

Net-Zero America - mississippi 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 -		8,123	9,222				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Resistance (%)							
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric	9.46	29.3	77	90.8	91.9	92	92
Heat Pump (%)							
Sales of space heating units - Electric	4.72	4.61	4.92	6.26	6.57	6.57	6.55
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.89	0.56	0.024	0	0	0
Sales of space heating units - Gas Furnace	85.8	63.2	17.5	2.95	1.48	1.43	1.43
(%)							
Sales of water heating units - Electric	0.153	10.6	55.7	65.7	66.1	66.2	66.2
Heat Pump (%)							
Sales of water heating units - Electric	5.64	9.97	28	32.1	32.3	32.3	32.3
Resistance (%)							
Sales of water heating units - Gas Furnace	92.7	77.8	14.7	0.62	0	0	0
(%)							
Sales of water heating units - Other (%)	1.56	1.58	1.58	1.58	1.58	1.57	1.56

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.03	2.09	3.69	3.94	2.98	3.07
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)	70.6	70.6	68.1	64.4	61.3	60.1	60.4
Final energy use - Industry (PJ)	201	206	208	206	206	204	203
Final energy use - Residential (PJ)	99.2	92.9	85.6	76.5	69.1	64.8	63
Final energy use - Transportation (PJ)	350	323	285	238	196	170	160

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		2.27	2.78				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.8	81	96.7	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	24.2	19	3.26	0.164	0	0	0
Sales of space heating units - Electric	29.5	45.1	80.4	88.3	88.7	88.6	88.6
Heat Pump (%)							
Sales of space heating units - Electric	28.6	27.1	11.4	7.85	7.68	7.79	7.8
Resistance (%)							
Sales of space heating units - Fossil (%)	11.7	11.3	3.21	1.36	1.27	1.25	1.25
Sales of space heating units - Gas (%)	30.2	16.4	4.98	2.47	2.38	2.36	2.35
Sales of water heating units - Electric	0	12.1	64	75.6	76.1	76.1	76.1
Heat Pump (%)							
Sales of water heating units - Electric	67.2	69.3	30.5	21.8	21.4	21.4	21.4
Resistance (%)							
Sales of water heating units - Gas Furnace	29.2	16.1	3.02	0.128	0	0	0
(%)							
Sales of water heating units - Other (%)	3.59	2.49	2.46	2.47	2.48	2.48	2.49

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		398	1,016	1,653	2,501	2,725	2,596
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.053		0.878		3.92		6.35
units)							
Public EV charging plugs - L2 (1000 units)	0.175		21.1		94.3		153
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 (%)	1.54	1.81	1.26	0.402	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	3.93	15.2	46.5	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.7	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.44	4.55	3.22	1.19	0.291	0.064	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.339	0.203	0.063	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.097	0.064	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0.002	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	2.86	0	0	2.52	0
Capital invested - Solar PV - Base (billion \$2018)		1.43	1.39	5.45	9.46	9.29	10.8
Capital invested - Solar PV - Constrained (billion \$2018)		0.876	2.23	4.75	5.05	7.97	9.84
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	0.529	1.14
Capital invested - Wind - Constrained (billion \$2018)		0	0	0	15.8	0	0
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	16.9	27.3	38.6	55	78.1	108	146
Installed renewables - Solar - Base land use assumptions (MW)	57.5	1,306	2,668	8,450	19,104	30,185	43,876
Installed renewables - Solar - Constrained land use assumptions (MW)	52.5	1,042	3,281	13,125	21,236	33,049	45,975
Installed renewables - Wind - Base land use assumptions (MW)	0	0	0	0	0	472	1,550
Installed renewables - Wind - Constrained land use assumptions (MW)	0	0	0	0	13,398	13,398	13,398

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Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	2.37	2.37	2.37
Biomass w/ccu power plant (GWh)	0	0	3,205	3,205	3,205	6,036	6,036
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)	112	2,150	4,376	13,814	31,219	49,326	71,640
Solar - Constrained land use assumptions	103	1,718	5,358	21,445	34,720	53,997	75,091
(GWh)							
Wind - Base land use assumptions (GWh)	0	0	0	0	0	1,363	4,502
Wind - Constrained land use assumptions	0	0	0	0	33,562	33,562	33,562
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	125	365	581	1,029	1,029
Conversion capital investment -		0	2,620	4,363	3,928	8,452	0
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	1	1	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	4	7	14	14
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	2	2	2	4	4
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	1	1	1
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	3.17	13.7	18.5	30.9	31.4
Annual - BECCS (MMT)		0	3.17	8.78	13.7	24.3	24.3
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	4.93	4.83	6.52	7.04
Cumulative - All (MMT)		0	3.17	16.9	35.4	66.3	97.6
Cumulative - BECCS (MMT)		0	3.17	11.9	25.7	50	74.3
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	4.93	9.76	16.3	23.3

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	589	2,034	2,607	3,243	3,577
Cumulative investment - All (million \$2018)		0	2,939	6,495	6,986	7,602	7,791
Cumulative investment - Spur (million \$2018)		0	84.9	787	1,278	1,895	2,084
Cumulative investment - Trunk (million \$2018)		0	2,854	5,707	5,707	5,707	5,707
Spur (km)		0	103	1,060	1,633	2,269	2,604
Trunk (km)		0	487	973	973	973	973

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

	•						
Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	6.58	21.1	37.9	60.2	80.1
Injection wells (wells)		0	6	24	42	70	86
Resource characterization, appraisal, permitting costs (million \$2020)		32.8	590	935	935	935	935
Wells and facilities construction costs (million \$2020)		0	181	705	1,257	2,102	2,610

