

Net-Zero America - georgia state report

2021-03-18

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 -		34,949	38,935				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	46	79.9	86.5	86.9	86.9	86.9
Resistance (%)							
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric	7.3	27.4	70.6	84	85.3	85.4	85.4
Heat Pump (%)							
Sales of space heating units - Electric	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Resistance (%)							
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	0	0	0
Sales of space heating units - Gas Furnace	86	60.5	18.4	3.67	2	1.95	1.94
(%)							
Sales of water heating units - Electric	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Heat Pump (%)							
Sales of water heating units - Electric	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Resistance (%)							
Sales of water heating units - Gas Furnace	92.1	74.6	14.1	0.594	0	0	0
(%)							
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		7.03	7.31	10.9	11.6	9.14	9.44
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)	252	253	245	233	223	221	224
Final energy use - Industry (PJ)	420	427	428	425	426	427	431
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		8.06	8.87				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	66.9	74	95.5	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Sales of space heating units - Electric	25.4	45	81.3	89.4	89.8	89.7	89.7
Heat Pump (%)							
Sales of space heating units - Electric	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Resistance (%)							
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of water heating units - Electric	0	11.6	61.4	72.5	73	72.9	72.9
Heat Pump (%)							
Sales of water heating units - Electric	47.2	57.2	31	25.2	24.9	24.9	24.9
Resistance (%)							
Sales of water heating units - Gas Furnace	50	29.1	5.49	0.232	0	0	0
(%)							
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,609	4,204	6,681	10,172	11,015	10,532
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.376		3.15		12.8		20.6
units)							
Public EV charging plugs - L2 (1000 units)	2.43		75.7		308		494
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 (%)	1.47	1.74	1.22	0.391	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.2	16.1	47.7	82.3	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.4	77	47.5	16	3.22	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.69	4.74	3.31	1.22	0.298	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.335	0.196	0.061	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.098	0.094	0.06	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	0	0	0	0	0	0	0
(billion \$2018)							
Capital invested - Biomass w/ccu allam	0	0	0	0.034	0	0	0.013
power plant (billion \$2018)							
Capital invested - Biomass w/ccu power	0	0	0	0.007	6.93	0.666	0.001
plant (billion \$2018)							
Capital invested - Solar PV - Base (billion		0	6.5	23.3	14.7	31.2	25.3
\$2018)							
Capital invested - Solar PV - Constrained		1.41	10.8	26.5	21	26.4	28.1
(billion \$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 - Rooftop PV (MW)	381	614	869	1,237	1,756	2,428	3,288
Installed renewables - Solar - Base land	1,259	1,259	7,616	32,309	48,813	86,096	118,046
use assumptions (MW)							
Installed renewables - Solar -	1,176	1,176	7,240	23,564	49,101	82,514	111,786
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	0	0	0	0	0	0	0
use assumptions (MW)							
Installed renewables - Wind - Constrained	0	0	0	0	0	0	0
land use assumptions (MW)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	33.7	33.7	33.7	47
Biomass w/ccu power plant (GWh)	0	0	0	8.06	7,781	8,528	8,529

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

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)	2,538	2,538	13,248	54,705	82,365	144,675	198,271
Solar - Constrained land use assumptions	2,371	2,371	12,565	39,857	82,678	138,608	187,741
(GWh)							
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Wind - Constrained land use assumptions	0	0	0	0	0	0	0
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	0	18.6	628	1,015	1,134
Conversion capital investment -		0	0	408	13,059	7,815	2,416
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	1	1	1	2
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	1	6	14	16
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	1	6	7	8
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	1	1	1	2
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0.55	18.4	25.9	31.9
Annual - BECCS (MMT)		0	0	0.47	16.5	25.8	28.8
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0.08	1.93	0.05	3.05
Cumulative - All (MMT)		0	0	0.55	19	44.8	76.7
Cumulative - BECCS (MMT)		0	0	0.47	17	42.8	71.6
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0.08	2.01	2.06	5.11

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

14510 10: 21 000114110 11 122/111 1: 0000 0	OZ pipomie	,0					
Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	570	1,282	2,064	3,105	3,550
Cumulative investment - All (million		0	2,891	5,025	5,797	6,725	7,046
\$2018)							
Cumulative investment - Spur (million		0	0	206	978	1,906	2,226
\$2018)							
Cumulative investment - Trunk (million		0	2,891	4,819	4,819	4,819	4,819
\$2018)							
Spur (km)		0	0	376	1,159	2,199	2,645
Trunk (km)		0	570	906	906	906	906

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

	•						
Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	5.28	7.23	12.1	16.8
Injection wells (wells)		0	4	18	30	52	66
Resource characterization, appraisal, permitting costs (million \$2020)		101	277	379	379	379	379
Wells and facilities construction costs (million \$2020)		0	135	528	941	1,573	1,953

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-66
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-3,806
deployment - Cropland measures (1000							
tCO2e/y)							/77
Carbon sink potential - Aggressive							-67.7
deployment - Permanent conservation							
cover (1000 tC02e/y)							0.07.0
Carbon sink potential - Aggressive							-3,940
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-66
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							1.075
Carbon sink potential - Moderate							-1,975
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-33.9
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-2,075
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							38.6
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,609
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							123
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,771
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							38.6
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							835
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							61.6
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							935
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-781
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-61,940
counting overlap) (1000 tC02e/y)							
Carbon sink potential - High - Avoid							-2,764
deforestation (1000 tC02e/y)							10.001
Carbon sink potential - High - Extend							-12,001
rotation length (1000 tCO2e/y) Carbon sink potential - High - Improve							/ / / 0
plantations (1000 tCO2e/y)							-6,449
Carbon sink potential - High - Increase							-25,469
retention of HWP (1000 tCO2e/y)							-23,469
Carbon sink potential - High - Increase							-1,000
trees outside forests (1000 tCO2e/y)							-1,000
Carbon sink potential - High - Reforest							-1,887
cropland (1000 tCO2e/y)							-1,001
Carbon sink potential - High - Reforest							-5,666
pasture (1000 tCO2e/y)							0,000
Carbon sink potential - High - Restore							-5,922
productivity (1000 tCO2e/y)							0//
Carbon sink potential - Low - Accelerate							-391
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-20,952
counting overlap) (1000 tCO2e/y)							-, -
Carbon sink potential - Low - Avoid							-461
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,610
rotation length (1000 tCO2e/y)							•
Carbon sink potential - Low - Improve							-3,281
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-8,490
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-350
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-944
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-429
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,996
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-586
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-41,389
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,612
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-8,306
rotation length (1000 tC02e/y)							
Carbon sink potential - Mid - Improve							-4,808
plantations (1000 tC02e/y)							
Carbon sink potential - Mid - Increase							-16,980
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-675
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-1,415
cropland (1000 tC02e/y)							22:-
Carbon sink potential - Mid - Reforest							-3,047
pasture (1000 tC02e/y)							2.2-2
Carbon sink potential - Mid - Restore							-3,959
productivity (1000 tCO2e/y)							

