

# Net-Zero America - massachusetts state report

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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 <a href="https://netzeroamerica.prince-ton.edu">https://netzeroamerica.prince-ton.edu</a>.
- 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 -		13,317	14,546				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Sales of space heating units - Electric	4.31	10.7	38.6	72.2	77.8	78.1	78.1
Heat Pump (%)							
Sales of space heating units - Electric	2.07	4.58	16.4	21.3	21.9	21.9	21.9
Resistance (%)							
Sales of space heating units - Fossil (%)	23.7	29.9	5.74	0.244	0	0	0
Sales of space heating units - Gas Furnace	69.9	54.9	39.2	6.26	0.372	0	0
(%)							
Sales of water heating units - Electric	2.04	3.48	15.8	41.1	45.6	46	45.9
Heat Pump (%)							
Sales of water heating units - Electric	10.2	12.4	23.9	48	52.3	52.5	52.5
Resistance (%)							
Sales of water heating units - Gas Furnace	84.8	80.4	58.4	9.31	0.551	0	0
(%)							
Sales of water heating units - Other (%)	2.99	3.76	1.89	1.58	1.56	1.56	1.58

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.59	2.67	6.63	7.17	6.63	7.04
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)	253	241	230	215	199	188	181
Final energy use - Industry (PJ)	81.4	79.3	79.4	79.4	80.6	81.8	83.4
Final energy use - Residential (PJ)	286	269	250	218	185	159	144
Final energy use - Transportation (PJ)	500	466	414	349	289	250	231

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		5.62	6.19				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	64.1	71.7	95.2	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	35.9	28.3	4.84	0.243	0	0	0
Sales of space heating units - Electric	6.91	13.1	53.5	87.8	93.1	93.4	93.4
Heat Pump (%)							
Sales of space heating units - Electric	6.17	9.15	7.14	3.07	2.34	2.27	2.46
Resistance (%)							
Sales of space heating units - Fossil (%)	32.4	41.6	13.8	4.85	4.07	4.05	3.91
Sales of space heating units - Gas (%)	54.5	36.2	25.6	4.29	0.5	0.264	0.249
Sales of water heating units - Electric	0	1.22	12.2	31.8	35.2	35.4	35.4
Heat Pump (%)							
Sales of water heating units - Electric	30.5	48.9	54.7	62.9	64.4	64.5	64.5
Resistance (%)							
Sales of water heating units - Gas Furnace	60	44.2	31.9	5.09	0.3	0	0
(%)							
Sales of water heating units - Other (%)	9.47	5.72	1.16	0.145	0.102	0.103	0.103

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		962	2,495	3,997	6,074	6,591	6,294
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.317		1.49		6.24		10
units)							
Public EV charging plugs - L2 (1000 units)	2.26		35.7		150		241
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 (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.41	16.7	48.7	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.9	4.89	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant	0	0	1.13	0	0	0	0
(billion \$2018)  Capital invested - Biomass w/ccu allam	0	0	0	0.005	0.001	0	0
power plant (billion \$2018)	0	0	0	0.003	0.001	0	U
Capital invested - Biomass w/ccu power	0	0	0.006	0	0.001	0	0.015
plant (billion \$2018)			0.000		0.001		0.010
Capital invested - Offshore Wind - Base		1.95	8.25	14.1	18.8	9.71	0.655
(billion \$2018)							
Capital invested - Offshore Wind -		0	8.66	15.6	15	0	4.55
Constrained (billion \$2018)							
Capital invested - Solar PV - Base (billion		0	1.33	1.91	4.38	5.83	0
\$2018)							
Capital invested - Solar PV - Constrained		0.202	0.495	3.92	2.72	7.22	0
(billion \$2018)							
Capital invested - Wind - Base (billion		0.105	1.71	0.488	0.32	0	0.218
\$2018)							
Capital invested - Wind - Constrained		0.105	1.92	0.167	0.279	0.17	0.21
(billion \$2018)							
Installed renewables - OffshoreWind -	70.3	758	3,920	10,140	19,410	25,645	26,167
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	70.3	758	3,920	10,140	19,410	25,645	26,167
Constrained land use assumptions (MW)							
Installed renewables - Rooftop PV (MW)	2,978	5,185	6,070	7,104	8,278	9,583	11,044
Installed renewables - Solar - Base land	694	694	1,998	4,023	8,962	15,915	15,915
use assumptions (MW)							
Installed renewables - Solar -	0	0	2,362	5,812	10,661	19,695	19,695
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	125	165	878	1,096	1,247	1,247	1,361
use assumptions (MW)							
Installed renewables - Wind - Constrained	125	165	964	1,082	1,170	1,254	1,397
land use assumptions (MW)							

Table 7: E+ scenario	DILLAD 2: Cloan	Electricity	Congration
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Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	2,220	2,220	2,220	2,220	2,220
Biomass w/ccu allam power plant (GWh)	0	0	0	5.42	6.26	6.26	6.26
Biomass w/ccu power plant (GWh)	0	0	6.99	6.99	7.72	7.72	24.1
OffshoreWind - Base land use	282	3,054	15,934	42,263	81,669	108,977	111,425
assumptions (GWh)							
OffshoreWind - Constrained land use	282	3,054	15,934	42,263	81,669	108,977	111,425
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	744	744	2,706	5,783	13,162	23,466	23,466
Solar - Constrained land use assumptions	0	0	3,587	8,733	15,925	29,321	29,321
(GWh)							
Wind - Base land use assumptions (GWh)	502	655	3,259	4,034	4,572	4,572	4,977
Wind - Constrained land use assumptions	502	655	3,559	3,981	4,288	4,586	5,084
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	73.3	74.6	75	75.5	151
Conversion capital investment -		0	1,267	43.3	12.5	12.6	2,040
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	1	1	1	2
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Power (quantity)	0	0	2	2	2	2	2
Number of facilities - Power ccu	0	0	1	1	1	1	2
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	2
Number of facilities - Pyrolysis ccu	0	0	0	1	1	1	2
(quantity)							
Number of facilities - Sng (quantity)	0	0	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	0.02	0.03	0.03	1.32
Annual - BECCS (MMT)		0	0.01	0.02	0.02	0.02	1.31
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0.01	0.01	0	0.01
Cumulative - All (MMT)		0	0.01	0.03	0.06	0.09	1.41
Cumulative - BECCS (MMT)		0	0.01	0.03	0.05	0.07	1.38
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0.01	0.02	0.02	0.03