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-172
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-6,293
deployment - Cropland measures (1000							
tCO2e/y)							(0.4
Carbon sink potential - Aggressive							-68.6
deployment - Permanent conservation							
cover (1000 tC02e/y)							/ 50/
Carbon sink potential - Aggressive							-6,534
deployment - Total (1000 tC02e/y)							170
Carbon sink potential - Moderate							-172
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							0.050
Carbon sink potential - Moderate							-3,250
deployment - Cropland measures (1000							
tCO2e/y)							0/0
Carbon sink potential - Moderate							-34.3
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-3,456
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							69.5
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,815
Aggressive deployment - Cropland							
measures (1000 hectares)							405
Land impacted for carbon sink -							125
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							2,009
Aggressive deployment - Total (1000							
hectares)							,,,
Land impacted for carbon sink - Moderate							69.5
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							939
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							62.4
deployment - Permanent conservation							
cover (1000 hectares)							4.0=-
Land impacted for carbon sink - Moderate							1,070
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	2020	2020	2000	2000	20.0		-746
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-50,122
counting overlap) (1000 tCO2e/y)							007.22
Carbon sink potential - High - Avoid							-1,278
deforestation (1000 tCO2e/y)							.,
Carbon sink potential - High - Extend							-8,378
rotation length (1000 tC02e/y)							2,212
Carbon sink potential - High - Improve							-5,109
plantations (1000 tCO2e/y)							-,
Carbon sink potential - High - Increase							-15,703
retention of HWP (1000 tCO2e/y)							.07.00
Carbon sink potential - High - Increase							-809
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,522
cropland (1000 tCO2e/y)							0,022
Carbon sink potential - High - Reforest							-6,558
pasture (1000 tC02e/y)							0,000
Carbon sink potential - High - Restore							-5,019
productivity (1000 tCO2e/y)							0,017
Carbon sink potential - Low - Accelerate							-374
regeneration (1000 tCO2e/y)							014
Carbon sink potential - Low - All (not						+	-17,371
counting overlap) (1000 tC02e/y)							-11,511
Carbon sink potential - Low - Avoid							-213
deforestation (1000 tC02e/y)							-210
Carbon sink potential - Low - Extend							-3,218
·							-3,218
rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve							-2,599
•							-2,599
plantations (1000 tC02e/y)							F 00/
Carbon sink potential - Low - Increase							-5,234
retention of HWP (1000 tC02e/y)							000
Carbon sink potential - Low - Increase							-283
trees outside forests (1000 tC02e/y)							0.0/1
Carbon sink potential - Low - Reforest							-3,261
cropland (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-497
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,692
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-560
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-33,702
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-746
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,798
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-3,809
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-10,469
retention of HWP (1000 tC02e/y)							
Carbon sink potential - Mid - Increase							-546
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-4,891
cropland (1000 tCO2e/y)							.,
Carbon sink potential - Mid - Reforest							-3,528
pasture (1000 tCO2e/y)							-,020
Carbon sink potential - Mid - Restore							-3,356
productivity (1000 tC02e/y)							5,000
p. 3445titti (1300 t0020/1)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							122
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							173
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,272
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,882
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 -							76.8
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							431
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							186
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,664
High - Restore productivity (1000							,
hectares)							
Land impacted for carbon sink potential -							8,807
High - Total impacted (over 30 years)							-,
(1000 hectares)							
Land impacted for carbon sink potential -							61.1
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							162
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,637
Low - Extend rotation length (1000							,
hectares)							
Land impacted for carbon sink potential -							941
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 -							40.4
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							216
Low - Reforest cropland (1000 hectares)							_
Land impacted for carbon sink potential -							32.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,007
Low - Restore productivity (1000							.,001
hectares)							
Land impacted for carbon sink potential -							4,096
Low - Total impacted (over 30 years)							.,0 70
(1000 hectares)							
Land impacted for carbon sink potential -			+				91.6
							71.0
Mid - Accelerate regeneration (1000							

				_	
Table 13. Ex	ccanario -	DIII $\Lambda D A \cdot$	Land sinks -	Enracte	lcontinuedl
Table 15. LT	occiiui iu -	FILLAN U.	Luiiu siiiks -	ו טו בטנט	lcontinucui

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							168
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,954
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,416
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 -							58.6
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							323
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							234
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,027
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,273
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)		446	376	302	227	143	99.1
Natural gas consumption - Cumulative (tcf)							9,085
Natural gas production - Annual (tcf)		43.4	41	35.7	30.2	24	18.6
Oil consumption - Annual (million bbls)		75.7	66.7	53.5	41	31.1	23.1
Oil consumption - Cumulative (million bbls)							1,650
Oil production - Annual (million bbls)		30.3	30.5	30.4	24.1	19.6	13

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		220	0.234	0.211	0.138	0.085	0.005
Monetary damages from air pollution - Natural Gas (million 2019\$)		83.6	59.1	32.9	27	12.3	4.72
Monetary damages from air pollution - Transportation (million 2019\$)		429	398	301	173	78.1	30.4
Premature deaths from air pollution - Coal (deaths)		24.9	0.026	0.024	0.016	0.01	0.001
Premature deaths from air pollution - Natural Gas (deaths)		9.43	6.67	3.71	3.05	1.39	0.533
Premature deaths from air pollution - Transportation (deaths)		48.3	44.8	33.9	19.4	8.78	3.42

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		189	382	879	1,095	1,486	1,221
By economic sector - Construction (jobs)		5,108	6,096	10,102	12,546	13,918	17,638
By economic sector - Manufacturing		6,520	7,438	9,493	9,166	8,160	9,567
(jobs)							
By economic sector - Mining (jobs)		4,845	4,039	3,230	2,135	1,564	986

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

Table 16: E+ Scellul 10 - IMPACTS - Jubs (Ct	-						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		375	424	1,169	2,154	2,578	3,730
By economic sector - Pipeline (jobs)		557	829	869	478	423	430
By economic sector - Professional (jobs)		2,896	2,895	4,772	6,444	7,924	9,510
By economic sector - Trade (jobs)		2,569	2,375	3,189	4,098	4,721	5,977
By economic sector - Utilities (jobs)		5,944	6,784	9,692	10,212	11,514	13,573
By education level - All sectors -		8,761	9,590	13,506	15,104	16,333	19,865
Associates degree or some college (jobs)							
By education level - All sectors -		6,583	6,789	8,936	9,747	10,478	12,320
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		205	204	283	339	387	453
degree (jobs)		11.010	10.100	10 = (0		22 (2 (
By education level - All sectors - High		11,912	13,109	18,563	20,775	22,486	26,929
school diploma or less (jobs)		15/0	4.570	0.107	0.010	0.400	
By education level - All sectors - Masters		1,543	1,572	2,107	2,362	2,603	3,066
or professional degree (jobs)			1.000	0.770	0.010		
By resource sector - Biomass (jobs)		633	1,009	2,448	3,263	5,424	5,229
By resource sector - CO2 (jobs)		12.8	3,162	4,290	1,772	2,278	2,838
By resource sector - Coal (jobs)		218	0	0	0	0	0
By resource sector - Grid (jobs)		6,142	6,203	11,297	14,577	17,732	23,650
By resource sector - Natural Gas (jobs)		6,086	4,934	4,471	4,263	3,622	2,000
By resource sector - Nuclear (jobs)		727	715	704	693	402	0
By resource sector - Oil (jobs)		10,204	8,953	7,700	5,576	4,129	2,634
By resource sector - Solar (jobs)		3,340	3,975	9,403	15,361	16,457	23,050
By resource sector - Wind (jobs)		1,640	2,311	3,082	2,822	2,243	3,233
Median wages - Annual - All (\$2019 per		54,192	54,236	53,714	53,644	54,302	54,459
job)							
On-Site or In-Plant Training - Total jobs - 1		4,646	5,062	7,058	7,830	8,436	10,187
to 4 years (jobs)							
On-Site or In-Plant Training - Total jobs - 4		1,804	1,988	2,832	3,188	3,502	4,250
to 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		4,671	5,018	7,002	7,866	8,519	10,200
None (jobs)							
On-Site or In-Plant Training - Total jobs -		228	255	365	410	449	548
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		17,656	18,940	26,137	29,033	31,381	37,448
Up to 1 year (jobs)							
On-the-Job Training - All sectors - 1 to 4		5,942	6,484	9,051	10,037	10,818	13,080
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		1,684	1,879	2,737	3,123	3,451	4,223
years (jobs)							
On-the-Job Training - All sectors - None		1,580	1,664	2,301	2,611	2,840	3,419
(jobs)							
On-the-Job Training - All sectors - Over 10		287	314	432	474	495	597
years (jobs)							
On-the-Job Training - All sectors - Up to 1		19,511	20,922	28,874	32,083	34,684	41,314
year (jobs)							
Related work experience - All sectors - 1		10,647	11,395	15,661	17,356	18,744	22,368
to 4 years (jobs)							
Related work experience - All sectors - 4		6,809	7,309	10,039	11,088	11,956	14,336
to 10 years (jobs)							
Related work experience - All sectors -		4,088	4,461	6,275	7,027	7,660	9,197
None (jobs)							
Related work experience - All sectors -		1,903	2,027	2,730	2,967	3,149	3,761
Over 10 years (jobs)							
Related work experience - All sectors - Up		5,558	6,070	8,690	9,888	10,778	12,970
to 1 year (jobs)							
Wage income - All (million \$2019)		1,572	1,696	2,331	2,593	2,840	3,411

