

Net-Zero America - arizona state report

2021-03-05

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

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Notes

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

Data by category and subcategory

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	15,691	17,430	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	9.42	24.7	74.5	91.3	93	93.1	93.1
Sales of space heating units - Electric Resistance (%)	8.85	3.72	4.18	5.96	6.38	6.41	6.34
Sales of space heating units - Fossil (%)	0	0.191	0.037	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	81.7	71.4	21.3	2.75	0.604	0.53	0.531
Sales of water heating units - Electric Heat Pump (%)	0.083	10.5	56.1	67.4	68.1	68.1	68.1
Sales of water heating units - Electric Resistance (%)	4.09	5.98	25.6	31.1	31.5	31.5	31.5
Sales of water heating units - Gas Furnace (%)	94.7	83.1	18	1.12	0.029	0	0
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		5.56	5.85	7.13	7.54	7.14	7.45

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	154	154	150	142	136	133	134
Final energy use - Industry (PJ)	138	138	137	143	157	161	165
Final energy use - Residential (PJ)	190	187	180	168	158	153	152
Final energy use - Transportation (PJ)	577	543	484	411	345	303	285

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	9.03	12.9	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	82.8	86.5	97.7	99.9	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	17.2	13.5	2.31	0.116	0	0	0
Sales of space heating units - Electric	20.5	39.8	77.9	87.9	88.7	88.6	88.5
Heat Pump (%)							
Sales of space heating units - Electric	25.1	29.4	12.9	8.67	8.4	8.53	8.6
Resistance (%)							
Sales of space heating units - Fossil (%)	3.8	4.75	2.83	2.2	1.94	1.88	1.97
Sales of space heating units - Gas (%)	50.6	26.1	6.34	1.28	0.966	0.96	0.955
Sales of water heating units - Electric	0	11.1	59.1	70.5	71.1	71.1	71.1
Heat Pump (%)							
Sales of water heating units - Electric	46.7	56.4	31.4	25.8	25.6	25.6	25.6
Resistance (%)							
Sales of water heating units - Gas Furnace	49.7	29.2	6.29	0.391	0.01	0	0
(%)							
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.24	3.23	3.24	3.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	1,096	2,868	4,551	6,933	7,503	7,177
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.323	0	1.88	0	7.6	0	12.2
units)							
Public EV charging plugs - L2 (1000 units)	1.11	0	45.2	0	183	0	293
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 (%)	1.52	1.79	1.25	0.398	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.01	15.5	46.9	82	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.7	48.4	16.3	3.27	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.51	4.61	3.24	1.2	0.293	0.064	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.338	0.201	0.062	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.063	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0.005	0.135	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0.057
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0.315
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	0	0	0	1.17
Capital invested - Solar PV - Constrained (billion \$2018)	0	1.03	0	0	1.13	0.159	6.01
Capital invested - Wind - Base (billion \$2018)	0	0	0.096	0.499	0.141	0.13	0.33
Capital invested - Wind - Constrained (billion \$2018)	0	0.159	0.739	5.99	10.7	12.7	9.9
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed (cumulative) - Rooftop PV (MW)	1,845	2,808	3,773	4,985	6,485	8,313	10,586
Installed (cumulative) - Solar - Base land use assumptions (MW)	5,833	5,833	5,833	5,833	5,833	5,833	7,101
Installed (cumulative) - Wind - Base land use assumptions (MW)	618	618	691	1,093	1,212	1,328	1,640

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	10.1	276	276	276	276	276
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	57.2
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	354
Solar - Base land use assumptions (GWh)	14,540	0	0	0	0	0	3,095
Solar - Constrained land use assumptions (GWh)	13,756	0	0	0	1,205	9,782	5,452