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	171	314	314	314	549
Cumulative investment - All (million \$2018)		0	264	339	339	339	494
Cumulative investment - Spur (million \$2018)		0	19.1	94.2	94.2	94.2	249
Cumulative investment - Trunk (million \$2018)		0	245	245	245	245	245
Spur (km)		0	36.2	179	179	179	414
Trunk (km)		0	135	135	135	135	135

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

Table 12: E+ Scenario - PILLAR 6: Land Sink			0000	0005	007.0	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							105
Carbon sink potential - Aggressive							-105
deployment - Cropland measures (1000							
tCO2e/y)							0.00
Carbon sink potential - Aggressive							-3.29
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-109
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate			П		T		-55
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-1.64
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-56.7
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							63.5
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							5.98
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							69.5
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							33.2
deployment - Cropland measures (1000							55.2
hectares)							
Land impacted for carbon sink - Moderate							2.99
deployment - Permanent conservation							2.,,
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							36.2
deployment - Total (1000 hectares)							50.2
acproyment - rotar (1000 nectal es)							

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

2035   2040   2045   2050   -36.4     -4,728     -1,146     -1,955     0     -518     -210
-4,728 -1,146 -1,955 0 -518
-1,146 -1,955 0 -518
-1,146 -1,955 0 -518
-1,955 0 -518
-1,955 0 -518
-518
-518
-518
-518
210
010
-210
0
-307
-555
-18.3
-1,417
-191
-751
-101
0
-173
-113
-73.7
-13.1
0
00.0
-23.3
-187
-27.4
-3,072
-669
-1,353
0
-345
-142
0
-165
-371

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							5.96
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							155
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							997
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							20
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							J
Land impacted for carbon sink potential -							8.73
High - Reforest pasture (1000 hectares)							0.10
Land impacted for carbon sink potential -	+	+					184
High - Restore productivity (1000							104
hectares)							
Land impacted for carbon sink potential -							1,371
High - Total impacted (over 30 years)							1,311
(1000 hectares)							
Land impacted for carbon sink potential -		-					2.98
							2.70
Low - Accelerate regeneration (1000							
hectares)							1//
Land impacted for carbon sink potential -							146
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							382
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							10.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.51
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							111
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							654
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4.47
Mid - Accelerate regeneration (1000							
hectares)							

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Table 15. E+	scenuro -	PILLAR O.	Luiiu Siiiks -	Furests	lconunueur

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							150
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							689
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							15.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							10.9
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							224
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,095
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		340	286	230	173	109	75.5
Natural gas consumption - Cumulative (tcf)							6,921
Natural gas production - Annual (tcf)		0	0	0	0	0	0
Oil consumption - Annual (million bbls)		88.4	76.2	58.5	42.2	29.3	19.2
Oil consumption - Cumulative (million bbls)							1,813
Oil production - Annual (million bbls)		0	0	0	0	0	0

#### Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		557	0.598	0.597	0.568	0.345	0.018
Monetary damages from air pollution - Natural Gas (million 2019\$)		288	155	107	108	66.1	35.6
Monetary damages from air pollution - Transportation (million 2019\$)		2,027	1,872	1,408	804	356	128
Premature deaths from air pollution - Coal (deaths)		62.9	0.068	0.067	0.064	0.039	0.002
Premature deaths from air pollution - Natural Gas (deaths)		32.5	17.5	12.1	12.2	7.46	4.02
Premature deaths from air pollution - Transportation (deaths)		228	211	158	90.4	40	14.3

#### Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		112	304	293	247	198	283
By economic sector - Construction (jobs)		13,426	11,963	16,967	24,459	25,943	26,720
By economic sector - Manufacturing		4,933	8,934	9,220	11,052	14,311	19,224
(jobs)							
By economic sector - Mining (jobs)		1,719	1,228	795	484	273	151

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

Table 16: E+ Scending - IMPAG13 - Jobs (Co	Jiitiiiueuj						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		2,212	1,664	2,324	3,509	4,214	5,723
By economic sector - Pipeline (jobs)		423	387	281	208	135	113
By economic sector - Professional (jobs)		5,017	5,504	8,234	12,721	14,433	16,236
By economic sector - Trade (jobs)		3,698	3,519	4,916	7,459	8,665	10,294
By economic sector - Utilities (jobs)		5,496	8,636	14,907	22,673	22,600	18,210
By education level - All sectors -		11,757	13,447	18,695	26,901	29,456	31,307
Associates degree or some college (jobs)							
By education level - All sectors -		7,188	8,334	11,372	16,322	18,044	19,500
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		266	281	395	588	660	738
degree (jobs)							
By education level - All sectors - High		16,095	18,089	24,679	34,909	38,093	40,553
school diploma or less (jobs)							
By education level - All sectors - Masters		1,732	1,987	2,797	4,092	4,518	4,857
or professional degree (jobs)							
By resource sector - Biomass (jobs)		482	839	834	744	722	1,210
By resource sector - CO2 (jobs)		0	243	2.22	5.64	5.63	185
By resource sector - Grid (jobs)		7,278	14,160	28,053	42,603	43,034	34,301
By resource sector - Natural Gas (jobs)		4,338	3,538	2,624	3,481	2,501	1,473
By resource sector - Nuclear (jobs)		0	0.012	0.027	0.03	0.058	0.074
By resource sector - Oil (jobs)		3,930	3,107	2,204	1,475	957	589
By resource sector - Solar (jobs)		20,140	14,280	13,698	18,680	24,790	34,338
By resource sector - Wind (jobs)		870	5,971	10,522	15,823	18,760	24,859
Median wages - Annual - All (\$2019 per		67,705	68,862	70,930	72,487	73,095	72,989
job)		01,103	00,002	10,750	12,401	13,073	12,707
On-Site or In-Plant Training - Total jobs - 1		6,120	6,920	9,628	13,822	15,048	15,833
to 4 years (jobs)		0,120	0,920	9,020	13,022	13,040	10,000
On-Site or In-Plant Training - Total jobs - 4		2,637	2,822	4,051	5,910	6,327	6,464
to 10 years (jobs)		2,031	2,022	4,001	3,910	0,321	0,404
On-Site or In-Plant Training - Total jobs -		6,096	6,877	9,350	13,353	14,750	16,036
None (jobs)		0,070	0,011	9,330	13,333	14,130	10,030
On-Site or In-Plant Training - Total jobs -		319	366	521	756	819	849
Over 10 years (jobs)		319	300	521	130	019	049
On-Site or In-Plant Training - Total jobs -		21,864	25,155	34,388	48,971	53,826	57,773
Up to 1 year (jobs)		21,004	25,155	34,388	46,971	53,626	51,113
		7,000	0.002	10 / 25	17000	10 / / E	00 / 1E
On-the-Job Training - All sectors - 1 to 4		7,880	8,903	12,435	17,900	19,465	20,415
years (jobs)		0.407	0.700	/ 007	F 011	/ 000	( ( 0 0
On-the-Job Training - All sectors - 4 to 10		2,627	2,788	4,037	5,911	6,320	6,438
years (jobs)		0.000	0.070	0.077	/ 001	, 05,	F 010
On-the-Job Training - All sectors - None		2,083	2,268	3,077	4,391	4,854	5,313
(jobs)		007	/ 01	5.0	700	071	0.0
On-the-Job Training - All sectors - Over 10		394	431	560	782	871	969
years (jobs)				27.000			
On-the-Job Training - All sectors - Up to 1		24,053	27,749	37,829	53,828	59,261	63,819
year (jobs)							
Related work experience - All sectors - 1		13,171	15,037	20,733	29,684	32,503	34,617
to 4 years (jobs)							
Related work experience - All sectors - 4		8,555	9,755	13,502	19,403	21,222	22,501
to 10 years (jobs)							
Related work experience - All sectors -		5,371	6,087	8,415	12,040	13,142	13,964
None (jobs)							
Related work experience - All sectors -		2,225	2,617	3,564	5,074	5,593	5,992
Over 10 years (jobs)							
Related work experience - All sectors - Up		7,714	8,643	11,725	16,611	18,310	19,879
to 1 year (jobs)							
Wage income - All (million \$2019)		2,508	2,902	4,110	6,004	6,636	7,078

