

Net-Zero America - utah 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.

Data by category and subcategory

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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	7,533	8,381	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	0.749	8.98	33.5	81.9	90.4	91	91
Sales of space heating units - Electric Resistance (%)	0.855	3.41	4.83	7.94	8.5	8.54	8.55
Sales of space heating units - Fossil (%)	0	0.208	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	98.4	87.4	61.6	10.2	1.06	0.491	0.49
Sales of water heating units - Electric Heat Pump (%)	0.008	1.61	16.7	45	50	50.3	50.3
Sales of water heating units - Electric Resistance (%)	0.41	2.69	16.3	44.1	49	49.3	49.3
Sales of water heating units - Gas Furnace (%)	99.5	95.3	66.6	10.6	0.622	0	0
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.72	1.81	3.2	3.44	3.67	3.91
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)	103	103	101	94.8	87.6	82.5	80.3
Final energy use - Industry (PJ)	86.5	89.3	90.2	96.9	111	116	122
Final energy use - Residential (PJ)	126	122	118	106	90.4	79.2	72.3
Final energy use - Transportation (PJ)	304	290	260	223	188	168	161

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	2.76	3.21	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	37.1	50.5	91.5	99.6	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	62.9	49.5	8.47	0.426	0	0	0
Sales of space heating units - Electric	3.03	9.9	34.8	79.5	87.6	88.4	88.2
Heat Pump (%)							
Sales of space heating units - Electric	3.81	7.35	5.69	2.51	1.97	1.95	1.97
Resistance (%)							
Sales of space heating units - Fossil (%)	3.57	9.24	8.91	8.06	7.57	7.25	7.38
Sales of space heating units - Gas (%)	89.6	73.5	50.6	9.98	2.86	2.43	2.43
Sales of water heating units - Electric	0	1.51	15.7	41.6	46.2	46.5	46.5
Heat Pump (%)							
Sales of water heating units - Electric	7.01	15.7	26.3	48.5	52.5	52.7	52.7
Resistance (%)							
Sales of water heating units - Gas Furnace	92.3	82	57.3	9.09	0.535	0	0
(%)							
Sales of water heating units - Other (%)	0.642	0.79	0.79	0.787	0.779	0.778	0.778

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	449	1,171	1,866	2,839	3,076	2,940
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.174	0	0.748	0	3.07	0	4.93
units)							
Public EV charging plugs - L2 (1000 units)	1.07	0	18	0	73.9	0	119
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 (%)	1.55	1.82	1.26	0.402	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.91	15.2	46.4	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.34	0.203	0.063	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	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	0	0.003	0.029	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	0.377
plant (billion \$2018)							
Capital invested - Solar PV - Base (billion	0	0	0	0	0	0	0.525
\$2018)							
Capital invested - Solar PV - Constrained	0	1.09	0	0	2.18	2.6	1.2
(billion \$2018)							
Capital invested - Wind - Base (billion	0	0.251	7.55	5.67	2.22	1.04	3.24
\$2018)							
Capital invested - Wind - Constrained	0	0.199	7.9	6.7	0.918	0.419	2.7
(billion \$2018)							
Installed (cumulative) - OffshoreWind -	0	0	0	0	0	0	0
Base land use assumptions (MW)							
Installed (cumulative) - Rooftop PV (MW)	540	833	1,113	1,450	1,851	2,318	2,871
Installed (cumulative) - Solar - Base land	768	768	768	768	768	768	1,335
use assumptions (MW)							
Installed (cumulative) - Wind - Base land	547	717	6,391	10,963	12,838	13,762	16,825
use assumptions (MW)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	4.9	61.8	61.8	61.8	61.8	61.8
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	423
Solar - Base land use assumptions (GWh)	2,042	0	0	0	0	0	1,245
Solar - Constrained land use assumptions (GWh)	2,037	0	0	0	15,608	2,359	2,413

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

	,		,				
Item	2020	2025	2030	2035	2040	2045	2050
Wind - Base land use assumptions (GWh)	1,617	508	16,025	12,502	4,938	2,416	8,258
Wind - Constrained land use assumptions	3,563	2,082	15,525	9,625	2,054	823	5,491
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0.333	3.78	4.99	5.18	5.22	26.6
Conversion capital investment -	0	2.83	32.3	18.6	2.91	0.542	346
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	0
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
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	0.4
Annual - BECCS (MMT)		0	0	0	0	0	0.4
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	0.4
Cumulative - BECCS (MMT)		0	0	0	0	0	0.4
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	22.6
Cumulative investment - All (million \$2018)		0	0	0	0	0	13.5
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	13.5
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	22.6
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 tC02e/y)							
Carbon sink potential - Aggressive							-360
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-15.7
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-376
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-184
deployment - Cropland measures (1000							
tCO2e/v)							
Carbon sink potential - Moderate							-7.84
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-192
deployment - Total (1000 tC02e/y)							.,_
Land impacted for carbon sink -		+	+				0
Aggressive deployment - Corn-ethanol to							O
energy grasses (1000 hectares)							
Land impacted for carbon sink -	+	+	+				646
Aggressive deployment - Cropland							040
measures (1000 hectares)							
Land impacted for carbon sink -							24.1
Aggressive deployment - Permanent							24.1
conservation cover (1000 hectares)							
Land impacted for carbon sink -							670
·							670
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							000
Land impacted for carbon sink - Moderate							329
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							12.1
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate	\top						341
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-1,412
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-18,580
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-838
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,600
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-10.6
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-29.8
retention of HWP (1000 tCO2e/y)							