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

lable 13: E+ scenario - PILLAR 6: Land sink		·			2212		
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							128
High - Accelerate regeneration (1000							
hectares)							07/
Land impacted for carbon sink potential -							374
High - Avoid deforestation (over 30 years)							
(1000 hectares)							(100
Land impacted for carbon sink potential -							6,120
High - Extend rotation length (1000							
hectares)							0.07/
Land impacted for carbon sink potential -							2,376
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 -							95
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							125
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							161
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,963
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							11,342
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							63.9
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							351
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,345
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,188
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 -							50
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							62.4
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							27.9
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,188
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,276
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							95.8
Mid - Accelerate regeneration (1000							
hectares)		I .				I	

Table 13: E+	econario -	DTIIAP 6.	I and sinks -	Enrocte	(continued)
Table 15. E+	SCEHUITO -	PILLAR D.	LUHU SHIKS -	FULESTS	COMUNICEUR

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							363
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,232
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,788
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 -							72.5
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							93.6
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							202
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,392
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							9,239
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)		572	482	387	291	183	127
Natural gas consumption - Cumulative							11,650
(tcf)							
Natural gas production - Annual (tcf)		0	0	0	0	0	0
Oil consumption - Annual (million bbls)		162	137	101	67.5	41.5	21.7
Oil consumption - Cumulative (million							3,127
bbls)							
Oil production - Annual (million bbls)		0	0	0	0	0	0

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		458	0.839	0.761	0.535	0.353	0.029
Monetary damages from air pollution - Natural Gas (million 2019\$)		310	291	175	133	67.2	25.4
Monetary damages from air pollution - Transportation (million 2019\$)		3,449	3,336	2,621	1,565	731	289
Premature deaths from air pollution - Coal (deaths)		51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Natural Gas (deaths)		35	32.8	19.8	15	7.59	2.87
Premature deaths from air pollution - Transportation (deaths)		388	375	295	176	82.2	32.5

Table 16: E+ scenario - IMPACTS - Jobs

2020	2025	2030	2035	2040	2045	2050
	518	841	481	1,473	1,714	1,546
	8,017	13,649	25,968	24,743	36,486	43,167
	13,877	25,461	25,847	21,005	24,522	20,768
	3,112	2,251	1,494	912	602	360
	2020	518 8,017 13,877	518 841 8,017 13,649 13,877 25,461	518 841 481 8,017 13,649 25,968 13,877 25,461 25,847	518 841 481 1,473 8,017 13,649 25,968 24,743 13,877 25,461 25,847 21,005	518 841 481 1,473 1,714 8,017 13,649 25,968 24,743 36,486 13,877 25,461 25,847 21,005 24,522

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

Table 16: E+ scenario - IMPACTS - Jobs (co	intinueaj						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		579	1,616	4,570	4,627	8,156	10,212
By economic sector - Pipeline (jobs)		733	929	757	444	412	396
By economic sector - Professional (jobs)		4,605	6,026	10,432	11,691	17,726	21,767
By economic sector - Trade (jobs)		3,315	4,064	7,122	7,274	11,466	14,462
By economic sector - Utilities (jobs)		12,277	14,692	19,695	20,934	26,102	31,429
By education level - All sectors -		14,596	21,930	30,902	29,700	40,706	46,413
Associates degree or some college (jobs)							
By education level - All sectors -		10,049	14,015	18,743	18,146	24,630	27,889
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		295	385	582	602	869	1,026
degree (jobs)							
By education level - All sectors - High		19,782	30,088	41,798	40,316	54,974	61,812
school diploma or less (jobs)							
By education level - All sectors - Masters		2,309	3,112	4,341	4,339	6,007	6,967
or professional degree (jobs)							
By resource sector - Biomass (jobs)		1,824	2,220	1,246	4,360	6,262	6,637
By resource sector - CO2 (jobs)		54.7	2,697	2,528	1,044	1,978	2,463
By resource sector - Coal (jobs)		1,328	0	0	0	0	0
By resource sector - Grid (jobs)		13,098	16,979	28,948	32,373	45,105	57,917
By resource sector - Natural Gas (jobs)		7,360	6,976	5,694	6,745	4,317	3,553
By resource sector - Nuclear (jobs)		3,150	3,100	2,705	2,175	1,690	605
By resource sector - Oil (jobs)		7,190	5,570	3,788	2,362	1,358	666
By resource sector - Solar (jobs)		12,993	31,052	50,735	41,815	60,787	64,464
By resource sector - Wind (jobs)		33.8	933	720	2,229	5,690	7,803
Median wages - Annual - All (\$2019 per		56,677	55,664	55,966	57,160	57,723	58,897
job)		7.547	11.17/	15.707	15 100	00.750	
On-Site or In-Plant Training - Total jobs - 1		7,516	11,176	15,784	15,180	20,750	23,661
to 4 years (jobs)							
On-Site or In-Plant Training - Total jobs - 4		2,807	4,041	6,176	6,059	8,443	9,921
to 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		7,660	11,410	15,790	15,238	20,886	23,555
None (jobs)							
On-Site or In-Plant Training - Total jobs -		381	570	824	802	1,102	1,275
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		28,669	42,332	57,791	55,824	76,006	85,696
Up to 1 year (jobs)							
On-the-Job Training - All sectors - 1 to 4		9,621	14,270	20,250	19,483	26,638	30,450
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		2,670	3,893	6,097	6,004	8,423	9,951
years (jobs)				•	-		
On-the-Job Training - All sectors - None		2,524	3,690	5,212	5,023	6,978	7,930
(jobs)		_, :	5,515	-,	5,525	7,	.,
On-the-Job Training - All sectors - Over 10		478	755	1,028	943	1,275	1,393
years (jobs)			.00	1,020	, .0	1,210	1,070
On-the-Job Training - All sectors - Up to 1		31,738	46,921	63,779	61,649	83,873	94,384
year (jobs)		31,130	40,721	03,117	01,047	03,013	74,504
Related work experience - All sectors - 1		16,928	24,699	34,161	33,101	45,188	51,334
to 4 years (jobs)		10,720	24,077	34,101	33,101	45,100	J1,JJ4
Related work experience - All sectors - 4		10.007	15 000	22 100	01 007	20.07.0	33,061
		10,896	15,900	22,109	21,297	29,042	33,061
to 10 years (jobs)		/ 707	0077	10.000	10 550	10 507	011/0
Related work experience - All sectors -		6,707	9,946	13,923	13,558	18,587	21,169
None (jobs)							
Related work experience - All sectors -		3,075	4,541	6,069	5,750	7,728	8,636
Over 10 years (jobs)							
Related work experience - All sectors - Up		9,425	14,443	20,104	19,397	26,641	29,908
to 1 year (jobs)							
Wage income - All (million \$2019)		2,666	3,870	5,394	5,322	7,343	8,489