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		13,315	14,553				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	40.7	44.7	56.5	72.7	82.9	86.4
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	59.3	55.3	43.5	27.3	17.1	13.6
Sales of space heating units - Electric	4.31	7.58	10.8	20.7	40.6	61.6	72.9
Heat Pump (%)							
Sales of space heating units - Electric	2.07	2.47	3.76	7.71	14.2	19.1	21
Resistance (%)							
Sales of space heating units - Fossil (%)	23.7	34.5	32.4	24.4	11.9	3.8	0.998
Sales of space heating units - Gas Furnace	69.9	55.4	53.1	47.2	33.3	15.5	5.06
(%)							
Sales of water heating units - Electric	2.04	2.9	4.29	8.99	20.1	34	42
Heat Pump (%)							
Sales of water heating units - Electric	10.2	11.8	12.9	17.6	28.1	41.1	48.8
Resistance (%)							
Sales of water heating units - Gas Furnace	84.8	81.2	79	70.2	49.4	23.1	7.53
(%)							
Sales of water heating units - Other (%)	2.99	4.09	3.78	3.24	2.41	1.82	1.65

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.91	1.91	3.04	3.17	5.62	6.03
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)	253	241	235	230	223	216	207
Final energy use - Industry (PJ)	81.4	79.4	79.8	80.8	82.8	83.9	85.2
Final energy use - Residential (PJ)	286	270	259	248	231	207	181
Final energy use - Transportation (PJ)	501	471	433	400	373	341	304

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		5.63	6.47				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	64	64.9	68.2	76.9	89	96.4	99
Resistance (%)							
Sales of cooking units - Gas (%)	36	35.1	31.8	23.1	11	3.56	0.957
Sales of space heating units - Electric	6.91	7.36	12	26	51.8	76	88
Heat Pump (%)							
Sales of space heating units - Electric	6.17	9.22	8.85	8.12	6.41	4.13	2.94
Resistance (%)							
Sales of space heating units - Fossil (%)	32.4	46.7	43.8	34.6	19.9	9.61	5.55
Sales of space heating units - Gas (%)	54.5	36.7	35.3	31.3	21.9	10.3	3.54
Sales of water heating units - Electric	0	0.459	1.73	5.83	15.1	26.1	32.4
Heat Pump (%)							
Sales of water heating units - Electric	30.5	48.3	49	51.2	55.6	60.5	63.2
Resistance (%)							
Sales of water heating units - Gas Furnace	60	44.6	43.2	38.4	27	12.6	4.1
(%)							
Sales of water heating units - Other (%)	9.47	6.6	6.08	4.62	2.32	0.811	0.288

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	161	327	1,113	3,470	5,067
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.317		0.499		2.34		6.43
units)							
Public EV charging plugs - L2 (1000 units)	2.26		12		56.3		154
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 (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.54	5.88	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC	0.112	0.376	0.317	0.239	0.168	0.092	0.043
(%)							
Vehicle sales - Light-duty - other (%)	0.097	0.1	0.09	0.078	0.056	0.03	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							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-105
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-3.29
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-109
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-55
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-1.64
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-56.7
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							63.5
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							5.98
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 -							69.5
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							33.2
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							2.99
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							36.2
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-36.4
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-4,728
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,146
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-1,955
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-518
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-210
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-307
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-555
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-18.3
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-1,417
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-191
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-751
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-173
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-73.7
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-23.3
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-187
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-27.4
regeneration (1000 tCO2e/y)							

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

Item Carbon sink potential - Mid - All (not	2020	2025	2030	2035	2040	2045	205 -3,07
							-3,07
counting overlap) (1000 tC02e/y)							
Carbon sink potential - Mid - Avoid							-66
deforestation (1000 tC02e/y)							4.05
Carbon sink potential - Mid - Extend							-1,35
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							(
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-34
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-14
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-16
pasture (1000 tC02e/y)							10
Carbon sink potential - Mid - Restore						+	-37
·							-31
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							5.9
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							15
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							99
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							
High - Improve plantations (1000							
hectares)							
-							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							2
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							8.7
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -						+	18
High - Restore productivity (1000							.0
hectares)							
							1.0-
Land impacted for carbon sink potential -							1,37
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2.9
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							14
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							38
Low - Extend rotation length (1000							00
nectares)							
Land impacted for carbon sink potential -							
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
Low - Increase retention of HWP (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							10.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.51
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							111
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							654
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4.47
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							150
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							689
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							15.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							10.9
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -		T					224
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -		T			$\Box$		1,095
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