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

lable 13: E+ scenario - PILLAR 6: Land sin		•		0005	00/0	0015	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)							-332
` ',							0.070
Carbon sink potential - High - Reforest							-2,378
cropland (1000 tCO2e/y)							1.000
Carbon sink potential - High - Reforest							-1,329
pasture (1000 tC02e/y)	+						/ / [1
Carbon sink potential - High - Restore							-4,651
productivity (1000 tC02e/y)							707
Carbon sink potential - Low - Accelerate							-707
regeneration (1000 tCO2e/y)							/ 755
Carbon sink potential - Low - All (not							-6,755
counting overlap) (1000 tCO2e/y)							1/ 0
Carbon sink potential - Low - Avoid							-140
deforestation (1000 tCO2e/y)							0.010
Carbon sink potential - Low - Extend							-2,919
rotation length (1000 tC02e/y)							
Carbon sink potential - Low - Improve							-5.38
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-9.92
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-116
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-1,189
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-101
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,568
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-1,060
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-12,667
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-489
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,260
rotation length (1000 tCO2e/y)							,
Carbon sink potential - Mid - Improve							-7.89
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase	+						-19.8
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-224
trees outside forests (1000 tCO2e/y)							:
Carbon sink potential - Mid - Reforest							-1,783
cropland (1000 tCO2e/y)							1,100
Carbon sink potential - Mid - Reforest							-715
pasture (1000 tC02e/y)							110
Carbon sink potential - Mid - Restore	+						-3,109
productivity (1000 tCO2e/y)							-3,107
Land impacted for carbon sink potential -							231
High - Accelerate regeneration (1000							231
hectares)							
							113
Land impacted for carbon sink potential -							113
High - Avoid deforestation (over 30 years)							
(1000 hectares)							0.07/
Land impacted for carbon sink potential -							3,876
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -	T						3.9
High - Improve plantations (1000							
hectares)							

Table 13: E+ 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 -							31.5
High - Increase trees outside forests							
(1000 hectares)							157
Land impacted for carbon sink potential -							157
High - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							37.8
High - Reforest pasture (1000 hectares)							31.0
Land impacted for carbon sink potential -							1,542
High - Restore productivity (1000							1,042
hectares)							
Land impacted for carbon sink potential -							5,992
High - Total impacted (over 30 years)							-,
(1000 hectares)							
Land impacted for carbon sink potential -							116
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							106
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,485
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1.95
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 -							16.6
Low - Increase trees outside forests							10.0
(1000 hectares)							
Land impacted for carbon sink potential -							78.6
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							6.55
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							933
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,743
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							173
Mid - Accelerate regeneration (1000							
hectares)							110
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years)							110
(1000 hectares)							
Land impacted for carbon sink potential -							2,680
Mid - Extend rotation length (1000							2,000
hectares)							
Land impacted for carbon sink potential -							2.93
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 -							24.1
Mid - Increase trees outside forests (1000							
hectares)							

Table 13: E+	ccanario -	DTII AD 6.	Land cinke	Enracte	(continued)
Table 13: <i>E+</i>	scenario -	PILLAR 6:	Luna sinks -	· Forests i	i continuea i

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							118
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							47.3
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,879
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,034
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		189	159	128	96	60.4	41.9
Natural gas consumption - Cumulative		0	0	0	0	0	3,842
(tcf)							
Natural gas production - Annual (tcf)		348	329	287	242	192	149
Oil consumption - Annual (million bbls)		53.1	45.7	34.9	24.7	16.6	10
Oil consumption - Cumulative (million		0	0	0	0	0	1,076
bbls)							
Oil production - Annual (million bbls)		48	48.2	48.1	38.1	31	20.6

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		158	0.183	0.183	0.163	0.107	0
Coal (million 2019\$)							
Monetary damages from air pollution -		38.7	29.3	22	19.4	15.2	11.3
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		745	724	572	341	160	64.3
Transportation (million 2019\$)							
Premature deaths from air pollution -		17.8	0.021	0.021	0.018	0.012	0
Coal (deaths)							
Premature deaths from air pollution -		4.37	3.31	2.48	2.19	1.72	1.28
Natural Gas (deaths)							
Premature deaths from air pollution -		83.8	81.5	64.3	38.3	18	7.23
Transportation (deaths)							

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		4.2	10.7	10.8	9.3	7.45	25
By economic sector - Construction (jobs)		4,630	7,652	8,842	8,198	7,716	9,218
By economic sector - Manufacturing		4,247	5,979	6,951	6,077	5,186	5,480
(jobs)							
By economic sector - Mining (jobs)		4,907	3,453	2,594	1,720	1,121	655
By economic sector - Other (jobs)		445	717	909	968	1,034	1,668
By economic sector - Pipeline (jobs)		401	356	302	229	161	108
By economic sector - Professional (jobs)		2,672	4,371	5,247	5,088	4,956	6,002
By economic sector - Trade (jobs)		2,730	3,174	3,505	3,276	3,138	3,829
By economic sector - Utilities (jobs)		3,947	7,062	7,742	6,905	6,562	6,858
By education level - All sectors -		7,240	10,231	11,371	10,292	9,532	10,866
Associates degree or some college (jobs)							
By education level - All sectors -		5,270	6,970	7,584	6,784	6,213	6,963
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		174	239	267	247	232	272
degree (jobs)							
By education level - All sectors - High		10,055	13,651	15,035	13,477	12,356	13,984
school diploma or less (jobs)							

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

14510 101 27 000114110 11 11 11010 0050 (0011							
Item	2020	2025	2030	2035	2040	2045	2050
By education level - All sectors - Masters		1,243	1,684	1,846	1,670	1,547	1,759
or professional degree (jobs)							
By resource sector - Biomass (jobs)		18	29.5	30.7	28	27.2	107
By resource sector - CO2 (jobs)		0	0	0	0	0	29.4
By resource sector - Coal (jobs)		2,670	1,040	529	460	414	367
By resource sector - Grid (jobs)		4,799	11,712	13,605	12,053	11,417	12,440
By resource sector - Natural Gas (jobs)		4,855	4,123	3,305	2,617	2,125	1,300
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		6,802	5,928	5,041	3,591	2,603	1,588
By resource sector - Solar (jobs)		3,444	3,627	4,869	5,150	5,442	9,230
By resource sector - Wind (jobs)		1,395	6,316	8,723	8,572	7,853	8,782
Median wages - Annual - All (\$2019 per		58,060	58,319	58,637	59,219	59,958	60,200
job)						.	•
On-Site or In-Plant Training - Total jobs - 1		3,831	5,342	5,897	5,310	4,898	5,541
to 4 years (jobs)		-,	.,.	-,-	-,-	,	-,-
On-Site or In-Plant Training - Total jobs - 4		1,511	2,176	2,407	2,184	2,036	2,316
to 10 years (jobs)			,				•
On-Site or In-Plant Training - Total jobs -		3,814	5,258	5,822	5,259	4,849	5,547
None (jobs)		,				.	
On-Site or In-Plant Training - Total jobs -		185	275	309	281	262	298
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		14,643	19,724	21,668	19,436	17,836	20,143
Up to 1 year (jobs)		·			-		•
On-the-Job Training - All sectors - 1 to 4		4,888	6,870	7,592	6,847	6,325	7,159
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		1,427	2,102	2,341	2,136	2,001	2,295
years (jobs)							
On-the-Job Training - All sectors - None		1,313	1,756	1,928	1,736	1,599	1,840
(jobs)							
On-the-Job Training - All sectors - Over 10		229	316	351	315	287	327
years (jobs)							
On-the-Job Training - All sectors - Up to 1		16,125	21,731	23,891	21,437	19,668	22,223
year (jobs)							
Related work experience - All sectors - 1		8,827	11,924	13,081	11,745	10,800	12,185
to 4 years (jobs)							
Related work experience - All sectors - 4		5,564	7,686	8,466	7,621	7,022	7,925
to 10 years (jobs)							
Related work experience - All sectors -		3,368	4,658	5,134	4,624	4,267	4,852
None (jobs)							
Related work experience - All sectors -		1,527	2,084	2,288	2,047	1,870	2,092
Over 10 years (jobs)							
Related work experience - All sectors - Up		4,696	6,424	7,134	6,434	5,921	6,789
to 1 year (jobs)							
Wage income - All (million \$2019)		1,393	1,912	2,117	1,923	1,792	2,038

