

Net-Zero America - pennsylvania state report

2021-03-15

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

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Notes

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		59,163	64,630				
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Sales of space heating units - Electric Heat Pump (%)	2.56	11.7	42	73.7	78.6	79.2	79.1
Sales of space heating units - Electric Resistance (%)	5.59	4.8	13.3	19	20.2	19.9	20
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of space heating units - Gas Furnace (%)	72.4	68.7	41.8	7.14	1.21	0.873	0.87
Sales of water heating units - Electric Heat Pump (%)	0.624	4.78	29.6	52.2	55.8	56	56
Sales of water heating units - Electric Resistance (%)	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Sales of water heating units - Gas Furnace (%)	94.2	89.8	50.2	7.42	0.426	0	0
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.13	6.27	11.6	12.4	12.4	13.1
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)	388	381	368	346	323	310	307
Final energy use - Industry (PJ)	791	783	767	757	724	706	669
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		10.8	12.5				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	55.4	64.9	94	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0
Sales of space heating units - Electric	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Heat Pump (%)							
Sales of space heating units - Electric	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Resistance (%)							
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of water heating units - Electric	0	3.85	24.2	40.2	42.6	42.8	42.8
Heat Pump (%)							
Sales of water heating units - Electric	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Resistance (%)							
Sales of water heating units - Gas Furnace	58.8	40.5	22.7	3.36	0.193	0	0
(%)							
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		2,057	5,276	8,545	12,946	14,088	13,433
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.267		3.52		15.4		24.9
units)							
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599
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 (%)	1.43	1.71	1.21	0.386	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.31	16.4	48.3	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.2	76.6	46.9	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.8	4.82	3.34	1.23	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.333	0.194	0.06	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.092	0.059	0.021	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0.031
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		1.23	2.29	11.7	18.8	27.7	33.5
Capital invested - Solar PV - Constrained (billion \$2018)		0.076	2.55	12.2	15.2	34.6	27.8
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Wind - Constrained (billion \$2018)		0	0	15.8	85.7	0	0
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202
Installed renewables - Solar - Base land use assumptions (MW)	93.6	1,174	3,412	15,866	37,030	70,125	112,448
Installed renewables - Solar - Constrained land use assumptions (MW)	40	3,741	8,736	22,113	41,148	89,554	123,134
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619
Installed renewables - Wind - Constrained land use assumptions (MW)	1,619	1,619	1,619	7,092	59,157	61,314	61,314

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	30.7
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	169	1,829	5,236	23,739	54,746	102,925	164,663
Solar - Constrained land use assumptions	72.1	5,753	13,458	33,323	61,312	131,716	180,658
(GWh)							
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
Wind - Constrained land use assumptions	6,912	6,912	6,912	27,090	188,236	193,048	193,048
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	0	0	0	0	446
Conversion capital investment -		0	0	0	0	0	9,012
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	0	9
(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	1
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	3.35	3.32	6.84	18.6
Annual - BECCS (MMT)		0	0	0	0	0	11.5
Annual - Cement and lime (MMT)		0	0	3.35	3.32	6.84	7.07
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	3.35	6.67	13.5	32.1
Cumulative - BECCS (MMT)		0	0	0	0	0	11.5
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	13.5	20.6
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	622	1,001	826	909	2,002
Cumulative investment - All (million \$2018)		0	1,668	2,719	2,627	2,709	3,539
Cumulative investment - Spur (million \$2018)		0	54.5	190	97.7	180	1,010
Cumulative investment - Trunk (million \$2018)		0	1,614	2,529	2,529	2,529	2,529
Spur (km)		0	107	332	157	241	1,333
Trunk (km)		0	515	669	669	669	669

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	ks - Agricu. 2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive	2020	2023	2030	2033	2040	2040	-304
deployment - Corn-ethanol to energy							-304
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,059
deployment - Cropland measures (1000							-2,009
tCO2e/y)							
Carbon sink potential - Aggressive							-95.2
deployment - Permanent conservation							70.2
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,458
deployment - Total (1000 tC02e/y)							-2,400
Carbon sink potential - Moderate							-304
deployment - Corn-ethanol to energy							-304
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate					+	+	-1,086
deployment - Cropland measures (1000							-1,000
tCO2e/y)							
Carbon sink potential - Moderate							-47.6
deployment - Permanent conservation							-41.0
cover (1000 tC02e/v)							
Carbon sink potential - Moderate							-1,437
deployment - Total (1000 tC02e/y)							-1,431
Land impacted for carbon sink -							139
Aggressive deployment - Corn-ethanol to							107
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,571
Aggressive deployment - Cropland							1,011
measures (1000 hectares)							
Land impacted for carbon sink -							173
Aggressive deployment - Permanent							113
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,884
Aggressive deployment - Total (1000							1,004
hectares)							
Land impacted for carbon sink - Moderate							139
deployment - Corn-ethanol to energy							107
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							829
deployment - Cropland measures (1000							027
hectares)							
Land impacted for carbon sink - Moderate							86.6
deployment - Permanent conservation							00.0
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,055
deployment - Total (1000 hectares)							1,000
uepioyment - rotal (1000 nectal es)							

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

Table 13: E+ scenario - PILLAR 6: Land sin							
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-291
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-27,852
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,777
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-440
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-5,935
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,121
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-186
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,122
pasture (1000 tCO2e/y)							,
Carbon sink potential - High - Restore							-3,875
productivity (1000 tCO2e/y)							2,212
Carbon sink potential - Low - Accelerate							-146
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-8,341
counting overlap) (1000 tCO2e/y)							0,041
Carbon sink potential - Low - Avoid							-517
deforestation (1000 tCO2e/y)							011
Carbon sink potential - Low - Extend							-3,371
rotation length (1000 tCO2e/y)							-5,511
Carbon sink potential - Low - Improve							-224
plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase							-1,978
retention of HWP (1000 tCO2e/y)							-1,910
							-392
Carbon sink potential - Low - Increase							-392
trees outside forests (1000 tC02e/y)							00.0
Carbon sink potential - Low - Reforest							-93.2
cropland (1000 tCO2e/y)							010
Carbon sink potential - Low - Reforest							-312
pasture (1000 tC02e/y)							1.00/
Carbon sink potential - Low - Restore							-1,306
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-218
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-18,092
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,811
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-6,074
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-328
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-3,957
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-757
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-140
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,217
pasture (1000 tC02e/y)							•
Carbon sink potential - Mid - Restore							-2,591
productivity (1000 tCO2e/y)							
, , , , , , , , , , , , , , , , , , , ,							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							47.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							420
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,476
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							162
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 -							107
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							12.3
High - Reforest cropland (1000 hectares)							12.0
Land impacted for carbon sink potential -							117
High - Reforest pasture (1000 hectares)							1111
Land impacted for carbon sink potential -							1,285
							1,200
High - Restore productivity (1000							
hectares)							/ /0/
Land impacted for carbon sink potential -							6,626
High - Total impacted (over 30 years)							
(1000 hectares)							20.0
Land impacted for carbon sink potential -							23.8
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							395
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,715
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							81
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 -							56.1
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							6.16
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							20.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							777
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -			-				3,074
Low - Total impacted (over 30 years)							3,014
(1000 hectares)							
							0.5
Land impacted for carbon sink potential -							35.7
Mid - Accelerate regeneration (1000							
hectares)							