2020	2025	2030	2035	2040	2045	2050
	557	0.598	0.597	0.568	0.345	0.018
	284	123	47.3	19.9	5.97	9.82
	2,064	2,069	1,991	1,771	1,392	941
	62.9	0.068	0.067	0.064	0.039	0.002
	32	13.9	5.34	2.25	0.674	1.11
	232	233	224	199	157	106
	2020	557 284 2,064 62.9	557 0.598 284 123 2,064 2,069 62.9 0.068 32 13.9	557 0.598 0.597 284 123 47.3 2,064 2,069 1,991 62.9 0.068 0.067 32 13.9 5.34	557         0.598         0.597         0.568           284         123         47.3         19.9           2,064         2,069         1,991         1,771           62.9         0.068         0.067         0.064           32         13.9         5.34         2.25	557         0.598         0.597         0.568         0.345           284         123         47.3         19.9         5.97           2,064         2,069         1,991         1,771         1,392           62.9         0.068         0.067         0.064         0.039           32         13.9         5.34         2.25         0.674

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		13,317	14,546				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Sales of space heating units - Electric	4.31	10.7	38.6	72.2	77.8	78.1	78.1
Heat Pump (%)							
Sales of space heating units - Electric	2.07	4.58	16.4	21.3	21.9	21.9	21.9
Resistance (%)							
Sales of space heating units - Fossil (%)	23.7	29.9	5.74	0.244	0	0	0
Sales of space heating units - Gas Furnace	69.9	54.9	39.2	6.26	0.372	0	0
(%)							
Sales of water heating units - Electric	2.04	3.48	15.8	41.1	45.6	46	45.9
Heat Pump (%)							
Sales of water heating units - Electric	10.2	12.4	23.9	48	52.3	52.5	52.5
Resistance (%)							
Sales of water heating units - Gas Furnace	84.8	80.4	58.4	9.31	0.551	0	0
(%)							
Sales of water heating units - Other (%)	2.99	3.76	1.89	1.58	1.56	1.56	1.58

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.59	2.67	6.63	7.17	6.63	7.04
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)	253	241	230	215	199	188	181
Final energy use - Industry (PJ)	81.4	79.3	79.4	79.4	80.6	81.8	83.4
Final energy use - Residential (PJ)	286	269	250	218	185	159	144
Final energy use - Transportation (PJ)	500	466	414	349	289	250	231

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		5.62	6.19				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	64.1	71.7	95.2	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	35.9	28.3	4.84	0.243	0	0	0
Sales of space heating units - Electric	6.91	13.1	53.5	87.8	93.1	93.4	93.4
Heat Pump (%)							
Sales of space heating units - Electric	6.17	9.15	7.14	3.07	2.34	2.27	2.46
Resistance (%)							
Sales of space heating units - Fossil (%)	32.4	41.6	13.8	4.85	4.07	4.05	3.91
Sales of space heating units - Gas (%)	54.5	36.2	25.6	4.29	0.5	0.264	0.249
Sales of water heating units - Electric	0	1.22	12.2	31.8	35.2	35.4	35.4
Heat Pump (%)							
Sales of water heating units - Electric	30.5	48.9	54.7	62.9	64.4	64.5	64.5
Resistance (%)							
Sales of water heating units - Gas Furnace	60	44.2	31.9	5.09	0.3	0	0
(%)							
Sales of water heating units - Other (%)	9.47	5.72	1.16	0.145	0.102	0.103	0.103

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		962	2,495	3,997	6,074	6,591	6,294
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.317		1.49		6.24		10
units)							
Public EV charging plugs - L2 (1000 units)	2.26		35.7		150		241
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 (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.41	16.7	48.7	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.9	4.89	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	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 - Offshore Wind - Base	2020	1.72	8.25	26	18.5	2.74	0
(billion \$2018)		1.12	0.20	20	10.5	2.14	U
,			0.40	/ 0/	0.07	0.07	
Capital invested - Solar PV - Base (billion		0	2.48	4.94	8.24	2.04	0
\$2018)							
Capital invested - Wind - Base (billion		0.105	1.71	0.488	0.32	0	0.218
\$2018)							
Installed renewables - OffshoreWind -	70.3	678	3,840	15,289	24,408	26,167	26,167
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	0	0	6,483	30,784	35,104	35,104	42,364
Constrained land use assumptions (MW)							
Installed renewables - Solar - Base land	694	694	3,124	8,366	17,647	20,077	20,077
use assumptions (MW)							
Installed renewables - Solar -	1,387	1,387	6,022	12,277	22,785	26,924	26,924
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	125	165	878	1,096	1,247	1,247	1,361
use assumptions (MW)							
Installed renewables - Wind - Constrained	250	330	1,929	2,165	2,340	2,509	3,021
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	282	2,728	15,604	63,855	103,414	111,425	111,425
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	26,329	129,043	148,281	148,281	180,138
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	744	744	4,409	12,176	25,995	29,584	29,584
Solar - Constrained land use assumptions	1,489	1,489	8,456	17,820	33,440	39,534	39,534
(GWh)							
Wind - Base land use assumptions (GWh)	502	655	3,259	4,034	4,572	4,572	4,977

## Table 31: E+RE+ scenario - PILLAR 2: Clean Electricity - Generation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Wind - Constrained land use assumptions	1,003	1,310	7,117	7,963	8,576	9,173	10,953
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-105
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-3.29
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-109
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-55
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-1.64
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-56.7
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							63.5
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							5.98
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							69.5
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							·
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							33.2
deployment - Cropland measures (1000							00.2
hectares)							
Land impacted for carbon sink - Moderate							2.99
deployment - Permanent conservation							2.77
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							36.2
deployment - Total (1000 hectares)							50.2
deproyment - Total (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 regeneration (1000 tCO2e/y)							-36.4
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-4,728
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,146

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

2020	2025	2030	2035	2040	2045	2050
						-1,955
						0
						F10
						-518
						010
						-210
						0
						0.07
						-307
						-555
						10.0
						-18.3
						4 / 4 7
						-1,417
						-191
						-751
						0
						-173
						-73.7
						0
						-23.3
						-187
						-27.4
						-3,072
						-669
						-1,353
						0
						-345
						-142
						0
						·
						-165
						100
					+	-371
						-011
						5.96
						5.70
						155
						155

