

# Net-Zero America - north carolina state report

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

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#### Notes

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		34,334	38,227				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	46	79.9	86.5	86.9	86.9	86.9
Resistance (%)							
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric	8.09	27.7	70	83.7	85	85.1	85.1
Heat Pump (%)							
Sales of space heating units - Electric	7.4	8.38	10.5	12.6	13	13	13
Resistance (%)							
Sales of space heating units - Fossil (%)	6.11	4.04	0.768	0.033	0	0	0
Sales of space heating units - Gas Furnace	78.4	59.9	18.7	3.71	1.95	1.9	1.9
(%)							
Sales of water heating units - Electric	0.257	10.4	53.9	64	64.5	64.5	64.5
Heat Pump (%)							
Sales of water heating units - Electric	6.38	10.9	28.3	32.5	32.8	32.8	32.8
Resistance (%)							
Sales of water heating units - Gas Furnace	88.8	74.6	14.8	0.738	0.009	0	0
(%)							
Sales of water heating units - Other (%)	4.56	4.13	3.01	2.74	2.74	2.73	2.73

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.1	6.25	10.2	10.8	10.4	10.8
Cumulative 5-yr (billion \$2018)							

Table 3: E+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	253	254	245	233	223	220	224
Final energy use - Industry (PJ)	343	347	348	344	341	338	339
Final energy use - Residential (PJ)	355	335	313	283	260	247	242
Final energy use - Transportation (PJ)	917	853	749	620	504	431	398

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		7.62	7.56				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.4	80.6	96.7	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	24.6	19.4	3.31	0.167	0	0	0
Sales of space heating units - Electric	32.3	47.7	81.1	88.9	89.3	89.3	89.2
Heat Pump (%)							
Sales of space heating units - Electric	22.7	22.3	9.54	6.48	6.3	6.42	6.45
Resistance (%)							
Sales of space heating units - Fossil (%)	11.5	13.1	4.52	2.55	2.46	2.42	2.41
Sales of space heating units - Gas (%)	33.5	16.9	4.84	2.03	1.91	1.91	1.9
Sales of water heating units - Electric	0	10	53.3	63.1	63.6	63.6	63.6
Heat Pump (%)							
Sales of water heating units - Electric	61.4	68.3	40.5	34.3	34	34	34
Resistance (%)							
Sales of water heating units - Gas Furnace	34.3	18.9	3.74	0.187	0.002	0	0
(%)							
Sales of water heating units - Other (%)	4.29	2.81	2.47	2.4	2.41	2.42	2.43

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,572	4,040	6,528	9,896	10,763	10,266
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.286		3.07		13.3		21.5
units)							
Public EV charging plugs - L2 (1000 units)	1.4		73.8		320		517
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 (%)	1.48	1.75	1.23	0.393	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.15	15.9	47.5	82.2	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.5	77.2	47.7	16.1	3.23	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.65	4.71	3.29	1.21	0.297	0.065	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.336	0.197	0.061	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.099	0.094	0.061	0.021	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0.041
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Offshore Wind - Base (billion \$2018)		0	0	0	7.29	3.33	0
Capital invested - Offshore Wind - Constrained (billion \$2018)		0	0	0	6.79	2.75	0
Capital invested - Solar PV - Base (billion \$2018)		0.319	11.5	13.4	8.86	6.87	4.82
Capital invested - Solar PV - Constrained (billion \$2018)		2.3	9.86	12.9	9.89	4.44	3.52
Capital invested - Wind - Base (billion \$2018)		0	0.15	0	0.121	0	0
Capital invested - Wind - Constrained (billion \$2018)		0	0.252	0	0	0	0.037
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	4,197	6,452	6,452
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	4,197	6,452	6,452
Installed renewables - Rooftop PV (MW)	299	482	682	972	1,379	1,906	2,581
Installed renewables - Solar - Base land use assumptions (MW)	2,315	2,594	13,855	28,086	38,065	46,266	52,364
Installed renewables - Solar - Constrained land use assumptions (MW)	802	1,495	10,776	25,929	33,804	40,014	50,521
Installed renewables - Wind - Base land use assumptions (MW)	208	208	320	320	423	423	423
Installed renewables - Wind - Constrained land use assumptions (MW)	208	208	398	398	398	398	433

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	41.1
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	17,825	26,721	26,721
OffshoreWind - Constrained land use	0	0	0	0	17.825	26.721	26,721
assumptions (GWh)	· ·				11,020	20,121	20,121
Solar - Base land use assumptions (GWh)	4,358	4,814	23,450	47,034	63,567	77,168	87,246
Solar - Constrained land use assumptions (GWh)	1,582	2,734	18,158	43,284	56,333	66,651	83,952
Wind - Base land use assumptions (GWh)	734	734	1,115	1,115	1,397	1,397	1,397
Wind - Constrained land use assumptions (GWh)	734	734	1,305	1,305	1,305	1,305	1,432

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

		37					
Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	218	218	218	218	920
Conversion capital investment -		0	0	0	0	0	14,438
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	0	16
(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	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0.55	4.91	0.67	24.7
Annual - BECCS (MMT)		0	0	0	0	0	18.5
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0.55	4.91	0.67	6.19
Cumulative - All (MMT)		0	0	0.55	5.46	6.13	30.9
Cumulative - BECCS (MMT)		0	0	0	0	0	18.5
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0.55	5.46	6.13	12.3

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	0	243	245	374	1,682
Cumulative investment - All (million \$2018)		0	0	1,364	1,366	1,458	2,604
Cumulative investment - Spur (million \$2018)		0	0	9.11	11.6	104	1,250
Cumulative investment - Trunk (million \$2018)		0	0	1,354	1,354	1,354	1,354
Spur (km)		0	0	15.4	17.9	146	1,455
Trunk (km)		0	0	227	227	227	227

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	0	0	0	0
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)		0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)		0	0	0	0	0	0