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		8,119	9,209				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	43.5	47.1	51.3	61.6	76.1	85	88
Resistance (%)							
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Sales of space heating units - Electric	9.46	20.2	25.6	41.4	66.1	83.2	89.6
Heat Pump (%)							
Sales of space heating units - Electric	4.72	4.61	4.65	4.77	5.23	5.91	6.33
Resistance (%)							
Sales of space heating units - Fossil (%)	0	3.34	3.16	2.39	1.19	0.387	0.102
Sales of space heating units - Gas Furnace	85.8	71.8	66.6	51.4	27.5	10.5	3.93
(%)							
Sales of water heating units - Electric	0.153	1.96	7.08	21.8	44.4	59.2	64.3
Heat Pump (%)							
Sales of water heating units - Electric	5.64	6.47	8.38	14.4	23.5	29.5	31.6
Resistance (%)							
Sales of water heating units - Gas Furnace	92.7	90	83	62.2	30.5	9.74	2.53
(%)							
Sales of water heating units - Other (%)	1.56	1.58	1.58	1.58	1.58	1.57	1.56

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.69	1.71	2.12	2.18	3.13	3.3
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)	70.6	70.8	69.9	68.7	66.7	64.8	63.6
Final energy use - Industry (PJ)	201	207	209	208	209	207	206
Final energy use - Residential (PJ)	99.2	93.3	89.2	84.7	79.1	73.1	68.2
Final energy use - Transportation (PJ)	351	326	298	275	258	238	214

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		2.25	2.65				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.7	76.4	78.6	84.4	92.6	97.6	99.4
Resistance (%)							
Sales of cooking units - Gas (%)	24.3	23.6	21.4	15.6	7.42	2.39	0.644
Sales of space heating units - Electric	29.5	38.3	42.3	54.1	71.8	83.3	87.2
Heat Pump (%)							
Sales of space heating units - Electric	28.6	30.1	28.3	23	15.1	10.1	8.37
Resistance (%)							
Sales of space heating units - Fossil (%)	11.7	12.9	12.1	9.17	5.03	2.44	1.57
Sales of space heating units - Gas (%)	30.2	18.6	17.3	13.8	8.07	4.19	2.84
Sales of water heating units - Electric	0	2.08	7.99	25	51.1	68.1	74
Heat Pump (%)							
Sales of water heating units - Electric	67.2	76.8	72.5	59.6	40.1	27.4	23
Resistance (%)							
Sales of water heating units - Gas Furnace	29.2	18.6	17	12.9	6.35	2.02	0.528
(%)							
Sales of water heating units - Other (%)	3.59	2.49	2.47	2.49	2.51	2.49	2.49

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	63.7	135	456	1,438	2,094
Public EV charging plugs - DC Fast (1000 units)	0.053		0.263		1.45		4.06
Public EV charging plugs - L2 (1000 units)	0.175		6.32		34.8		97.8
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.56	1.97	2.06	1.64	1.05	0.537	0.23
Vehicle sales - Light-duty - EV (%)	1.89	4.69	11.9	25.9	48.4	72.1	87.6
Vehicle sales - Light-duty - gasoline (%)	91.7	87.4	79.6	66.6	46.2	24.8	11
Vehicle sales - Light-duty - hybrid (%)	4.6	5.4	6.07	5.52	4.14	2.44	1.18
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.38	0.326	0.249	0.176	0.098	0.045
Vehicle sales - Light-duty - other (%)	0.103	0.106	0.096	0.084	0.061	0.033	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen 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							-172
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-6,293
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-68.6
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-6,534
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-172
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,250
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-34.3
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,456
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							69.5
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,815
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							125
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 -							2,009
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							69.5
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							939
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							62.4
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,070
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							-746
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-50,122
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,278
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,378
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-5,109
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-15,703
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-809
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,522
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,558
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-5,019
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-374
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-17,371
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-213
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-3,218
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-2,599
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-5,234
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-283
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-3,261
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-497
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,692
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-560
regeneration (1000 tCO2e/y)							

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

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Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - All (not							-33,702
counting overlap) (1000 tC02e/y)							-746
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-746
Carbon sink potential - Mid - Extend							-5,798
rotation length (1000 tC02e/y)							-5,190
Carbon sink potential - Mid - Improve							-3,809
plantations (1000 tCO2e/y)							-3,009
Carbon sink potential - Mid - Increase	1						-10,469
retention of HWP (1000 tC02e/y)							-10,409
Carbon sink potential - Mid - Increase							-546
trees outside forests (1000 tCO2e/y)							-540
Carbon sink potential - Mid - Reforest		 	+				-4,891
cropland (1000 tCO2e/y)							4,071
Carbon sink potential - Mid - Reforest							-3,528
pasture (1000 tC02e/y)							0,020
Carbon sink potential - Mid - Restore			+				-3,356
productivity (1000 tC02e/y)							0,000
Land impacted for carbon sink potential -							122
High - Accelerate regeneration (1000							122
hectares)							
Land impacted for carbon sink potential -							173
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -			+				4,272
High - Extend rotation length (1000							•
hectares)							
Land impacted for carbon sink potential -							1,882
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 -							76.8
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							431
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							186
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,664
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,807
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							61.1
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							162
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,637
Low - Extend rotation length (1000							
hectares)	1						
Land impacted for carbon sink potential -							941
Low - Improve plantations (1000							
hectares)	1						
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							