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		34,927	38,922				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	36.2	40.9	53.4	71	81.7	85.5
Resistance (%)							
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric	7.3	19.2	24.1	38.5	61	76.9	83
Heat Pump (%)							
Sales of space heating units - Electric	6.68	7.92	8.16	8.87	10.2	11.6	12.4
Resistance (%)							
Sales of space heating units - Fossil (%)	0	4.46	4.13	3.1	1.52	0.487	0.128
Sales of space heating units - Gas Furnace	86	68.4	63.6	49.6	27.2	11	4.45
(%)							
Sales of water heating units - Electric	0.221	2.04	7.05	21.5	43.6	58	63
Heat Pump (%)							
Sales of water heating units - Electric	5.5	7.53	9.45	15.2	24	29.8	31.8
Resistance (%)							
Sales of water heating units - Gas Furnace	92.1	86.3	79.4	59.6	29.1	9.31	2.42
(%)							
Sales of water heating units - Other (%)	2.13	4.12	4.13	3.73	3.23	2.87	2.75

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.72	5.83	7.6	7.92	9.61	10.1
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)	252	254	251	248	242	237	235
Final energy use - Industry (PJ)	420	427	430	431	435	436	439
Final energy use - Residential (PJ)	362	345	337	326	309	288	268
Final energy use - Transportation (PJ)	1,059	999	916	848	794	730	654

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		7.98	8.75				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	66.8	67.7	70.7	78.7	89.9	96.7	99.1
Resistance (%)							
Sales of cooking units - Gas (%)	33.2	32.3	29.3	21.3	10.1	3.27	0.881
Sales of space heating units - Electric	25.4	38	42.2	54.2	72.4	84.2	88.3
Heat Pump (%)							
Sales of space heating units - Electric	18.4	21.9	20.5	16.6	10.8	7.24	5.98
Resistance (%)							
Sales of space heating units - Fossil (%)	4.42	6.22	5.88	4.75	3	1.86	1.47
Sales of space heating units - Gas (%)	51.8	33.9	31.4	24.5	13.8	6.68	4.21
Sales of water heating units - Electric	0	1.99	7.66	24	49	65.3	70.9
Heat Pump (%)							
Sales of water heating units - Electric	47.2	62.3	59.3	50.6	37.5	28.9	26
Resistance (%)							
Sales of water heating units - Gas Furnace	50	33.6	30.9	23.3	11.4	3.65	0.952
(%)							
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.14	2.15

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)		0	274	545	1,871	5,792	8,472
Public EV charging plugs - DC Fast (1000 units)	0.376		1.11		4.86		13.2
Public EV charging plugs - L2 (1000 units)	2.43		26.7		117		316
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 (%)	1.48	1.9	2.04	1.62	1.03	0.527	0.226
Vehicle sales - Light-duty - EV (%)	1.99	4.9	12.3	26.6	49.1	72.5	87.8
Vehicle sales - Light-duty - gasoline (%)	91.5	87.1	78.9	65.8	45.4	24.3	10.8
Vehicle sales - Light-duty - hybrid (%)	4.87	5.66	6.33	5.72	4.25	2.48	1.2
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.378	0.321	0.243	0.172	0.095	0.044
Vehicle sales - Light-duty - other (%)	0.099	0.103	0.093	0.081	0.058	0.032	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
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							-66
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,806
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-67.7
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,940
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-66
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,975
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-33.9
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-2,075
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							38.6
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,609
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							123
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 -							1,771
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							38.6
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							835
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							61.6
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							935
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							-781
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-61,940
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,764
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-12,001
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-6,449
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-25,469
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,000
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-1,887
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,666
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-5,922
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-391
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-20,952
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-461
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,610
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-3,281
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-8,490
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-350
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-944
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-429
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,996
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-586
regeneration (1000 tCO2e/y)							