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

Table 12: E+ scenario - PILLAR 6: Land sink			0000	0005	0010	007.	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-207
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,978
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-102
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-3,287
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-207
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,569
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-51
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,827
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							117
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,723
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							186
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							2,025
Aggressive deployment - Total (1000							_,
hectares)							
Land impacted for carbon sink - Moderate							117
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							908
deployment - Cropland measures (1000							,00
hectares)							
Land impacted for carbon sink - Moderate							92.8
deployment - Permanent conservation							72.0
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,118
•							1,110
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							-370
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-44,532
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,061
deforestation (1000 tC02e/y)							40.007
Carbon sink potential - High - Extend							-10,827
rotation length (1000 tCO2e/y)							0.557
Carbon sink potential - High - Improve							-2,556
plantations (1000 tC02e/y)							17770
Carbon sink potential - High - Increase							-17,779
retention of HWP (1000 tC02e/y)							1 10 0
Carbon sink potential - High - Increase							-1,133
trees outside forests (1000 tC02e/y)  Carbon sink potential - High - Reforest							-567
cropland (1000 tC02e/y)							-301
Carbon sink potential - High - Reforest							-4,291
pasture (1000 tCO2e/y)							-4,271
Carbon sink potential - High - Restore							-3,947
productivity (1000 tC02e/y)							-5,741
Carbon sink potential - Low - Accelerate							-186
regeneration (1000 tCO2e/y)							-100
Carbon sink potential - Low - All (not							-14,417
counting overlap) (1000 tC02e/y)							-14,411
Carbon sink potential - Low - Avoid							-510
deforestation (1000 tC02e/y)							010
Carbon sink potential - Low - Extend							-4,159
rotation length (1000 tC02e/y)							1,107
Carbon sink potential - Low - Improve							-1,300
plantations (1000 tCO2e/y)							.,000
Carbon sink potential - Low - Increase							-5,926
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-397
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-284
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-325
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,331
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-278
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-29,452
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,785
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-7,493
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-1,906
plantations (1000 tC02e/y)							
Carbon sink potential - Mid - Increase							-11,852
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-765
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-426
cropland (1000 tC02e/y)							2 2 2 2
Carbon sink potential - Mid - Reforest							-2,308
pasture (1000 tC02e/y)							0 / 22
Carbon sink potential - Mid - Restore							-2,639
productivity (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							60.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							414
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							5,521
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							942
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 -							108
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							37.5
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							122
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,308
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,513
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							30.3
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							389
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,115
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							471
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							56.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							18.8
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							21.1
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							792
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,894
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							45.5
Mid - Accelerate regeneration (1000							
hectares)						1	

Table 13: F+ sce	onario - DIII AE	6. I and einke.	_ Enrocte l	rontinued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							402
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,818
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							708
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 -							82.2
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							28.1
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							153
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,594
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,831
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)		451	380	305	229	144	100
Natural gas consumption - Cumulative (tcf)							9,180
Natural gas production - Annual (tcf)		0	0	0	0	0	0
Oil consumption - Annual (million bbls)		155	134	102	73.3	50.5	33.8
Oil consumption - Cumulative (million bbls)							3,171
Oil production - Annual (million bbls)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		694	0.947	0.916	0.765	0.543	0.048
Monetary damages from air pollution - Natural Gas (million 2019\$)		506	354	208	162	83.8	31.3
Monetary damages from air pollution - Transportation (million 2019\$)		2,831	2,683	2,069	1,209	552	210
Premature deaths from air pollution - Coal (deaths)		78.4	0.107	0.103	0.086	0.061	0.005
Premature deaths from air pollution - Natural Gas (deaths)		57.1	39.9	23.5	18.2	9.46	3.53
Premature deaths from air pollution - Transportation (deaths)		318	302	233	136	62	23.6

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		197	583	636	538	432	1,266
By economic sector - Construction (jobs)		7,710	15,129	19,400	20,839	20,299	21,048
By economic sector - Manufacturing		12,055	22,072	22,363	18,103	20,209	16,696
(jobs)							
By economic sector - Mining (jobs)		2,824	2,017	1,298	785	442	248

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

Table 16: E+ scenario - IMPACTS - Jobs (co	ntinueaj						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		606	2,321	3,208	3,534	3,697	4,221
By economic sector - Pipeline (jobs)		624	529	580	306	214	266
By economic sector - Professional (jobs)		4,232	6,771	8,277	9,663	9,830	11,785
By economic sector - Trade (jobs)		3,119	4,611	5,448	6,161	6,321	7,179
By economic sector - Utilities (jobs)		11,455	12,267	15,939	18,359	17,676	17,594
By education level - All sectors -		13,392	20,878	24,615	25,196	25,524	25,661
Associates degree or some college (jobs)							
By education level - All sectors -		9,152	13,335	15,121	15,273	15,436	15,777
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		270	400	460	492	492	555
degree (jobs)							
By education level - All sectors - High		17,902	28,670	33,470	33,694	34,012	34,450
school diploma or less (jobs)							
By education level - All sectors - Masters		2,107	3,018	3,481	3,634	3,656	3,861
or professional degree (jobs)							
By resource sector - Biomass (jobs)		846	1,607	1,811	1,621	1,574	5,404
By resource sector - CO2 (jobs)		0	0	1,361	15.5	132	1,102
By resource sector - Coal (jobs)		1,272	0	0	0	0	0
By resource sector - Grid (jobs)		12,301	16,441	24,419	32,083	32,774	31,857
By resource sector - Natural Gas (jobs)		6,808	5,312	4,485	4,655	3,135	3,014
By resource sector - Nuclear (jobs)		2,723	2,679	1,990	804	265	0
By resource sector - Oil (jobs)		6,905	5,452	3,846	2,563	1,651	1,037
By resource sector - Solar (jobs)		11,788	33,795	38,427	31,805	30,735	29,173
By resource sector - Wind (jobs)		178	1,013	810	4,744	8,853	8,715
Median wages - Annual - All (\$2019 per		58,191	56,638	57,274	58,525	59,152	60,278
job)							
On-Site or In-Plant Training - Total jobs - 1		6,898	10,660	12,567	12,874	12,975	13,046
to 4 years (jobs)							
On-Site or In-Plant Training - Total jobs - 4		2,612	3,938	4,823	5,147	5,102	5,264
to 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		6,966	10,945	12,640	12,725	12,884	13,129
None (jobs)							
On-Site or In-Plant Training - Total jobs -		350	540	653	685	691	702
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		25,996	40,218	46,465	46,857	47,467	48,162
Up to 1 year (jobs)							•
On-the-Job Training - All sectors - 1 to 4		8,849	13,610	16,096	16,548	16,660	16,751
years (jobs)			,			,	•
On-the-Job Training - All sectors - 4 to 10		2,495	3,821	4,741	5,104	5,057	5,228
years (jobs)		, -	-,-		-, -	,	-, -
On-the-Job Training - All sectors - None		2,295	3,591	4,141	4,176	4,216	4,337
(jobs)		_,	-,	.,	.,	1,210	.,
On-the-Job Training - All sectors - Over 10		435	722	818	789	802	784
years (jobs)							
On-the-Job Training - All sectors - Up to 1		28,748	44,557	51,353	51,671	52,383	53,203
year (jobs)		20,1.0	,55	3.,000	0.,0	02,000	00,200
Related work experience - All sectors - 1		15,457	23,564	27,397	27,890	28,148	28,581
to 4 years (jobs)		.5, .5.	20,00	2.,67.	2.,070	207.10	_0,00.
Related work experience - All sectors - 4		9,983	15,144	17,664	18,040	18,200	18,395
to 10 years (jobs)		7,700	10,144	11,004	10,040	10,200	10,070
Related work experience - All sectors -		6,102	9,462	11,124	11,363	11,463	11,716
None (jobs)		0,102	7,402	11,124	11,000	11,400	11,110
Related work experience - All sectors -		2,800	4,272	4,887	4,881	4,960	4,918
Over 10 years (jobs)		2,000	7,212	4,001	7,001	4,700	7,710
Related work experience - All sectors - Up		8,481	13,858	16,077	16,115	16,347	16,693
to 1 year (jobs)		0,401	10,000	10,011	10,110	10,041	10,070
Wage income - All (million \$2019)		2,492	3,756	4,419	4,582	4,681	4,841
vvage income - An (inililon \$2017)		۷,47۷	3,130	4,417	4,002	4,001	4,041