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 - Extend rotation length (1000							997
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000 hectares)							
Land impacted for carbon sink potential -							20
High - Increase trees outside forests							20
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							8.73
High - Reforest pasture (1000 hectares)							10/
Land impacted for carbon sink potential - High - Restore productivity (1000							184
hectares)							
Land impacted for carbon sink potential -							1,371
High - Total impacted (over 30 years)							1,011
(1000 hectares)							
Land impacted for carbon sink potential -							2.98
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							146
Low - Avoid deforestation (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							382
Low - Extend rotation length (1000							002
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000 hectares)							
Land impacted for carbon sink potential -							10.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.51
Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential -							111
Low - Restore productivity (1000							111
hectares)							
Land impacted for carbon sink potential -							654
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4.47
Mid - Accelerate regeneration (1000							
hectares)  Land impacted for carbon sink potential -							150
Mid - Avoid deforestation (over 30 years)							130
(1000 hectares)							
Land impacted for carbon sink potential -							689
Mid - Extend rotation length (1000							-
hectares)							
Land impacted for carbon sink potential -							0
Mid - 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 -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							15.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							10.9
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							224
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,095
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 -		557	0.598	0.597	0.568	0.345	0.018
Coal (million 2019\$)							
Monetary damages from air pollution -		273	137	76.8	69.5	24	12.3
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		2,027	1,872	1,408	804	356	128
Transportation (million 2019\$)							
Premature deaths from air pollution -		62.9	0.068	0.067	0.064	0.039	0.002
Coal (deaths)							
Premature deaths from air pollution -		30.8	15.5	8.67	7.84	2.71	1.39
Natural Gas (deaths)							
Premature deaths from air pollution -		228	211	158	90.4	40	14.3
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 -		13,317	14,546				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Sales of space heating units - Electric	4.31	10.7	38.6	72.2	77.8	78.1	78.1
Heat Pump (%)							
Sales of space heating units - Electric	2.07	4.58	16.4	21.3	21.9	21.9	21.9
Resistance (%)							
Sales of space heating units - Fossil (%)	23.7	29.9	5.74	0.244	0	0	0
Sales of space heating units - Gas Furnace	69.9	54.9	39.2	6.26	0.372	0	0
(%)							
Sales of water heating units - Electric	2.04	3.48	15.8	41.1	45.6	46	45.9
Heat Pump (%)							
Sales of water heating units - Electric	10.2	12.4	23.9	48	52.3	52.5	52.5
Resistance (%)							
Sales of water heating units - Gas Furnace	84.8	80.4	58.4	9.31	0.551	0	0
(%)							
Sales of water heating units - Other (%)	2.99	3.76	1.89	1.58	1.56	1.56	1.58

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.59	2.67	6.63	7.17	6.63	7.04
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)	253	241	230	215	199	188	181
Final energy use - Industry (PJ)	81.4	79.3	79.4	79.4	80.6	81.8	83.4
Final energy use - Residential (PJ)	286	269	250	218	185	159	144
Final energy use - Transportation (PJ)	500	466	414	349	289	250	231

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		5.62	6.19				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	64.1	71.7	95.2	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	35.9	28.3	4.84	0.243	0	0	0
Sales of space heating units - Electric	6.91	13.1	53.5	87.8	93.1	93.4	93.4
Heat Pump (%)							
Sales of space heating units - Electric	6.17	9.15	7.14	3.07	2.34	2.27	2.46
Resistance (%)							
Sales of space heating units - Fossil (%)	32.4	41.6	13.8	4.85	4.07	4.05	3.91
Sales of space heating units - Gas (%)	54.5	36.2	25.6	4.29	0.5	0.264	0.249
Sales of water heating units - Electric	0	1.22	12.2	31.8	35.2	35.4	35.4
Heat Pump (%)							
Sales of water heating units - Electric	30.5	48.9	54.7	62.9	64.4	64.5	64.5
Resistance (%)							
Sales of water heating units - Gas Furnace	60	44.2	31.9	5.09	0.3	0	0
(%)							
Sales of water heating units - Other (%)	9.47	5.72	1.16	0.145	0.102	0.103	0.103

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		962	2,495	3,997	6,074	6,591	6,294
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.317		1.49		6.24		10
units)							
Public EV charging plugs - L2 (1000 units)	2.26		35.7		150		241
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 (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.41	16.7	48.7	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.9	4.89	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	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

## Table 39: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base (billion \$2018)		6.33	5.44	6.44	2.81	1.2	1.44
Capital invested - Offshore Wind - Constrained (billion \$2018)		3.86	6.35	7.03	2.97	1.19	1.97
Capital invested - Solar PV - Base (billion \$2018)		0.489	1.5	0.551	0.859	0.368	1.16
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0	0	1.24	1.34
Capital invested - Wind - Base (billion \$2018)		0.105	0.866	0	0	0	0.67
Capital invested - Wind - Constrained (billion \$2018)		0.105	0.871	0	0	0.229	0.615
Installed renewables - OffshoreWind - Base land use assumptions (MW)	70.3	2,304	4,387	7,217	8,604	9,372	10,524
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	1,364	3,797	6,889	8,356	9,123	10,698
Installed renewables - Solar - Base land use assumptions (MW)	694	1,121	2,584	3,169	4,136	4,575	6,037
Installed renewables - Solar - Constrained land use assumptions (MW)	1,908	1,908	1,908	1,908	1,908	3,382	5,074
Installed renewables - Wind - Base land use assumptions (MW)	125	165	526	526	526	526	878
Installed renewables - Wind - Constrained land use assumptions (MW)	125	165	528	528	528	642	964

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	282	9,335	17,830	29,632	35,720	39,074	43,861
assumptions (GWh)							
OffshoreWind - Constrained land use	0	5,479	15,454	28,171	34,272	37,485	44,149
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	744	1,390	3,583	4,461	5,906	6,565	8,762
Solar - Constrained land use assumptions	2,577	2,577	2,577	2,577	2,577	4,764	7,272
(GWh)							
Wind - Base land use assumptions (GWh)	502	655	1,991	1,991	1,991	1,991	3,259
Wind - Constrained land use assumptions	502	655	2,000	2,000	2,000	2,407	3,559
_(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-105
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-3.29
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-109
deployment - Total (1000 tCO2e/y)							