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

Item Carbon sink potential - Mid - All (not	2020	2025	2030	2035	2040	2045	2050 -41,389
counting overlap) (1000 tCO2e/y)							•
Carbon sink potential - Mid - Avoid deforestation (1000 tC02e/y)							-1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y)							-675
Carbon sink potential - Mid - Reforest							-1,415
cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest							-3,047
pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore							-3,959
productivity (1000 tC02e/y) Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							2,376
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)							95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,342
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							1,188
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 -							50
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							62.4
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							27.9
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,188
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,276
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							95.8
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							363
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,232
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,788
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 -							72.5
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							93.6
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							202
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,392
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							9,239
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		458	0.839	0.761	0.535	0.353	0.029
Coal (million 2019\$)							
Monetary damages from air pollution -		308	210	87.8	29.9	9.22	5.25
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		3,513	3,692	3,720	3,460	2,838	1,999
Transportation (million 2019\$)							
Premature deaths from air pollution -		51.7	0.095	0.086	0.06	0.04	0.003
Coal (deaths)							
Premature deaths from air pollution -		34.8	23.7	9.91	3.38	1.04	0.593
Natural Gas (deaths)							
Premature deaths from air pollution -		395	415	418	389	319	225
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)		34,949	38,935				
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	7.3	27.4	70.6	84	85.3	85.4	85.4
Sales of space heating units - Electric Resistance (%)	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	0	0	0
Sales of space heating units - Gas Furnace (%)	86	60.5	18.4	3.67	2	1.95	1.94
Sales of water heating units - Electric Heat Pump (%)	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Sales of water heating units - Electric Resistance (%)	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Sales of water heating units - Gas Furnace (%)	92.1	74.6	14.1	0.594	0	0	0
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		7.03	7.31	10.9	11.6	9.14	9.44
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)	252	253	245	233	223	221	224
Final energy use - Industry (PJ)	420	427	428	425	426	427	431
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		8.06	8.87				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	66.9	74	95.5	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Sales of space heating units - Electric	25.4	45	81.3	89.4	89.8	89.7	89.7
Heat Pump (%)							
Sales of space heating units - Electric	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Resistance (%)							
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of water heating units - Electric	0	11.6	61.4	72.5	73	72.9	72.9
Heat Pump (%)							
Sales of water heating units - Electric	47.2	57.2	31	25.2	24.9	24.9	24.9
Resistance (%)							
Sales of water heating units - Gas Furnace	50	29.1	5.49	0.232	0	0	0
(%)							
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,609	4,204	6,681	10,172	11,015	10,532
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.376		3.15		12.8		20.6
units)							
Public EV charging plugs - L2 (1000 units)	2.43		75.7		308		494
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 (%)	1.47	1.74	1.22	0.391	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.2	16.1	47.7	82.3	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.4	77	47.5	16	3.22	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.69	4.74	3.31	1.22	0.298	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.335	0.196	0.061	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.098	0.094	0.06	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 - Offshore Wind - Base		0	0	0	0	0.214	18.5
(billion \$2018)							
Capital invested - Solar PV - Base (billion		0.849	8.24	44	39.1	25.6	31.1
\$2018)							
Installed renewables - OffshoreWind -	0	0	0	0	0	145	14,875
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	28,997
Constrained land use assumptions (MW)							
Installed renewables - Solar - Base land	1,259	2,002	10,057	56,767	100,810	131,410	170,775
use assumptions (MW)							
Installed renewables - Solar -	2,519	6,366	41,556	119,226	202,229	284,556	363,290
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	0	0	0	0	0	0	0
use assumptions (MW)							
Installed renewables - Wind - Constrained	0	0	0	0	0	0	0
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	514	52,926
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	103,114
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	2,538	3,787	17,297	95,627	169,536	220,970	287,120
Solar - Constrained land use assumptions	5,076	11,571	70,639	200,934	340,126	478,238	610,957
(GWh)							
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Wind - Constrained land use assumptions	0	0	0	0	0	0	0
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-66
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,806
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-67.7
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-3,940
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-66
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,975
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-33.9
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,075
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							38.6
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,609
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							123
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,771
Aggressive deployment - Total (1000							•
hectares)							
Land impacted for carbon sink - Moderate							38.6
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							835
deployment - Cropland measures (1000							230
hectares)							
Land impacted for carbon sink - Moderate							61.6
deployment - Permanent conservation							01.0
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							935
deployment - Total (1000 hectares)							/00
aspisymonic rotal (1000 hostal co)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-781
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-61,940
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,764
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-12,001
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-6,449
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-25,469
retention of HWP (1000 tCO2e/y)							

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

Item Conhon sink notantial High Increase	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-1,000
trees outside forests (1000 tC02e/y)							1.00
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,88
Carbon sink potential - High - Reforest pasture (1000 tC02e/y)							-5,666
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,922
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-39
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-20,952
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)							-46
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-3,28
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)							-350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - Low - Reforest pasture (1000 tC02e/y)							-429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,99
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-58
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-41,38
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,61
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,30
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-4,80
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-16,98
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-67
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,41
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,04
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,95
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							12
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							37
(1000 hectares) Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,12
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							2,37

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

Land impacted for carbon sink potential -	2020	2025	2030	2035	2040	2045	2050
High - Increase retention of HWP (1000							·
hectares)							
Land impacted for carbon sink potential -							95
High - Increase trees outside forests							, ,
(1000 hectares)							
Land impacted for carbon sink potential -							125
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							16
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,96
High - Restore productivity (1000							
hectares)							44.07
Land impacted for carbon sink potential -							11,342
High - Total impacted (over 30 years)							
(1000 hectares) Land impacted for carbon sink potential -							63.9
Low - Accelerate regeneration (1000							03.1
hectares)							
Land impacted for carbon sink potential -							35
Low - Avoid deforestation (over 30 years)							00
(1000 hectares)							
Land impacted for carbon sink potential -							2,34
Low - Extend rotation length (1000							,-
hectares)							
Land impacted for carbon sink potential -							1,188
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							50
Low - Increase trees outside forests							
(1000 hectares)							(0.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential -							27.9
Low - Reforest pasture (1000 hectares)							21.
Land impacted for carbon sink potential -							1,188
Low - Restore productivity (1000							1,100
hectares)							
Land impacted for carbon sink potential -							5,27
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							95.8
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							36
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,23
Mid - Extend rotation length (1000							
hectares)							170
Land impacted for carbon sink potential -							1,788
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							
Mid - Increase retention of HWP (1000 hectares)							
Land impacted for carbon sink potential -		+					72.
Mid - Increase trees outside forests (1000							12.
hectares)							

Table 33: E+RE+ scenario -	DILLAR 6. Land sinks.	Enrests (continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							93.6
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							202
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,392
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							9,239
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 -		458	0.839	0.761	0.535	0.353	0.029
Coal (million 2019\$)							
Monetary damages from air pollution -		329	278	138	81.3	18.7	6.69
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		3,449	3,336	2,621	1,565	731	289
Transportation (million 2019\$)							
Premature deaths from air pollution -		51.7	0.095	0.086	0.06	0.04	0.003
Coal (deaths)							
Premature deaths from air pollution -		37.1	31.4	15.5	9.18	2.11	0.755
Natural Gas (deaths)							
Premature deaths from air pollution -		388	375	295	176	82.2	32.5
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		34,949	38,935				
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	7.3	27.4	70.6	84	85.3	85.4	85.4
Sales of space heating units - Electric Resistance (%)	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	0	0	0
Sales of space heating units - Gas Furnace (%)	86	60.5	18.4	3.67	2	1.95	1.94
Sales of water heating units - Electric Heat Pump (%)	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Sales of water heating units - Electric Resistance (%)	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Sales of water heating units - Gas Furnace (%)	92.1	74.6	14.1	0.594	0	0	0
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		7.03	7.31	10.9	11.6	9.14	9.44
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)	252	253	245	233	223	221	224