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		34,313	38,231				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	36.2	40.9	53.4	71	81.7	85.5
Resistance (%)							
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric	8.09	19.7	24.6	38.6	60.7	76.6	82.8
Heat Pump (%)							
Sales of space heating units - Electric	7.4	8.06	8.29	9.07	10.5	11.9	12.7
Resistance (%)							
Sales of space heating units - Fossil (%)	6.11	4.68	4.33	3.28	1.62	0.513	0.134
Sales of space heating units - Gas Furnace	78.4	67.5	62.8	49.1	27.1	11	4.45
(%)							
Sales of water heating units - Electric	0.257	2.02	6.97	21.3	43.2	57.6	62.7
Heat Pump (%)							
Sales of water heating units - Electric	6.38	7.55	9.45	15.2	24.1	29.9	32
Resistance (%)							
Sales of water heating units - Gas Furnace	88.8	86.1	79.3	59.7	29.4	9.53	2.51
(%)							
Sales of water heating units - Other (%)	4.56	4.35	4.31	3.87	3.3	2.91	2.77

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.28	5.33	6.71	6.92	9.8	10.3
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)	253	255	252	248	242	237	235
Final energy use - Industry (PJ)	343	348	349	349	350	347	346
Final energy use - Residential (PJ)	355	336	326	315	300	282	265
Final energy use - Transportation (PJ)	918	861	785	722	672	613	544

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		7.58	7.45				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.3	75.9	78.2	84.2	92.5	97.6	99.3
Resistance (%)							
Sales of cooking units - Gas (%)	24.7	24.1	21.8	15.8	7.55	2.44	0.656
Sales of space heating units - Electric	32.3	41.3	45.1	56.1	73	84	87.9
Heat Pump (%)							
Sales of space heating units - Electric	22.7	24.7	23.3	18.9	12.4	8.34	6.89
Resistance (%)							
Sales of space heating units - Fossil (%)	11.5	14.8	13.8	11	6.65	3.78	2.79
Sales of space heating units - Gas (%)	33.5	19.2	17.8	13.9	7.91	3.85	2.41
Sales of water heating units - Electric	0	1.73	6.65	20.8	42.6	56.9	61.8
Heat Pump (%)							
Sales of water heating units - Electric	61.4	73.6	70.5	61.3	47.3	38.2	35.1
Resistance (%)							
Sales of water heating units - Gas Furnace	34.3	21.8	20	15.2	7.52	2.43	0.641
(%)							
Sales of water heating units - Other (%)	4.29	2.87	2.83	2.74	2.59	2.48	2.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	256	534	1,808	5,675	8,272
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.286		0.97		4.96		13.8
units)							
Public EV charging plugs - L2 (1000 units)	1.4		23.3		119		331
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 (%)	1.49	1.92	2.04	1.62	1.03	0.529	0.227
Vehicle sales - Light-duty - EV (%)	1.97	4.86	12.2	26.4	49	72.4	87.7
Vehicle sales - Light-duty - gasoline (%)	91.5	87.1	79	65.9	45.5	24.4	10.8
Vehicle sales - Light-duty - hybrid (%)	4.83	5.62	6.28	5.69	4.23	2.48	1.19
Vehicle sales - Light-duty - hydrogen FC	0.112	0.378	0.322	0.244	0.172	0.095	0.044
(%)							
Vehicle sales - Light-duty - other (%)	0.1	0.103	0.094	0.081	0.058	0.032	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 22: E- scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-207
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,978
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-102
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,287
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-207
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,569
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-51
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,827
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							117
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,723
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							186
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 -							2,025
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							117
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							908
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							92.8
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,118
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	2020	2020	2000	2000	2040	2040	-370
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-44,532
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,061
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-10,827
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-2,556
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-17,779
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,133
trees outside forests (1000 tC02e/y)							•
Carbon sink potential - High - Reforest							-567
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,291
pasture (1000 tC02e/y)							•
Carbon sink potential - High - Restore							-3,947
productivity (1000 tCO2e/y)							•
Carbon sink potential - Low - Accelerate							-186
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-14,417
counting overlap) (1000 tCO2e/y)							,
Carbon sink potential - Low - Avoid							-510
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,159
rotation length (1000 tCO2e/y)							, -
Carbon sink potential - Low - Improve							-1,300
plantations (1000 tCO2e/y)							,
Carbon sink potential - Low - Increase							-5,926
retention of HWP (1000 tCO2e/y)							-, -
Carbon sink potential - Low - Increase							-397
trees outside forests (1000 tCO2e/y)							07.
Carbon sink potential - Low - Reforest							-284
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-325
pasture (1000 tC02e/y)							020
Carbon sink potential - Low - Restore							-1,331
productivity (1000 tCO2e/y)							1,001
Carbon sink potential - Mid - Accelerate							-278
Ca. Son on a potential into According to							210

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

Carbon sink potential - Mid - All (not	2020	2025	2030	2035	2040	2045	2050 -29,452
counting overlap) (1000 tC02e/y)							-29,432
Carbon sink potential - Mid - Avoid							-1,785
·							-1,700
deforestation (1000 tC02e/y)							7/00
Carbon sink potential - Mid - Extend							-7,493
rotation length (1000 tCO2e/y)							100
Carbon sink potential - Mid - Improve							-1,906
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-11,852
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-765
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-426
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,308
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-2,639
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							60.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							414
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							5,52
High - Extend rotation length (1000							3,32
hectares)							
•							0//
Land impacted for carbon sink potential -							942
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							108
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							37.5
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							122
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,308
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,513
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							30.3
Low - Accelerate regeneration (1000							00.
hectares)							
Land impacted for carbon sink potential -						+	389
Low - Avoid deforestation (over 30 years)							30
(1000 hectares)							0.11
Land impacted for carbon sink potential -							2,11
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							47
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)		1					

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

Land impacted for carbon sink potential- Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential- Low - Reforest cropland (1000 hectares)  Land impacted for carbon sink potential- Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential- Low - Restore productivity (1000 hectares)  Land impacted for carbon sink potential- Low - Total impacted for carbon sink potential- Low - Total impacted (over 30 years) (1000 hectares)  Land impacted for carbon sink potential- Mid - Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential- Mid - Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential- Mid - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential- Mid - Limprove plantations (1000 hectares)  Land impacted for carbon sink potential- Mid - Limprove plantations (1000 hectares)  Land impacted for carbon sink potential- Mid - Improve plantations (1000 hectares)  Land impacted for carbon sink potential- Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential- Mid - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest cropland (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest posture (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest posture (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest posture (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest posture (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest posture (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest posture (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest posture (1000 hectares)  Land impacted for carbon sink potential- Mid - Reforest posture (1000 hectares)  Land impacted for carbon sink potential- Mid -	Item	2020	2025	2030	2035	2040	2045	2050
(1000 hectares)   18.8	Land impacted for carbon sink potential -							56.7
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	Low - Increase trees outside forests							
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hectares)								
	hectares)							