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

2020	2025	2030	2035	2040	2045	2050
						407
						3,095
						122
						0
						81.3
						9.24
						147
						1,565
						5,463
	2020	2020 2025	2020 2025 2030	2020 2025 2030 2035	2020 2025 2030 2035 2040	2020 2025 2030 2035 2040 2045

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		1,128	951	763	574	361	251
Natural gas consumption - Cumulative (tcf)							22,977
Natural gas production - Annual (tcf)		7,475	7,066	6,154	5,204	4,126	3,205
Oil consumption - Annual (million bbls)		181	162	132	104	81	62
Oil consumption - Cumulative (million bbls)							4,048
Oil production - Annual (million bbls)		8.39	8.42	8.41	6.66	5.42	3.6

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		2,374	1.62	1.6	1.47	1	0.081
Monetary damages from air pollution - Natural Gas (million 2019\$)		615	453	294	268	170	68
Monetary damages from air pollution - Transportation (million 2019\$)		4,170	3,868	2,927	1,689	768	300
Premature deaths from air pollution - Coal (deaths)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Natural Gas (deaths)		69.4	51.1	33.2	30.3	19.2	7.67
Premature deaths from air pollution - Transportation (deaths)		469	435	329	190	86.4	33.7

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		375	568	326	211	97.7	632
By economic sector - Construction (jobs)		16,338	16,396	22,401	28,171	34,355	45,295
By economic sector - Manufacturing		19,602	22,640	28,984	28,119	23,357	29,915
(jobs)							
By economic sector - Mining (jobs)		13,345	9,256	6,636	4,454	2,850	1,740

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

Table 16: E+ Scending - IMPACTS - Jubs (CC	•						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		840	1,025	2,668	4,597	6,936	10,799
By economic sector - Pipeline (jobs)		2,600	2,426	1,920	1,378	931	741
By economic sector - Professional (jobs)		7,981	7,156	9,193	11,823	14,796	20,938
By economic sector - Trade (jobs)		6,468	5,545	6,817	8,520	10,749	15,134
By economic sector - Utilities (jobs)		22,849	21,083	22,795	24,713	26,600	31,661
By education level - All sectors -		28,277	27,133	32,433	36,054	39,103	50,749
Associates degree or some college (jobs)		10.107	17.07/	00 / / 0	00.007	00.001	00 107
By education level - All sectors -		19,136	17,876	20,440	22,007	23,331	30,187
Bachelors degree (jobs) By education level - All sectors - Doctoral		573	512	590	672	768	1,034
degree (jobs)		573	512	590	672	768	1,034
By education level - All sectors - High		37,948	36,483	43,620	48,135	51,879	67,564
school diploma or less (jobs)		31,740	30,463	43,020	40,133	31,019	01,304
By education level - All sectors - Masters		4,461	4,091	4,658	5,117	5,591	7,319
or professional degree (jobs)		4,401	4,071	4,030	3,111	3,391	1,017
By resource sector - Biomass (jobs)		1,243	1,475	817	568	365	2,730
By resource sector - CO2 (jobs)		0	1,596	1,020	136	246	1,446
By resource sector - Coal (jobs)		5,457	2,203	1,748	1,519	1,367	1,211
By resource sector - Grid (jobs)		17,018	17,049	25,485	33,636	43,359	57,865
By resource sector - Natural Gas (jobs)		34,052	28,380	22,686	19,157	13,137	7,603
By resource sector - Nuclear (jobs)		4,428	3,817	3,179	1,814	636	0
By resource sector - Oil (jobs)		11,169	9,436	7,556	5,500	4,056	2,774
By resource sector - Solar (jobs)		9,472	12,101	26,280	37,790	48,918	72,736
By resource sector - Wind (jobs)		7,559	10,039	12,969	11,865	8,587	10,490
Median wages - Annual - All (\$2019 per		62,196	62,443	62,390	63,104	64,136	64,668
job)		02,170	02,443	02,370	03,104	04,130	04,000
On-Site or In-Plant Training - Total jobs - 1		14,758	14,077	16,683	18,469	20,011	25,828
to 4 years (jobs)		,	,	.5,555	.0, .0,	20,011	_0,0_0
On-Site or In-Plant Training - Total jobs - 4		5,839	5,485	6,450	7,325	8,213	10,550
to 10 years (jobs)		2,223	5, 155	5, 125	.,	7,2.0	,
On-Site or In-Plant Training - Total jobs -		14,411	13,811	16,423	18,119	19,532	25,569
None (jobs)							
On-Site or In-Plant Training - Total jobs -		743	719	863	971	1,066	1,377
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		54,645	52,002	61,322	67,102	71,851	93,531
Up to 1 year (jobs)							
On-the-Job Training - All sectors - 1 to 4		19,018	18,116	21,429	23,745	25,759	33,185
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		5,582	5,257	6,258	7,204	8,176	10,545
years (jobs)							
On-the-Job Training - All sectors - None		4,761	4,505	5,356	5,945	6,494	8,561
(jobs)							
On-the-Job Training - All sectors - Over 10		894	880	1,065	1,157	1,211	1,566
years (jobs)							
On-the-Job Training - All sectors - Up to 1		60,141	57,337	67,632	73,934	79,031	102,997
year (jobs)		00.070	01.000	04.440	40.000	10.000	FF 07/
Related work experience - All sectors - 1		32,879	31,090	36,443	40,009	43,099	55,874
to 4 years (jobs)		011/7	00.005	00.57/	05 001	07.07/	05.075
Related work experience - All sectors - 4 to 10 years (jobs)		21,167	20,095	23,574	25,901	27,874	35,975
Related work experience - All sectors -		12,873	12,326	14,603	16,190	17,586	22,930
None (jobs)		12,013	12,326	14,603	10,190	11,300	22,930
Related work experience - All sectors -		5,876	5,616	6,574	7,083	7,435	9,555
Over 10 years (jobs)		3,010	3,010	0,514	1,000	1,430	9,000
Related work experience - All sectors - Up		17,602	16,968	20,547	22,802	24,678	32,520
to 1 year (jobs)		11,002	10,700	20,041	22,002	27,010	02,020
Wage income - All (million \$2019)		5,622	5,376	6,348	7,067	7,741	10,145
**************************************		0,022	5,510	5,540	1,001	1,171	10,170