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

	-	•	-				
Item	2020	2025	2030	2035	2040	2045	2050
Wind - Base land use assumptions (GWh)	1,920	0	227	1,183	334	320	862
Wind - Constrained land use assumptions	2,143	613	1,061	13,815	21,261	21,504	22,291
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0.64	13.2	14.8	14.9	15.2	44.8
Conversion capital investment -	0	5.8	151	30.3	3.23	4.74	665
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	2
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	2	2	2	2
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	2
Number of facilities - Power (quantity)	0	2	2	2	2	2	2
Number of facilities - Power ccu	0	0	0	0	0	0	2
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	2	2	2	2
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Sng (quantity)	0	2	2	2	2	2	2
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	0.01	0.01	3.33	3.5	4.27
Annual - BECCS (MMT)		0	0	0	0	0	0.67
Annual - Cement and lime (MMT)		0	0	0	3.32	3.42	3.53
Annual - NGCC (MMT)		0	0.01	0.01	0.01	0.08	0.07
Cumulative - All (MMT)		0	0.01	0.02	3.35	6.85	11.1
Cumulative - BECCS (MMT)		0	0	0	0	0	0.67
Cumulative - Cement and lime (MMT)		0	0	0	3.32	6.74	10.3
Cumulative - NGCC (MMT)		0	0.01	0.02	0.03	0.11	0.18

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	415	415	504	514	885
Cumulative investment - All (million \$2018)		0	445	445	531	537	740
Cumulative investment - Spur (million \$2018)		0	5.14	5.13	90.9	97.6	300
Cumulative investment - Trunk (million \$2018)		0	440	440	440	440	440
Spur (km)		0	9.36	9.36	98.6	108	479
Trunk (km)		0	406	406	406	406	406

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-450
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-9.92
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-460
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							_
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate		+					-227
deployment - Cropland measures (1000							221
tCO2e/y)							
Carbon sink potential - Moderate							-4.96
deployment - Permanent conservation							-4.70
cover (1000 tC02e/y)							000
Carbon sink potential - Moderate							-232
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							506
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							15.2
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							521
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate		+					257
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							7.61
deployment - Permanent conservation							1.01
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							264
							264
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							-1,802
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-16,318
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,857
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,019
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-144
retention of HWP (1000 tCO2e/y)							

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

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Item	2020	2025	2030	2035	2040	2045	2050 -410
Carbon sink potential - High - Increase							-410
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							0//
Carbon sink potential - High - Reforest							-96.6
pasture (1000 tC02e/y)							/ 000
Carbon sink potential - High - Restore							-4,989
productivity (1000 tC02e/y)							000
Carbon sink potential - Low - Accelerate							-903
regeneration (1000 tCO2e/y)							F 700
Carbon sink potential - Low - All (not							-5,789
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-310
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,696
rotation length (1000 tC02e/y)							
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-48.1
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-143
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-7.32
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,682
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-1,352
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-11,053
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,083
deforestation (1000 tCO2e/y)							,
Carbon sink potential - Mid - Extend							-4,858
rotation length (1000 tCO2e/y)							.,
Carbon sink potential - Mid - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-96.2
retention of HWP (1000 tCO2e/y)							70.2
Carbon sink potential - Mid - Increase							-277
trees outside forests (1000 tC02e/y)							211
Carbon sink potential - Mid - Reforest							0
cropland (1000 tCO2e/y)							U
Carbon sink potential - Mid - Reforest							-52
pasture (1000 tC02e/y)							-52
Carbon sink potential - Mid - Restore							-3,335
productivity (1000 tCO2e/y)							-ა,ააⴢ
							295
Land impacted for carbon sink potential -							295
High - Accelerate regeneration (1000							
hectares)							0.51
Land impacted for carbon sink potential -							251
High - Avoid deforestation (over 30 years)							
(1000 hectares)							^ ==-
Land impacted for carbon sink potential -							3,579
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)			1			I .	

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000 hectares)							
Land impacted for carbon sink potential -							38.9
High - Increase trees outside forests							30.7
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							2.74
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,654
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,821
High - Total impacted (over 30 years)							
(1000 hectares) Land impacted for carbon sink potential -							147
Low - Accelerate regeneration (1000							147
hectares)							
Land impacted for carbon sink potential -							236
Low - Avoid deforestation (over 30 years)							200
(1000 hectares)							
Land impacted for carbon sink potential -							1,371
Low - Extend rotation length (1000							·
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							00.5
Land impacted for carbon sink potential -							20.5
Low - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							U
Land impacted for carbon sink potential -							0.476
Low - Reforest pasture (1000 hectares)							00
Land impacted for carbon sink potential -							1,001
Low - Restore productivity (1000							•
hectares)							
Land impacted for carbon sink potential -							2,776
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							221
Mid - Accelerate regeneration (1000							
hectares)							0//
Land impacted for carbon sink potential -							244
Mid - Avoid deforestation (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							2,475
Mid - Extend rotation length (1000							2,410
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							29.7
Mid - Increase trees outside forests (1000							
hectares)							