Table 24: E- scenario - IMPACTS - Health

2020	2025	2030	2035	2040	2045	2050
	694	0.947	0.916	0.765	0.543	0.048
	474	317	122	48.4	17.2	9.11
	2,881	2,959	2,922	2,667	2,149	1,488
	78.4	0.107	0.103	0.086	0.061	0.005
	53.5	35.8	13.7	5.46	1.94	1.03
	324	333	329	300	242	167
	2020	694 474 2,881 78.4 53.5	694 0.947 474 317 2,881 2,959 78.4 0.107 53.5 35.8	694 0.947 0.916 474 317 122 2,881 2,959 2,922 78.4 0.107 0.103 53.5 35.8 13.7	694     0.947     0.916     0.765       474     317     122     48.4       2,881     2,959     2,922     2,667       78.4     0.107     0.103     0.086       53.5     35.8     13.7     5.46	694     0.947     0.916     0.765     0.543       474     317     122     48.4     17.2       2,881     2,959     2,922     2,667     2,149       78.4     0.107     0.103     0.086     0.061       53.5     35.8     13.7     5.46     1.94

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		34,334	38,227				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	46	79.9	86.5	86.9	86.9	86.9
Resistance (%)							
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric	8.09	27.7	70	83.7	85	85.1	85.1
Heat Pump (%)							
Sales of space heating units - Electric	7.4	8.38	10.5	12.6	13	13	13
Resistance (%)							
Sales of space heating units - Fossil (%)	6.11	4.04	0.768	0.033	0	0	0
Sales of space heating units - Gas Furnace	78.4	59.9	18.7	3.71	1.95	1.9	1.9
(%)							
Sales of water heating units - Electric	0.257	10.4	53.9	64	64.5	64.5	64.5
Heat Pump (%)							
Sales of water heating units - Electric	6.38	10.9	28.3	32.5	32.8	32.8	32.8
Resistance (%)							
Sales of water heating units - Gas Furnace	88.8	74.6	14.8	0.738	0.009	0	0
(%)							
Sales of water heating units - Other (%)	4.56	4.13	3.01	2.74	2.74	2.73	2.73

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.1	6.25	10.2	10.8	10.4	10.8
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	253	254	245	233	223	220	224
Final energy use - Industry (PJ)	343	347	348	344	341	338	339
Final energy use - Residential (PJ)	355	335	313	283	260	247	242
Final energy use - Transportation (PJ)	917	853	749	620	504	431	398

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		7.62	7.56				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.4	80.6	96.7	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	24.6	19.4	3.31	0.167	0	0	0
Sales of space heating units - Electric	32.3	47.7	81.1	88.9	89.3	89.3	89.2
Heat Pump (%)							
Sales of space heating units - Electric	22.7	22.3	9.54	6.48	6.3	6.42	6.45
Resistance (%)							
Sales of space heating units - Fossil (%)	11.5	13.1	4.52	2.55	2.46	2.42	2.41
Sales of space heating units - Gas (%)	33.5	16.9	4.84	2.03	1.91	1.91	1.9
Sales of water heating units - Electric	0	10	53.3	63.1	63.6	63.6	63.6
Heat Pump (%)							
Sales of water heating units - Electric	61.4	68.3	40.5	34.3	34	34	34
Resistance (%)							
Sales of water heating units - Gas Furnace	34.3	18.9	3.74	0.187	0.002	0	0
(%)							
Sales of water heating units - Other (%)	4.29	2.81	2.47	2.4	2.41	2.42	2.43

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,572	4,040	6,528	9,896	10,763	10,266
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.286		3.07		13.3		21.5
units)							
Public EV charging plugs - L2 (1000 units)	1.4		73.8		320		517
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 (%)	1.48	1.75	1.23	0.393	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.15	15.9	47.5	82.2	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.5	77.2	47.7	16.1	3.23	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.65	4.71	3.29	1.21	0.297	0.065	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.336	0.197	0.061	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.099	0.094	0.061	0.021	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base		0	0	11.4	17.2	57.9	14.5
(billion \$2018)							
Capital invested - Solar PV - Base (billion		4.49	12.2	19	6.47	9.14	7.8
\$2018)							
Capital invested - Wind - Base (billion		0	0.15	0.078	0.046	0	0
\$2018)							
Installed renewables - OffshoreWind -	0	0	0	5,570	15,458	54,728	66,260
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	0	0	0	9,491	12,903	12,903	130,643
Constrained land use assumptions (MW)							
Installed renewables - Solar - Base land	2,514	6,440	18,331	38,477	45,767	56,668	66,527
use assumptions (MW)							
Installed renewables - Solar -	4,176	9,734	34,639	81,664	100,676	129,341	155,191
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	208	208	320	384	423	423	423
use assumptions (MW)							
Installed renewables - Wind - Constrained	416	416	795	795	795	795	1,146
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	23,197	65,591	228,715	276,814
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	39,833	53,442	53,442	546,001
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	4,688	11,220	31,035	64,392	76,535	94,582	110,804
Solar - Constrained land use assumptions	7,980	17,215	58,470	136,511	168,080	215,434	258,069
(GWh)							
Wind - Base land use assumptions (GWh)	734	734	1,115	1,287	1,397	1,397	1,397

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

Item	2020	2025	2030	2035	2040	2045	2050
Wind - Constrained land use assumptions	1,469	1,469	2,609	2,609	2,609	2,609	3,714
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-207
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,978
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-102
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-3,287
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-207
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,569
deployment - Cropland measures (1000							.,
tCO2e/y)							
Carbon sink potential - Moderate							-51
deployment - Permanent conservation							0.
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,827
deployment - Total (1000 tC02e/y)							1,021
Land impacted for carbon sink -							117
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -			+				1,723
Aggressive deployment - Cropland							1,1 20
measures (1000 hectares)							
Land impacted for carbon sink -							186
Aggressive deployment - Permanent							100
conservation cover (1000 hectares)							
Land impacted for carbon sink -							2,025
							2,025
Aggressive deployment - Total (1000							
hectares)							117
Land impacted for carbon sink - Moderate							117
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							908
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							92.8
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,118
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-370
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-44,532
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,061