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	7,532	8,365	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric	0.749	7.59	10.3	19	39.5	64.5	79
Heat Pump (%)							
Sales of space heating units - Electric	0.855	3.35	3.5	4.01	5.26	6.85	7.79
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.241	0.225	0.172	0.092	0.04	0.021
Sales of space heating units - Gas Furnace	98.4	88.8	86	76.8	55.2	28.6	13.2
(%)							

Table 17: E- scenario -	DILLAR 1. Efficience	//Electrification -	Commercial	continued
Table II. E- Scellul IO -	PILLAK I. EIIILIEIIL	// EIECH 111CUHUH -	CUITITIETCIULT	Continueur

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric	0.008	0.63	2.29	7.68	20	34.8	43.4
Heat Pump (%)							
Sales of water heating units - Electric	0.41	2	3.48	8.38	19.9	34.2	42.5
Resistance (%)							
Sales of water heating units - Gas Furnace	99.5	97	93.8	83.6	59.7	30.6	13.7
(%)							
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.43	1.48	1.97	2.07	2.75	2.92
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)	103	103	103	102	99.5	96.4	92.8
Final energy use - Industry (PJ)	86.5	89.4	90.4	97.9	112	117	124
Final energy use - Residential (PJ)	126	122	121	118	114	105	94.6
Final energy use - Transportation (PJ)	304	292	270	253	241	225	207

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	2.75	3.16	0	0	0	0
Sales of cooking units - Electric Resistance (%)	36.9	38.5	44.3	59.5	80.7	93.8	98.3
Sales of cooking units - Gas (%)	63.1	61.5	55.7	40.5	19.3	6.23	1.68
Sales of space heating units - Electric Heat Pump (%)	3.03	8.14	10.8	19.7	39.7	63.6	77.1
Sales of space heating units - Electric Resistance (%)	3.81	7.45	7.24	6.69	5.41	3.74	2.75
Sales of space heating units - Fossil (%)	3.57	9.27	9.34	9.11	8.39	7.66	7.61
Sales of space heating units - Gas (%)	89.6	75.1	72.6	64.6	46.5	25	12.6
Sales of water heating units - Electric Heat Pump (%)	0	0.562	2.11	7.14	18.6	32.3	40.2
Sales of water heating units - Electric Resistance (%)	7.01	15.2	16.4	20.2	29.3	40.6	47.3
Sales of water heating units - Gas Furnace (%)	92.3	83.4	80.7	71.9	51.3	26.3	11.8
Sales of water heating units - Other (%)	0.642	0.79	0.789	0.787	0.783	0.781	0.778

Table 21: E- scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	76.1	152	522	1,618	2,366
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.174	0	0.26	0	1.16	0	3.16
units)							
Public EV charging plugs - L2 (1000 units)	1.07	0	6.25	0	27.9	0	75.9
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 (%)	1.56	1.97	2.06	1.64	1.05	0.537	0.23

Table 21: E- scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	1.89	4.68	11.8	25.9	48.4	72	87.6
Vehicle sales - Light-duty - gasoline (%)	91.8	87.5	79.6	66.7	46.2	24.9	11
Vehicle sales - Light-duty - hybrid (%)	4.58	5.39	6.05	5.51	4.13	2.44	1.18
Vehicle sales - Light-duty - hydrogen FC	0.113	0.38	0.326	0.249	0.177	0.098	0.046
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.106	0.097	0.084	0.061	0.033	0.015
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							C
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-360
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-15.7
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-376
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							(
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-184
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-7.8
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-19
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							640
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							24
Aggressive deployment - Permanent							- '
conservation cover (1000 hectares)							
Land impacted for carbon sink -							67
Aggressive deployment - Total (1000							01
hectares)							
Land impacted for carbon sink - Moderate							
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							32
deployment - Cropland measures (1000							32
hectares)							10
Land impacted for carbon sink - Moderate							12
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 - Moderate							341
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							-1,412
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-18,580
counting overlap) (1000 tCO2e/y)							000
Carbon sink potential - High - Avoid							-838
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,600
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-10.6
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-29.8
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-332
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							-2,378
cropland (1000 tCO2e/y)							_,0.0
Carbon sink potential - High - Reforest							-1,329
pasture (1000 tC02e/y)							-1,327
Carbon sink potential - High - Restore							-4,651
							-4,631
productivity (1000 tCO2e/y)							707
Carbon sink potential - Low - Accelerate							-707
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-6,755
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-140
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,919
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-5.38
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-9.92
retention of HWP (1000 tCO2e/y)							7.72
Carbon sink potential - Low - Increase							-116
trees outside forests (1000 tC02e/y)							-110
							1100
Carbon sink potential - Low - Reforest							-1,189
cropland (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-101
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,568
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-1,060
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-12,667
counting overlap) (1000 tCO2e/y)							,
Carbon sink potential - Mid - Avoid							-489
deforestation (1000 tCO2e/y)							107
Carbon sink potential - Mid - Extend							-5,260
rotation length (1000 tCO2e/y)							-5,260
• • • • • • • • • • • • • • • • • • • •							7.00
Carbon sink potential - Mid - Improve							-7.89
plantations (1000 tC02e/y)							
Carbon sink potential - Mid - Increase							-19.8
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase						T	-224
trees outside forests (1000 tCO2e/y)							