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	420	427	428	425	426	427	431
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		8.06	8.87				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	66.9	74	95.5	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Sales of space heating units - Electric	25.4	45	81.3	89.4	89.8	89.7	89.7
Heat Pump (%)							
Sales of space heating units - Electric	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Resistance (%)							
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of water heating units - Electric	0	11.6	61.4	72.5	73	72.9	72.9
Heat Pump (%)							
Sales of water heating units - Electric	47.2	57.2	31	25.2	24.9	24.9	24.9
Resistance (%)							
Sales of water heating units - Gas Furnace	50	29.1	5.49	0.232	0	0	0
(%)							
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,609	4,204	6,681	10,172	11,015	10,532
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.376		3.15		12.8		20.6
_units)							
Public EV charging plugs - L2 (1000 units)	2.43		75.7		308		494
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 (%)	1.47	1.74	1.22	0.391	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.2	16.1	47.7	82.3	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.4	77	47.5	16	3.22	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.69	4.74	3.31	1.22	0.298	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.335	0.196	0.061	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.098	0.094	0.06	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		0.592	1.02	4.63	8.35	15	1.17
\$2018)							
Capital invested - Solar PV - Constrained		0	0	7.72	9.68	11.9	0.605
(billion \$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	1,259	1,777	2,778	7,694	17,099	35,032	36,506
use assumptions (MW)							
Installed renewables - Solar -	1,259	1,259	1,259	9,461	20,362	34,503	35,268
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	0	0	0	0	0	0	0
use assumptions (MW)							
Installed renewables - Wind - Constrained	0	0	0	0	0	0	0
land use assumptions (MW)							

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)	2,538	3,410	5,100	13,337	29,100	59,194	61,675
Solar - Constrained land use assumptions	2,538	2,538	2,538	16,270	34,550	58,217	59,496
(GWh)							
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Wind - Constrained land use assumptions	0	0	0	0	0	0	0
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-66
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,806
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-67.7
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,940
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-66
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,975
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-33.9
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,075
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							38.6
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							1,609
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							123
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,771
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							38.6
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							835
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							61.6
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							935
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							-781
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-61,940
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,764
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-12,001
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-6,449
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-25,469
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,000
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-1,887
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,666
pasture (1000 tC02e/y)							
Carbon sink potential - High - Restore							-5,922
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-391
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-20,952
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-461
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,610
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-3,281
plantations (1000 tCO2e/y)							•
Carbon sink potential - Low - Increase							-8,490
retention of HWP (1000 tCO2e/y)							•
Carbon sink potential - Low - Increase							-350
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest		+	+				-944
cropland (1000 tCO2e/y)							, , ,

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

Item Conhon sink notantial Low Referent	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - Low - Reforest							-42
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,99
productivity (1000 tC02e/y)							
Carbon sink potential - Mid - Accelerate							-58
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-41,38
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,61
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-8,30
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-4,80
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-16,98
retention of HWP (1000 tCO2e/y)							,.
Carbon sink potential - Mid - Increase							-67
trees outside forests (1000 tC02e/y)							0.
Carbon sink potential - Mid - Reforest							-1,41
cropland (1000 tC02e/y)							-1,41
Carbon sink potential - Mid - Reforest							-3,04
pasture (1000 tC02e/y)							-3,04
							0.05
Carbon sink potential - Mid - Restore							-3,95
productivity (1000 tCO2e/y)							10
Land impacted for carbon sink potential -							12
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							37
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							6,12
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							2,37
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							9
High - Increase trees outside forests							,
(1000 hectares)							
Land impacted for carbon sink potential -							12
							12
High - Reforest cropland (1000 hectares)							1/
Land impacted for carbon sink potential -							16
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,96
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							11,34
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							63.
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							35
Low - Avoid deforestation (over 30 years)							30
(1000 hectares)							
Land impacted for carbon sink potential -							2,34
Low - Extend rotation length (1000							2,04
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1,188
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 -							50
Low - Increase trees outside forests							
(1000 hectares)							(0.1
Land impacted for carbon sink potential -							62.4
Low - Reforest cropland (1000 hectares)							070
Land impacted for carbon sink potential -							27.9
Low - Reforest pasture (1000 hectares)							1100
Land impacted for carbon sink potential -							1,188
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,276
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							95.8
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							363
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,232
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,788
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 -							72.5
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							93.6
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							202
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -			T				2,392
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							9,239
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		458	0.839	0.761	0.535	0.353	0.029
Monetary damages from air pollution - Natural Gas (million 2019\$)		315	293	303	240	81.5	25.1
Monetary damages from air pollution - Transportation (million 2019\$)		3,449	3,336	2,621	1,565	731	289
Premature deaths from air pollution - Coal (deaths)		51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Natural Gas (deaths)		35.5	33.1	34.3	27	9.2	2.83
Premature deaths from air pollution - Transportation (deaths)		388	375	295	176	82.2	32.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		34,927	38,922				
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump (%)	7.3	19.2	24.1	38.5	61	76.9	83
Sales of space heating units - Electric Resistance (%)	6.68	7.92	8.16	8.87	10.2	11.6	12.4
Sales of space heating units - Fossil (%)	0	4.46	4.13	3.1	1.52	0.487	0.128
Sales of space heating units - Gas Furnace (%)	86	68.4	63.6	49.6	27.2	11	4.45
Sales of water heating units - Electric Heat Pump (%)	0.221	2.04	7.05	21.5	43.6	58	63
Sales of water heating units - Electric Resistance (%)	5.5	7.53	9.45	15.2	24	29.8	31.8
Sales of water heating units - Gas Furnace (%)	92.1	86.3	79.4	59.6	29.1	9.31	2.42
Sales of water heating units - Other (%)	2.13	4.12	4.13	3.73	3.23	2.87	2.75

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.72	5.83	7.6	7.92	9.61	10.1
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)	252	254	251	248	242	237	235
Final energy use - Industry (PJ)	420	427	430	431	435	436	439
Final energy use - Residential (PJ)	362	345	337	326	309	288	268
Final energy use - Transportation (PJ)	1,059	999	916	848	794	730	654