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

Item Corporation High Extend	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-10,827
.,							0.557
Carbon sink potential - High - Improve							-2,556
plantations (1000 tCO2e/y)  Carbon sink potential - High - Increase							-17,779
retention of HWP (1000 tCO2e/y)							-11,119
Carbon sink potential - High - Increase							-1,133
trees outside forests (1000 tC02e/y)							-1,133
Carbon sink potential - High - Reforest							-567
cropland (1000 tC02e/y)							-301
Carbon sink potential - High - Reforest							-4,291
pasture (1000 tC02e/y)							-4,271
Carbon sink potential - High - Restore							-3,947
productivity (1000 tCO2e/y)							-5,741
Carbon sink potential - Low - Accelerate							-186
regeneration (1000 tC02e/y)							-100
Carbon sink potential - Low - All (not							-14,417
counting overlap) (1000 tC02e/y)							-14,411
Carbon sink potential - Low - Avoid							-510
deforestation (1000 tC02e/y)							-310
Carbon sink potential - Low - Extend							-4,159
rotation length (1000 tC02e/y)							-4,107
Carbon sink potential - Low - Improve							-1,300
plantations (1000 tCO2e/y)							-1,500
Carbon sink potential - Low - Increase							-5,926
retention of HWP (1000 tC02e/y)							-5,720
Carbon sink potential - Low - Increase							-397
trees outside forests (1000 tC02e/y)							-371
Carbon sink potential - Low - Reforest							-284
cropland (1000 tC02e/y)							-204
Carbon sink potential - Low - Reforest							-325
pasture (1000 tC02e/y)							020
Carbon sink potential - Low - Restore							-1,331
productivity (1000 tCO2e/y)							1,001
Carbon sink potential - Mid - Accelerate							-278
regeneration (1000 tCO2e/y)							210
Carbon sink potential - Mid - All (not							-29,452
counting overlap) (1000 tCO2e/y)							27,102
Carbon sink potential - Mid - Avoid							-1,785
deforestation (1000 tC02e/y)							1,100
Carbon sink potential - Mid - Extend							-7,493
rotation length (1000 tCO2e/y)							1,170
Carbon sink potential - Mid - Improve							-1,906
plantations (1000 tCO2e/y)							1,700
Carbon sink potential - Mid - Increase							-11,852
retention of HWP (1000 tCO2e/y)							11,002
Carbon sink potential - Mid - Increase							-765
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-426
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,308
pasture (1000 tC02e/y)							2,500
Carbon sink potential - Mid - Restore							-2,639
productivity (1000 tC02e/y)							_,007
Land impacted for carbon sink potential -							60.6
High - Accelerate regeneration (1000							50.0
hectares)							
Land impacted for carbon sink potential -							414
High - Avoid deforestation (over 30 years)							714
(1000 hectares)							

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

Item Land impacted for carbon sink potential -	2020	2025	2030	2035	2040	2045	2050
High - Extend rotation length (1000							5,521
hectares)							
Land impacted for carbon sink potential -							942
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 -							108
High - Increase trees outside forests							100
(1000 hectares)							
Land impacted for carbon sink potential -							37.5
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							122
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,308
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,513
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							30.3
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							389
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							0.11
Land impacted for carbon sink potential - Low - Extend rotation length (1000							2,115
hectares)							
Land impacted for carbon sink potential -							471
Low - Improve plantations (1000							711
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							56.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							18.8
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							21.1
Low - Reforest pasture (1000 hectares)							700
Land impacted for carbon sink potential -							792
Low - Restore productivity (1000 hectares)							
Land impacted for carbon sink potential -							3,894
Low - Total impacted (over 30 years)							3,074
(1000 hectares)							
Land impacted for carbon sink potential -							45.5
Mid - Accelerate regeneration (1000							10.0
hectares)							
Land impacted for carbon sink potential -							402
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,818
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							708
Mid - Improve plantations (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							82.2
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							28.1
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							153
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,594
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,831
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 -		694	0.947	0.916	0.765	0.543	0.048
Coal (million 2019\$)							
Monetary damages from air pollution -		419	347	198	120	32	9.24
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		2,831	2,683	2,069	1,209	552	210
Transportation (million 2019\$)							
Premature deaths from air pollution -		78.4	0.107	0.103	0.086	0.061	0.005
Coal (deaths)							
Premature deaths from air pollution -		47.3	39.2	22.3	13.6	3.61	1.04
Natural Gas (deaths)							
Premature deaths from air pollution -		318	302	233	136	62	23.6
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 -		34,334	38,227				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	46	79.9	86.5	86.9	86.9	86.9
Resistance (%)							
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric	8.09	27.7	70	83.7	85	85.1	85.1
Heat Pump (%)							
Sales of space heating units - Electric	7.4	8.38	10.5	12.6	13	13	13
Resistance (%)							
Sales of space heating units - Fossil (%)	6.11	4.04	0.768	0.033	0	0	0
Sales of space heating units - Gas Furnace	78.4	59.9	18.7	3.71	1.95	1.9	1.9
(%)							
Sales of water heating units - Electric	0.257	10.4	53.9	64	64.5	64.5	64.5
Heat Pump (%)							
Sales of water heating units - Electric	6.38	10.9	28.3	32.5	32.8	32.8	32.8
Resistance (%)							
Sales of water heating units - Gas Furnace	88.8	74.6	14.8	0.738	0.009	0	0
_ (%)							
Sales of water heating units - Other (%)	4.56	4.13	3.01	2.74	2.74	2.73	2.73

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.1	6.25	10.2	10.8	10.4	10.8
Cumulative 5-yr (billion \$2018)							

#### Table 37: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	253	254	245	233	223	220	224
Final energy use - Industry (PJ)	343	347	348	344	341	338	339
Final energy use - Residential (PJ)	355	335	313	283	260	247	242
Final energy use - Transportation (PJ)	917	853	749	620	504	431	398

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		7.62	7.56				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.4	80.6	96.7	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	24.6	19.4	3.31	0.167	0	0	0
Sales of space heating units - Electric	32.3	47.7	81.1	88.9	89.3	89.3	89.2
Heat Pump (%)							
Sales of space heating units - Electric	22.7	22.3	9.54	6.48	6.3	6.42	6.45
Resistance (%)							
Sales of space heating units - Fossil (%)	11.5	13.1	4.52	2.55	2.46	2.42	2.41
Sales of space heating units - Gas (%)	33.5	16.9	4.84	2.03	1.91	1.91	1.9
Sales of water heating units - Electric	0	10	53.3	63.1	63.6	63.6	63.6
Heat Pump (%)							
Sales of water heating units - Electric	61.4	68.3	40.5	34.3	34	34	34
Resistance (%)							
Sales of water heating units - Gas Furnace	34.3	18.9	3.74	0.187	0.002	0	0
(%)							
Sales of water heating units - Other (%)	4.29	2.81	2.47	2.4	2.41	2.42	2.43

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,572	4,040	6,528	9,896	10,763	10,266
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.286		3.07		13.3		21.5
units)							
Public EV charging plugs - L2 (1000 units)	1.4		73.8		320		517
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 (%)	1.48	1.75	1.23	0.393	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.15	15.9	47.5	82.2	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.5	77.2	47.7	16.1	3.23	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.65	4.71	3.29	1.21	0.297	0.065	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.336	0.197	0.061	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.099	0.094	0.061	0.021	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)		0.351	0.989	7.64	7.58	5.7	1.48
Capital invested - Solar PV - Constrained (billion \$2018)		1.15	0.299	6.56	6.89	6.54	0
Capital invested - Wind - Base (billion \$2018)		0.052	0	0	0.056	0	0
Capital invested - Wind - Constrained (billion \$2018)		0.049	0.06	0	0	0	0
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Solar - Base land use assumptions (MW)	1,997	2,304	3,271	11,382	19,921	26,727	28,595
Installed renewables - Solar - Constrained land use assumptions (MW)	1,701	2,705	2,998	9,961	17,724	25,531	25,531
Installed renewables - Wind - Base land use assumptions (MW)	208	243	243	243	290	290	290
Installed renewables - Wind - Constrained land use assumptions (MW)	208	241	286	286	286	286	286