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		59,150	64,632				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	18.5	21.6	27.5	43	64.5	77.7	82.3
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Sales of space heating units - Electric	2.56	7.82	11.2	21.8	42.1	62.6	73.2
Heat Pump (%)							
Sales of space heating units - Electric	5.59	3.46	4.4	7.36	12.7	16.8	19
Resistance (%)							
Sales of space heating units - Fossil (%)	19.4	17.2	16.4	12.8	6.63	2.21	0.78
Sales of space heating units - Gas Furnace	72.4	71.6	67.9	58.1	38.6	18.3	7.04
(%)							
Sales of water heating units - Electric	0.624	1.34	4.16	12.7	28.8	44.1	51.9
Heat Pump (%)							
Sales of water heating units - Electric	3.49	2.59	4.34	9.88	21.2	33.5	40.1
Resistance (%)							
Sales of water heating units - Gas Furnace	94.2	94.7	90.2	76.4	49.4	22.1	7.82
(%)							
Sales of water heating units - Other (%)	1.74	1.35	1.32	1.03	0.608	0.33	0.23

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.07	5.09	7.06	7.31	10.1	10.6
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)	388	381	378	375	368	359	349
Final energy use - Industry (PJ)	791	783	769	764	735	716	676
Final energy use - Residential (PJ)	467	428	403	379	349	315	281
Final energy use - Transportation (PJ)	817	772	705	650	607	555	495

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		10.8	13				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	55.2	56.3	60.5	71.3	86.3	95.6	98.8
Resistance (%)							
Sales of cooking units - Gas (%)	44.8	43.7	39.5	28.7	13.7	4.42	1.19
Sales of space heating units - Electric	8.42	13.6	18	31.2	54.5	74.9	84.5
Heat Pump (%)							
Sales of space heating units - Electric	9.49	12.2	11.8	10.4	7.78	5.17	3.89
Resistance (%)							
Sales of space heating units - Fossil (%)	24.2	34.8	32.7	26.6	17	10.3	7.7
Sales of space heating units - Gas (%)	57.9	39.4	37.5	31.8	20.7	9.65	3.89
Sales of water heating units - Electric	0	0.823	3.14	10.1	22.7	34.2	39.8
Heat Pump (%)							
Sales of water heating units - Electric	35.5	52.7	52.6	52.6	53.5	55.2	56.4
Resistance (%)							
Sales of water heating units - Gas Furnace	58.8	42.8	40.8	34.6	22.4	10	3.56
(%)							
Sales of water heating units - Other (%)	5.73	3.74	3.46	2.63	1.37	0.535	0.247

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	333	699	2,363	7,431	10,827
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.267		1.09		5.72		16
units)							
Public EV charging plugs - L2 (1000 units)	1.32		26.2		137		383
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 (%)	1.45	1.88	2.04	1.61	1.02	0.523	0.225
Vehicle sales - Light-duty - EV (%)	2.03	4.99	12.5	26.8	49.4	72.7	87.8
Vehicle sales - Light-duty - gasoline (%)	91.3	86.9	78.6	65.4	45	24.1	10.7
Vehicle sales - Light-duty - hybrid (%)	4.99	5.77	6.44	5.8	4.29	2.5	1.2
Vehicle sales - Light-duty - hydrogen FC	0.112	0.377	0.319	0.241	0.17	0.094	0.044
(%)							
Vehicle sales - Light-duty - other (%)	0.098	0.101	0.091	0.079	0.057	0.031	0.014
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							-304
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,059
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-95.2
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,458
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-304
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,086
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-47.6
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,437
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							139
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,571
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							173
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							1,884
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							139
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							829
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							86.6
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,055
deployment - Total (1000 hectares)							

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

Table 23: E- scenario - PILLAR 6: Land sink Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate	2020	2023	2030	2033	2040	2045	-291
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-27,852
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,777
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-440
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-5,935
retention of HWP (1000 tC02e/y)							
Carbon sink potential - High - Increase							-1,121
trees outside forests (1000 tCO2e/y)							,
Carbon sink potential - High - Reforest							-186
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,122
pasture (1000 tCO2e/y)							.,
Carbon sink potential - High - Restore							-3,875
productivity (1000 tCO2e/y)							0,0.0
Carbon sink potential - Low - Accelerate							-146
regeneration (1000 tCO2e/y)							1 10
Carbon sink potential - Low - All (not							-8,341
counting overlap) (1000 tCO2e/y)							0,0
Carbon sink potential - Low - Avoid							-517
deforestation (1000 tCO2e/y)							0
Carbon sink potential - Low - Extend							-3,371
rotation length (1000 tCO2e/y)							0,011
Carbon sink potential - Low - Improve							-224
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,978
retention of HWP (1000 tCO2e/y)							1,710
Carbon sink potential - Low - Increase							-392
trees outside forests (1000 tCO2e/y)							072
Carbon sink potential - Low - Reforest							-93.2
cropland (1000 tCO2e/y)							70.2
Carbon sink potential - Low - Reforest							-312
pasture (1000 tC02e/y)							012
Carbon sink potential - Low - Restore	+						-1,306
productivity (1000 tC02e/y)							-1,500
Carbon sink potential - Mid - Accelerate							-218
regeneration (1000 tCO2e/y)							-210
regeneration (1000 to02e/y)							