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

Item 2020 2025

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							40.4
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							216
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							32.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,007
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							4,096
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							91.6
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							168
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,954
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,416
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 -							58.6
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							323
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							234
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,027
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,273
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Table 24. L Scenario Inn Aoro meditir							
Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		220	0.234	0.211	0.138	0.085	0.005
Coal (million 2019\$)							
Monetary damages from air pollution -		78.8	47.2	20.4	7.86	2.97	2.04
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		436	438	424	380	301	205
Transportation (million 2019\$)							
Premature deaths from air pollution -		24.9	0.026	0.024	0.016	0.01	0.001
Coal (deaths)							
Premature deaths from air pollution -		8.9	5.33	2.31	0.888	0.335	0.23
Natural Gas (deaths)							
Premature deaths from air pollution -		49	49.2	47.7	42.8	33.9	23.1
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)		8,123	9,222				
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric Heat Pump (%)	9.46	29.3	77	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	4.72	4.61	4.92	6.26	6.57	6.57	6.55
Sales of space heating units - Fossil (%)	0	2.89	0.56	0.024	0	0	0
Sales of space heating units - Gas Furnace (%)	85.8	63.2	17.5	2.95	1.48	1.43	1.43
Sales of water heating units - Electric Heat Pump (%)	0.153	10.6	55.7	65.7	66.1	66.2	66.2
Sales of water heating units - Electric Resistance (%)	5.64	9.97	28	32.1	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	92.7	77.8	14.7	0.62	0	0	0
Sales of water heating units - Other (%)	1.56	1.58	1.58	1.58	1.58	1.57	1.56

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.03	2.09	3.69	3.94	2.98	3.07
Cumulative 5-yr (billion \$2018)							

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

	, ,		n P										
Item	2020	2025	2030	2035	2040	2045	2050						
Final energy use - Commercial (PJ)	70.6	70.6	68.1	64.4	61.3	60.1	60.4						
Final energy use - Industry (PJ)	201	206	208	206	206	204	203						
Final energy use - Residential (PJ)	99.2	92.9	85.6	76.5	69.1	64.8	63						
Final energy use - Transportation (PJ)	350	323	285	238	196	170	160						

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		2.27	2.78				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.8	81	96.7	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	24.2	19	3.26	0.164	0	0	0
Sales of space heating units - Electric	29.5	45.1	80.4	88.3	88.7	88.6	88.6
Heat Pump (%)							
Sales of space heating units - Electric	28.6	27.1	11.4	7.85	7.68	7.79	7.8
Resistance (%)							
Sales of space heating units - Fossil (%)	11.7	11.3	3.21	1.36	1.27	1.25	1.25
Sales of space heating units - Gas (%)	30.2	16.4	4.98	2.47	2.38	2.36	2.35
Sales of water heating units - Electric	0	12.1	64	75.6	76.1	76.1	76.1
Heat Pump (%)							
Sales of water heating units - Electric	67.2	69.3	30.5	21.8	21.4	21.4	21.4
Resistance (%)							
Sales of water heating units - Gas Furnace	29.2	16.1	3.02	0.128	0	0	0
(%)							
Sales of water heating units - Other (%)	3.59	2.49	2.46	2.47	2.48	2.48	2.49

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		398	1,016	1,653	2,501	2,725	2,596
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.053		0.878		3.92		6.35
units)							
Public EV charging plugs - L2 (1000 units)	0.175		21.1		94.3		153
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 (%)	1.54	1.81	1.26	0.402	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	3.93	15.2	46.5	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.7	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.44	4.55	3.22	1.19	0.291	0.064	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.339	0.203	0.063	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.097	0.064	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion		2.71	4.34	7.5	19.5	24.7	31.9
\$2018)							
Capital invested - Wind - Base (billion		0	0	0	0.242	1.56	33.8
\$2018)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	0
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	0
Constrained land use assumptions (MW)							
Installed renewables - Solar - Base land	57.5	2,431	6,673	14,638	36,553	66,004	106,269
use assumptions (MW)							
Installed renewables - Solar -	115	5,335	12,895	33,021	84,033	157,006	238,198
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	0	0	0	0	205	1,597	33,504
use assumptions (MW)							
Installed renewables - Wind - Constrained	0	0	0	6,062	26,795	26,795	29,285
land use assumptions (MW)							

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	112	3,996	10,932	23,931	59,775	107,942	173,781
Solar - Constrained land use assumptions	225	8,761	21,079	53,942	137,442	256,617	389,257
(GWh)							
Wind - Base land use assumptions (GWh)	0	0	0	0	582	4,639	85,097
Wind - Constrained land use assumptions	0	0	0	15,051	67,125	67,125	74,355
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-172
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-6,293
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-68.6
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-6,534
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-172
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,250
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-34.3
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-3,456
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							69.5
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,815
Aggressive deployment - Cropland							,
measures (1000 hectares)							
Land impacted for carbon sink -							125
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -	+						2,009
Aggressive deployment - Total (1000							_,00,
hectares)							
Land impacted for carbon sink - Moderate							69.5
deployment - Corn-ethanol to energy							07.0
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							939
deployment - Cropland measures (1000							,,,
hectares)							
Land impacted for carbon sink - Moderate		+					62.4
deployment - Permanent conservation							02.4
cover (1000 hectares)							
Land impacted for carbon sink - Moderate		-					1,070
deployment - Total (1000 hectares)							1,070
deployment - rotal (1000 nectal es)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-746
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-50,122
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,278
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,378
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-5,109
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-15,703
retention of HWP (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-809
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-6,522
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-6,558
Carbon sink potential - High - Restore productivity (1000 tC02e/y)							-5,019
Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)							-374
Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)							-17,371
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)							-213
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,218
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-2,599
Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)							-5,234
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)							-283
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-3,261
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-497
Carbon sink potential - Low - Restore							-1,692
productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate							-560
regeneration (1000 tC02e/y) Carbon sink potential - Mid - All (not							-33,702
counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid							-746
deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend							-5,798
rotation length (1000 tCO2e/y) Carbon sink potential - Mid - Improve							-3,809
plantations (1000 tC02e/y) Carbon sink potential - Mid - Increase							-10,469
retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase							-546
trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest							-4,891
cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest							-3,528
pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore							-3,356
productivity (1000 tC02e/y) Land impacted for carbon sink potential -							122
High - Accelerate regeneration (1000 hectares)							470
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							173
Land impacted for carbon sink potential - High - Extend rotation length (1000							4,272
hectares) Land impacted for carbon sink potential -							1,882
High - Improve plantations (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares)							
Land impacted for carbon sink potential -							76.8
High - Increase trees outside forests							
(1000 hectares)							/ 01
Land impacted for carbon sink potential -							431
High - Reforest cropland (1000 hectares)							107
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							186
Land impacted for carbon sink potential -							1///
High - Restore productivity (1000							1,664
hectares)							
Land impacted for carbon sink potential -							8,807
High - Total impacted (over 30 years)							0,001
(1000 hectares)							
Land impacted for carbon sink potential -							61.1
Low - Accelerate regeneration (1000							· · · ·
hectares)							
Land impacted for carbon sink potential -							162
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,637
Low - Extend rotation length (1000							•
hectares)							
Land impacted for carbon sink potential -							941
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 -							40.4
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							216
Low - Reforest cropland (1000 hectares)							00.0
Land impacted for carbon sink potential -							32.3
Low - Reforest pasture (1000 hectares)							1.007
Land impacted for carbon sink potential - Low - Restore productivity (1000							1,007
hectares)							
Land impacted for carbon sink potential -							4,096
Low - Total impacted (over 30 years)							4,070
(1000 hectares)							
Land impacted for carbon sink potential -							91.6
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							168
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,954
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,416
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 -							58.6
Mid - Increase trees outside forests (1000							
hectares)							