#### 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)	3,833	4,343	5,952	19,453	33,552	44,837	47,907
Solar - Constrained land use assumptions	3,350	5,000	5,486	17,082	29,911	42,873	42,873
(GWh)							
Wind - Base land use assumptions (GWh)	734	862	862	862	1,013	1,013	1,013
Wind - Constrained land use assumptions	734	854	999	999	999	999	999
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-207
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,978
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-102
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,287
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-207
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-1,569
deployment - Cropland measures (1000							
tCO2e/y) Carbon sink potential - Moderate							-51
deployment - Permanent conservation							-51
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,827
deployment - Total (1000 tCO2e/y)							, -
Land impacted for carbon sink -							117
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,723
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							186
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							0.005
Land impacted for carbon sink -							2,025
Aggressive deployment - Total (1000 hectares)							
Land impacted for carbon sink - Moderate	+						117
deployment - Corn-ethanol to energy							1117
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							908
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							92.8
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,118
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)							-370
Carbon sink potential - High - All (not							-44,532
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,061
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-10,827
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-2,556
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-17,779
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,133
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-567
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,291
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-3,947
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-186
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-14,417
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-510
deforestation (1000 tCO2e/y)							

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

	2030	2035	2040	2045	2050
					-4,159
					1.000
					-1,300
					-5,926
					-39
					-284
					-325
					-1,33
					-278
					-29,452
					-1,78
					-7,49
					-1,90
					-11,85
					-76
					-420
					-2,308
					-2,63
					60.0
					41
					5,52
					94
					ı
					10
					37.
					12:
					1,308

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							8,513
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							30.3
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							389
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,115
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							471
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							56.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							18.8
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							21.1
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							792
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,894
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							45.5
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							402
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,818
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							708
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 -							82.2
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							28.1
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							153
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -		+					1,594
Mid - Restore productivity (1000							.,
hectares)							
Land impacted for carbon sink potential -		+	-				6,831
Mid - Total impacted (over 30 years) (1000							2,00

Table /./	r.pr	acanania	IMPACTS -	Hoalth
Table 44.	F+KF-	srpnnrin -	IIVIPALIS -	HPNITN

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		694	0.947	0.916	0.765	0.543	0.048
Coal (million 2019\$)							
Monetary damages from air pollution -		579	457	461	351	107	36.1
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		2,831	2,683	2,069	1,209	552	210
Transportation (million 2019\$)							
Premature deaths from air pollution -		78.4	0.107	0.103	0.086	0.061	0.005
Coal (deaths)							
Premature deaths from air pollution -		65.3	51.6	52	39.6	12.1	4.07
Natural Gas (deaths)							
Premature deaths from air pollution -		318	302	233	136	62	23.6
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		34,313	38,231				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	36.2	40.9	53.4	71	81.7	85.5
Resistance (%)							
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric	8.09	19.7	24.6	38.6	60.7	76.6	82.8
Heat Pump (%)							
Sales of space heating units - Electric	7.4	8.06	8.29	9.07	10.5	11.9	12.7
Resistance (%)							
Sales of space heating units - Fossil (%)	6.11	4.68	4.33	3.28	1.62	0.513	0.134
Sales of space heating units - Gas Furnace	78.4	67.5	62.8	49.1	27.1	11	4.45
(%)							
Sales of water heating units - Electric	0.257	2.02	6.97	21.3	43.2	57.6	62.7
Heat Pump (%)							
Sales of water heating units - Electric	6.38	7.55	9.45	15.2	24.1	29.9	32
Resistance (%)							
Sales of water heating units - Gas Furnace	88.8	86.1	79.3	59.7	29.4	9.53	2.51
(%)							
Sales of water heating units - Other (%)	4.56	4.35	4.31	3.87	3.3	2.91	2.77

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.28	5.33	6.71	6.92	9.8	10.3
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)	253	255	252	248	242	237	235
Final energy use - Industry (PJ)	343	348	349	349	350	347	346
Final energy use - Residential (PJ)	355	336	326	315	300	282	265
Final energy use - Transportation (PJ)	918	861	785	722	672	613	544

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		7.58	7.45				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	75.3	75.9	78.2	84.2	92.5	97.6	99.3
Resistance (%)							
Sales of cooking units - Gas (%)	24.7	24.1	21.8	15.8	7.55	2.44	0.656
Sales of space heating units - Electric	32.3	41.3	45.1	56.1	73	84	87.9
Heat Pump (%)							

Table 48: E-B+ scenario -	DILLAD 1. Efficier	ov/Electrification	Dooidontial	(continued)
1aule 40. E-D+ Scellul lu -	PILLAK I. EIIILIEI	ICV/EIECH IIICUHUII	- Residential	rconunueur

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	22.7	24.7	23.3	18.9	12.4	8.34	6.89
Resistance (%)							
Sales of space heating units - Fossil (%)	11.5	14.8	13.8	11	6.65	3.78	2.79
Sales of space heating units - Gas (%)	33.5	19.2	17.8	13.9	7.91	3.85	2.41
Sales of water heating units - Electric	0	1.73	6.65	20.8	42.6	56.9	61.8
Heat Pump (%)							
Sales of water heating units - Electric	61.4	73.6	70.5	61.3	47.3	38.2	35.1
Resistance (%)							
Sales of water heating units - Gas Furnace	34.3	21.8	20	15.2	7.52	2.43	0.641
(%)							
Sales of water heating units - Other (%)	4.29	2.87	2.83	2.74	2.59	2.48	2.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	256	534	1,808	5,675	8,272
Cumulative 5-yr (million \$2018)	0.007		0.07				
Public EV charging plugs - DC Fast (1000	0.286		0.97		4.96		13.8
units)							
Public EV charging plugs - L2 (1000 units)	1.4		23.3		119		331
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 (%)	1.49	1.92	2.04	1.62	1.03	0.529	0.227
Vehicle sales - Light-duty - EV (%)	1.97	4.86	12.2	26.4	49	72.4	87.7
Vehicle sales - Light-duty - gasoline (%)	91.5	87.1	79	65.9	45.5	24.4	10.8
Vehicle sales - Light-duty - hybrid (%)	4.83	5.62	6.28	5.69	4.23	2.48	1.19
Vehicle sales - Light-duty - hydrogen FC	0.112	0.378	0.322	0.244	0.172	0.095	0.044
(%)							
Vehicle sales - Light-duty - other (%)	0.1	0.103	0.094	0.081	0.058	0.032	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0.006	0.925	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	11.5	1,827	1,827	1,827	1,827	1,827
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0