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

Item Carbon sink potential - Mid - All (not	2020	2025	2030	2035	2040	2045	2050 -18,092
counting overlap) (1000 tCO2e/y)							•
Carbon sink potential - Mid - Avoid							-1,811
deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend							-6,074
rotation length (1000 tCO2e/y)							-0,014
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y)							-757
Carbon sink potential - Mid - Reforest							-140
cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tC02e/y)							-2,591
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential -							117
High - Reforest pasture (1000 hectares) Land impacted for carbon sink potential - High - Restore productivity (1000							1,285
hectares) Land impacted for carbon sink potential - High - Total impacted (over 30 years)							6,626
(1000 hectares) Land impacted for carbon sink potential - Low - Accelerate regeneration (1000							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years)							395
(1000 hectares) Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							56.1
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							6.16
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							20.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							777
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,074
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							35.7
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							407
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,095
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							122
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 -							81.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							9.24
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							147
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,565
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,463
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Monetary damages from air pollution - Coal (million 2019\$) 2,374 1.62 1.6 1.47 1 0.0 Monetary damages from air pollution - Natural Gas (million 2019\$) 589 376 166 77.4 25.1 16 Monetary damages from air pollution - Transportation (million 2019\$) 4,245 4,272 4,139 3,715 2,952 2,02 Premature deaths from air pollution - Coal (deaths) 268 0.183 0.181 0.166 0.113 0.00 Premature deaths from air pollution - Natural Gas (deaths) 66.5 42.4 18.8 8.74 2.84 1.8	Table 24. L- Scendi to - IMPACTS - Health							
Coal (million 2019\$) 589 376 166 77.4 25.1 16 Natural Gas (million 2019\$) 4,245 4,272 4,139 3,715 2,952 2,02 Monetary damages from air pollution - Transportation (million 2019\$) 4,245 4,272 4,139 3,715 2,952 2,02 Premature deaths from air pollution - Coal (deaths) 268 0.183 0.181 0.166 0.113 0.00 Premature deaths from air pollution - Natural Gas (deaths) 66.5 42.4 18.8 8.74 2.84 1.8	Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Natural Gas (million 2019\$) 589 376 166 77.4 25.1 16 Monetary damages from air pollution - Transportation (million 2019\$) 4,245 4,272 4,139 3,715 2,952 2,02 Premature deaths from air pollution - Coal (deaths) 268 0.183 0.181 0.166 0.113 0.00 Premature deaths from air pollution - Natural Gas (deaths) 66.5 42.4 18.8 8.74 2.84 1.8	Monetary damages from air pollution -		2,374	1.62	1.6	1.47	1	0.081
Natural Gas (million 2019\$) 4,245 4,272 4,139 3,715 2,952 2,02 Transportation (million 2019\$) 268 0.183 0.181 0.166 0.113 0.00 Premature deaths from air pollution - Coal (deaths) 66.5 42.4 18.8 8.74 2.84 1.8 Natural Gas (deaths) 18.8 <td< td=""><td>`</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	`							
Monetary damages from air pollution - Transportation (million 2019\$) 4,245 4,272 4,139 3,715 2,952 2,02 Premature deaths from air pollution - Coal (deaths) 268 0.183 0.181 0.166 0.113 0.00 Premature deaths from air pollution - Natural Gas (deaths) 66.5 42.4 18.8 8.74 2.84 1.8	Monetary damages from air pollution -		589	376	166	77.4	25.1	16.2
Transportation (million 2019\$) 268 0.183 0.181 0.166 0.113 0.00 Coal (deaths) Premature deaths from air pollution - Natural Gas (deaths) 66.5 42.4 18.8 8.74 2.84 1.8	Natural Gas (million 2019\$)							
Premature deaths from air pollution - Coal (deaths) 268 0.183 0.181 0.166 0.113 0.00 Premature deaths from air pollution - Natural Gas (deaths) 66.5 42.4 18.8 8.74 2.84 1.8	Monetary damages from air pollution -		4,245	4,272	4,139	3,715	2,952	2,023
Coal (deaths) Premature deaths from air pollution - 66.5 42.4 18.8 8.74 2.84 1.8 Natural Gas (deaths)	Transportation (million 2019\$)							
Premature deaths from air pollution - 66.5 42.4 18.8 8.74 2.84 1.8 Natural Gas (deaths)	Premature deaths from air pollution -		268	0.183	0.181	0.166	0.113	0.009
Natural Gas (deaths)	Coal (deaths)							
	•		66.5	42.4	18.8	8.74	2.84	1.83
Premature deaths from air pollution - 477 480 466 418 332 22	Natural Gas (deaths)							
•	Premature deaths from air pollution -		477	480	466	418	332	228
Transportation (deaths)	Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		59,163	64,630				
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Sales of space heating units - Electric Heat Pump (%)	2.56	11.7	42	73.7	78.6	79.2	79.1
Sales of space heating units - Electric Resistance (%)	5.59	4.8	13.3	19	20.2	19.9	20
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of space heating units - Gas Furnace (%)	72.4	68.7	41.8	7.14	1.21	0.873	0.87
Sales of water heating units - Electric Heat Pump (%)	0.624	4.78	29.6	52.2	55.8	56	56
Sales of water heating units - Electric Resistance (%)	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Sales of water heating units - Gas Furnace (%)	94.2	89.8	50.2	7.42	0.426	0	0
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.13	6.27	11.6	12.4	12.4	13.1
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)	388	381	368	346	323	310	307
Final energy use - Industry (PJ)	791	783	767	757	724	706	669
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		10.8	12.5				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	55.4	64.9	94	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0
Sales of space heating units - Electric	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Heat Pump (%)							
Sales of space heating units - Electric	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Resistance (%)							
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of water heating units - Electric	0	3.85	24.2	40.2	42.6	42.8	42.8
Heat Pump (%)							
Sales of water heating units - Electric	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Resistance (%)							
Sales of water heating units - Gas Furnace	58.8	40.5	22.7	3.36	0.193	0	0
(%)							
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		2,057	5,276	8,545	12,946	14,088	13,433
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.267		3.52		15.4		24.9
units)							
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599
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 (%)	1.43	1.71	1.21	0.386	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.31	16.4	48.3	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.2	76.6	46.9	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.8	4.82	3.34	1.23	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.333	0.194	0.06	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.092	0.059	0.021	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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion		3.22	5.38	30.1	47.8	37.4	20.4
\$2018)							
Capital invested - Wind - Base (billion		0	0	0	0	53	92.8
\$2018)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	0
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	0
Constrained land use assumptions (MW)							
Installed renewables - Solar - Base land	93.6	2,906	8,171	40,113	93,933	138,575	164,416
use assumptions (MW)							
Installed renewables - Solar -	187	7,815	25,680	121,507	218,837	261,025	334,257
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	1,619	1,619	1,619	1,619	1,619	27,886	76,561
use assumptions (MW)							
Installed renewables - Wind - Constrained	3,238	3,238	3,238	79,098	122,628	122,628	122,628
land use assumptions (MW)							

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	169	4,440	12,355	59,174	137,449	201,306	240,508
Solar - Constrained land use assumptions	338	12,023	38,750	179,024	319,962	379,989	490,835
(GWh)							
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	99,062	239,521
Wind - Constrained land use assumptions	13,823	13,823	13,823	269,647	386,096	386,096	386,096
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-304
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,059
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-95.2
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,458
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-304
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,086
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-47.6
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,437
deployment - Total (1000 tC02e/y)							•
Land impacted for carbon sink -							139
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,571
Aggressive deployment - Cropland							, -
measures (1000 hectares)							
Land impacted for carbon sink -							173
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,884
Aggressive deployment - Total (1000							.,00 .
hectares)							
Land impacted for carbon sink - Moderate							139
deployment - Corn-ethanol to energy							107
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							829
deployment - Cropland measures (1000							027
hectares)							
Land impacted for carbon sink - Moderate			+				86.6
deployment - Permanent conservation							00.0
cover (1000 hectares)							
Land impacted for carbon sink - Moderate			-				1,055
deployment - Total (1000 hectares)							1,000
deployment - rotal (1000 nectal es)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-291
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-27,852
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,777
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-440
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-5,935
retention of HWP (1000 tCO2e/y)							