Table 33: E+RE+	. cronario -	DTII AD A	I and cinke -	Forests	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							323
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							234
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,027
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,273
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 -		220	0.234	0.211	0.138	0.085	0.005
Coal (million 2019\$)							
Monetary damages from air pollution -		89.4	62.1	33.1	21	5.74	2.37
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		429	398	301	173	78.1	30.4
Transportation (million 2019\$)							
Premature deaths from air pollution -		24.9	0.026	0.024	0.016	0.01	0.001
Coal (deaths)							
Premature deaths from air pollution -		10.1	7.01	3.73	2.37	0.648	0.267
Natural Gas (deaths)							
Premature deaths from air pollution -		48.3	44.8	33.9	19.4	8.78	3.42
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		8,123	9,222				
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric Heat Pump (%)	9.46	29.3	77	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	4.72	4.61	4.92	6.26	6.57	6.57	6.55
Sales of space heating units - Fossil (%)	0	2.89	0.56	0.024	0	0	0
Sales of space heating units - Gas Furnace (%)	85.8	63.2	17.5	2.95	1.48	1.43	1.43
Sales of water heating units - Electric Heat Pump (%)	0.153	10.6	55.7	65.7	66.1	66.2	66.2
Sales of water heating units - Electric Resistance (%)	5.64	9.97	28	32.1	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	92.7	77.8	14.7	0.62	0	0	0
Sales of water heating units - Other (%)	1.56	1.58	1.58	1.58	1.58	1.57	1.56

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.03	2.09	3.69	3.94	2.98	3.07
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)	70.6	70.6	68.1	64.4	61.3	60.1	60.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	201	206	208	206	206	204	203
Final energy use - Residential (PJ)	99.2	92.9	85.6	76.5	69.1	64.8	63
Final energy use - Transportation (PJ)	350	323	285	238	196	170	160

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		2.27	2.78				
Sales of cooking units - Electric Resistance (%)	75.8	81	96.7	99.8	100	100	100
Sales of cooking units - Gas (%)	24.2	19	3.26	0.164	0	0	0
Sales of space heating units - Electric Heat Pump (%)	29.5	45.1	80.4	88.3	88.7	88.6	88.6
Sales of space heating units - Electric Resistance (%)	28.6	27.1	11.4	7.85	7.68	7.79	7.8
Sales of space heating units - Fossil (%)	11.7	11.3	3.21	1.36	1.27	1.25	1.25
Sales of space heating units - Gas (%)	30.2	16.4	4.98	2.47	2.38	2.36	2.35
Sales of water heating units - Electric Heat Pump (%)	0	12.1	64	75.6	76.1	76.1	76.1
Sales of water heating units - Electric Resistance (%)	67.2	69.3	30.5	21.8	21.4	21.4	21.4
Sales of water heating units - Gas Furnace (%)	29.2	16.1	3.02	0.128	0	0	0
Sales of water heating units - Other (%)	3.59	2.49	2.46	2.47	2.48	2.48	2.49

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		398	1,016	1,653	2,501	2,725	2,596
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.053		0.878		3.92		6.35
units)							
Public EV charging plugs - L2 (1000 units)	0.175		21.1		94.3		153
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 (%)	1.54	1.81	1.26	0.402	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	3.93	15.2	46.5	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.7	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.44	4.55	3.22	1.19	0.291	0.064	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.339	0.203	0.063	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.097	0.064	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion		0.952	0.805	1.37	3.54	4.8	0
\$2018)							
Capital invested - Solar PV - Constrained		3.09	2.54	2.21	6.75	2.85	0.089
(billion \$2018)							
Capital invested - Wind - Constrained		0	0	0	0	0	0.445
(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	57.5	890	1,677	3,129	7,111	12,838	12,838
use assumptions (MW)							
Installed renewables - Solar -	57.5	2,757	5,244	7,594	15,199	18,600	18,712
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	420
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)	112	1,477	2,771	5,143	11,643	20,968	20,968
Solar - Constrained land use assumptions	112	4,533	8,599	12,450	24,940	30,501	30,686
(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	1,052
(GWh)							

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

Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tC02e/y) Carbon sink potential - Aggressive deployment - Cropland measures (1000 tC02e/y) Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tC02e/y) Carbon sink potential - Aggressive -6,534
grasses (1000 tC02e/y) Carbon sink potential - Aggressive deployment - Cropland measures (1000 tC02e/y) Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tC02e/y)
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y) Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)
deployment - Cropland measures (1000 tC02e/y) Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tC02e/y)
tCO2e/y) Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y) -68.6
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tC02e/y)
deployment - Permanent conservation cover (1000 tCO2e/y)
cover (1000 tCO2e/y)
Carbon sink notential - Aggressive -6.534
0,004
deployment - Total (1000 tCO2e/y)
Carbon sink potential - Moderate -172
deployment - Corn-ethanol to energy
grasses (1000 tCO2e/y)
Carbon sink potential - Moderate -3,250
deployment - Cropland measures (1000
tCO2e/y)
Carbon sink potential - Moderate -34.3
deployment - Permanent conservation
cover (1000 tCO2e/y)
Carbon sink potential - Moderate -3,456
deployment - Total (1000 tCO2e/y)
Land impacted for carbon sink - 69.5
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 -							1,815
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							125
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							2,009
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							69.5
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							939
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							62.4
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,070
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 regeneration (1000 tCO2e/y)							-746
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-50,122
Carbon sink potential - High - Avoid							-1,278
deforestation (1000 tC02e/y) Carbon sink potential - High - Extend							-8,378
rotation length (1000 tCO2e/y) Carbon sink potential - High - Improve							-5,109
plantations (1000 tC02e/y)							
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-15,703
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-809
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-6,522
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-6,558
Carbon sink potential - High - Restore productivity (1000 tC02e/y)							-5,019
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-374
Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)							-17,371
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)							-213
Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)							-3,218
Carbon sink potential - Low - Improve plantations (1000 tC02e/y)							-2,599
Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)							-5,234
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)							-283
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-3,261