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

		2222				
2020	2025	2030	2035	2040	2045	2050
	314	656	656	656	656	656
	6.65	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	1	1	1	1
0	0	0	0	0	0	0
0	1	1	1	1	1	1
0	0	0	0	0	0	0
0	0	0	1	1	1	1
0	0	0	0	0	0	0
0	1	1	1	1	1	1
0	0	0	0	0	0	0
	0 0 0 0 0	314 6.65 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0	314     656       6.65     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     0       0     1       1     1	314     656     656       6.65     0     0       0     0     0     0       0     0     0     0       0     0     0     0       0     0     0     0       0     0     0     0       0     0     0     0       0     0     0     1       0     0     0     0       0     0     0     0       0     1     1     1       1     1     1     1	314     656     656     656       6.65     0     0     0       0     0     0     0     0       0     0     0     0     0       0     0     0     0     0     0       0     0     0     0     0     0       0     0     0     0     0     0       0     0     0     0     0     0       0     0     0     0     0     0       0     0     0     0     0     0       0     1     1     1     1     1       0     0     1     1     1     1	314     656     656     656     656       6.65     0     0     0     0       0     0     0     0     0       0     0     0     0     0       0     0     0     0     0       0     0     0     0     0       0     0     0     0     0       0     1     1     1     1       0     0     0     0     0       0     0     0     1     1     1       0     0     0     0     0       0     1     1     1     1       0     0     0     0     0       0     1     1     1     1       1     1     1     1     1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	0
Annual - BECCS (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	0	0
Cumulative - BECCS (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	0	227	227	227	358
Cumulative investment - All (million \$2018)		0	0	1,354	1,354	1,354	1,459
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	105
Cumulative investment - Trunk (million \$2018)		0	0	1,354	1,354	1,354	1,354
Spur (km)		0	0	0	0	0	130
Trunk (km)		0	0	227	227	227	227

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

		-					
Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	0	0	0	0
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal,		0	0	0	0	0	0
permitting costs (million \$2020)							
Wells and facilities construction costs		0	0	0	0	0	0
(million \$2020)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-639

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

Item Carbon sink potential - Aggressive	2020	2025	2030	2035	2040	2045	2050 -2,559
deployment - Cropland measures (1000 tCO2e/y)							-2,559
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy crops (1000 tCO2e/y)							O
Carbon sink potential - Aggressive deployment - Pasture to energy crops							0
(1000 tC02e/y)							
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-86.7
Carbon sink potential - Aggressive deployment - Total (1000 tC02e/y)							-3,285
Carbon sink potential - Moderate							-639
deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate deployment - Cropland measures (1000							-1,348
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 tCO2e/y)							
Carbon sink potential - Moderate							-43.3
deployment - Permanent conservation cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,030
deployment - Total (1000 tCO2e/y)							070
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to							379
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,635
Aggressive deployment - Cropland							
measures (1000 hectares)  Land impacted for carbon sink -							104
Aggressive deployment - Cropland to							104
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							134
Aggressive deployment - Pasture to energy crops (1000 hectares)							
Land impacted for carbon sink -							158
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,410
Land impacted for carbon sink - Moderate							379
deployment - Corn-ethanol to energy							
grasses (1000 hectares)  Land impacted for carbon sink - Moderate							775
deployment - Cropland measures (1000							113
hectares)							
Land impacted for carbon sink - Moderate							104
deployment - Cropland to woody energy							
crops (1000 hectares)  Land impacted for carbon sink - Moderate							134
deployment - Pasture to energy crops (1000 hectares)							104

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate							78.8
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,472
deployment - Total (1000 hectares)							

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-370
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-44,532
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,061
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-10,827
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-2,556
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-17,779
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,133
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							-567
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,291
pasture (1000 tC02e/y)							
Carbon sink potential - High - Restore							-3,947
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-186
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-14,417
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-510
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-4,159
rotation length (1000 tC02e/y)							1000
Carbon sink potential - Low - Improve							-1,300
plantations (1000 tC02e/y)							F 00 /
Carbon sink potential - Low - Increase							-5,926
retention of HWP (1000 tCO2e/y)							007
Carbon sink potential - Low - Increase							-397
trees outside forests (1000 tC02e/y)							00/
Carbon sink potential - Low - Reforest							-284
cropland (1000 tCO2e/y)							005
Carbon sink potential - Low - Reforest							-325
pasture (1000 tCO2e/y) Carbon sink potential - Low - Restore							-1,331
·							-1,331
productivity (1000 tC02e/y)  Carbon sink potential - Mid - Accelerate							-278
regeneration (1000 tC02e/y)							-218
Carbon sink potential - Mid - All (not							-29,452
counting overlap) (1000 tC02e/y)							-27,432
Carbon sink potential - Mid - Avoid							-1,785
deforestation (1000 tCO2e/y)							-1,100
Carbon sink potential - Mid - Extend							-7,493
rotation length (1000 tCO2e/y)							-1,473
Carbon sink potential - Mid - Improve							-1,906
plantations (1000 tCO2e/y)							-1,700
Carbon sink potential - Mid - Increase							-11,852
retention of HWP (1000 tCO2e/y)							11,002

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

Item Conhon sink notantial, Mid. Increase	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase							-765
trees outside forests (1000 tC02e/y)							101
Carbon sink potential - Mid - Reforest							-426
cropland (1000 tC02e/y)							0.000
Carbon sink potential - Mid - Reforest							-2,308
pasture (1000 tC02e/y)							0.700
Carbon sink potential - Mid - Restore							-2,639
productivity (1000 tC02e/y)  Land impacted for carbon sink potential -							(0/
·							60.6
High - Accelerate regeneration (1000							
hectares)							/1/
Land impacted for carbon sink potential -							414
High - Avoid deforestation (over 30 years)							
(1000 hectares)							F F04
Land impacted for carbon sink potential -							5,521
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							942
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 -							108
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							37.5
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							122
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,308
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,513
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							30.3
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							389
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,115
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							471
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							_
hectares)							
Land impacted for carbon sink potential -							56.7
Low - Increase trees outside forests							00.1
(1000 hectares)							
Land impacted for carbon sink potential -							18.8
Low - Reforest cropland (1000 hectares)							10.0
Land impacted for carbon sink potential -	-						21.1
Low - Reforest pasture (1000 hectares)							∠1.1
Land impacted for carbon sink potential -							792
Land impacted for carbon sink potential - Low - Restore productivity (1000							192
LOW - RESIDIE OF OUGHVILVILVILOU		1	[				

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,894
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							45.5
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							402
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,818
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							708
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							82.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							28.1
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							153
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,594
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,831

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		694	0.947	0.916	0.765	0.543	0.048
Monetary damages from air pollution - Natural Gas (million 2019\$)		448	307	144	92.8	50.4	21.5
Monetary damages from air pollution - Transportation (million 2019\$)		2,881	2,959	2,922	2,667	2,149	1,488
Premature deaths from air pollution - Coal (deaths)		78.4	0.107	0.103	0.086	0.061	0.005
Premature deaths from air pollution - Natural Gas (deaths)		50.5	34.7	16.2	10.5	5.69	2.42
Premature deaths from air pollution - Transportation (deaths)		324	333	329	300	242	167

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		33,829	35,143				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	34.3	34.3	34.3	34.4	34.3	34.3
Resistance (%)							
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Sales of space heating units - Electric	8.09	26.8	56.4	70.2	72	72.2	72.3
Heat Pump (%)							
Sales of space heating units - Electric	7.4	9.19	13.8	20.2	25.1	25.8	25.8
Resistance (%)							
Sales of space heating units - Fossil (%)	6.11	4.41	2.99	1.35	0.201	0.017	0

Table 59: RFF scenario -	DTILADA EEGalaman	/Flactuifiantian	0	(h
Tanie 59' REE Scenncin -	- PILLAR I' EMICIPOCV	/FIPCTCITICATION -	Linmmerrini i	rnntiniieni