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

Item Carbon sink potential - High - Increase	2020	2025	2030	2035	2040	2045	2050 -1,12
trees outside forests (1000 tC02e/y)							-1,12
Carbon sink potential - High - Reforest							-186
cropland (1000 tCO2e/y)							-100
Carbon sink potential - High - Reforest							-4,12
pasture (1000 tCO2e/y)							-4,12
Carbon sink potential - High - Restore							-3,87
productivity (1000 tCO2e/y)							-3,673
							-140
Carbon sink potential - Low - Accelerate							-140
regeneration (1000 tCO2e/y)							0.07
Carbon sink potential - Low - All (not							-8,34
counting overlap) (1000 tC02e/y)							
Carbon sink potential - Low - Avoid							-51
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-3,37
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-22
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,978
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-39
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-93.:
cropland (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-31:
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,30
productivity (1000 tCO2e/y)							1,00
Carbon sink potential - Mid - Accelerate							-218
regeneration (1000 tCO2e/y)							210
Carbon sink potential - Mid - All (not							-18,09
counting overlap) (1000 tC02e/y)							-10,07
Carbon sink potential - Mid - Avoid							-1,81
deforestation (1000 tC02e/y)							-1,01
							/ 07
Carbon sink potential - Mid - Extend							-6,074
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-328
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-3,95
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-75
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-14
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,21
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-2,59
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							47.
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							42
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -	+	-				+	4,47
High - Extend rotation length (1000							4,41
hectares)							
-							1/
Land impacted for carbon sink potential -							16
High - Improve plantations (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares)							
Land impacted for carbon sink potential -							107
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							12.3
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							117
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,285
High - Restore productivity (1000							
hectares)							/ /0/
Land impacted for carbon sink potential -							6,626
High - Total impacted (over 30 years)							
(1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000							23.8
hectares)							
Land impacted for carbon sink potential -							395
Low - Avoid deforestation (over 30 years)							393
(1000 hectares)							
Land impacted for carbon sink potential -							1,715
Low - Extend rotation length (1000							1,110
hectares)							
Land impacted for carbon sink potential -							81
Low - Improve plantations (1000							O1
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							Ū
hectares)							
Land impacted for carbon sink potential -							56.1
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							6.16
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							20.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							777
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,074
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							35.7
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							407
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,095
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							122
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 -							81.3
Mid - Increase trees outside forests (1000							
hectares)							

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Table 33: E+RE+ Scenoi	'10 - PILLAR 6: Lana Sin	ks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							9.24
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							147
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,565
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,463
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 -		2,374	1.62	1.6	1.47	1	0.081
Coal (million 2019\$)							
Monetary damages from air pollution -		548	388	233	167	59.1	11.4
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,170	3,868	2,927	1,689	768	300
Transportation (million 2019\$)							
Premature deaths from air pollution -		268	0.183	0.181	0.166	0.113	0.009
Coal (deaths)							
Premature deaths from air pollution -		61.8	43.8	26.3	18.8	6.67	1.29
Natural Gas (deaths)							
Premature deaths from air pollution -		469	435	329	190	86.4	33.7
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		59,163	64,630				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	18.5	33.7	75.3	83.5	83.9	84	84
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Sales of space heating units - Electric	2.56	11.7	42	73.7	78.6	79.2	79.1
Heat Pump (%)							
Sales of space heating units - Electric	5.59	4.8	13.3	19	20.2	19.9	20
Resistance (%)							
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of space heating units - Gas Furnace	72.4	68.7	41.8	7.14	1.21	0.873	0.87
(%)							
Sales of water heating units - Electric	0.624	4.78	29.6	52.2	55.8	56	56
Heat Pump (%)							
Sales of water heating units - Electric	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Resistance (%)							
Sales of water heating units - Gas Furnace	94.2	89.8	50.2	7.42	0.426	0	0
(%)							
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.13	6.27	11.6	12.4	12.4	13.1
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)	388	381	368	346	323	310	307

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	791	783	767	757	724	706	669
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		10.8	12.5				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	55.4	64.9	94	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0
Sales of space heating units - Electric	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Heat Pump (%)							
Sales of space heating units - Electric	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Resistance (%)							
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of water heating units - Electric	0	3.85	24.2	40.2	42.6	42.8	42.8
Heat Pump (%)							
Sales of water heating units - Electric	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Resistance (%)							
Sales of water heating units - Gas Furnace	58.8	40.5	22.7	3.36	0.193	0	0
(%)							
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		2,057	5,276	8,545	12,946	14,088	13,433
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.267		3.52		15.4		24.9
units)							
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599
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 (%)	1.43	1.71	1.21	0.386	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.31	16.4	48.3	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.2	76.6	46.9	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.8	4.82	3.34	1.23	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.333	0.194	0.06	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.092	0.059	0.021	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)		0	0.794	0.689	1.23	1.11	0
Capital invested - Solar PV - Constrained (billion \$2018)		0.746	2.35	1.42	1.73	4.6	0.659
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Wind - Constrained (billion \$2018)		0	0	0	0	0	0
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Solar - Base land use assumptions (MW)	93.6	93.6	870	1,601	2,985	4,312	4,312
Installed renewables - Solar - Constrained land use assumptions (MW)	93.6	746	3,041	4,549	6,495	11,985	12,817
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619
Installed renewables - Wind - Constrained land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	169	169	1,359	2,465	4,576	6,564	6,564
Solar - Constrained land use assumptions	169	1,166	4,672	6,963	9,894	18,163	19,405
(GWh)							
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
Wind - Constrained land use assumptions	6,912	6,912	6,912	6,912	6,912	6,912	6,912
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-304
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,059
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-95.2
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,458
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-304
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,086
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-47.6
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,437
deployment - Total (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							139
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,571
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							173
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,884
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							139
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							829
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							86.6
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,055
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							-291
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-27,852
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,777
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-440
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-5,935
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,121
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-186
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,122
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-3,875
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-146
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-8,341
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-517
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-3,371
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-224
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,978
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-392
trees outside forests (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - Low - Reforest							-93.
cropland (1000 tCO2e/y)							0.1
Carbon sink potential - Low - Reforest							-31
pasture (1000 tC02e/y)							1.00
Carbon sink potential - Low - Restore							-1,30
productivity (1000 tC02e/y)							- 01
Carbon sink potential - Mid - Accelerate							-21
regeneration (1000 tCO2e/y)							10.00
Carbon sink potential - Mid - All (not							-18,09
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,81
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-6,07
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-32
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-3,95
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-75
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-14
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,21
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-2,59
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							47.
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							42
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,47
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							16
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							10
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							12.
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							11
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,28
High - Restore productivity (1000							.,_0
nectares)							
Land impacted for carbon sink potential -							6,62
High - Total impacted (over 30 years)							0,02
(1000 hectares)							
and impacted for carbon sink potential -						+	23
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000							23.
nectares)							
•							20
Land impacted for carbon sink potential -							39
Low - Avoid deforestation (over 30 years)					1		

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1,715
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							81
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 -							56.1
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							6.16
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							20.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							777
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,074
Low - Total impacted (over 30 years)							0,014
(1000 hectares)							
Land impacted for carbon sink potential -							35.7
Mid - Accelerate regeneration (1000							30.1
hectares)							
Land impacted for carbon sink potential -							407
Mid - Avoid deforestation (over 30 years)							401
(1000 hectares)							
Land impacted for carbon sink potential -							3,095
Mid - Extend rotation length (1000							3,093
hectares)							
Land impacted for carbon sink potential -							122
							122
Mid - Improve plantations (1000 hectares)							0
Land impacted for carbon sink potential -							U
Mid - Increase retention of HWP (1000							
hectares)							01.0
Land impacted for carbon sink potential -							81.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							9.24
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							147
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,565
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,463
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 -		2,374	1.62	1.6	1.47	1	0.081
Coal (million 2019\$)							
Monetary damages from air pollution -		621	483	573	436	166	51.7
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,170	3,868	2,927	1,689	768	300
Transportation (million 2019\$)							
Premature deaths from air pollution -		268	0.183	0.181	0.166	0.113	0.009
Coal (deaths)							