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

Canbon sink notantial Low Potorest	2020	2025	2030	2035	2040	2045	205 -49
Carbon sink potential - Low - Reforest							-49
pasture (1000 tC02e/y)							1.40
Carbon sink potential - Low - Restore							-1,69
productivity (1000 tC02e/y)							
Carbon sink potential - Mid - Accelerate							-56
regeneration (1000 tC02e/y)							
Carbon sink potential - Mid - All (not							-33,70
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-74
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,79
rotation length (1000 tC02e/y)							
Carbon sink potential - Mid - Improve							-3,80
plantations (1000 tCO2e/y)							•
Carbon sink potential - Mid - Increase							-10,46
retention of HWP (1000 tCO2e/y)							10, 10
Carbon sink potential - Mid - Increase							-54
trees outside forests (1000 tC02e/y)							-04
Carbon sink potential - Mid - Reforest							-4,89
							-4,69
cropland (1000 tC02e/y)							0.50
Carbon sink potential - Mid - Reforest							-3,52
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-3,35
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							12
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							17
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,27
High - Extend rotation length (1000							.,
hectares)							
Land impacted for carbon sink potential -							1,88
High - Improve plantations (1000							1,00
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							76.
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							43
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							18
High - Reforest pasture (1000 hectares)							.5
Land impacted for carbon sink potential -		+					1,66
High - Restore productivity (1000							1,00
hectares)							
							0 00
Land impacted for carbon sink potential -							8,80
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							61
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							16
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -		-					1,63
Low - Extend rotation length (1000							1,00
hectares)							

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

Item Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							941
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 -							40.4
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							216
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							32.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,007
Low - Restore productivity (1000							
hectares)							/ 00/
Land impacted for carbon sink potential -							4,096
Low - Total impacted (over 30 years)							
(1000 hectares)							01./
Land impacted for carbon sink potential -							91.6
Mid - Accelerate regeneration (1000 hectares)							
Land impacted for carbon sink potential -							168
Mid - Avoid deforestation (over 30 years)							100
(1000 hectares)							
Land impacted for carbon sink potential -							2,954
Mid - Extend rotation length (1000							2,754
hectares)							
Land impacted for carbon sink potential -							1,416
Mid - Improve plantations (1000 hectares)							1,410
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							58.6
Mid - Increase trees outside forests (1000							00.0
hectares)							
Land impacted for carbon sink potential -							323
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							234
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,027
Mid - Restore productivity (1000							•
hectares)							
Land impacted for carbon sink potential -							7,273
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\$)		220	0.234	0.211	0.138	0.085	0.005
Monetary damages from air pollution - Natural Gas (million 2019\$)		84.9	54.3	50.1	40.1	15	4.65
Monetary damages from air pollution - Transportation (million 2019\$)		429	398	301	173	78.1	30.4
Premature deaths from air pollution - Coal (deaths)		24.9	0.026	0.024	0.016	0.01	0.001
Premature deaths from air pollution - Natural Gas (deaths)		9.59	6.13	5.65	4.53	1.69	0.525
Premature deaths from air pollution - Transportation (deaths)		48.3	44.8	33.9	19.4	8.78	3.42

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		8,119	9,209				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	43.5	47.1	51.3	61.6	76.1	85	88
Resistance (%)							
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Sales of space heating units - Electric	9.46	20.2	25.6	41.4	66.1	83.2	89.6
Heat Pump (%)							
Sales of space heating units - Electric	4.72	4.61	4.65	4.77	5.23	5.91	6.33
Resistance (%)							
Sales of space heating units - Fossil (%)	0	3.34	3.16	2.39	1.19	0.387	0.102
Sales of space heating units - Gas Furnace	85.8	71.8	66.6	51.4	27.5	10.5	3.93
(%)							
Sales of water heating units - Electric	0.153	1.96	7.08	21.8	44.4	59.2	64.3
Heat Pump (%)							
Sales of water heating units - Electric	5.64	6.47	8.38	14.4	23.5	29.5	31.6
Resistance (%)							
Sales of water heating units - Gas Furnace	92.7	90	83	62.2	30.5	9.74	2.53
(%)							
Sales of water heating units - Other (%)	1.56	1.58	1.58	1.58	1.58	1.57	1.56

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.69	1.71	2.12	2.18	3.13	3.3
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)	70.6	70.8	69.9	68.7	66.7	64.8	63.6
Final energy use - Industry (PJ)	201	207	209	208	209	207	206
Final energy use - Residential (PJ)	99.2	93.3	89.2	84.7	79.1	73.1	68.2
Final energy use - Transportation (PJ)	351	326	298	275	258	238	214

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

2020	2025	2030	2035	2040	2045	2050
	2.25	2.65				
75.7	76.4	78.6	84.4	92.6	97.6	99.4
24.3	23.6	21.4	15.6	7.42	2.39	0.644
29.5	38.3	42.3	54.1	71.8	83.3	87.2
28.6	30.1	28.3	23	15.1	10.1	8.37
11.7	12.9	12.1	9.17	5.03	2.44	1.57
30.2	18.6	17.3	13.8	8.07	4.19	2.84
0	2.08	7.99	25	51.1	68.1	74
67.2	76.8	72.5	59.6	40.1	27.4	23
29.2	18.6	17	12.9	6.35	2.02	0.528
3.59	2.49	2.47	2.49	2.51	2.49	2.49
	75.7 24.3 29.5 28.6 11.7 30.2 0 67.2	2.25 75.7 76.4 24.3 23.6 29.5 38.3 28.6 30.1 11.7 12.9 30.2 18.6 0 2.08 67.2 76.8 29.2 18.6	2.25 2.65 75.7 76.4 78.6 24.3 23.6 21.4 29.5 38.3 42.3 28.6 30.1 28.3 11.7 12.9 12.1 30.2 18.6 17.3 0 2.08 7.99 67.2 76.8 72.5 29.2 18.6 17	2.25 2.65 75.7 76.4 78.6 84.4 24.3 23.6 21.4 15.6 29.5 38.3 42.3 54.1 28.6 30.1 28.3 23 11.7 12.9 12.1 9.17 30.2 18.6 17.3 13.8 0 2.08 7.99 25 67.2 76.8 72.5 59.6 29.2 18.6 17 12.9	2.25 2.65 75.7 76.4 78.6 84.4 92.6 24.3 23.6 21.4 15.6 7.42 29.5 38.3 42.3 54.1 71.8 28.6 30.1 28.3 23 15.1 11.7 12.9 12.1 9.17 5.03 30.2 18.6 17.3 13.8 8.07 0 2.08 7.99 25 51.1 67.2 76.8 72.5 59.6 40.1 29.2 18.6 17 12.9 6.35	2.25 2.65 75.7 76.4 78.6 84.4 92.6 97.6 24.3 23.6 21.4 15.6 7.42 2.39 29.5 38.3 42.3 54.1 71.8 83.3 28.6 30.1 28.3 23 15.1 10.1 11.7 12.9 12.1 9.17 5.03 2.44 30.2 18.6 17.3 13.8 8.07 4.19 0 2.08 7.99 25 51.1 68.1 67.2 76.8 72.5 59.6 40.1 27.4 29.2 18.6 17 12.9 6.35 2.02

