Sales of space heating units - Fossil (%)	37.2	45.9	12.9	2.88	2.05	2.02	1.96
Sales of space heating units - Gas (%)	54.1	35.8	25.3	4.26	0.506	0.272	0.257
Sales of water heating units - Electric	0	1.46	13.8	34.6	38.2	38.4	38.4
Heat Pump (%)							
Sales of water heating units - Electric	22.1	39.5	47.7	59.4	61.4	61.5	61.5
Resistance (%)							
Sales of water heating units - Gas Furnace	65.5	51	36.9	5.9	0.348	0	0
(%)							
Sales of water heating units - Other (%)	12.4	7.96	1.57	0.146	0.084	0.085	0.085

Table 29: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	167	429	695	1,053	1,145	1,092
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.024	0	0.247	0	1.08	0	1.74
units)							
Public EV charging plugs - L2 (1000 units)	0.374	0	5.92	0	25.9	0	41.8
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.21	1.51	1.13	0.357	0.069	0.013	0
Vehicle sales - Light-duty - EV (%)	5.05	18.7	51.6	83.8	96.6	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88	74	43.5	14.5	3.02	0.582	0
Vehicle sales - Light-duty - hybrid (%)	5.53	5.35	3.58	1.29	0.321	0.072	0
Vehicle sales - Light-duty - hydrogen FC	0.108	0.32	0.176	0.053	0.011	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.086	0.082	0.05	0.017	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 30: E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity

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Item	2020	2025	2030	2035	2040	2045	2050					
Capital invested - Offshore Wind - Base (billion \$2018)	0	0	0.829	1.6	0	0	0					
Capital invested - Solar PV - Base (billion \$2018)	0	0	0.656	0	0	0	0					
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	268	906	906	906	906					
Installed (cumulative) - Solar - Base land use assumptions (MW)	105	105	652	652	652	652	652					
Installed (cumulative) - Wind - Base land use assumptions (MW)	91.4	91.4	91.4	91.4	91.4	91.4	91.4					

Table 31: E+RE+ scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	1,073	2,558			
assumptions (GWh)							
OffshoreWind - Constrained land use	297	1,938	936	0			
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	220	0	987	0			
Solar - Constrained land use assumptions	220	0	1,399	0			
(GWh)							
Wind - Base land use assumptions (GWh)	371	0	0	0			
Wind - Constrained land use assumptions	371	0	0	0			
(GWh)							

Table 32: E+RE+ scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-10.3
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-0.327
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-10.7
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-5.39
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-0.164
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-5.55
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							6.55
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							0.595
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							7.15
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3.43
deployment - Cropland measures (1000							-
hectares)							
Land impacted for carbon sink - Moderate							0.298
deployment - Permanent conservation							3.270
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							3.72
deployment - Total (1000 hectares)							0.12
acproyritions - rotal (1000 lieutal es)							

Table 33: E+RE+ scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-8.13
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-617
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-165
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-246
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-54.9
retention of HWP (1000 tCO2e/y)							

Table 33: E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-28.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tC02e/y)							-50.3
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-63.9
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-4.07
Carbon sink potential - Low - All (not							-180
counting overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid							-27.6
deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend							-94.6
rotation length (1000 tCO2e/y) Carbon sink potential - Low - Improve							0
plantations (1000 tC02e/y) Carbon sink potential - Low - Increase							-18.3
retention of HWP (1000 tCO2e/y) Carbon sink potential - Low - Increase							-9.99
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-3.81
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-21.5
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-6.1
Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y)							-399
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-96.5
Carbon sink potential - Mid - Extend							-170
rotation length (1000 tCO2e/y) Carbon sink potential - Mid - Improve							0
plantations (1000 tCO2e/y) Carbon sink potential - Mid - Increase							-36.6
retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase							-19.3
trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest							0
cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest							-27
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-42.7
Land impacted for carbon sink potential - High - Accelerate regeneration (1000							1.33
hectares)							
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							22.4
(1000 hectares)							40.
Land impacted for carbon sink potential - High - Extend rotation length (1000							126
hectares) Land impacted for carbon sink potential -							0
High - Improve plantations (1000 hectares)							