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

Item Conhon sink notantial, Mid. Referent	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,783
Carbon sink potential - Mid - Reforest							-715
pasture (1000 tC02e/y)							-110
Carbon sink potential - Mid - Restore	+						-3,109
productivity (1000 tCO2e/y)							•
Land impacted for carbon sink potential -							231
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							113
High - Avoid deforestation (over 30 years)							
(1000 hectares) Land impacted for carbon sink potential -							3,876
High - Extend rotation length (1000							3,010
hectares)							
Land impacted for carbon sink potential -							3.9
High - Improve plantations (1000							0.,
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							31.5
High - Increase trees outside forests							
(1000 hectares)							157
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							157
Land impacted for carbon sink potential -			-				37.8
High - Reforest pasture (1000 hectares)							31.0
Land impacted for carbon sink potential -							1,542
High - Restore productivity (1000							, -
hectares)							
Land impacted for carbon sink potential -							5,992
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							116
Low - Accelerate regeneration (1000 hectares)							
Land impacted for carbon sink potential -							106
Low - Avoid deforestation (over 30 years)							100
(1000 hectares)							
Land impacted for carbon sink potential -	+						1,485
Low - Extend rotation length (1000							,
hectares)							
Land impacted for carbon sink potential -							1.95
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 -							16.6
Low - Increase trees outside forests							10.0
(1000 hectares)							
Land impacted for carbon sink potential -							78.6
Low - Reforest cropland (1000 hectares)							. 5.0
Land impacted for carbon sink potential -							6.55
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							933
Low - Restore productivity (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 -							2,743
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							173
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							110
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,680
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							2.93
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 -							24.1
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							118
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							47.3
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,879
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,034
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		158	0.183	0.183	0.163	0.107	0
Monetary damages from air pollution - Natural Gas (million 2019\$)		42.5	21.4	14.9	8.71	4.13	4.99
Monetary damages from air pollution - Transportation (million 2019\$)		757	796	806	751	617	436
Premature deaths from air pollution - Coal (deaths)		17.8	0.021	0.021	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)		4.79	2.42	1.68	0.983	0.467	0.563
Premature deaths from air pollution - Transportation (deaths)		85.1	89.6	90.6	84.5	69.4	49.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	7,533	8,381	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	54.6	83	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	0.749	8.98	33.5	81.9	90.4	91	91
Heat Pump (%)							
Sales of space heating units - Electric	0.855	3.41	4.83	7.94	8.5	8.54	8.55
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.208	0.04	0.002	0	0	0

Table 25: F+RF+	scenario - DIII AR 1	Efficiency/Electrification -	Commercial (continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	98.4	87.4	61.6	10.2	1.06	0.491	0.49
Sales of water heating units - Electric Heat Pump (%)	0.008	1.61	16.7	45	50	50.3	50.3
Sales of water heating units - Electric Resistance (%)	0.41	2.69	16.3	44.1	49	49.3	49.3
Sales of water heating units - Gas Furnace (%)	99.5	95.3	66.6	10.6	0.622	0	0
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.72	1.81	3.2	3.44	3.67	3.91
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	103	103	101	94.8	87.6	82.5	80.3
Final energy use - Industry (PJ)	86.5	89.3	90.2	96.9	111	116	122
Final energy use - Residential (PJ)	126	122	118	106	90.4	79.2	72.3
Final energy use - Transportation (PJ)	304	290	260	223	188	168	161

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	2.76	3.21	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	37.1	50.5	91.5	99.6	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	62.9	49.5	8.47	0.426	0	0	0
Sales of space heating units - Electric	3.03	9.9	34.8	79.5	87.6	88.4	88.2
Heat Pump (%)							
Sales of space heating units - Electric	3.81	7.35	5.69	2.51	1.97	1.95	1.97
Resistance (%)							
Sales of space heating units - Fossil (%)	3.57	9.24	8.91	8.06	7.57	7.25	7.38
Sales of space heating units - Gas (%)	89.6	73.5	50.6	9.98	2.86	2.43	2.43
Sales of water heating units - Electric	0	1.51	15.7	41.6	46.2	46.5	46.5
Heat Pump (%)							
Sales of water heating units - Electric	7.01	15.7	26.3	48.5	52.5	52.7	52.7
Resistance (%)							
Sales of water heating units - Gas Furnace	92.3	82	57.3	9.09	0.535	0	0
(%)							
Sales of water heating units - Other (%)	0.642	0.79	0.79	0.787	0.779	0.778	0.778

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	449	1,171	1,866	2,839	3,076	2,940
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.174	0	0.748	0	3.07	0	4.93
Public EV charging plugs - L2 (1000 units)	1.07	0	18	0	73.9	0	119
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

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.55	1.82	1.26	0.402	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.91	15.2	46.4	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.34	0.203	0.063	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	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

isto do. 2 The bootharto Treeth 2. Gloan elocation, denot during capacity										
Item	2020	2025	2030	2035	2040	2045	2050			
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	0	0	0	7.15			
Capital invested - Wind - Base (billion \$2018)	0	0.668	8.7	6.39	4.89	2.47	3.24			
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0			
Installed (cumulative) - Solar - Base land use assumptions (MW)	768	768	768	768	768	768	8,483			
Installed (cumulative) - Wind - Base land use assumptions (MW)	547	1,001	7,535	12,685	16,824	19,028	22,089			

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,042	0	0	0	0	0	16,142
Solar - Constrained land use assumptions (GWh)	2,042	0	0	10,834	4,539	4,837	15,788
Wind - Base land use assumptions (GWh)	1,617	1,331	18,362	13,914	10,844	5,461	7,656
Wind - Constrained land use assumptions (GWh)	3,563	4,044	17,306	8,018	4,733	1,601	4,423