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	63.7	135	456	1,438	2,094
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.053		0.263		1.45		4.06
_units)							
Public EV charging plugs - L2 (1000 units)	0.175		6.32		34.8		97.8
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC	0.332	0.969	2.74	7.17	15.7	26.3	34
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.56	1.97	2.06	1.64	1.05	0.537	0.23
Vehicle sales - Light-duty - EV (%)	1.89	4.69	11.9	25.9	48.4	72.1	87.6
Vehicle sales - Light-duty - gasoline (%)	91.7	87.4	79.6	66.6	46.2	24.8	11
Vehicle sales - Light-duty - hybrid (%)	4.6	5.4	6.07	5.52	4.14	2.44	1.18
Vehicle sales - Light-duty - hydrogen FC	0.113	0.38	0.326	0.249	0.176	0.098	0.045
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.106	0.096	0.084	0.061	0.033	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant	0	0	0	0	0	0	0
(billion \$2018)					0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	U	U	U	U	U	U	U
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	10.1	11.5	24	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	11,378	24,305	51,189	51,189	51,189

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	701	1,498	3,156	3,563	3,563
Conversion capital investment -		0	9,299	10,565	21,971	4,675	0
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	5	5
(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	9	19	40	40	40
(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	11.3	24.1	50.7	56.7	57
Annual - BECCS (MMT)		0	11.3	24	50.6	56.7	56.5
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0.1	0.08	0.07	0.56
Cumulative - All (MMT)		0	11.3	35.4	86.1	143	200
Cumulative - BECCS (MMT)		0	11.3	35.3	86	143	199
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0.1	0.18	0.25	0.81

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	837	1,795	3,172	3,780	3,685
Cumulative investment - All (million \$2018)		0	3,530	7,100	10,298	10,924	10,789
Cumulative investment - Spur (million \$2018)		0	434	909	2,297	2,923	2,787
Cumulative investment - Trunk (million \$2018)		0	3,096	6,192	8,002	8,002	8,002
Spur (km)		0	350	822	1,958	2,566	2,471
Trunk (km)		0	487	973	1,214	1,214	1,214

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	7.39	36.4	71.3	98.5	104
Injection wells (wells)		0	8	34	60	100	124
Resource characterization, appraisal, permitting costs (million \$2020)		32.8	810	1,299	1,299	1,299	1,299
Wells and facilities construction costs (million \$2020)		0	257	1,000	1,782	2,980	3,700

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-637
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-5,685
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Aggressive							-58.1
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-6,380
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							
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-637
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,929
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-29.1
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-3,594
deployment - Total (1000 tCO2e/y)							•
Land impacted for carbon sink -							257
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							4,057
Aggressive deployment - Cropland							1,001
measures (1000 hectares)							
Land impacted for carbon sink -							119
Aggressive deployment - Cropland to							117
woody energy crops (1000 hectares)							
Land impacted for carbon sink -						+	265
Aggressive deployment - Pasture to							200
energy crops (1000 hectares)							
Land impacted for carbon sink -							106
							100
Aggressive deployment - Permanent							
conservation cover (1000 hectares) Land impacted for carbon sink -							/ 000
							4,803
Aggressive deployment - Total (1000							
hectares)							057
Land impacted for carbon sink - Moderate							257
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							0/0
Land impacted for carbon sink - Moderate							848
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							119
deployment - Cropland to woody energy							
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							265
deployment - Pasture to energy crops							
(1000 hectares)							
Land impacted for carbon sink - Moderate							52.9
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,542
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-746
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-50,122
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,278
deforestation (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - High - Extend							-8,37
rotation length (1000 tCO2e/y)							F 40
Carbon sink potential - High - Improve							-5,10
plantations (1000 tC02e/y)							
Carbon sink potential - High - Increase							-15,70
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-80
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,52
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,55
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-5,01
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-37
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-17,37
counting overlap) (1000 tC02e/y)							·
Carbon sink potential - Low - Avoid							-21
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-3,21
rotation length (1000 tC02e/y)							0,2.
Carbon sink potential - Low - Improve							-2,59
plantations (1000 tCO2e/y)							-2,07
Carbon sink potential - Low - Increase							-5,23
retention of HWP (1000 tC02e/y)							-5,25
Carbon sink potential - Low - Increase							-28
							-20
trees outside forests (1000 tC02e/y)							0.07
Carbon sink potential - Low - Reforest							-3,26
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-49
pasture (1000 tC02e/y)							4 (0
Carbon sink potential - Low - Restore							-1,69
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-56
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-33,70
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-74
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,79
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-3,80
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-10,46
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-54
trees outside forests (1000 tC02e/y)							0 1
Carbon sink potential - Mid - Reforest							-4,89
cropland (1000 tCO2e/y)							7,0
Carbon sink potential - Mid - Reforest							-3,52
pasture (1000 tC02e/y)							-3,32
							0.05
Carbon sink potential - Mid - Restore							-3,35
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							12
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							17
High - Avoid deforestation (over 30 years)							

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

Thomas Th			-	2035	00/0	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							4,272
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,882
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 -							76.8
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							431
							431
High - Reforest cropland (1000 hectares)							40.4
Land impacted for carbon sink potential -							186
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,664
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,807
High - Total impacted (over 30 years)							•
(1000 hectares)							
Land impacted for carbon sink potential -							61.1
Low - Accelerate regeneration (1000							01.1
•							
hectares)							1/0
Land impacted for carbon sink potential -							162
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,637
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							941
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							U
•							
hectares)							
Land impacted for carbon sink potential -							40.4
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							216
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							32.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,007
Low - Restore productivity (1000							1,001
· · · · · · · · · · · · · · · · · · ·							
hectares)							
Land impacted for carbon sink potential -							4,096
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							91.6
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							168
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -	+						2,954
							2,754
Mid - Extend rotation length (1000							
hectares)	1						
	1	1	1			1	1,416
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)						ļ	1,410

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 -							58.6
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							323
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							234
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,027
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,273
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 -		220	0.234	0.211	0.138	0.085	0.005
Coal (million 2019\$)							
Monetary damages from air pollution -		91.1	54.2	27.4	17.2	8.77	3.88
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		436	438	424	380	301	205
Transportation (million 2019\$)							
Premature deaths from air pollution -		24.9	0.026	0.024	0.016	0.01	0.001
Coal (deaths)							
Premature deaths from air pollution -		10.3	6.12	3.09	1.95	0.99	0.438
Natural Gas (deaths)							
Premature deaths from air pollution -		49	49.2	47.7	42.8	33.9	23.1
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		7,974	8,300				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	43.5	45.6	45.9	45.7	46	45.9	45.7
Resistance (%)							
Sales of cooking units - Gas (%)	56.5	54.4	54.1	54.3	54	54.1	54.3
Sales of space heating units - Electric	9.46	31.9	71.2	79	79.3	79.4	79.4
Heat Pump (%)							
Sales of space heating units - Electric	4.72	6.4	12	15.8	18.7	19.2	19.2
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.67	0.47	0.024	0	0	0
Sales of space heating units - Gas Furnace	85.8	59	16.4	5.24	1.95	1.48	1.43
(%)							
Sales of water heating units - Electric	0.153	0.153	0.147	0.149	0.149	0.145	0.148
Heat Pump (%)							
Sales of water heating units - Electric	5.64	5.74	5.58	5.66	5.62	5.55	5.6
Resistance (%)							
Sales of water heating units - Gas Furnace	92.7	92.5	92.7	92.6	92.7	92.7	92.7
(%)							
Sales of water heating units - Other (%)	1.56	1.58	1.58	1.58	1.58	1.57	1.56