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		7.98	8.75				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	66.8	67.7	70.7	78.7	89.9	96.7	99.1
Resistance (%)							
Sales of cooking units - Gas (%)	33.2	32.3	29.3	21.3	10.1	3.27	0.881
Sales of space heating units - Electric	25.4	38	42.2	54.2	72.4	84.2	88.3
Heat Pump (%)							
Sales of space heating units - Electric	18.4	21.9	20.5	16.6	10.8	7.24	5.98
Resistance (%)							
Sales of space heating units - Fossil (%)	4.42	6.22	5.88	4.75	3	1.86	1.47
Sales of space heating units - Gas (%)	51.8	33.9	31.4	24.5	13.8	6.68	4.21
Sales of water heating units - Electric	0	1.99	7.66	24	49	65.3	70.9
Heat Pump (%)							
Sales of water heating units - Electric	47.2	62.3	59.3	50.6	37.5	28.9	26
Resistance (%)							
Sales of water heating units - Gas Furnace	50	33.6	30.9	23.3	11.4	3.65	0.952
(%)							
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.14	2.15

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	274	545	1,871	5,792	8,472
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.376		1.11		4.86		13.2
units)							
Public EV charging plugs - L2 (1000 units)	2.43		26.7		117		316
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 (%)	1.48	1.9	2.04	1.62	1.03	0.527	0.226
Vehicle sales - Light-duty - EV (%)	1.99	4.9	12.3	26.6	49.1	72.5	87.8
Vehicle sales - Light-duty - gasoline (%)	91.5	87.1	78.9	65.8	45.4	24.3	10.8
Vehicle sales - Light-duty - hybrid (%)	4.87	5.66	6.33	5.72	4.25	2.48	1.2
Vehicle sales - Light-duty - hydrogen FC	0.112	0.378	0.321	0.243	0.172	0.095	0.044
(%)							
Vehicle sales - Light-duty - other (%)	0.099	0.103	0.093	0.081	0.058	0.032	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 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)	1	1	1	1	1	1	1
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	2	1	1	1	1	1	1
Capital invested - Biomass w/ccu power plant (billion \$2018)	1	1	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	1	1	1	1	1	1	1
Biomass w/ccu allam power plant (GWh)	2	1	1	1	1	1	1
Biomass w/ccu power plant (GWh)	1	1	1	1	1	1	1

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

	•	<u> </u>					
Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	0	1,341	2,217	2,884	2,939
Conversion capital investment -		0	0	18,864	12,338	8,109	678
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	9	10
(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	18	30	30	30
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	22.9	37.8	48.2	48.1
Annual - BECCS (MMT)		0	0	22.8	37.8	48.2	48.1
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0.07	0.05	0.05	0.04
Cumulative - All (MMT)		0	0	22.9	60.7	109	157
Cumulative - BECCS (MMT)		0	0	22.8	60.6	109	157
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0.07	0.12	0.17	0.21

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	570	2,000	2,851	3,430	4,050
Cumulative investment - All (million \$2018)		0	2,891	6,153	7,284	8,156	8,572
Cumulative investment - Spur (million \$2018)		0	0	1,333	2,272	3,144	3,560
Cumulative investment - Trunk (million \$2018)		0	2,891	4,819	5,012	5,012	5,012
Spur (km)		0	0	1,095	1,945	2,525	3,144
Trunk (km)		0	570	906	906	906	906

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	6.42	11.9	15.8	16.7
Injection wells (wells)		0	4	18	32	54	68
Resource characterization, appraisal, permitting costs (million \$2020)		101	292	404	404	404	404
Wells and facilities construction costs (million \$2020)		0	141	548	976	1,633	2,027

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-306
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,445
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							
(1000 tCO2e/y)							
Carbon sink potential - Aggressive							-58.6
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,810
deployment - Total (1000 tCO2e/y)							

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

Table 56: E-B+ scenario - PILLAR 6: Land s	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate	2020	2020	2000	2000	2040	2040	-306
deployment - Corn-ethanol to energy							000
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,784
deployment - Cropland measures (1000							-1,104
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							U
crops (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							U
(1000 tCO2e/y)							
							-29.3
Carbon sink potential - Moderate							-29.3
deployment - Permanent conservation							
cover (1000 tC02e/y)							0.100
Carbon sink potential - Moderate							-2,120
deployment - Total (1000 tCO2e/y)							404
Land impacted for carbon sink -							191
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,605
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							85.3
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							147
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							
Land impacted for carbon sink -							107
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,135
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							191
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							757
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							85.3
deployment - Cropland to woody energy							
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							147
deployment - Pasture to energy crops							
(1000 hectares)							
Land impacted for carbon sink - Moderate							53.3
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,233
deployment - Total (1000 hectares)							.,=50
aspisyment Total (1000 Hootal 60)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-781
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-61,940
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,764
deforestation (1000 tCO2e/y)							

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

Item Carbon sink potential - High - Extend	2020	2025	2030	2035	2040	2045	2050 -12,00°
rotation length (1000 tCO2e/y)							-12,00
Carbon sink potential - High - Improve							-6,449
plantations (1000 tCO2e/y)							-0,449
Carbon sink potential - High - Increase							-25,469
retention of HWP (1000 tC02e/y)							-25,469
Carbon sink potential - High - Increase							-1,000
trees outside forests (1000 tCO2e/y)							-1,000
Carbon sink potential - High - Reforest							-1,887
cropland (1000 tCO2e/y)							-1,001
							Г///
Carbon sink potential - High - Reforest							-5,666
pasture (1000 tC02e/y)							F 000
Carbon sink potential - High - Restore							-5,922
productivity (1000 tCO2e/y)							00
Carbon sink potential - Low - Accelerate							-39
regeneration (1000 tCO2e/y)							00.050
Carbon sink potential - Low - All (not							-20,952
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-46
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-4,610
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-3,28
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-8,490
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-350
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-944
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-429
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,996
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-586
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-41,389
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,612
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-8,306
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-4,808
plantations (1000 tCO2e/y)							•
Carbon sink potential - Mid - Increase							-16,980
retention of HWP (1000 tCO2e/y)							-,
Carbon sink potential - Mid - Increase		+					-675
trees outside forests (1000 tC02e/y)							0.0
Carbon sink potential - Mid - Reforest							-1,415
cropland (1000 tCO2e/y)							.,
Carbon sink potential - Mid - Reforest							-3,04
pasture (1000 tC02e/y)							0,04
Carbon sink potential - Mid - Restore		-					-3,959
productivity (1000 tCO2e/y)							0,70
and impacted for carbon sink potential -				+			128
High - Accelerate regeneration (1000							120
nectares)							
-							374
Land impacted for carbon sink potential -							3/4
High - Avoid deforestation (over 30 years)	[