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							-360
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-15.7
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-376
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-184
deployment - Cropland measures (1000							
tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-7.84
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-192
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 -							646
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							24.1
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							670
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							329
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							12.1
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							341
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-1,412
Carbon sink potential - High - All (not							-18,580
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-838
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,600
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-10.6
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-29.8
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-332
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-2,378
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-1,329
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-4,651
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-707
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-6,755
counting overlap) (1000 tCO2e/y)							·
Carbon sink potential - Low - Avoid							-140
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,919
rotation length (1000 tCO2e/y)							_,

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

Item Conhon sink notantial Law Improve	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - Low - Improve							-5.3
plantations (1000 tC02e/y)							0.0
Carbon sink potential - Low - Increase							-9.9
retention of HWP (1000 tC02e/y)							-11
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-11
Carbon sink potential - Low - Reforest							110
							-1,18
cropland (1000 tC02e/y)							10
Carbon sink potential - Low - Reforest							-10
pasture (1000 tC02e/y)							1 5 (
Carbon sink potential - Low - Restore							-1,56
productivity (1000 tC02e/y)							1.07
Carbon sink potential - Mid - Accelerate							-1,06
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-12,66
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-48
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,26
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-7.8
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-19.
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-22
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-1,78
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-71
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-3,10
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							23
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							11
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,87
High - Extend rotation length (1000							-,
hectares)							
Land impacted for carbon sink potential -							3
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							31.
High - Increase trees outside forests							01.
(1000 hectares)							
and impacted for carbon sink potential -							15
High - Reforest cropland (1000 hectares)							10
							37.
Land impacted for carbon sink potential -							31.
High - Reforest pasture (1000 hectares)				-			1 - 1
Land impacted for carbon sink potential -							1,54
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,99
High - Total impacted (over 30 years)							

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 -							116
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							106
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,485
Low - Extend rotation length (1000							,
hectares)							
Land impacted for carbon sink potential -							1.95
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							Ū
hectares)							
Land impacted for carbon sink potential -							16.6
Low - Increase trees outside forests							10.0
(1000 hectares)							
Land impacted for carbon sink potential -							78.6
Low - Reforest cropland (1000 hectares)							10.0
Land impacted for carbon sink potential -							6.55
Low - Reforest pasture (1000 hectares)							0.55
Land impacted for carbon sink potential -							933
Low - Restore productivity (1000							933
hectares) Land impacted for carbon sink potential -							2,743
							2,143
Low - Total impacted (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							173
							113
Mid - Accelerate regeneration (1000							
hectares)							110
Land impacted for carbon sink potential -							110
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							0.400
Land impacted for carbon sink potential -							2,680
Mid - Extend rotation length (1000							
hectares)							2.93
Land impacted for carbon sink potential -							2.93
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							0/ 1
Land impacted for carbon sink potential -							24.1
Mid - Increase trees outside forests (1000							
hectares)							110
Land impacted for carbon sink potential -							118
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							47.3
Mid - Reforest pasture (1000 hectares)							4 2=-
Land impacted for carbon sink potential -							1,879
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,034
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 -		158	0.183	0.183	0.163	0.107	0
Coal (million 2019\$)							

Table 34:	E+RE+ scenario -	· IMPACTS -	Health	l continued l

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Natural Gas (million 2019\$)		37.2	22.7	13	9.6	4.4	3.47
Monetary damages from air pollution - Transportation (million 2019\$)		745	724	572	341	160	64.3
Premature deaths from air pollution - Coal (deaths)		17.8	0.021	0.021	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)		4.2	2.57	1.46	1.08	0.496	0.392
Premature deaths from air pollution - Transportation (deaths)		83.8	81.5	64.3	38.3	18	7.23

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	7,533	8,381	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	0.749	8.98	33.5	81.9	90.4	91	91
Sales of space heating units - Electric Resistance (%)	0.855	3.41	4.83	7.94	8.5	8.54	8.55
Sales of space heating units - Fossil (%)	0	0.208	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	98.4	87.4	61.6	10.2	1.06	0.491	0.49
Sales of water heating units - Electric Heat Pump (%)	0.008	1.61	16.7	45	50	50.3	50.3
Sales of water heating units - Electric Resistance (%)	0.41	2.69	16.3	44.1	49	49.3	49.3
Sales of water heating units - Gas Furnace (%)	99.5	95.3	66.6	10.6	0.622	0	0
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.72	1.81	3.2	3.44	3.67	3.91
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)	103	103	101	94.8	87.6	82.5	80.3
Final energy use - Industry (PJ)	86.5	89.3	90.2	96.9	111	116	122
Final energy use - Residential (PJ)	126	122	118	106	90.4	79.2	72.3
Final energy use - Transportation (PJ)	304	290	260	223	188	168	161

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	2.76	3.21	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	37.1	50.5	91.5	99.6	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	62.9	49.5	8.47	0.426	0	0	0
Sales of space heating units - Electric	3.03	9.9	34.8	79.5	87.6	88.4	88.2
Heat Pump (%)							
Sales of space heating units - Electric	3.81	7.35	5.69	2.51	1.97	1.95	1.97
Resistance (%)							

Table 38: E+RE-	acanania DII	IAD 1. Eff	icionou/Floota	ification	Dooidontial	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Fossil (%)	3.57	9.24	8.91	8.06	7.57	7.25	7.38
Sales of space heating units - Gas (%)	89.6	73.5	50.6	9.98	2.86	2.43	2.43
Sales of water heating units - Electric Heat Pump (%)	0	1.51	15.7	41.6	46.2	46.5	46.5
Sales of water heating units - Electric Resistance (%)	7.01	15.7	26.3	48.5	52.5	52.7	52.7
Sales of water heating units - Gas Furnace (%)	92.3	82	57.3	9.09	0.535	0	0
Sales of water heating units - Other (%)	0.642	0.79	0.79	0.787	0.779	0.778	0.778