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.32	2.41	3.75	3.99	3.1	3.21
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)	70.6	71.9	72.2	72.2	72.8	74.9	78.5
Final energy use - Industry (PJ)	201	210	218	222	228	232	238
Final energy use - Residential (PJ)	99.2	93.5	91	89.7	89.7	90.9	92.4
Final energy use - Transportation (PJ)	350	326	299	283	283	291	302

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		2.2	2.3				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.5	75.5	75.5	75.5	75.5	75.5	75.5
Resistance (%)							
Sales of cooking units - Gas (%)	24.5	24.5	24.5	24.5	24.5	24.5	24.5
Sales of space heating units - Electric	26.6	55.5	56.3	57.6	58.8	60.4	62.7
Heat Pump (%)							
Sales of space heating units - Electric	29.8	23.9	23.5	22.8	21.8	20.4	18
Resistance (%)							
Sales of space heating units - Fossil (%)	12.2	6.81	6.91	6.74	6.58	6.52	6.54
Sales of space heating units - Gas (%)	31.4	13.8	13.3	12.9	12.8	12.7	12.7
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	67.2	78.4	78.5	78.3	78.1	78.1	78
Resistance (%)							
Sales of water heating units - Gas Furnace	29.2	19.2	19	19.2	19.4	19.4	19.5
(%)							
Sales of water heating units - Other (%)	3.59	2.49	2.47	2.49	2.52	2.51	2.52

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - diesel (%)	98.1	98.2	97.9	97	95.6	93.5	91.6
Vehicle sales - Heavy-duty - EV (%)	0	0	0	0	0	0	0
Vehicle sales - Heavy-duty - gasoline (%)	0.229	0.242	0.257	0.274	0.294	0.317	0.343
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.096	0.112	0.13	0.15	0.174	0.202
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.119	0.138	0.16	0.186	0.216	0.25	0.29
Vehicle sales - Heavy-duty - other (%)	1.51	1.31	1.57	2.37	3.69	5.71	7.57
Vehicle sales - Light-duty - diesel (%)	1.55	1.96	2.18	2.03	1.83	1.7	1.62
Vehicle sales - Light-duty - EV (%)	3.58	5.62	6.4	7.87	9.58	11.1	12.3
Vehicle sales - Light-duty - gasoline (%)	90.2	86.6	84.5	82.6	80.6	78.6	77.1
Vehicle sales - Light-duty - hybrid (%)	4.45	5.3	6.48	7.05	7.62	8.2	8.64
Vehicle sales - Light-duty - hydrogen FC	0.111	0.377	0.346	0.307	0.304	0.304	0.315
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.106	0.102	0.103	0.102	0.101	0.103
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen FC (%)	0.175	0.208	0.242	0.285	0.339	0.409	0.487
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

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

Thom	2020	2025	2030	2035	2040	2045	2050
Item	2020	2025	2030	2035	2040	2045	
Carbon sink potential - High - Accelerate							-746
regeneration (1000 tC02e/y)							
Carbon sink potential - High - All (not							-50,122
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,278
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,378
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-5,109
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-15,703
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-809
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,522
cropland (1000 tCO2e/y)							·
Carbon sink potential - High - Reforest							-6,558
pasture (1000 tCO2e/y)							-,
Carbon sink potential - High - Restore							-5,019
productivity (1000 tCO2e/y)							0,017
Carbon sink potential - Low - Accelerate							-374
regeneration (1000 tC02e/y)							014
Carbon sink potential - Low - All (not							-17,371
counting overlap) (1000 tC02e/y)							-11,511
Carbon sink potential - Low - Avoid							-213
							-213
deforestation (1000 tC02e/y)							0.010
Carbon sink potential - Low - Extend							-3,218
rotation length (1000 tCO2e/y)							0.500
Carbon sink potential - Low - Improve							-2,599
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-5,234
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-283
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-3,261
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-497
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,692
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-560
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-33,702
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-746
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,798
rotation length (1000 tCO2e/y)							-,
Carbon sink potential - Mid - Improve							-3,809
plantations (1000 tCO2e/y)							0,007
Carbon sink potential - Mid - Increase							-10,469
retention of HWP (1000 tC02e/y)							10,707
Carbon sink potential - Mid - Increase							-546
trees outside forests (1000 tC02e/y)							-540
Carbon sink potential - Mid - Reforest							-4,891
•							-4,071
cropland (1000 tC02e/y)							0.500
Carbon sink potential - Mid - Reforest							-3,528
pasture (1000 tC02e/y)							0.057
Carbon sink potential - Mid - Restore							-3,356
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 -							122
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							173
High - Avoid deforestation (over 30 years)							
(1000 hectares)							/ 070
Land impacted for carbon sink potential -							4,272
High - Extend rotation length (1000 hectares)							
Land impacted for carbon sink potential -							1,882
High - Improve plantations (1000							1,002
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							76.8
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							431
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							186
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,664
High - Restore productivity (1000							
hectares) Land impacted for carbon sink potential -							8,807
High - Total impacted (over 30 years)							0,007
(1000 hectares)							
Land impacted for carbon sink potential -							61.1
Low - Accelerate regeneration (1000							01.1
hectares)							
Land impacted for carbon sink potential -							162
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,637
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							941
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000							0
hectares)							
Land impacted for carbon sink potential -							40.4
Low - Increase trees outside forests							40.4
(1000 hectares)							
Land impacted for carbon sink potential -							216
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							32.3
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,007
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							4,096
Low - Total impacted (over 30 years)							
(1000 hectares)							24 :
Land impacted for carbon sink potential -							91.6
Mid - Accelerate regeneration (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							168
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,954
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							1,416
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 -							58.6
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							323
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							234
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,027
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,273
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	-32.9		-14.9				-12.1
uptake (Mt CO2e/y)							
Business-as-usual carbon sink - Retained	-4.27		-7.13				-7.5
in Hardwood Products (Mt CO2e/y)							
Business-as-usual carbon sink - Total (Mt	-37.1		-22				-19.6
CO2e/y)							

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		949	632	431	348	317	316
Coal (million 2019\$)							
Monetary damages from air pollution -		94.8	100	105	101	103	106
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		436	444	452	463	473	483
Transportation (million 2019\$)							
Premature deaths from air pollution -		107	71.4	48.7	39.3	35.9	35.6
Coal (deaths)							
Premature deaths from air pollution -		10.7	11.3	11.9	11.4	11.6	12
Natural Gas (deaths)							
Premature deaths from air pollution -		49	49.9	50.9	52	53.2	54.3
Transportation (deaths)							