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

2020	2025	2030	2035	2040	2045	2050
						0
						-55
						-1.64
						-56.7
						0
						63.5
						5.98
						69.5
						0
						33.2
						2.99
						36.2
						00.2
	2020	2020 2025	2020 2025 2030	2020 2025 2030 2035	2020 2025 2030 2035 2040	

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-36.4
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-4,728
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,146
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-1,955
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-518
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-210
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-307
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-555
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-18.3
regeneration (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - All (not							-1,41
counting overlap) (1000 tC02e/y)							10
Carbon sink potential - Low - Avoid							-19
deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend							-75
rotation length (1000 tC02e/y)							-15
Carbon sink potential - Low - Improve							(
plantations (1000 tCO2e/y)							,
Carbon sink potential - Low - Increase							-17:
retention of HWP (1000 tCO2e/y)							-111
Carbon sink potential - Low - Increase							-73.
trees outside forests (1000 tC02e/y)							-13.
Carbon sink potential - Low - Reforest		+					(
cropland (1000 tC02e/y)							,
Carbon sink potential - Low - Reforest		+					-23.3
pasture (1000 tC02e/y)							-20.
Carbon sink potential - Low - Restore		+					-18
productivity (1000 tCO2e/y)							-10
Carbon sink potential - Mid - Accelerate							-27.4
regeneration (1000 tCO2e/y)							-21.
Carbon sink potential - Mid - All (not							-3,07
counting overlap) (1000 tC02e/y)							-3,01
Carbon sink potential - Mid - Avoid							-66
deforestation (1000 tCO2e/y)							-00
Carbon sink potential - Mid - Extend							-1,35
rotation length (1000 tC02e/y)							-1,33
Carbon sink potential - Mid - Improve							
plantations (1000 tCO2e/y)							,
Carbon sink potential - Mid - Increase							-34
retention of HWP (1000 tC02e/y)							-34
Carbon sink potential - Mid - Increase							-14:
trees outside forests (1000 tCO2e/y)							-14.
Carbon sink potential - Mid - Reforest							(
cropland (1000 tCO2e/y)							,
Carbon sink potential - Mid - Reforest							-16
pasture (1000 tCO2e/y)							-10
Carbon sink potential - Mid - Restore							-37
productivity (1000 tCO2e/y)							-51
Land impacted for carbon sink potential -							5.90
High - Accelerate regeneration (1000							3.70
hectares)							
Land impacted for carbon sink potential -							15
High - Avoid deforestation (over 30 years)							15
(1000 hectares)							
Land impacted for carbon sink potential -							99
•							77
High - Extend rotation length (1000 hectares)							
Land impacted for carbon sink potential -							(
High - Improve plantations (1000							'
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
=							
hectares)						+	0
Land impacted for carbon sink potential -							2
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							(
High - Reforest cropland (1000 hectares)  Land impacted for carbon sink potential -							
i and impacted for carbon sink notential -							8.7

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 - High - Restore productivity (1000 hectares)							184
Land impacted for carbon sink potential - High - Total impacted (over 30 years)							1,371
(1000 hectares)  Land impacted for carbon sink potential - Low - Accelerate regeneration (1000							2.98
hectares)  Land impacted for carbon sink potential -							146
Low - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential -							382
Low - Extend rotation length (1000 hectares)							
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							10.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							111
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							654
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							4.47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							150
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							689
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							0
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)							15.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							10.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							224
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,095

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		557	0.598	0.597	0.568	0.345	0.018
Coal (million 2019\$)							
Monetary damages from air pollution -		286	161	172	129	66.5	15.4
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		2,027	1,872	1,408	804	356	128
Transportation (million 2019\$)							
Premature deaths from air pollution -		62.9	0.068	0.067	0.064	0.039	0.002
Coal (deaths)							
Premature deaths from air pollution -		32.3	18.1	19.4	14.5	7.5	1.74
Natural Gas (deaths)							
Premature deaths from air pollution -		228	211	158	90.4	40	14.3
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 -		13,315	14,553				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	40.7	44.7	56.5	72.7	82.9	86.4
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	59.3	55.3	43.5	27.3	17.1	13.6
Sales of space heating units - Electric	4.31	7.58	10.8	20.7	40.6	61.6	72.9
Heat Pump (%)							
Sales of space heating units - Electric	2.07	2.47	3.76	7.71	14.2	19.1	21
Resistance (%)							
Sales of space heating units - Fossil (%)	23.7	34.5	32.4	24.4	11.9	3.8	0.998
Sales of space heating units - Gas Furnace	69.9	55.4	53.1	47.2	33.3	15.5	5.06
(%)							
Sales of water heating units - Electric	2.04	2.9	4.29	8.99	20.1	34	42
Heat Pump (%)							
Sales of water heating units - Electric	10.2	11.8	12.9	17.6	28.1	41.1	48.8
Resistance (%)							
Sales of water heating units - Gas Furnace	84.8	81.2	79	70.2	49.4	23.1	7.53
(%)							
Sales of water heating units - Other (%)	2.99	4.09	3.78	3.24	2.41	1.82	1.65

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.91	1.91	3.04	3.17	5.62	6.03
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)	253	241	235	230	223	216	207
Final energy use - Industry (PJ)	81.4	79.4	79.8	80.8	82.8	83.9	85.2
Final energy use - Residential (PJ)	286	270	259	248	231	207	181
Final energy use - Transportation (PJ)	501	471	433	400	373	341	304

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		5.63	6.47				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	64	64.9	68.2	76.9	89	96.4	99
Resistance (%)							
Sales of cooking units - Gas (%)	36	35.1	31.8	23.1	11	3.56	0.957
Sales of space heating units - Electric	6.91	7.36	12	26	51.8	76	88
Heat Pump (%)							

Table /.Q. E. R. scanario	PILLAR 1: Efficiency/Electrification	- Posidential (continued)
- Table 40. E-D+ Sceliul 10 -	PILLAR I. EIIICIEIICV/EIECUTIICUUUII	- Residential Icontinuear