Table 13: E+	ccanario -	DTII AD 6.	Land cinke	Enracte	(continued)
Table 13: <i>E+</i>	scenario -	PILLAR 6:	Luna sinks -	· Forests i	i continuea i

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.44
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,015
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							4,988
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)		298	251	201	152	95.4	66.1
Natural gas consumption - Cumulative (tcf)		0	0	0	0	0	6,065
Natural gas production - Annual (tcf)		0.056	0.053	0.046	0.039	0.031	0.024
Oil consumption - Annual (million bbls)		95.3	80.2	58.8	39.2	23.7	12.1
Oil consumption - Cumulative (million bbls)		0	0	0	0	0	1,832
Oil production - Annual (million bbls)		0.014	0.014	0.014	0.011	0.009	0.006

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		154	0.207	0.206	0.126	0.076	0
Coal (million 2019\$)							
Monetary damages from air pollution -		204	143	115	103	62.2	11.7
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,446	1,367	1,051	610	275	101
Transportation (million 2019\$)							
Premature deaths from air pollution -		17.4	0.023	0.023	0.014	0.009	0
Coal (deaths)							
Premature deaths from air pollution -		23.1	16.1	13	11.6	7.02	1.32
Natural Gas (deaths)							
Premature deaths from air pollution -		163	154	118	68.6	30.9	11.4
Transportation (deaths)							

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		96.6	118	120	76.5	32.7	55.5
By economic sector - Construction (jobs)		12,181	11,584	11,952	12,453	11,946	16,076
By economic sector - Manufacturing		5,140	7,178	8,643	7,914	6,751	7,449
(jobs)							
By economic sector - Mining (jobs)		1,940	1,239	774	443	226	106
By economic sector - Other (jobs)		1,529	1,565	1,827	2,128	2,392	4,297
By economic sector - Pipeline (jobs)		400	390	260	197	119	104
By economic sector - Professional (jobs)		5,261	4,878	5,036	5,275	5,284	7,561
By economic sector - Trade (jobs)		3,777	3,306	3,377	3,549	3,635	5,564
By economic sector - Utilities (jobs)		12,549	11,868	11,464	11,412	10,291	9,631
By education level - All sectors -		13,646	13,474	13,997	14,170	13,307	16,555
Associates degree or some college (jobs)							
By education level - All sectors -		8,645	8,407	8,512	8,358	7,824	9,779
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		291	272	271	268	261	361
degree (jobs)							
By education level - All sectors - High		18,187	17,954	18,643	18,643	17,380	21,718
school diploma or less (jobs)							