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	78.4	59.6	26.8	8.28	2.71	1.96	1.9
Sales of water heating units - Electric Heat Pump (%)	0.257	0.277	0.272	0.274	0.275	0.273	0.274
Sales of water heating units - Electric Resistance (%)	6.38	6.85	6.76	6.78	6.8	6.76	6.77
Sales of water heating units - Gas Furnace (%)	88.8	88.5	88.5	88.5	88.5	88.5	88.5
Sales of water heating units - Other (%)	4.56	4.4	4.5	4.42	4.47	4.48	4.45

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.29	6.46	8.19	8.55	7.99	8.24
Cumulative 5-yr (billion \$2018)							

#### Table 61: REF scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	253	258	261	264	267	276	291
Final energy use - Industry (PJ)	344	359	375	389	406	422	442
Final energy use - Residential (PJ)	355	338	334	334	339	348	357
Final energy use - Transportation (PJ)	917	863	796	756	756	778	806

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		7.46	6.79				
Sales of cooking units - Electric Resistance (%)	75.1	75.1	75.1	75.1	75.1	75.1	75.1
Sales of cooking units - Gas (%)	24.9	24.9	24.9	24.9	24.9	24.9	24.9
Sales of space heating units - Electric Heat Pump (%)	30.3	53.9	54.7	55.8	56.8	58.1	60.1
Sales of space heating units - Electric Resistance (%)	23.3	20.2	19.9	19.3	18.5	17.3	15.2
Sales of space heating units - Fossil (%)	11.8	10.1	7.34	6.13	5.97	5.93	5.99
Sales of space heating units - Gas (%)	34.5	15.8	18.1	18.8	18.7	18.7	18.7
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	61.4	74.7	74.8	74.6	74.5	74.5	74.4
Sales of water heating units - Gas Furnace (%)	34.3	22.4	22.4	22.5	22.6	22.6	22.7
Sales of water heating units - Other (%)	4.29	2.88	2.88	2.9	2.93	2.93	2.94

#### 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 (%)	1.48	1.91	2.17	2.02	1.82	1.69	1.61
Vehicle sales - Light-duty - EV (%)	3.79	5.9	6.7	8.25	10	11.5	12.7
Vehicle sales - Light-duty - gasoline (%)	89.8	86.2	84	82	79.9	78	76.5
Vehicle sales - Light-duty - hybrid (%)	4.67	5.5	6.72	7.28	7.83	8.38	8.78

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - hydrogen FC	0.11	0.374	0.342	0.303	0.299	0.299	0.31
(%)							
Vehicle sales - Light-duty - other (%)	0.099	0.103	0.099	0.099	0.099	0.098	0.1
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen	0.175	0.208	0.242	0.285	0.339	0.409	0.487
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

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

Itom	2020	2025	2030	2035	2040	2045	2050
Item  Carbon sink potential - High - Accelerate	2020	2025	2030	2035	2040	2045	-370
regeneration (1000 tCO2e/y)							-310
Carbon sink potential - High - All (not							-44,532
counting overlap) (1000 tC02e/y)							-44,332
Carbon sink potential - High - Avoid							-3,061
deforestation (1000 tC02e/y)							-3,001
Carbon sink potential - High - Extend							-10,827
rotation length (1000 tCO2e/y)							-10,021
Carbon sink potential - High - Improve							-2,556
plantations (1000 tCO2e/y)							-2,556
Carbon sink potential - High - Increase							-17,779
retention of HWP (1000 tCO2e/y)							-11,117
Carbon sink potential - High - Increase							-1,133
trees outside forests (1000 tC02e/y)							-1,133
Carbon sink potential - High - Reforest							-567
cropland (1000 tCO2e/y)							-301
Carbon sink potential - High - Reforest							-4,291
pasture (1000 tCO2e/y)							-4,271
Carbon sink potential - High - Restore							-3,947
productivity (1000 tC02e/y)							-5,741
Carbon sink potential - Low - Accelerate							-186
regeneration (1000 tCO2e/y)							-100
Carbon sink potential - Low - All (not							-14,417
counting overlap) (1000 tC02e/y)							-14,411
Carbon sink potential - Low - Avoid							-510
deforestation (1000 tC02e/y)							010
Carbon sink potential - Low - Extend							-4,159
rotation length (1000 tC02e/y)							4,107
Carbon sink potential - Low - Improve							-1,300
plantations (1000 tCO2e/y)							1,000
Carbon sink potential - Low - Increase							-5,926
retention of HWP (1000 tCO2e/y)							0,720
Carbon sink potential - Low - Increase							-397
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-284
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-325
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,331
productivity (1000 tCO2e/y)							•
Carbon sink potential - Mid - Accelerate							-278
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-29,452
counting overlap) (1000 tCO2e/y)							•
Carbon sink potential - Mid - Avoid							-1,785
deforestation (1000 tC02e/y)							-

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Extend							-7,493
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-1,906
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-11,852
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-765
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-426
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,308
pasture (1000 tCO2e/y)							_,
Carbon sink potential - Mid - Restore							-2,639
productivity (1000 tCO2e/y)							_,00,
Land impacted for carbon sink potential -							60.6
High - Accelerate regeneration (1000							00.0
hectares)							
Land impacted for carbon sink potential -							414
High - Avoid deforestation (over 30 years)							414
(1000 hectares)							
Land impacted for carbon sink potential -							5,521
High - Extend rotation length (1000							5,521
• • • • • • • • • • • • • • • • • • • •							
hectares)							0/0
Land impacted for carbon sink potential -							942
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 -							108
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							37.5
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							122
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,308
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,513
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							30.3
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							389
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,115
Low - Extend rotation length (1000							2,110
hectares)							
Land impacted for carbon sink potential -		-			+		471
Low - Improve plantations (1000							471
hectares)							
-							^
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							= -
Land impacted for carbon sink potential -							56.7
Low - Increase trees outside forests							
(1000 hectares)		1	1	l l		1	

Table 6/1	DEE conar	O - DILLARA	: Land sinks -	Enrocte	Continued
Table 04.	KEF SURIIUI	U - PILLAK O.	. Luliu Siliks -	FULESIS I	CUITLITIUEUT

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							18.8
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							21.
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							792
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,894
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							45.5
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							402
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,818
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							708
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							(
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							82.2
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							28.
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							153
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,594
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,83
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	-30.9		-14.5				-11.7
uptake (Mt CO2e/y)							
Business-as-usual carbon sink - Retained	-4.84		-8.07				-8.49
in Hardwood Products (Mt CO2e/y)							
Business-as-usual carbon sink - Total (Mt	-35.8		-22.6				-20.2
CO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		2,275	1,484	1,291	1,204	1,168	1,112
Monetary damages from air pollution - Natural Gas (million 2019\$)		397	445	518	510	562	542
Monetary damages from air pollution - Transportation (million 2019\$)		2,876	2,995	3,110	3,238	3,364	3,495
Premature deaths from air pollution - Coal (deaths)		257	168	146	136	132	126
Premature deaths from air pollution - Natural Gas (deaths)		44.9	50.3	58.5	57.6	63.5	61.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		323	337	350	364	378	393
Transportation (deaths)							