Table 33: E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares)							
Land impacted for carbon sink potential -							2.71
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							1.43
High - Reforest pasture (1000 hectares)							1.40
Land impacted for carbon sink potential -							21.2
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							175
High - Total impacted (over 30 years)							
(1000 hectares)							0.//5
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000							0.665
hectares)							
Land impacted for carbon sink potential -							21
Low - Avoid deforestation (over 30 years)							21
(1000 hectares)							
Land impacted for carbon sink potential -							48.1
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares) Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -						-	1.43
Low - Increase trees outside forests							10
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.247
Low - Reforest pasture (1000 hectares)							10.0
Land impacted for carbon sink potential -							12.8
Low - Restore productivity (1000 hectares)							
Land impacted for carbon sink potential -							84.3
Low - Total impacted (over 30 years)							04.0
(1000 hectares)							
Land impacted for carbon sink potential -							0.997
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							21.7
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							0/.0
Land impacted for carbon sink potential - Mid - Extend rotation length (1000							86.8
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							Ū
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							,
hectares)							
Land impacted for carbon sink potential -							2.07
Mid - Increase trees outside forests (1000							
hectares)							

Table 33: <i>E+RE+</i>	scenario -	DTII AR 6.	I and sinks -	Forests	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.79
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							25.8
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							139
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 34: E+RE+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		98.2	0.103	0.103	0.098	0.06	0.003
Coal (million 2019\$)							
Monetary damages from air pollution -		53.9	24.7	13.9	14.4	5.11	3.01
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		330	306	231	132	59.1	21.5
Transportation (million 2019\$)							
Premature deaths from air pollution -		11.1	0.012	0.012	0.011	0.007	0
Coal (deaths)							
Premature deaths from air pollution -		6.09	2.79	1.57	1.63	0.577	0.339
Natural Gas (deaths)							
Premature deaths from air pollution -		37.1	34.4	26	14.9	6.64	2.42
Transportation (deaths)							

Table 35: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	1,952	2,131	0	0	0	0
Sales of cooking units - Electric Resistance (%)	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Sales of space heating units - Electric Heat Pump (%)	2.71	10.5	38.5	72.1	77.6	77.9	78
Sales of space heating units - Electric Resistance (%)	1.36	4.58	16.4	21.3	22	22.1	22
Sales of space heating units - Fossil (%)	27.4	29.9	5.75	0.244	0	0	0
Sales of space heating units - Gas Furnace (%)	68.5	55	39.3	6.28	0.373	0	0
Sales of water heating units - Electric Heat Pump (%)	1.43	3.46	15.8	41.2	45.7	46	46
Sales of water heating units - Electric Resistance (%)	7.28	12.2	23.8	48	52.2	52.5	52.5
Sales of water heating units - Gas Furnace (%)	88.4	80.6	58.5	9.33	0.552	0	0
Sales of water heating units - Other (%)	2.9	3.75	1.86	1.55	1.53	1.53	1.55

Table 36: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.337	0.347	1.19	1.3	1.08	1.15
Cumulative 5-yr (billion \$2018)							

Table 37: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	37.9	36	34.2	31.9	29.5	27.8	26.7

Table 37: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	7.41	7.1	7.08	7.12	7.25	7.42	7.63
Final energy use - Residential (PJ)	45.6	42.8	39.4	34.2	28.6	24.4	21.9
Final energy use - Transportation (PJ)	58.1	53.8	47.4	39.2	31.8	27.1	24.9

Table 38: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	0.886	0.975	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	55.1	64.6	94	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	44.9	35.4	6.05	0.305	0	0	0
Sales of space heating units - Electric	4.86	12.4	57.2	90.9	95.9	96.2	96.2
Heat Pump (%)							
Sales of space heating units - Electric	3.87	5.87	4.58	1.99	1.51	1.47	1.61
Resistance (%)							
Sales of space heating units - Fossil (%)	37.2	45.9	12.9	2.88	2.05	2.02	1.96
Sales of space heating units - Gas (%)	54.1	35.8	25.3	4.26	0.506	0.272	0.257
Sales of water heating units - Electric	0	1.46	13.8	34.6	38.2	38.4	38.4
Heat Pump (%)							
Sales of water heating units - Electric	22.1	39.5	47.7	59.4	61.4	61.5	61.5
Resistance (%)							
Sales of water heating units - Gas Furnace	65.5	51	36.9	5.9	0.348	0	0
(%)							
Sales of water heating units - Other (%)	12.4	7.96	1.57	0.146	0.084	0.085	0.085