Table 44: E+RE- scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		70.1	54.5	64.6	49.2	18.8	5.84
Natural Gas (deaths)							
Premature deaths from air pollution -		469	435	329	190	86.4	33.7
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 -		59,150	64,632				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	18.5	21.6	27.5	43	64.5	77.7	82.3
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Sales of space heating units - Electric	2.56	7.82	11.2	21.8	42.1	62.6	73.2
Heat Pump (%)							
Sales of space heating units - Electric	5.59	3.46	4.4	7.36	12.7	16.8	19
Resistance (%)							
Sales of space heating units - Fossil (%)	19.4	17.2	16.4	12.8	6.63	2.21	0.78
Sales of space heating units - Gas Furnace	72.4	71.6	67.9	58.1	38.6	18.3	7.04
(%)							
Sales of water heating units - Electric	0.624	1.34	4.16	12.7	28.8	44.1	51.9
Heat Pump (%)							
Sales of water heating units - Electric	3.49	2.59	4.34	9.88	21.2	33.5	40.1
Resistance (%)							
Sales of water heating units - Gas Furnace	94.2	94.7	90.2	76.4	49.4	22.1	7.82
(%)							
Sales of water heating units - Other (%)	1.74	1.35	1.32	1.03	0.608	0.33	0.23

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.07	5.09	7.06	7.31	10.1	10.6
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)	388	381	378	375	368	359	349
Final energy use - Industry (PJ)	791	783	769	764	735	716	676
Final energy use - Residential (PJ)	467	428	403	379	349	315	281
Final energy use - Transportation (PJ)	817	772	705	650	607	555	495

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		10.8	13				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	55.2	56.3	60.5	71.3	86.3	95.6	98.8
Resistance (%)							
Sales of cooking units - Gas (%)	44.8	43.7	39.5	28.7	13.7	4.42	1.19
Sales of space heating units - Electric	8.42	13.6	18	31.2	54.5	74.9	84.5
Heat Pump (%)							
Sales of space heating units - Electric	9.49	12.2	11.8	10.4	7.78	5.17	3.89
Resistance (%)							
Sales of space heating units - Fossil (%)	24.2	34.8	32.7	26.6	17	10.3	7.7
Sales of space heating units - Gas (%)	57.9	39.4	37.5	31.8	20.7	9.65	3.89
Sales of water heating units - Electric	0	0.823	3.14	10.1	22.7	34.2	39.8
Heat Pump (%)							
Sales of water heating units - Electric	35.5	52.7	52.6	52.6	53.5	55.2	56.4
Resistance (%)							

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

	•	•	•	-			
Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	58.8	42.8	40.8	34.6	22.4	10	3.56
Sales of water heating units - Other (%)	5.73	3.74	3.46	2.63	1.37	0.535	0.247

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

		•				
2020	2025	2030	2035	2040	2045	2050
	0	333	699	2,363	7,431	10,827
0.267		1.09		5.72		16
1.32		26.2		137		383
97.4	96	91.3	79.8	58.2	32.1	13.7
0.498	1.45	4.11	10.8	23.6	39.5	51
0.228	0.236	0.239	0.225	0.179	0.109	0.051
0.083	0.094	0.104	0.107	0.092	0.06	0.03
0.332	0.969	2.74	7.17	15.7	26.3	34
1.5	1.28	1.46	1.95	2.25	1.96	1.14
1.45	1.88	2.04	1.61	1.02	0.523	0.225
2.03	4.99	12.5	26.8	49.4	72.7	87.8
91.3	86.9	78.6	65.4	45	24.1	10.7
4.99	5.77	6.44	5.8	4.29	2.5	1.2
0.112	0.377	0.319	0.241	0.17	0.094	0.044
0.098	0.101	0.091	0.079	0.057	0.031	0.014
64.8	62.2	57.7	49.4	35.6	19.6	8.37
0.664	1.94	5.49	14.3	31.4	52.6	68
33.8	34.7	34.7	31.9	24.4	14.2	6.33
0.363	0.418	0.464	0.478	0.414	0.275	0.141
0.166	0.485	1.37	3.58	7.86	13.2	17
0.253	0.266	0.279	0.286	0.258	0.184	0.102
	0.267 1.32 97.4 0.498 0.228 0.083 0.332 1.5 1.45 2.03 91.3 4.99 0.112 0.098 64.8 0.664 33.8 0.363 0.166	0.267 1.32 97.4 96 0.498 1.45 0.228 0.236 0.083 0.094 0.332 0.969 1.5 1.28 1.45 1.88 2.03 4.99 91.3 86.9 4.99 5.77 0.112 0.377 0.098 0.101 64.8 62.2 0.664 1.94 33.8 34.7 0.363 0.418 0.166 0.485	0.267 1.09 1.32 26.2 97.4 96 91.3 0.498 1.45 4.11 0.228 0.236 0.239 0.083 0.094 0.104 0.332 0.969 2.74 1.5 1.28 1.46 1.45 1.88 2.04 2.03 4.99 12.5 91.3 86.9 78.6 4.99 5.77 6.44 0.112 0.377 0.319 0.098 0.101 0.091 64.8 62.2 57.7 0.664 1.94 5.49 33.8 34.7 34.7 0.363 0.418 0.464 0.166 0.485 1.37	0 333 699 0.267 1.09 1.32 26.2 97.4 96 91.3 79.8 0.498 1.45 4.11 10.8 0.228 0.236 0.239 0.225 0.083 0.094 0.104 0.107 0.332 0.969 2.74 7.17 1.5 1.28 1.46 1.95 1.45 1.88 2.04 1.61 2.03 4.99 12.5 26.8 91.3 86.9 78.6 65.4 4.99 5.77 6.44 5.8 0.112 0.377 0.319 0.241 0.098 0.101 0.091 0.079 64.8 62.2 57.7 49.4 0.664 1.94 5.49 14.3 33.8 34.7 34.7 31.9 0.363 0.418 0.464 0.478 0.166 0.485 1.37 3.58 </td <td>0 333 699 2,363 0.267 1.09 5.72 1.32 26.2 137 97.4 96 91.3 79.8 58.2 0.498 1.45 4.11 10.8 23.6 0.228 0.236 0.239 0.225 0.179 0.083 0.094 0.104 0.107 0.092 0.332 0.969 2.74 7.17 15.7 1.5 1.28 1.46 1.95 2.25 1.45 1.88 2.04 1.61 1.02 2.03 4.99 12.5 26.8 49.4 91.3 86.9 78.6 65.4 45 4.99 5.77 6.44 5.8 4.29 0.112 0.377 0.319 0.241 0.17 0.098 0.101 0.091 0.079 0.057 64.8 62.2 57.7 49.4 35.6 0.664 1.94 5.49</td> <td>0 333 699 2,363 7,431 0.267 1.09 5.72 1.32 26.2 137 97.4 96 91.3 79.8 58.2 0.498 1.45 4.11 10.8 23.6 39.5 0.228 0.236 0.239 0.225 0.179 0.109 0.083 0.094 0.104 0.107 0.092 0.06 0.332 0.969 2.74 7.17 15.7 26.3 1.5 1.28 1.46 1.95 2.25 1.96 1.45 1.88 2.04 1.61 1.02 0.523 2.03 4.99 12.5 26.8 49.4 72.7 91.3 86.9 78.6 65.4 45 24.1 4.99 5.77 6.44 5.8 4.29 2.5 0.112 0.377 0.319 0.241 0.17 0.094 0.098 0.101 0.091 0.079<</td>	0 333 699 2,363 0.267 1.09 5.72 1.32 26.2 137 97.4 96 91.3 79.8 58.2 0.498 1.45 4.11 10.8 23.6 0.228 0.236 0.239 0.225 0.179 0.083 0.094 0.104 0.107 0.092 0.332 0.969 2.74 7.17 15.7 1.5 1.28 1.46 1.95 2.25 1.45 1.88 2.04 1.61 1.02 2.03 4.99 12.5 26.8 49.4 91.3 86.9 78.6 65.4 45 4.99 5.77 6.44 5.8 4.29 0.112 0.377 0.319 0.241 0.17 0.098 0.101 0.091 0.079 0.057 64.8 62.2 57.7 49.4 35.6 0.664 1.94 5.49	0 333 699 2,363 7,431 0.267 1.09 5.72 1.32 26.2 137 97.4 96 91.3 79.8 58.2 0.498 1.45 4.11 10.8 23.6 39.5 0.228 0.236 0.239 0.225 0.179 0.109 0.083 0.094 0.104 0.107 0.092 0.06 0.332 0.969 2.74 7.17 15.7 26.3 1.5 1.28 1.46 1.95 2.25 1.96 1.45 1.88 2.04 1.61 1.02 0.523 2.03 4.99 12.5 26.8 49.4 72.7 91.3 86.9 78.6 65.4 45 24.1 4.99 5.77 6.44 5.8 4.29 2.5 0.112 0.377 0.319 0.241 0.17 0.094 0.098 0.101 0.091 0.079<