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	449	1,171	1,866	2,839	3,076	2,940
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.174	0	0.748	0	3.07	0	4.93
units)							
Public EV charging plugs - L2 (1000 units)	1.07	0	18	0	73.9	0	119
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 (%)	1.55	1.82	1.26	0.402	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.91	15.2	46.4	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.34	0.203	0.063	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	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 - Solar PV - Base (billion \$2018)		1.57	1.01	0.394	0.559	0.839	0
Capital invested - Solar PV - Constrained (billion \$2018)		0.463	0	0	2.75	2.17	0
Capital invested - Wind - Base (billion \$2018)		0.149	2.14	4.88	3.54	1.7	1.52
Capital invested - Wind - Constrained (billion \$2018)		0.838	1.8	5.5	3.35	1.73	0.966

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	5,120	2,460	1,785	705	1,131	1,794	0
Solar - Constrained land use assumptions	2,203	711	0	0	5,780	4,885	0
(GWh)							
Wind - Base land use assumptions (GWh)	1,617	299	4,612	11,071	8,101	4,054	3,958
Wind - Constrained land use assumptions	3,189	1,614	3,784	11,406	6,636	3,524	2,049
(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							-360
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-15.7
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-376
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-184
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-7.84
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-192
deployment - Total (1000 tC02e/y)							172
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							U
energy grasses (1000 hectares)							
Land impacted for carbon sink -							646
Aggressive deployment - Cropland							040
measures (1000 hectares)							
Land impacted for carbon sink -							24.1
Aggressive deployment - Permanent							24.1
conservation cover (1000 hectares)							
							/70
Land impacted for carbon sink -							670
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							329
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							12.1
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							341
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							-1,412
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-18,580
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-838
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,600
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-10.6
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-29.8
retention of HWP (1000 tCO2e/y)							

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

Carbon sink notantial High Increase	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - High - Increase							-33
trees outside forests (1000 tC02e/y)							0.07
Carbon sink potential - High - Reforest							-2,37
cropland (1000 tC02e/y)							-1,32
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-1,32
Carbon sink potential - High - Restore							-4,65
productivity (1000 tCO2e/y)							-4,65
Carbon sink potential - Low - Accelerate							-70
regeneration (1000 tCO2e/y)							-10
Carbon sink potential - Low - All (not							-6,75
counting overlap) (1000 tCO2e/y)							-0,13
Carbon sink potential - Low - Avoid							-14
deforestation (1000 tC02e/y)							-14
Carbon sink potential - Low - Extend							-2,91
rotation length (1000 tC02e/y)							-2,71
Carbon sink potential - Low - Improve							-5.3
plantations (1000 tCO2e/y)							-0.0
Carbon sink potential - Low - Increase							-9.9
retention of HWP (1000 tCO2e/y)							-7.7
Carbon sink potential - Low - Increase							-11
trees outside forests (1000 tCO2e/y)							-,,
Carbon sink potential - Low - Reforest							-1,18
cropland (1000 tCO2e/y)							-1,10
Carbon sink potential - Low - Reforest							-10
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,56
productivity (1000 tC02e/y)							1,00
Carbon sink potential - Mid - Accelerate							-1,06
regeneration (1000 tC02e/y)							.,00
Carbon sink potential - Mid - All (not							-12,66
counting overlap) (1000 tCO2e/y)							,00
Carbon sink potential - Mid - Avoid							-48
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,26
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-7.8
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-19.
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-22
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-1,78
cropland (1000 tCO2e/y)							•
Carbon sink potential - Mid - Reforest							-71
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-3,10
productivity (1000 tCO2e/y)							, -
Land impacted for carbon sink potential -							23
High - Accelerate regeneration (1000							
nectares)							
Land impacted for carbon sink potential -							1
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,87
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							3
High - Improve plantations (1000							
hectares)							

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

Land impacted for carbon sink potential -	2020	2025	2030	2035	2040	2045	2050
High - Increase retention of HWP (1000							·
hectares) Land impacted for carbon sink potential -							31.5
High - Increase trees outside forests							31.0
(1000 hectares)							
Land impacted for carbon sink potential -							15
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							37.8
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,542
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,992
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							116
Low - Accelerate regeneration (1000							
hectares) Land impacted for carbon sink potential -							106
Low - Avoid deforestation (over 30 years)							100
(1000 hectares)							
Land impacted for carbon sink potential -							1,485
Low - Extend rotation length (1000							1,400
hectares)							
Land impacted for carbon sink potential -							1.9
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							16.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							78. <i>6</i>
Low - Reforest cropland (1000 hectares)							/ [
Land impacted for carbon sink potential -							6.55
Low - Reforest pasture (1000 hectares)							933
Land impacted for carbon sink potential - Low - Restore productivity (1000							933
hectares)							
Land impacted for carbon sink potential -							2,743
Low - Total impacted (over 30 years)							2,170
(1000 hectares)							
Land impacted for carbon sink potential -							173
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							110
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,680
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							2.93
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							(
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							24.
Mid - Increase trees outside forests (1000 hectares)							

Table 43: E+RE-	cconario	DTIIAD	6. Land sinks	Enrocte	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							118
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							47.3
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,879
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,034
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 -		158	0.183	0.183	0.163	0.107	0
Coal (million 2019\$)							
Monetary damages from air pollution -		41.6	28.3	24.9	28.7	21.3	6.72
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		745	724	572	341	160	64.3
Transportation (million 2019\$)							
Premature deaths from air pollution -		17.8	0.021	0.021	0.018	0.012	0
Coal (deaths)							
Premature deaths from air pollution -		4.69	3.19	2.81	3.24	2.4	0.758
Natural Gas (deaths)							
Premature deaths from air pollution -		83.8	81.5	64.3	38.3	18	7.23
Transportation (deaths)							

Table 45: E-B+ 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	7,532	8,365	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump (%)	0.749	7.59	10.3	19	39.5	64.5	79
Sales of space heating units - Electric Resistance (%)	0.855	3.35	3.5	4.01	5.26	6.85	7.79
Sales of space heating units - Fossil (%)	0	0.241	0.225	0.172	0.092	0.04	0.021
Sales of space heating units - Gas Furnace (%)	98.4	88.8	86	76.8	55.2	28.6	13.2
Sales of water heating units - Electric Heat Pump (%)	0.008	0.63	2.29	7.68	20	34.8	43.4
Sales of water heating units - Electric Resistance (%)	0.41	2	3.48	8.38	19.9	34.2	42.5
Sales of water heating units - Gas Furnace (%)	99.5	97	93.8	83.6	59.7	30.6	13.7
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.43	1.48	1.97	2.07	2.75	2.92
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)	103	103	103	102	99.5	96.4	92.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	86.5	89.4	90.4	97.9	112	117	124
Final energy use - Residential (PJ)	126	122	121	118	114	105	94.6
Final energy use - Transportation (PJ)	304	292	270	253	241	225	207