Table 39: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	167	429	695	1,053	1,145	1,092
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.024	0	0.247	0	1.08	0	1.74
units)							
Public EV charging plugs - L2 (1000 units)	0.374	0	5.92	0	25.9	0	41.8
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.21	1.51	1.13	0.357	0.069	0.013	0
Vehicle sales - Light-duty - EV (%)	5.05	18.7	51.6	83.8	96.6	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88	74	43.5	14.5	3.02	0.582	0
Vehicle sales - Light-duty - hybrid (%)	5.53	5.35	3.58	1.29	0.321	0.072	0
Vehicle sales - Light-duty - hydrogen FC	0.108	0.32	0.176	0.053	0.011	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.086	0.082	0.05	0.017	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 40: E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base		0	1.22	0.529	0	0	0.271
(billion \$2018)							
Capital invested - Offshore Wind -		2.75	0	0	0	0	0
Constrained (billion \$2018)							
Capital invested - Solar PV - Base (billion		0	0	0	0	0	0
\$2018)							
Capital invested - Solar PV - Constrained		0	0	0	0	0	0
(billion \$2018)							
Capital invested - Wind - Base (billion		0	0	0	0	0	0
\$2018)							
Capital invested - Wind - Constrained		0	0	0	0	0	0
(billion \$2018)							

Table 41: E+RE- scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	1,567	837			833
assumptions (GWh)							
OffshoreWind - Constrained land use	297	2,874	0	0			0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	220	0	0	0			0
Solar - Constrained land use assumptions	583	0	0	0			0
(GWh)							
Wind - Base land use assumptions (GWh)	371	0	0	0			0
Wind - Constrained land use assumptions	371	0	0	0			0
(GWh)							

Table 42: E+RE- scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-10.3
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-0.327
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-10.7
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-5.39
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-0.164
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-5.55
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							6.55
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							0.595
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							

Table 42: E+RE- scenario - PILLAR 6: Land sinks - Agriculture (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							7.15
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3.43
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							0.298
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							3.72
deployment - Total (1000 hectares)							

Table 43: E+RE- scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-8.13
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-617
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-165
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-246
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-54.9
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-28.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-50.3
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-63.9
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-4.07
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-180
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-27.6
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-94.6
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-18.3
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-9.99
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-3.81
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-21.5
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-6.1
regeneration (1000 tCO2e/y)							

Table 43: E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)

Item Carbon sink potential - Mid - All (not	2020	2025	2030	2035	2040	2045	2050 -399
counting overlap) (1000 tC02e/y)							-39
Carbon sink potential - Mid - Avoid							-96.5
deforestation (1000 tC02e/y)							-70.0
Carbon sink potential - Mid - Extend							-17(
rotation length (1000 tC02e/y)							-17(
Carbon sink potential - Mid - Improve							(
plantations (1000 tCO2e/y)							,
Carbon sink potential - Mid - Increase							-36.6
retention of HWP (1000 tCO2e/y)							-50.0
Carbon sink potential - Mid - Increase							-19.3
trees outside forests (1000 tC02e/y)							-17.0
Carbon sink potential - Mid - Reforest							(
·							
cropland (1000 tCO2e/y)							0-
Carbon sink potential - Mid - Reforest							-2
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-42.
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							1.33
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							22.4
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							126
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							(
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2.7
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							(
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.43
High - Reforest pasture (1000 hectares)							1
Land impacted for carbon sink potential -							21.5
High - Restore productivity (1000							21
hectares)							
Land impacted for carbon sink potential -							175
High - Total impacted (over 30 years)							113
(1000 hectares)							
							0.77
Land impacted for carbon sink potential -							0.66
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							2
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							48
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							

Table 43: E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1.43
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.247
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							12.8
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							84.3
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.997
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							21.7
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							86.8
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2.07
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.79
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							25.8
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							139
Mid - Total impacted (over 30 years) (1000							-
hectares)							