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	6.17	9.22	8.85	8.12	6.41	4.13	2.94
Resistance (%)							
Sales of space heating units - Fossil (%)	32.4	46.7	43.8	34.6	19.9	9.61	5.55
Sales of space heating units - Gas (%)	54.5	36.7	35.3	31.3	21.9	10.3	3.54
Sales of water heating units - Electric	0	0.459	1.73	5.83	15.1	26.1	32.4
Heat Pump (%)							
Sales of water heating units - Electric	30.5	48.3	49	51.2	55.6	60.5	63.2
Resistance (%)							
Sales of water heating units - Gas Furnace	60	44.6	43.2	38.4	27	12.6	4.1
(%)							
Sales of water heating units - Other (%)	9.47	6.6	6.08	4.62	2.32	0.811	0.288

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

	,.		•				
Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	161	327	1,113	3,470	5,067
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.317		0.499		2.34		6.43
units)							
Public EV charging plugs - L2 (1000 units)	2.26		12		56.3		154
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 (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.54	5.88	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC	0.112	0.376	0.317	0.239	0.168	0.092	0.043
(%)							
Vehicle sales - Light-duty - other (%)	0.097	0.1	0.09	0.078	0.056	0.03	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 50: E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0.403	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.006	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.006	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	792	792	792	792	792
Biomass w/ccu allam power plant (GWh)	0	0	0	5.53	5.81	6.24	6.24
Biomass w/ccu power plant (GWh)	0	0	7.09	7.09	7.22	7.57	7.57

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	48.1	52	54.9	56.1	376
Conversion capital investment -		0	456	66.9	44.2	19.3	4,630
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	1	1	1	2
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Power (quantity)	0	0	1	1	1	1	1
Number of facilities - Power ccu	0	0	1	1	1	1	1
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	3
Number of facilities - Pyrolysis ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Sng (quantity)	0	0	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	0.02	0.03	0.03	2.76
Annual - BECCS (MMT)		0	0.01	0.02	0.02	0.02	2.75
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0.01
Cumulative - All (MMT)		0	0.01	0.03	0.06	0.09	2.85
Cumulative - BECCS (MMT)		0	0.01	0.03	0.05	0.07	2.82
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0.01

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	171	314	314	314	393
Cumulative investment - All (million \$2018)		0	264	339	339	339	407
Cumulative investment - Spur (million \$2018)		0	19.1	94.2	94.2	94.2	162
Cumulative investment - Trunk (million \$2018)		0	245	245	245	245	245
Spur (km)		0	36.2	179	179	179	257
Trunk (km)		0	135	135	135	135	135

#### 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,		0	0	0	0	0	0
permitting costs (million \$2020)							
Wells and facilities construction costs		0	0	0	0	0	0
(million \$2020)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
grasses (1000 touze/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-105
deployment - Cropland measures (1000							
tCO2e/y) Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							U
crops (1000 tC02e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Aggressive							-3.29
deployment - Permanent conservation							
cover (1000 tC02e/y)							100
Carbon sink potential - Aggressive							-109
deployment - Total (1000 tC02e/y)  Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							U
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-55
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tC02e/y)							
Carbon sink potential - Moderate deployment - Pasture to energy crops							0
(1000 tC02e/y)							
Carbon sink potential - Moderate							-1.64
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-56.7
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)  Land impacted for carbon sink -							157
Aggressive deployment - Cropland							157
measures (1000 hectares)							
Land impacted for carbon sink -							0
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							1.5
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							F 00
Land impacted for carbon sink - Aggressive deployment - Permanent							5.98
conservation cover (1000 hectares)							
Land impacted for carbon sink -							164
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							33.2
deployment - Cropland measures (1000 hectares)							
Land impacted for carbon sink - Moderate	+						0
deployment - Cropland to woody energy							U
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							1.5
deployment - Pasture to energy crops							
(1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate							2.99
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							37.7
deployment - Total (1000 hectares)							

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

Table 57: E-B+ scenario - PILLAR 6: Land	sinks - Fores	sts					
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-36.4
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-4,728
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,146
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-1,955
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-518
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-210
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-307
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-555
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-18.3
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-1,417
counting overlap) (1000 tCO2e/y)							•
Carbon sink potential - Low - Avoid							-191
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-751
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-173
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-73.7
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-23.3
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-187
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-27.4
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-3,072
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-669
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-1,353
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-345
retention of HWP (1000 tCO2e/y)							

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

Item Corporation Mid Increase	2020	2025	2030	2035	2040	2045	2050 -142
Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y)							-142
							(
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							·
Carbon sink potential - Mid - Reforest							-165
pasture (1000 tC02e/y)							-100
Carbon sink potential - Mid - Restore							-371
productivity (1000 tC02e/y)							-31
Land impacted for carbon sink potential -							5.96
High - Accelerate regeneration (1000							0.70
hectares)							
Land impacted for carbon sink potential -							155
High - Avoid deforestation (over 30 years)							100
(1000 hectares)							
Land impacted for carbon sink potential -							997
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							C
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							С
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							20
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							C
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							8.73
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							184
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,371
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2.98
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							146
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							000
Land impacted for carbon sink potential -							382
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							C
Low - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							
Low - Increase retention of HWP (1000							·
hectares)							
Land impacted for carbon sink potential -							10.5
Low - Increase trees outside forests							10.5
(1000 hectares)							
Land impacted for carbon sink potential -							
Low - Reforest cropland (1000 hectares)							·
Land impacted for carbon sink potential -							1.5
Low - Reforest pasture (1000 hectares)							1.5
Land impacted for carbon sink potential -							111
Land impacted for carbon sink potential -							111
Low - Restore productivity (1000	1	1	I	1	l l	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 - Low - Total impacted (over 30 years) (1000 hectares)							654
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							4.47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							150
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							689
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							0
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)							15.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							10.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							224
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,095

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		557	0.598	0.597	0.568	0.345	0.018
Monetary damages from air pollution - Natural Gas (million 2019\$)		283	116	54.9	43.4	26.5	14.5
Monetary damages from air pollution - Transportation (million 2019\$)		2,064	2,069	1,991	1,771	1,392	941
Premature deaths from air pollution - Coal (deaths)		62.9	0.068	0.067	0.064	0.039	0.002
Premature deaths from air pollution - Natural Gas (deaths)		32	13.1	6.2	4.9	2.99	1.63
Premature deaths from air pollution - Transportation (deaths)		232	233	224	199	157	106

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		13,153	13,534				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	36.9	39	38.6	38.5	38.3	38.5	38.4
Resistance (%)							
Sales of cooking units - Gas (%)	63.1	61	61.4	61.5	61.7	61.5	61.6
Sales of space heating units - Electric	4.31	12.9	41	64	67.7	68.1	68.2
Heat Pump (%)							
Sales of space heating units - Electric	2.07	2.89	7.66	20	30.1	31.7	31.8
Resistance (%)							
Sales of space heating units - Fossil (%)	23.7	33.3	23.6	9.31	1.33	0.106	0