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	2.75	3.16	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	36.9	38.5	44.3	59.5	80.7	93.8	98.3
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	61.5	55.7	40.5	19.3	6.23	1.68
Sales of space heating units - Electric	3.03	8.14	10.8	19.7	39.7	63.6	77.1
Heat Pump (%)							
Sales of space heating units - Electric	3.81	7.45	7.24	6.69	5.41	3.74	2.75
Resistance (%)							
Sales of space heating units - Fossil (%)	3.57	9.27	9.34	9.11	8.39	7.66	7.61
Sales of space heating units - Gas (%)	89.6	75.1	72.6	64.6	46.5	25	12.6
Sales of water heating units - Electric	0	0.562	2.11	7.14	18.6	32.3	40.2
Heat Pump (%)							
Sales of water heating units - Electric	7.01	15.2	16.4	20.2	29.3	40.6	47.3
Resistance (%)							
Sales of water heating units - Gas Furnace	92.3	83.4	80.7	71.9	51.3	26.3	11.8
(%)							
Sales of water heating units - Other (%)	0.642	0.79	0.789	0.787	0.783	0.781	0.778

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

Thoma	0000	0005	, , , , , , ,	0005	0070	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	76.1	152	522	1,618	2,366
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.174	0	0.26	0	1.16	0	3.16
units)							
Public EV charging plugs - L2 (1000 units)	1.07	0	6.25	0	27.9	0	75.9
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 (%)	1.56	1.97	2.06	1.64	1.05	0.537	0.23
Vehicle sales - Light-duty - EV (%)	1.89	4.68	11.8	25.9	48.4	72	87.6
Vehicle sales - Light-duty - gasoline (%)	91.8	87.5	79.6	66.7	46.2	24.9	11
Vehicle sales - Light-duty - hybrid (%)	4.58	5.39	6.05	5.51	4.13	2.44	1.18
Vehicle sales - Light-duty - hydrogen FC	0.113	0.38	0.326	0.249	0.177	0.098	0.046
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.106	0.097	0.084	0.061	0.033	0.015
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
	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 (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

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	0
Conversion capital investment -	0	0	0	0	0	0	0
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	0
(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 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	0
Annual - BECCS (MMT)		0	0	0	0	0	0
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	0
Cumulative - BECCS (MMT)		0	0	0	0	0	0
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	0
Cumulative investment - All (million \$2018)		0	0	0	0	0	0
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	0
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	0
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							-360
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							-15.7
deployment - Permanent conservation							10.1
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-376
deployment - Total (1000 tC02e/y)							-510
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							U
grasses (1000 tC02e/y)							
							-184
Carbon sink potential - Moderate deployment - Cropland measures (1000							-104
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-7.84
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-192
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 -							1,595
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							0.002
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							1.05
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							
Land impacted for carbon sink -			+			+	24.1
Aggressive deployment - Permanent							∠4.1
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,620
Aggressive deployment - Total (1000							1,020
hectares)							
HEGIAI ESJ							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							329
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							0.002
deployment - Cropland to woody energy							
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							1.05
deployment - Pasture to energy crops							
(1000 hectares)							
Land impacted for carbon sink - Moderate							12.1
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							342
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							-1,41
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-18,580
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-838
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,600
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-10.6
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-29.8
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-332
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-2,378
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-1,329
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-4,65
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-707
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-6,755
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-140
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,919
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-5.38
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-9.92
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-116
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-1,189
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-10
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,568
productivity (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Accelerate							-1,060
regeneration (1000 tC02e/y)							
Carbon sink potential - Mid - All (not							-12,667
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-489
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,260
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-7.89
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-19.8
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-224
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-1,783
cropland (1000 tCO2e/y)							•
Carbon sink potential - Mid - Reforest							-715
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-3,109
productivity (1000 tCO2e/y)							57.57
Land impacted for carbon sink potential -							231
High - Accelerate regeneration (1000							201
hectares)							
Land impacted for carbon sink potential -			-				113
High - Avoid deforestation (over 30 years)							113
(1000 hectares)							
Land impacted for carbon sink potential -							3,876
							3,010
High - Extend rotation length (1000 hectares)							
-							2.0
Land impacted for carbon sink potential -							3.9
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 -							31.5
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							157
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							37.8
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,542
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,992
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							116
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							106
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -					+		1,485
Low - Extend rotation length (1000							., .00
hectares)							
Land impacted for carbon sink potential -		+			+		1.95
Low - Improve plantations (1000							1.70
hectares)							
1100(01)00)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							16.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							78.6
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							6.55
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							933
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,743
Low - Total impacted (over 30 years)							, -
(1000 hectares)							
Land impacted for carbon sink potential -							173
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							110
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,680
Mid - Extend rotation length (1000							,
hectares)							
Land impacted for carbon sink potential -							2.93
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 -							24.1
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							118
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							47.3
Mid - Reforest pasture (1000 hectares)							11.0
Land impacted for carbon sink potential -		+				+	1,879
Mid - Restore productivity (1000							.,017
hectares)							
Land impacted for carbon sink potential -						+	5,034
Mid - Total impacted (over 30 years) (1000							0,004
hectares)							
nootal ooj							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		158	0.183	0.183	0.163	0.107	0
Coal (million 2019\$)							
Monetary damages from air pollution -		40.1	23.8	17.5	14.1	8.86	8.42
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		757	796	806	751	617	436
Transportation (million 2019\$)							
Premature deaths from air pollution -		17.8	0.021	0.021	0.018	0.012	0
Coal (deaths)							
Premature deaths from air pollution -		4.53	2.69	1.98	1.59	1	0.951
Natural Gas (deaths)							
Premature deaths from air pollution -		85.1	89.6	90.6	84.5	69.4	49.1
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	7,440	7,806	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	44.7	44.7	44.6	44.4	44.5	44.6
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	55.3	55.3	55.4	55.6	55.5	55.4
Sales of space heating units - Electric	0.749	14.6	48.1	74.1	78.4	78.8	78.8
Heat Pump (%)							
Sales of space heating units - Electric	0.855	4.29	8.82	15.6	19.9	20.6	20.7
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.225	0.13	0.037	0.005	0	0
Sales of space heating units - Gas Furnace	98.4	80.9	43	10.2	1.68	0.552	0.49
(%)							
Sales of water heating units - Electric	0.008	0.03	0.03	0.03	0.03	0.03	0.03
Heat Pump (%)							
Sales of water heating units - Electric	0.41	1.46	1.46	1.47	1.46	1.47	1.46
Resistance (%)							
Sales of water heating units - Gas Furnace	99.5	98.1	98.1	98.1	98.1	98.1	98.1
(%)							
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.54	1.6	1.88	1.97	2.43	2.57
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)	103	105	107	106	106	108	113
Final energy use - Industry (PJ)	86.4	92	95.3	99.3	105	112	121
Final energy use - Residential (PJ)	126	123	123	125	127	130	132
Final energy use - Transportation (PJ)	304	294	276	267	271	282	297