Table 44: E+RE- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		98.2	0.103	0.103	0.098	0.06	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)		56.5	32.3	34.1	25.9	13.8	3.37
Monetary damages from air pollution - Transportation (million 2019\$)		330	306	231	132	59.1	21.5
Premature deaths from air pollution - Coal (deaths)		11.1	0.012	0.012	0.011	0.007	0
Premature deaths from air pollution - Natural Gas (deaths)		6.37	3.65	3.85	2.93	1.56	0.38
Premature deaths from air pollution - Transportation (deaths)		37.1	34.4	26	14.9	6.64	2.42

Table 45: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	1,952	2,132	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	40.7	44.7	56.5	72.7	82.9	86.4
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	59.3	55.3	43.5	27.3	17.1	13.6
Sales of space heating units - Electric	2.71	7.42	10.6	20.5	40.4	61.4	72.8
Heat Pump (%)							
Sales of space heating units - Electric	1.36	2.46	3.76	7.72	14.3	19.2	21.2
Resistance (%)							
Sales of space heating units - Fossil (%)	27.4	34.6	32.4	24.5	11.9	3.78	0.991
Sales of space heating units - Gas Furnace	68.5	55.5	53.2	47.3	33.4	15.6	5.09
(%)							
Sales of water heating units - Electric	1.43	2.87	4.27	8.98	20.1	34	42.1
Heat Pump (%)							
Sales of water heating units - Electric	7.28	11.6	12.8	17.4	28	41.1	48.8
Resistance (%)							
Sales of water heating units - Gas Furnace	88.4	81.4	79.2	70.3	49.5	23.1	7.55
(%)							
Sales of water heating units - Other (%)	2.9	4.09	3.79	3.25	2.39	1.79	1.62

Table 46: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.246	0.245	0.466	0.491	0.969	1.05
Cumulative 5-yr (billion \$2018)							

Table 47: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	37.9	36	35	34.2	33.1	31.9	30.6
Final energy use - Industry (PJ)	7.41	7.1	7.11	7.23	7.42	7.57	7.74
Final energy use - Residential (PJ)	45.6	43	41.1	39.3	36.3	32.3	28
Final energy use - Transportation (PJ)	58.2	54.4	49.9	45.9	42.7	38.8	34.4

Table 48: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	0.888	1.03	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	54.9	56.1	60.2	71.1	86.2	95.6	98.8
Resistance (%)							
Sales of cooking units - Gas (%)	45.1	43.9	39.8	28.9	13.8	4.45	1.2
Sales of space heating units - Electric	4.86	5.74	10.9	26.2	53.8	78.8	90.8
Heat Pump (%)							
Sales of space heating units - Electric	3.87	5.91	5.68	5.25	4.15	2.68	1.92
Resistance (%)							
Sales of space heating units - Fossil (%)	37.2	52.1	48.5	37.5	20.3	8.33	3.72
Sales of space heating units - Gas (%)	54.1	36.3	34.9	31	21.7	10.2	3.52
Sales of water heating units - Electric	0	0.513	1.93	6.5	16.6	28.5	35.2
Heat Pump (%)							
Sales of water heating units - Electric	22.1	38.7	39.7	42.7	48.9	55.9	59.7
Resistance (%)							
Sales of water heating units - Gas Furnace	65.5	51.6	49.9	44.4	31.3	14.6	4.75
(%)							
Sales of water heating units - Other (%)	12.4	9.19	8.47	6.4	3.18	1.08	0.344

Table 49: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	27.1	56.8	192	604	880
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.024	0	0.077	0	0.4	0	1.12
units)							
Public EV charging plugs - L2 (1000 units)	0.374	0	1.84	0	9.6	0	26.8
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC	0.332	0.969	2.74	7.17	15.7	26.3	34
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.22	1.69	2	1.57	0.98	0.498	0.214
Vehicle sales - Light-duty - EV (%)	2.29	5.57	13.6	28.7	51.4	74	88.4
Vehicle sales - Light-duty - gasoline (%)	90.5	85.8	76.9	63.1	42.8	22.8	10.1
Vehicle sales - Light-duty - hybrid (%)	5.76	6.51	7.15	6.34	4.59	2.61	1.24
Vehicle sales - Light-duty - hydrogen FC	0.112	0.37	0.307	0.227	0.157	0.086	0.04
(%)							
Vehicle sales - Light-duty - other (%)	0.088	0.091	0.082	0.07	0.05	0.027	0.012
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 50: E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant	0	0	0	0	0	0	0
(billion \$2018)							
Capital invested - Biomass w/ccu allam	0	0	0	0	0	0	0
power plant (billion \$2018)							
Capital invested - Biomass w/ccu power	0	0	0	0	0	0	0
plant (billion \$2018)							