Table CO. DCC assessia	DILLAD 1. Efficiency /Floorwiff continue	0
Table 59: REE Scenorio	- PTLLAR 1 <sup>,</sup> Efficiency/Flectrification -	Commerciai I continuea i

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace	69.9	50.9	27.8	6.73	0.854	0.047	0
Sales of water heating units - Electric	2.04	2.38	2.35	2.36	2.34	2.36	2.35
Heat Pump (%)							
Sales of water heating units - Electric	10.2	11.3	11.1	11.3	11.2	11.1	11.1
Resistance (%)							
Sales of water heating units - Gas Furnace	84.8	82.1	82.5	82.3	82.3	82.6	82.5
(%)							
Sales of water heating units - Other (%)	2.99	4.16	4.05	4.05	4.14	3.96	4.03

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.9	1.89	4.44	4.74	4.91	5.2
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)	253	246	249	250	251	258	269
Final energy use - Industry (PJ)	81.4	81.9	84.8	88.8	94.4	99.2	104
Final energy use - Residential (PJ)	286	272	264	261	258	256	255
Final energy use - Transportation (PJ)	501	474	444	426	429	442	458

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.48	5.7				
Sales of cooking units - Electric Resistance (%)	63.6	63.6	63.6	63.6	63.6	63.6	63.6
Sales of cooking units - Gas (%)	36.4	36.4	36.4	36.4	36.4	36.4	36.4
Sales of space heating units - Electric Heat Pump (%)	6.66	9.84	10.2	10.6	10.9	11.2	11.6
Sales of space heating units - Electric Resistance (%)	6.21	8.92	8.73	8.57	8.52	8.08	7.76
Sales of space heating units - Fossil (%)	32.5	40.9	22.6	9.73	8.85	8.82	8.8
Sales of space heating units - Gas (%)	54.6	40.4	58.5	71.1	71.7	71.9	71.8
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	30.5	48.1	48.1	48.2	48.2	48.2	48.2
Sales of water heating units - Gas Furnace (%)	60	45.1	45.1	45	45	45	45
Sales of water heating units - Other (%)	9.47	6.78	6.78	6.83	6.83	6.84	6.85

#### 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 (%)	1.4	1.84	2.16	2.01	1.81	1.68	1.6
Vehicle sales - Light-duty - EV (%)	4.05	6.23	7.05	8.7	10.6	12.1	13.3
Vehicle sales - Light-duty - gasoline (%)	89.4	85.7	83.4	81.3	79.2	77.3	75.8
Vehicle sales - Light-duty - hybrid (%)	4.92	5.75	7	7.55	8.08	8.59	8.94

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - hydrogen FC	0.11	0.372	0.337	0.298	0.293	0.293	0.303
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.099	0.095	0.096	0.095	0.094	0.096
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen	0.175	0.208	0.242	0.285	0.339	0.409	0.487
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate	2020	2020	2000	2000	2040	2040	-36.4
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-4,728
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,146
deforestation (1000 tC02e/y)							1055
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-1,955
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							U
Carbon sink potential - High - Increase							-518
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-210
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-307
pasture (1000 tCO2e/y)  Carbon sink potential - High - Restore							-555
productivity (1000 tCO2e/y)							-555
Carbon sink potential - Low - Accelerate							-18.3
regeneration (1000 tCO2e/y)							10.0
Carbon sink potential - Low - All (not							-1,417
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-191
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-751
rotation length (1000 tC02e/y)							0
Carbon sink potential - Low - Improve plantations (1000 tC02e/y)							U
Carbon sink potential - Low - Increase							-173
retention of HWP (1000 tCO2e/y)							110
Carbon sink potential - Low - Increase							-73.7
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-23.3
pasture (1000 tC02e/y)							107
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-187
Carbon sink potential - Mid - Accelerate							-27.4
regeneration (1000 tCO2e/y)							21.4
Carbon sink potential - Mid - All (not							-3,072
counting overlap) (1000 tCO2e/y)							,
Carbon sink potential - Mid - Avoid							-669
deforestation (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Extend							-1,353
rotation length (1000 tC02e/y)							
Carbon sink potential - Mid - Improve							0
plantations (1000 tC02e/y)							0/5
Carbon sink potential - Mid - Increase							-345
retention of HWP (1000 tC02e/y)							1/0
Carbon sink potential - Mid - Increase							-142
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-165
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-371
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							5.96
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							155
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							997
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							20
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							_
Land impacted for carbon sink potential -							8.73
High - Reforest pasture (1000 hectares)							00
Land impacted for carbon sink potential -							184
High - Restore productivity (1000							10-1
hectares)							
Land impacted for carbon sink potential -							1,371
High - Total impacted (over 30 years)							1,011
(1000 hectares)							
Land impacted for carbon sink potential -							2.98
Low - Accelerate regeneration (1000							2.70
hectares)							
Land impacted for carbon sink potential -							146
							140
Low - Avoid deforestation (over 30 years)							
(1000 hectares)  Land impacted for carbon sink potential -							382
·							302
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							10.5
Low - Increase trees outside forests							
(1000 hectares)							

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Table 64'	RFF scenario	- PILLAR 6' I	l and sinks -	- Enrests I	continuedi

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							1.51
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							111
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							654
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4.47
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							150
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							689
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							15.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							10.9
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							224
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,095
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-4.85		-2.63				-2.35
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.141		-0.253				-0.263
Business-as-usual carbon sink - Total (Mt CO2e/y)	-4.99		-2.89				-2.62

#### Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		1,560	979	909	885	867	767
Monetary damages from air pollution - Natural Gas (million 2019\$)		223	162	211	251	229	208
Monetary damages from air pollution - Transportation (million 2019\$)		2,059	2,091	2,116	2,147	2,176	2,204
Premature deaths from air pollution - Coal (deaths)		176	111	103	100	98	86.7
Premature deaths from air pollution - Natural Gas (deaths)		25.2	18.3	23.8	28.4	25.8	23.5

## Table 66: REF scenario - IMPACTS - Health (continued)

	•	,					
Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		232	235	238	242	245	248
Transportation (deaths)							