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 - High - Extend rotation length (1000							6,120
hectares)							
Land impacted for carbon sink potential - High - Improve plantations (1000							2,376
hectares)							0
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential -							95
High - Increase trees outside forests (1000 hectares)							90
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							161
Land impacted for carbon sink potential -							1,963
High - Restore productivity (1000 hectares)							
Land impacted for carbon sink potential - High - Total impacted (over 30 years)							11,342
(1000 hectares)							(0.0
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							63.9
Land impacted for carbon sink potential -							351
Low - Avoid deforestation (over 30 years) (1000 hectares)							001
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000							1,188
hectares)							
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential -							50
Low - Increase trees outside forests (1000 hectares)							30
Land impacted for carbon sink potential -							62.4
Low - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							27.9
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential - Low - Restore productivity (1000							1,188
hectares) Land impacted for carbon sink potential -							E 07/
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,276
Land impacted for carbon sink potential -							95.8
Mid - Accelerate regeneration (1000 hectares)							
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000							4,232
hectares) Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,788

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							72.5
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							93.6
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							202
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,392
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							9,239
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 -		458	0.839	0.761	0.535	0.353	0.029
Coal (million 2019\$)							
Monetary damages from air pollution -		352	215	97.2	59	29.9	12.2
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		3,513	3,692	3,720	3,460	2,838	1,999
Transportation (million 2019\$)							
Premature deaths from air pollution -		51.7	0.095	0.086	0.06	0.04	0.003
Coal (deaths)							
Premature deaths from air pollution -		39.8	24.3	11	6.66	3.37	1.38
Natural Gas (deaths)							
Premature deaths from air pollution -		395	415	418	389	319	225
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		34,430	35,753				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	34.3	34.3	34.3	34.4	34.3	34.3
Resistance (%)							
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Sales of space heating units - Electric	7.3	29.1	63.5	71.8	72.4	72.4	72.4
Heat Pump (%)							
Sales of space heating units - Electric	6.68	9.42	14.6	20.2	24.8	25.6	25.6
Resistance (%)							
Sales of space heating units - Fossil (%)	0	4.09	2.54	1.21	0.181	0.016	0
Sales of space heating units - Gas Furnace	86	57.4	19.3	6.83	2.61	2	1.94
(%)							
Sales of water heating units - Electric	0.221	0.279	0.274	0.275	0.276	0.274	0.275
Heat Pump (%)							
Sales of water heating units - Electric	5.5	6.83	6.74	6.75	6.78	6.74	6.75
Resistance (%)							
Sales of water heating units - Gas Furnace	92.1	88.7	88.7	88.7	88.7	88.7	88.7
(%)							
Sales of water heating units - Other (%)	2.13	4.16	4.3	4.23	4.29	4.32	4.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		7.5	7.83	10.5	11.1	9.45	9.79
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)	252	257	260	262	266	276	290
Final energy use - Industry (PJ)	420	441	459	477	500	522	549
Final energy use - Residential (PJ)	362	345	342	342	347	357	368
Final energy use - Transportation (PJ)	1,058	1,005	938	900	906	935	973

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		7.85	7.66				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	66.5	66.5	66.5	66.5	66.5	66.5	66.5
Resistance (%)							
Sales of cooking units - Gas (%)	33.5	33.5	33.5	33.5	33.5	33.5	33.5
Sales of space heating units - Electric	23.1	53.2	54.3	56	57.1	58.3	60.1
Heat Pump (%)							
Sales of space heating units - Electric	19	17.4	17.2	16.5	15.9	14.8	12.9
Resistance (%)							
Sales of space heating units - Fossil (%)	4.53	3.7	3.73	3.74	3.7	3.7	3.74
Sales of space heating units - Gas (%)	53.4	25.6	24.8	23.8	23.3	23.2	23.3
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	47.2	63.3	63.3	63.2	63.1	63	63
Resistance (%)							
Sales of water heating units - Gas Furnace	50	34.6	34.6	34.7	34.8	34.8	34.9
(%)							
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.15	2.16

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

2020	2025	2030	2035	2040	2045	2050
98.1	98.2	97.9	97	95.6	93.5	91.6
0	0	0	0	0	0	0
0.229	0.242	0.257	0.274	0.294	0.317	0.343
0.083	0.096	0.112	0.13	0.15	0.174	0.202
0.119	0.138	0.16	0.186	0.216	0.25	0.29
1.51	1.31	1.57	2.37	3.69	5.71	7.57
1.47	1.9	2.17	2.02	1.82	1.69	1.61
3.84	5.96	6.76	8.33	10.1	11.6	12.8
89.8	86.1	83.9	81.9	79.8	77.9	76.3
4.71	5.54	6.77	7.33	7.87	8.41	8.81
0.11	0.374	0.341	0.302	0.298	0.298	0.308
0.098	0.102	0.098	0.099	0.098	0.097	0.099
65.2	63.5	61.6	59.6	58	56.5	55.2
0.027	0.105	0.329	0.671	0.895	0.973	0.993
34	35.5	37	38.5	39.7	40.8	41.7
0.365	0.427	0.496	0.577	0.674	0.793	0.929
0.175	0.208	0.242	0.285	0.339	0.409	0.487
0.255	0.271	0.298	0.345	0.42	0.528	0.671
	98.1 0 0.229 0.083 0.119 1.51 1.47 3.84 89.8 4.71 0.11 0.098 65.2 0.027 34 0.365 0.175	98.1 98.2 0 0 0.229 0.242 0.083 0.096 0.119 0.138 1.51 1.31 1.47 1.9 3.84 5.96 89.8 86.1 4.71 5.54 0.11 0.374 0.098 0.102 65.2 63.5 0.027 0.105 34 35.5 0.365 0.427 0.175 0.208	98.1 98.2 97.9 0 0 0 0.229 0.242 0.257 0.083 0.096 0.112 0.119 0.138 0.16 1.51 1.31 1.57 1.47 1.9 2.17 3.84 5.96 6.76 89.8 86.1 83.9 4.71 5.54 6.77 0.11 0.374 0.341 0.098 0.102 0.098 65.2 63.5 61.6 0.027 0.105 0.329 34 35.5 37 0.365 0.427 0.496 0.175 0.208 0.242	98.1 98.2 97.9 97 0 0 0 0 0.229 0.242 0.257 0.274 0.083 0.096 0.112 0.13 0.119 0.138 0.16 0.186 1.51 1.31 1.57 2.37 1.47 1.9 2.17 2.02 3.84 5.96 6.76 8.33 89.8 86.1 83.9 81.9 4.71 5.54 6.77 7.33 0.11 0.374 0.341 0.302 0.098 0.102 0.098 0.099 65.2 63.5 61.6 59.6 0.027 0.105 0.329 0.671 34 35.5 37 38.5 0.365 0.427 0.496 0.577 0.175 0.208 0.242 0.285	98.1 98.2 97.9 97 95.6 0 0 0 0 0 0 0.229 0.242 0.257 0.274 0.294 0.083 0.096 0.112 0.13 0.15 0.119 0.138 0.16 0.186 0.216 1.51 1.31 1.57 2.37 3.69 1.47 1.9 2.17 2.02 1.82 3.84 5.96 6.76 8.33 10.1 89.8 86.1 83.9 81.9 79.8 4.71 5.54 6.77 7.33 7.87 0.11 0.374 0.341 0.302 0.298 0.098 0.102 0.098 0.099 0.098 65.2 63.5 61.6 59.6 58 0.027 0.105 0.329 0.671 0.895 34 35.5 37 38.5 39.7 0.365 0.427 0.496 <t< td=""><td>98.1 98.2 97.9 97 95.6 93.5 0 0 0 0 0 0 0.229 0.242 0.257 0.274 0.294 0.317 0.083 0.096 0.112 0.13 0.15 0.174 0.119 0.138 0.16 0.186 0.216 0.25 1.51 1.31 1.57 2.37 3.69 5.71 1.47 1.9 2.17 2.02 1.82 1.69 3.84 5.96 6.76 8.33 10.1 11.6 89.8 86.1 83.9 81.9 79.8 77.9 4.71 5.54 6.77 7.33 7.87 8.41 0.11 0.374 0.341 0.302 0.298 0.298 0.098 0.102 0.098 0.099 0.098 0.097 65.2 63.5 61.6 59.6 58 56.5 0.027 0.105 0.329</td></t<>	98.1 98.2 97.9 97 95.6 93.5 0 0 0 0 0 0 0.229 0.242 0.257 0.274 0.294 0.317 0.083 0.096 0.112 0.13 0.15 0.174 0.119 0.138 0.16 0.186 0.216 0.25 1.51 1.31 1.57 2.37 3.69 5.71 1.47 1.9 2.17 2.02 1.82 1.69 3.84 5.96 6.76 8.33 10.1 11.6 89.8 86.1 83.9 81.9 79.8 77.9 4.71 5.54 6.77 7.33 7.87 8.41 0.11 0.374 0.341 0.302 0.298 0.298 0.098 0.102 0.098 0.099 0.098 0.097 65.2 63.5 61.6 59.6 58 56.5 0.027 0.105 0.329