Table 51: E-B+ scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0

Table 52: E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	0	0	0	0	114
Conversion capital investment -	0	0	0	0	0	0	1,510
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0

Table 52: E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

Table 53: E-B+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	1.94
Annual - BECCS (MMT)		0	0	0	0	0	1.94
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	0	1.94
Cumulative - BECCS (MMT)		0	0	0	0	0	1.94
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0

Table 54: E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	0	0	0	0	79.2
Cumulative investment - All (million \$2018)		0	0	0	0	0	65.6
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	65.6
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	79.2
Trunk (km)		0	0	0	0	0	0

Table 55: E-B+ scenario - PILLAR 4: CCUS - CO2 storage

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	0	0	0	0
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)		0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)		0	0	0	0	0	0

Table 56: E-B+ scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-10.3
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Aggressive							-0.327
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-10.7
deployment - Total (1000 tCO2e/y)							

Table 56: E-B+ scenario - PILLAR 6: Land sinks - Agriculture (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							(
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-5.3
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							
deployment - Cropland to woody energy							
crops (1000 tC02e/y)							
Carbon sink potential - Moderate							
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-0.16
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-5.5
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							16
Aggressive deployment - Cropland							.0
measures (1000 hectares)							
Land impacted for carbon sink -							
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							0.04
Aggressive deployment - Pasture to							0.0
energy crops (1000 hectares)							
Land impacted for carbon sink -							0.59
Aggressive deployment - Permanent							0.07
conservation cover (1000 hectares)							
Land impacted for carbon sink -							16.
Aggressive deployment - Total (1000							10.
hectares)							
Land impacted for carbon sink - Moderate							
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3.4
deployment - Cropland measures (1000							3.4
hectares)							
Land impacted for carbon sink - Moderate							
deployment - Cropland to woody energy							
crops (1000 hectares)							0.07
Land impacted for carbon sink - Moderate							0.04
deployment - Pasture to energy crops							
(1000 hectares)							0.00
Land impacted for carbon sink - Moderate							0.29
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							3.7
deployment - Total (1000 hectares)							

Table 57: E-B+ scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-8.13
Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y)							-617
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-165

Table 57: E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend							-246
rotation length (1000 tC02e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tC02e/y)							
Carbon sink potential - High - Increase							-54.9
retention of HWP (1000 tC02e/y)							
Carbon sink potential - High - Increase							-28.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-50.3
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-63.9
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-4.07
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-180
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-27.6
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-94.6
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-18.3
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-9.99
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-3.81
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-21.5
productivity (1000 tC02e/y)							
Carbon sink potential - Mid - Accelerate							-6.1
regeneration (1000 tCO2e/y)							0.1
Carbon sink potential - Mid - All (not							-399
counting overlap) (1000 tCO2e/y)							0//
Carbon sink potential - Mid - Avoid							-96.5
deforestation (1000 tC02e/y)							-70.0
Carbon sink potential - Mid - Extend							-170
rotation length (1000 tCO2e/y)							-170
Carbon sink potential - Mid - Improve							0
plantations (1000 tCO2e/y)							U
							-36.6
Carbon sink potential - Mid - Increase							-36.6
retention of HWP (1000 tC02e/y)							10.0
Carbon sink potential - Mid - Increase							-19.3
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-27
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-42.7
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							1.33
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							22.4
High - Avoid deforestation (over 30 years)							
(1000 hectares)							

Table 57: E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)