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

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

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	0	0	0	0	1,316
Conversion capital investment -		0	0	0	0	0	14,912
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							

Table 52: <i>E-B+ scenario</i>	- PTI I AR 3º Clean tuels -	Rineneray (continued)

Item	2020	2025	2030	2035	2040	2045	2050
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	15
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	3.35	3.32	6.84	7.07
Annual - BECCS (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	3.35	3.32	6.84	7.07
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	3.35	6.67	13.5	20.6
Cumulative - BECCS (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	13.5	20.6
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	622	826	826	1,084	909
Cumulative investment - All (million \$2018)		0	1,668	2,627	2,627	3,210	3,121
Cumulative investment - Spur (million \$2018)		0	54.5	97.9	97.7	272	183
Cumulative investment - Trunk (million \$2018)		0	1,614	2,529	2,529	2,938	2,938
Spur (km)		0	107	157	157	416	241
Trunk (km)		0	515	669	669	669	669

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							-627
deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-1,912
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy crops (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Aggressive							-88.1
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,627
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-627
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,009
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate						+	-44.1
deployment - Permanent conservation							77.1
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,680
							-1,000
deployment - Total (1000 tC02e/y) Land impacted for carbon sink -							253
·							200
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							0.50/
Land impacted for carbon sink -							3,594
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							14.8
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							58.1
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							
Land impacted for carbon sink -							160
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,080
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							253
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							768
deployment - Cropland measures (1000							100
hectares)							
Land impacted for carbon sink - Moderate						+	14.8
deployment - Cropland to woody energy							14.0
crops (1000 hectares)							FO 1
Land impacted for carbon sink - Moderate							58.1
deployment - Pasture to energy crops							
(1000 hectares)							
Land impacted for carbon sink - Moderate							80.2
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,174
deployment - Total (1000 hectares)							

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

Table 57: E-B+ scenario - PILLAR 6: Land S			0000	0005	00/0	00/5	0050
Item Carbon sink potential - High - Accelerate	2020	2025	2030	2035	2040	2045	2050 -291
regeneration (1000 tCO2e/y)							-291
							07.050
Carbon sink potential - High - All (not							-27,852
counting overlap) (1000 tC02e/y)							0.107
Carbon sink potential - High - Avoid							-3,104
deforestation (1000 tC02e/y)							0.777
Carbon sink potential - High - Extend							-8,777
rotation length (1000 tC02e/y)							
Carbon sink potential - High - Improve							-440
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-5,935
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,121
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-186
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,122
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-3,875
productivity (1000 tCO2e/y)							-,
Carbon sink potential - Low - Accelerate							-146
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-8,341
counting overlap) (1000 tCO2e/y)							-0,541
Carbon sink potential - Low - Avoid							-517
deforestation (1000 tCO2e/y)							-311
Carbon sink potential - Low - Extend							-3,371
•							-3,371
rotation length (1000 tC02e/y)							007
Carbon sink potential - Low - Improve							-224
plantations (1000 tCO2e/y)							4.070
Carbon sink potential - Low - Increase							-1,978
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-392
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-93.2
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-312
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,306
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-218
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-18,092
counting overlap) (1000 tCO2e/y)							•
Carbon sink potential - Mid - Avoid							-1,811
deforestation (1000 tC02e/y)							, -
Carbon sink potential - Mid - Extend							-6,074
rotation length (1000 tCO2e/y)							0,011
Carbon sink potential - Mid - Improve							-328
plantations (1000 tCO2e/y)							020
Carbon sink potential - Mid - Increase		+					-3,957
retention of HWP (1000 tCO2e/y)							-3,731
							-757
Carbon sink potential - Mid - Increase							-151
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-140
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,217
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-2,591
productivity (1000 tCO2e/y)							
•		-	-	I			

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

Table 31. L-D+ Scenario - Fillar o. Lana		•	-				
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							47.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							420
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,476
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							162
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							ŭ
hectares)							
Land impacted for carbon sink potential -							107
High - Increase trees outside forests							101
(1000 hectares)							
							12.3
Land impacted for carbon sink potential -							12.3
High - Reforest cropland (1000 hectares)							117
Land impacted for carbon sink potential -							117
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,285
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,626
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							23.8
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							395
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,715
Low - Extend rotation length (1000							•
hectares)							
Land impacted for carbon sink potential -							81
Low - Improve plantations (1000							.
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							U
hectares)							
							F/1
Land impacted for carbon sink potential -							56.1
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							6.16
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							20.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							777
Low - Restore productivity (1000							
hectares)	1						
Land impacted for carbon sink potential -							3,074
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -	1		 				35.7
Mid - Accelerate regeneration (1000							··
	i .						