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

Table 64: REF scenario - PILLAR 6: Land s			2000	2005	00/0	2015	2050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-781
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-61,940
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,764
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-12,001
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-6,449
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-25,469
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,000
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-1,887
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,666
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-5,922
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-391
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-20,952
counting overlap) (1000 tCO2e/y)							-, -
Carbon sink potential - Low - Avoid							-461
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,610
rotation length (1000 tC02e/y)							1,010
Carbon sink potential - Low - Improve							-3,281
plantations (1000 tC02e/y)							0,201
Carbon sink potential - Low - Increase							-8,490
retention of HWP (1000 tCO2e/y)							0,470
Carbon sink potential - Low - Increase						+	-350
trees outside forests (1000 tC02e/y)							-550
Carbon sink potential - Low - Reforest							-944
cropland (1000 tCO2e/y)							-744
Carbon sink potential - Low - Reforest							-429
							-429
pasture (1000 tC02e/y)							100/
Carbon sink potential - Low - Restore							-1,996
productivity (1000 tC02e/y)							F0/
Carbon sink potential - Mid - Accelerate							-586
regeneration (1000 tC02e/y)							/1.000
Carbon sink potential - Mid - All (not							-41,389
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,612
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-8,306
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-4,808
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-16,980
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-675
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-1,415
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-3,047
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-3,959
productivity (1000 tCO2e/y)							
, , , , , , , , , , , , , , , , , , , ,							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -			2000			20.0	128
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							374
High - Avoid deforestation (over 30 years)							
(1000 hectares)							(100
Land impacted for carbon sink potential -							6,120
High - Extend rotation length (1000							
hectares) Land impacted for carbon sink potential -							2,376
High - Improve plantations (1000							2,310
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							J
hectares)							
Land impacted for carbon sink potential -							95
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							125
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							161
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,963
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							11,342
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							63.9
Low - Accelerate regeneration (1000							
hectares) Land impacted for carbon sink potential -							351
Low - Avoid deforestation (over 30 years)							331
(1000 hectares)							
Land impacted for carbon sink potential -						-	2,345
Low - Extend rotation length (1000							2,040
hectares)							
Land impacted for carbon sink potential -							1,188
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 -							50
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							62.4
Low - Reforest cropland (1000 hectares)							070
Land impacted for carbon sink potential -							27.9
Low - Reforest pasture (1000 hectares)							1100
Land impacted for carbon sink potential - Low - Restore productivity (1000							1,188
hectares)							
Land impacted for carbon sink potential -							5,276
Low - Total impacted (over 30 years)							5,210
(1000 hectares)							
Land impacted for carbon sink potential -							95.8
Mid - Accelerate regeneration (1000							, 5.0
hectares)							

<u>Table 64: REF scenario - PILLAR 6: Land sinks - Forests (continued)</u>

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years)							363
(1000 hectares)							
Land impacted for carbon sink potential -							4,232
Mid - Extend rotation length (1000 hectares)							
Land impacted for carbon sink potential -							1,788
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 -							72.5
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							93.6
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							202
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,392
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							9,239
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	-11.1		-19				-15.4
uptake (Mt CO2e/y)							
Business-as-usual carbon sink - Retained	-6.93		-11.6				-12.2
in Hardwood Products (Mt CO2e/y)							
Business-as-usual carbon sink - Total (Mt	-18		-30.5				-27.5
CO2e/y)							

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		1,958	1,331	1,080	977	935	926
Coal (million 2019\$)							
Monetary damages from air pollution -		306	381	400	439	483	526
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		3,505	3,734	3,959	4,203	4,447	4,695
Transportation (million 2019\$)							
Premature deaths from air pollution -		221	150	122	110	106	105
Coal (deaths)							
Premature deaths from air pollution -		34.5	43	45.1	49.6	54.5	59.4
Natural Gas (deaths)							
Premature deaths from air pollution -		394	420	445	473	500	528
Transportation (deaths)							