Thom	2020	2025	2030	2035	2040	2045	2050
Item	2020	2025	2030	2035	2040	2045	
Land impacted for carbon sink potential -							126
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2.71
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							U
							1/0
Land impacted for carbon sink potential -							1.43
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							21.2
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							175
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.665
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							21
Low - Avoid deforestation (over 30 years)							۷1
(1000 hectares)							
Land impacted for carbon sink potential -							48.1
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							1.43
Low - Increase trees outside forests							1.40
(1000 hectares)							
•							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.247
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							12.8
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							84.3
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.997
Mid - Accelerate regeneration (1000							0.771
hectares)							
							01.7
Land impacted for carbon sink potential -							21.7
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							86.8
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							-
		1	1				

<u>Table 57: E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)</u>

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2.07
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.79
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							25.8
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							139
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 58: E-B+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		98.2	0.103	0.103	0.098	0.06	0.003
Coal (million 2019\$)							
Monetary damages from air pollution -		56.2	20.8	9.63	7.86	4.93	3.07
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		336	338	327	292	231	157
Transportation (million 2019\$)							
Premature deaths from air pollution -		11.1	0.012	0.012	0.011	0.007	0
Coal (deaths)							
Premature deaths from air pollution -		6.34	2.35	1.09	0.887	0.557	0.347
Natural Gas (deaths)							
Premature deaths from air pollution -		37.8	38	36.8	32.9	26	17.7
Transportation (deaths)							

Table 59: REF scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	1,928	1,983	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	39	38.6	38.5	38.3	38.5	38.4
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	61	61.4	61.5	61.7	61.5	61.6
Sales of space heating units - Electric	2.71	12.7	40.8	63.9	67.6	67.9	68
Heat Pump (%)							
Sales of space heating units - Electric	1.36	2.89	7.67	20	30.2	31.9	32
Resistance (%)							
Sales of space heating units - Fossil (%)	27.4	33.4	23.6	9.33	1.34	0.106	0
Sales of space heating units - Gas Furnace	68.5	51	27.9	6.76	0.86	0.048	0
(%)							
Sales of water heating units - Electric	1.43	2.35	2.32	2.33	2.32	2.34	2.33
Heat Pump (%)							
Sales of water heating units - Electric	7.28	11.1	10.9	11.1	11.1	11	11
Resistance (%)							
Sales of water heating units - Gas Furnace	88.4	82.4	82.7	82.5	82.5	82.7	82.6
(%)							
Sales of water heating units - Other (%)	2.9	4.16	4.07	4.09	4.16	4	4.05

Table 60: REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.245	0.243	0.8	0.865	0.782	0.829
Cumulative 5-yr (billion \$2018)							

Table 61: REF scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	37.8	36.8	37.1	37.1	37.2	38.2	39.8
Final energy use - Industry (PJ)	7.42	7.31	7.55	7.93	8.42	8.89	9.39
Final energy use - Residential (PJ)	45.6	43.2	42	41.3	40.8	40.5	40.2
Final energy use - Transportation (PJ)	58.1	54.5	50.5	48.1	48.2	49.7	51.5

Table 62: REF scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	0.864	0.9	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	54.5	54.5	54.5	54.5	54.5	54.5	54.5
Resistance (%)							
Sales of cooking units - Gas (%)	45.5	45.5	45.5	45.5	45.5	45.5	45.5
Sales of space heating units - Electric	4.66	8.08	8.4	8.88	9.08	9.28	9.55
Heat Pump (%)							
Sales of space heating units - Electric	3.9	5.72	5.6	5.54	5.52	5.25	5.08
Resistance (%)							
Sales of space heating units - Fossil (%)	37.3	45.1	23.2	7.8	6.77	6.71	6.7
Sales of space heating units - Gas (%)	54.2	41.1	62.8	77.8	78.6	78.8	78.7
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	22.1	38.4	38.4	38.4	38.4	38.4	38.4
Resistance (%)							
Sales of water heating units - Gas Furnace	65.5	52.1	52.2	52.1	52.1	52.1	52.1
(%)							
Sales of water heating units - Other (%)	12.4	9.45	9.45	9.48	9.5	9.51	9.52