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 -							407
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,095
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							122
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 -							81.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							9.24
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							147
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,565
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,463
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		2,374	1.62	1.6	1.47	1	0.081
Coal (million 2019\$)							
Monetary damages from air pollution -		599	357	206	160	92.3	25.3
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,245	4,272	4,139	3,715	2,952	2,023
Transportation (million 2019\$)							
Premature deaths from air pollution -		268	0.183	0.181	0.166	0.113	0.009
Coal (deaths)							
Premature deaths from air pollution -		67.6	40.3	23.3	18.1	10.4	2.85
Natural Gas (deaths)							
Premature deaths from air pollution -		477	480	466	418	332	228
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		58,459	60,226				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	18.5	19.4	19.4	19.6	19.7	19.8	19.9
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	80.6	80.6	80.4	80.3	80.2	80.1
Sales of space heating units - Electric	2.56	12.8	39.8	61.7	65	65.6	65.5
Heat Pump (%)							
Sales of space heating units - Electric	5.59	4.04	8.87	21.3	31.9	33.3	33.6
Resistance (%)							
Sales of space heating units - Fossil (%)	19.4	16.7	13	5.8	0.885	0.071	0
Sales of space heating units - Gas Furnace	72.4	66.4	38.4	11.1	2.19	0.955	0.868
(%)							
Sales of water heating units - Electric	0.624	0.33	0.331	0.332	0.331	0.334	0.334
Heat Pump (%)							
Sales of water heating units - Electric	3.49	1.96	1.94	1.95	1.94	1.94	1.94
Resistance (%)							

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

The state of the s			•	-			
Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	94.2	96.3	96.3	96.3	96.3	96.2	96.2
Sales of water heating units - Other (%)	1.74	1.38	1.45	1.44	1.45	1.49	1.49

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.28	5.32	8.01	8.36	9.84	10.3
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)	388	385	387	386	389	402	426
Final energy use - Industry (PJ)	792	798	821	830	852	875	887
Final energy use - Residential (PJ)	467	430	411	398	391	386	383
Final energy use - Transportation (PJ)	816	774	716	682	684	705	733

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		10.4	10.9				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	54.8	54.8	54.8	54.8	54.8	54.8	54.8
Resistance (%)							
Sales of cooking units - Gas (%)	45.2	45.2	45.2	45.2	45.2	45.2	45.2
Sales of space heating units - Electric	6.94	20.6	21.2	22	22.5	23	23.7
Heat Pump (%)							
Sales of space heating units - Electric	9.71	11.3	11.1	10.9	10.7	10.1	9.42
Resistance (%)							
Sales of space heating units - Fossil (%)	24.6	29.7	17.7	10.2	9.79	9.79	9.79
Sales of space heating units - Gas (%)	58.8	38.5	50	56.9	57	57	57.1
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	35.5	52.7	52.6	52.5	52.4	52.4	52.3
Resistance (%)							
Sales of water heating units - Gas Furnace	58.8	43.5	43.6	43.7	43.7	43.8	43.9
(%)							
Sales of water heating units - Other (%)	5.73	3.84	3.85	3.85	3.86	3.86	3.87

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 (%)	1.44	1.87	2.16	2.02	1.81	1.69	1.6
Vehicle sales - Light-duty - EV (%)	3.95	6.1	6.91	8.53	10.3	11.9	13.1
Vehicle sales - Light-duty - gasoline (%)	89.6	85.9	83.6	81.6	79.5	77.5	76
Vehicle sales - Light-duty - hybrid (%)	4.82	5.65	6.89	7.44	7.98	8.5	8.88
Vehicle sales - Light-duty - hydrogen FC	0.11	0.373	0.339	0.3	0.296	0.295	0.306
(%)							
Vehicle sales - Light-duty - other (%)	0.097	0.101	0.097	0.097	0.097	0.095	0.098
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

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen FC (%)	0.175	0.208	0.242	0.285	0.339	0.409	0.487
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							-291
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-27,852
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,777
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-440
plantations (1000 tC02e/y)							
Carbon sink potential - High - Increase							-5,935
retention of HWP (1000 tCO2e/y)							-,
Carbon sink potential - High - Increase							-1,121
trees outside forests (1000 tCO2e/y)							.,
Carbon sink potential - High - Reforest							-186
cropland (1000 tCO2e/y)							100
Carbon sink potential - High - Reforest						+	-4,122
pasture (1000 tC02e/y)							-4,122
Carbon sink potential - High - Restore							-3,875
productivity (1000 tC02e/y)							-3,013
Carbon sink potential - Low - Accelerate							-146
							-140
regeneration (1000 tC02e/y)							0.071
Carbon sink potential - Low - All (not							-8,341
counting overlap) (1000 tC02e/y)							-4-
Carbon sink potential - Low - Avoid							-517
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-3,371
rotation length (1000 tC02e/y)							
Carbon sink potential - Low - Improve							-224
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,978
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-392
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-93.2
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-312
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,306
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-218
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-18,092
counting overlap) (1000 tC02e/y)							
Carbon sink potential - Mid - Avoid							-1,811
deforestation (1000 tCO2e/y)							.,
Carbon sink potential - Mid - Extend							-6,074
rotation length (1000 tCO2e/y)							2,01
Carbon sink potential - Mid - Improve							-328
plantations (1000 tCO2e/y)							020
Carbon sink potential - Mid - Increase							-3,957
retention of HWP (1000 tCO2e/y)							5,751

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y)							-757
Carbon sink potential - Mid - Reforest							-140
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,217
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-2,591
productivity (1000 tCO2e/y) Land impacted for carbon sink potential -							47.6
High - Accelerate regeneration (1000							41.0
hectares)							
Land impacted for carbon sink potential -							420
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,476
High - Extend rotation length (1000 hectares)							
Land impacted for carbon sink potential -							162
High - Improve plantations (1000							102
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							107
High - Increase trees outside forests							
(1000 hectares) Land impacted for carbon sink potential -							12.3
High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential -							117
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,285
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential - High - Total impacted (over 30 years)							6,626
(1000 hectares)							
Land impacted for carbon sink potential -							23.8
Low - Accelerate regeneration (1000							20.0
hectares)							
Land impacted for carbon sink potential -							395
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,715
Low - Extend rotation length (1000 hectares)							
Land impacted for carbon sink potential -							81
Low - Improve plantations (1000							0.
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							56.1
Low - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential -							6.16
Low - Reforest cropland (1000 hectares)							0.10
Land impacted for carbon sink potential -							20.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							777
Low - Restore productivity (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463

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)	-32.9		-14.7				-13.1
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.61		-2.91				-3.02
Business-as-usual carbon sink - Total (Mt CO2e/y)	-34.5		-17.6				-16.2

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		6,216	3,922	3,657	3,539	3,467	3,151
Coal (million 2019\$)							
Monetary damages from air pollution -		453	501	643	656	647	588
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,236	4,322	4,405	4,511	4,620	4,736
Transportation (million 2019\$)							
Premature deaths from air pollution -		702	443	413	400	392	356
Coal (deaths)							
Premature deaths from air pollution -		51.1	56.6	72.5	74	73	66.4
Natural Gas (deaths)							
Premature deaths from air pollution -		476	486	495	507	520	533
Transportation (deaths)							