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	2.68	2.8	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	36.3	36.3	36.3	36.3	36.3	36.3	36.3
Resistance (%)							
Sales of cooking units - Gas (%)	63.7	63.7	63.7	63.7	63.7	63.7	63.7
Sales of space heating units - Electric	2.42	11.3	11.7	12.3	12.7	13	13.3
Heat Pump (%)							
Sales of space heating units - Electric	3.86	7.17	7.1	7.05	7.03	6.83	6.47
Resistance (%)							
Sales of space heating units - Fossil (%)	3.61	9.13	9.24	9.18	8.79	8.45	8.65
Sales of space heating units - Gas (%)	90.1	72.4	72	71.5	71.5	71.7	71.5
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	7.01	14.8	14.8	14.8	14.9	14.9	14.9
Resistance (%)							
Sales of water heating units - Gas Furnace	92.3	84.4	84.4	84.4	84.4	84.4	84.3
(%)							
Sales of water heating units - Other (%)	0.642	0.79	0.789	0.787	0.784	0.782	0.78

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - diesel (%)	98.1	98.2	97.9	97	95.6	93.5	91.6
Vehicle sales - Heavy-duty - EV (%)	0	0	0	0	0	0	0
Vehicle sales - Heavy-duty - gasoline (%)	0.229	0.242	0.257	0.274	0.294	0.317	0.343
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.096	0.112	0.13	0.15	0.174	0.202
Vehicle sales - Heavy-duty - hydrogen FC	0.119	0.138	0.16	0.186	0.216	0.25	0.29
(%)							
Vehicle sales - Heavy-duty - other (%)	1.51	1.31	1.57	2.37	3.69	5.71	7.57
Vehicle sales - Light-duty - diesel (%)	1.56	1.97	2.18	2.03	1.83	1.71	1.62
Vehicle sales - Light-duty - EV (%)	3.56	5.59	6.37	7.84	9.55	11	12.2
Vehicle sales - Light-duty - gasoline (%)	90.2	86.7	84.5	82.7	80.6	78.7	77.1
Vehicle sales - Light-duty - hybrid (%)	4.44	5.28	6.46	7.03	7.6	8.18	8.63
Vehicle sales - Light-duty - hydrogen FC	0.111	0.377	0.346	0.307	0.304	0.305	0.316
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.106	0.102	0.103	0.102	0.101	0.104
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen	0.175	0.208	0.242	0.285	0.339	0.409	0.487
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-1,412
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-18,580
counting overlap) (1000 tC02e/y)							
Carbon sink potential - High - Avoid							-838
deforestation (1000 tC02e/y)							
Carbon sink potential - High - Extend							-7,600
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-10.6
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-29.8
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-332
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-2,378
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-1,329
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-4,651
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-707
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-6,755
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-140
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,919
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-5.38
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-9.92
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-116
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-1,189
cropland (1000 tCO2e/y)							, , , ,

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

Item Combon sink notantial Law Referent	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - Low - Reforest							-10
pasture (1000 tC02e/y)							1 = 7
Carbon sink potential - Low - Restore							-1,56
productivity (1000 tC02e/y)							10/
Carbon sink potential - Mid - Accelerate							-1,06
regeneration (1000 tC02e/y)							40 / /
Carbon sink potential - Mid - All (not							-12,66
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-48
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,26
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-7.8
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-19.
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-22
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-1,78
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-71
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-3,10
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							23
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							11
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,87
High - Extend rotation length (1000							0,01
hectares)							
Land impacted for carbon sink potential -							3.
High - Improve plantations (1000							0.
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							,
hectares)							
Land impacted for carbon sink potential -							31.
High - Increase trees outside forests							31.
(1000 hectares)							
Land impacted for carbon sink potential -							15
							15
High - Reforest cropland (1000 hectares)							07
Land impacted for carbon sink potential -							37.
High - Reforest pasture (1000 hectares)							4 = 1
Land impacted for carbon sink potential -							1,54
High - Restore productivity (1000							
hectares)							F 0.2
Land impacted for carbon sink potential -							5,99
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							11
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							10
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,48
Low - Extend rotation length (1000							,
	1		1			I .	

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

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Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1.95
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 -							16.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							78.6
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							6.55
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							933
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,743
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							173
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							110
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,680
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							2.93
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 -							24.1
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							118
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							47.3
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,879
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,034
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 uptake (Mt CO2e/y)	-0.72		2.42				0.695
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.008		-0.017				-0.018
Business-as-usual carbon sink - Total (Mt CO2e/y)	-0.728		2.41				0.677

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		203	155	74.4	59.8	56.1	52.8
Monetary damages from air pollution - Natural Gas (million 2019\$)		36.9	33.8	56.3	38.8	54.1	51.2
Monetary damages from air pollution - Transportation (million 2019\$)		757	808	859	914	969	1,026
Premature deaths from air pollution - Coal (deaths)		22.9	17.5	8.4	6.75	6.34	5.97
Premature deaths from air pollution - Natural Gas (deaths)		4.17	3.81	6.36	4.38	6.11	5.78
Premature deaths from air pollution - Transportation (deaths)		85.1	90.8	96.6	103	109	115