Table 63: REF scenario - PILLAR 1: Efficiency/Electrification - Transportation

2020	2025	2030	2035	2040	2045	2050
98.1	98.2	97.9	97	95.6	93.5	91.6
0	0	0	0	0	0	0
0.229	0.242	0.257	0.274	0.294	0.317	0.343
0.083	0.096	0.112	0.13	0.15	0.174	0.202
0.119	0.138	0.16	0.186	0.216	0.25	0.29
1.51	1.31	1.57	2.37	3.69	5.71	7.57
1.21	1.68	2.13	1.99	1.78	1.65	1.57
4.69	7.07	7.9	9.78	11.8	13.3	14.6
88.4	84.4	81.9	79.7	77.4	75.6	74.1
5.55	6.35	7.66	8.19	8.67	9.07	9.32
0.109	0.365	0.326	0.285	0.28	0.279	0.288
0.087	0.09	0.087	0.087	0.086	0.085	0.087
65.2	63.5	61.6	59.6	58	56.5	55.2
0.027	0.105	0.329	0.671	0.895	0.973	0.993
34	35.5	37	38.5	39.7	40.8	41.7
0.365	0.427	0.496	0.577	0.674	0.793	0.929
0.175	0.208	0.242	0.285	0.339	0.409	0.487
0.255	0.271	0.298	0.345	0.42	0.528	0.671
	98.1 0 0.229 0.083 0.119 1.51 1.21 4.69 88.4 5.55 0.109 0.087 65.2 0.027 34 0.365 0.175	98.1 98.2 0 0 0.229 0.242 0.083 0.096 0.119 0.138 1.51 1.31 1.21 1.68 4.69 7.07 88.4 84.4 5.55 6.35 0.109 0.365 0.087 0.09 65.2 63.5 0.027 0.105 34 35.5 0.365 0.427 0.175 0.208	98.1 98.2 97.9 0 0 0 0.229 0.242 0.257 0.083 0.096 0.112 0.119 0.138 0.16 1.51 1.31 1.57 1.21 1.68 2.13 4.69 7.07 7.9 88.4 84.4 81.9 5.55 6.35 7.66 0.109 0.365 0.326 0.087 0.09 0.087 65.2 63.5 61.6 0.027 0.105 0.329 34 35.5 37 0.365 0.427 0.496 0.175 0.208 0.242	98.1 98.2 97.9 97 0 0 0 0 0.229 0.242 0.257 0.274 0.083 0.096 0.112 0.13 0.119 0.138 0.16 0.186 1.51 1.31 1.57 2.37 1.21 1.68 2.13 1.99 4.69 7.07 7.9 9.78 88.4 84.4 81.9 79.7 5.55 6.35 7.66 8.19 0.109 0.365 0.326 0.285 0.087 0.09 0.087 0.087 65.2 63.5 61.6 59.6 0.027 0.105 0.329 0.671 34 35.5 37 38.5 0.365 0.427 0.496 0.577 0.175 0.208 0.242 0.285	98.1 98.2 97.9 97 95.6 0 0 0 0 0 0 0.229 0.242 0.257 0.274 0.294 0.083 0.096 0.112 0.13 0.15 0.119 0.138 0.16 0.186 0.216 1.51 1.31 1.57 2.37 3.69 1.21 1.68 2.13 1.99 1.78 4.69 7.07 7.9 9.78 11.8 88.4 84.4 81.9 79.7 77.4 5.55 6.35 7.66 8.19 8.67 0.109 0.365 0.326 0.285 0.28 0.087 0.09 0.087 0.087 0.086 65.2 63.5 61.6 59.6 58 0.027 0.105 0.329 0.671 0.895 34 35.5 37 38.5 39.7 0.365 0.427 0.496 <td< td=""><td>98.1 98.2 97.9 97 95.6 93.5 0 0 0 0 0 0 0.229 0.242 0.257 0.274 0.294 0.317 0.083 0.096 0.112 0.13 0.15 0.174 0.119 0.138 0.16 0.186 0.216 0.25 1.51 1.31 1.57 2.37 3.69 5.71 1.21 1.68 2.13 1.99 1.78 1.65 4.69 7.07 7.9 9.78 11.8 13.3 88.4 84.4 81.9 79.7 77.4 75.6 5.55 6.35 7.66 8.19 8.67 9.07 0.109 0.365 0.326 0.285 0.28 0.279 0.087 0.09 0.087 0.087 0.086 0.085 65.2 63.5 61.6 59.6 58 56.5 0.027 0.105 0.329</td></td<>	98.1 98.2 97.9 97 95.6 93.5 0 0 0 0 0 0 0.229 0.242 0.257 0.274 0.294 0.317 0.083 0.096 0.112 0.13 0.15 0.174 0.119 0.138 0.16 0.186 0.216 0.25 1.51 1.31 1.57 2.37 3.69 5.71 1.21 1.68 2.13 1.99 1.78 1.65 4.69 7.07 7.9 9.78 11.8 13.3 88.4 84.4 81.9 79.7 77.4 75.6 5.55 6.35 7.66 8.19 8.67 9.07 0.109 0.365 0.326 0.285 0.28 0.279 0.087 0.09 0.087 0.087 0.086 0.085 65.2 63.5 61.6 59.6 58 56.5 0.027 0.105 0.329

Table 64: REF scenario - PILLAR 6: Land sinks - Forests

Thom	2020	2025	2030	2035	2040	2045	2050
Item	2020	2025	2030	2035	2040	2045	
Carbon sink potential - High - Accelerate							-8.13
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-617
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-165
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-246
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-54.9
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-28.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-50.3
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-63.9
productivity (1000 tCO2e/y)							00.7
Carbon sink potential - Low - Accelerate							-4.07
regeneration (1000 tC02e/y)							4.01
Carbon sink potential - Low - All (not							-180
counting overlap) (1000 tC02e/y)							-100
Carbon sink potential - Low - Avoid							-27.6
							-21.0
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-94.6
rotation length (1000 tC02e/y)							
Carbon sink potential - Low - Improve							0
plantations (1000 tC02e/y)							
Carbon sink potential - Low - Increase							-18.3
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-9.99
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-3.81
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-21.5
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-6.1
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-399
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-96.5
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-170
rotation length (1000 tCO2e/y)							11.0
Carbon sink potential - Mid - Improve							0
plantations (1000 tCO2e/y)							· ·
Carbon sink potential - Mid - Increase							-36.6
retention of HWP (1000 tC02e/y)							-30.0
							-19.3
Carbon sink potential - Mid - Increase							-17.3
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-27
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-42.7
productivity (1000 tCO2e/y)							

Table 64: REF scenario - PILLAR 6: Land sinks - Forests (continued)

lable 64: REF scenario - PILLAR 6: Land si			•				
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1.33
High - Accelerate regeneration (1000							
hectares)							22.4
Land impacted for carbon sink potential -							22.4
High - Avoid deforestation (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							126
High - Extend rotation length (1000							120
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							U
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							2.71
High - Increase trees outside forests							2.11
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							Ū
Land impacted for carbon sink potential -							1.43
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							21.2
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							175
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.665
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							21
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							48.1
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							1.43
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.247
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							12.8
Low - Restore productivity (1000							
hectares)							0, 0
Land impacted for carbon sink potential -							84.3
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.997
Mid - Accelerate regeneration (1000							
hectares)		I					

Table 64: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							21.7
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							86.8
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2.07
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.79
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							25.8
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							139
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 65: REF scenario - PILLAR 6: Land sinks - Forests - REF only

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural	-1.01		-0.322				-0.288
uptake (Mt CO2e/y)							
Business-as-usual carbon sink - Retained	-0.015		-0.027				-0.028
in Hardwood Products (Mt CO2e/y)							
Business-as-usual carbon sink - Total (Mt	-1.02		-0.349				-0.316
CO2e/y)							

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		271	170	158	154	151	134
Coal (million 2019\$)							
Monetary damages from air pollution -		44.5	29	38.7	54.4	50.4	45.8
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		335	342	348	355	362	369
Transportation (million 2019\$)							
Premature deaths from air pollution -		30.7	19.2	17.8	17.4	17	15.2
Coal (deaths)							
Premature deaths from air pollution -		5.02	3.28	4.37	6.14	5.69	5.17
Natural Gas (deaths)							
Premature deaths from air pollution -		37.7	38.5	39.1	39.9	40.7	41.5
Transportation (deaths)							