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

Table 10. L+ Scenario - Intracto - Jobs (cor	•						
Item	2020	2025	2030	2035	2040	2045	2050
By education level - All sectors - Masters		2,105	2,019	2,030	2,008	1,904	2,429
or professional degree (jobs)							
By resource sector - Biomass (jobs)		248	284	290	200	123	251
By resource sector - CO2 (jobs)		0	442	9.81	95.9	39	273
By resource sector - Coal (jobs)		1,309	391	4.06	3	2.32	1.94
By resource sector - Grid (jobs)		17,764	17,025	18,372	18,856	16,843	17,400
By resource sector - Natural Gas (jobs)		4,563	3,873	3,719	4,692	4,265	1,996
By resource sector - Nuclear (jobs)		2,125	2,091	1,213	0.031	0.093	0.136
By resource sector - Oil (jobs)		4,241	3,276	2,218	1,371	776	371
By resource sector - Solar (jobs)		10,849	11,171	13,760	15,000	16,322	28,124
By resource sector - Wind (jobs)		1,775	3,573	3,866	3,228	2,306	2,425
Median wages - Annual - All (\$2019 per		59,133	59,519	59,798	60,498	61,285	61,297
job)							
On-Site or In-Plant Training - Total jobs - 1		7,107	6,976	7,199	7,258	6,794	8,403
to 4 years (jobs)							
On-Site or In-Plant Training - Total jobs - 4		3,023	2,891	2,941	3,019	2,848	3,533
to 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		6,883	6,795	7,014	6,995	6,580	8,359
None (jobs)							
On-Site or In-Plant Training - Total jobs -		375	368	383	393	369	450
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		25,485	25,096	25,914	25,781	24,086	30,096
Up to 1 year (jobs)							
On-the-Job Training - All sectors - 1 to 4		9,179	8,999	9,274	9,367	8,773	10,825
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		2,985	2,854	2,915	3,014	2,853	3,557
years (jobs)							
On-the-Job Training - All sectors - None		2,322	2,267	2,322	2,304	2,180	2,835
(jobs)							
On-the-Job Training - All sectors - Over 10		412	418	435	428	399	507
years (jobs)							
On-the-Job Training - All sectors - Up to 1		27,975	27,589	28,507	28,334	26,471	33,118
year (jobs)							
Related work experience - All sectors - 1		15,430	15,090	15,510	15,502	14,519	18,105
to 4 years (jobs)							
Related work experience - All sectors - 4		10,025	9,812	10,074	10,094	9,447	11,697
to 10 years (jobs)							
Related work experience - All sectors -		6,218	6,109	6,314	6,362	5,967	7,459
None (jobs)							
Related work experience - All sectors -		2,644	2,629	2,710	2,676	2,485	3,046
Over 10 years (jobs)							
Related work experience - All sectors - Up		8,558	8,486	8,844	8,812	8,258	10,534
to 1 year (jobs)							
Wage income - All (million \$2019)		2,535	2,508	2,599	2,629	2,493	3,117
-							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	15,683	17,443	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric	9.42	15.4	21.2	37.7	63.9	82.8	90.3
Heat Pump (%)							
Sales of space heating units - Electric	8.85	3.71	3.77	3.94	4.58	5.53	6.06
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.221	0.208	0.157	0.076	0.024	0.007
Sales of space heating units - Gas Furnace	81.7	80.6	74.8	58.2	31.5	11.7	3.68
(%)							

Table 17: E- scenario -	DILLAR 1. Efficience	//Electrification -	Commercial	continued
Table II. E- Scellul IO -	PILLAK I. EIIILIEIIL	// EIECH 111CUHUH -	CUITITIETCIULT	Continueur

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric	0.083	1.86	7.04	22	45.1	60.6	66.1
Heat Pump (%)							
Sales of water heating units - Electric	4.09	2.3	4.52	11	21.1	28	30.5
Resistance (%)							
Sales of water heating units - Gas Furnace	94.7	95.5	88	66.6	33.4	11.1	2.96
(%)							
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.08	5.31	5.56	5.79	6.91	7.24
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)	154	154	154	153	150	146	143
Final energy use - Industry (PJ)	138	139	137	144	160	164	168
Final energy use - Residential (PJ)	190	188	187	184	176	167	161
Final energy use - Transportation (PJ)	578	547	504	469	441	408	369

Table 20: E- 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)	0	8.98	12.7	0	0	0	0
Sales of cooking units - Electric Resistance (%)	82.8	83.2	84.8	89	94.7	98.3	99.5
Sales of cooking units - Gas (%)	17.2	16.8	15.2	11	5.27	1.7	0.457
Sales of space heating units - Electric Heat Pump (%)	20.5	32.5	36.8	49.4	69.2	82.3	86.9
Sales of space heating units - Electric Resistance (%)	25.1	32.5	30.6	25.2	16.8	11.2	9.24
Sales of space heating units - Fossil (%)	3.8	5.13	5.09	4.25	2.87	2.13	2.05
Sales of space heating units - Gas (%)	50.6	29.9	27.6	21.1	11.1	4.33	1.85
Sales of water heating units - Electric Heat Pump (%)	0	1.92	7.38	23.1	47.4	63.4	69.1
Sales of water heating units - Electric Resistance (%)	46.7	61.2	58.5	50.3	37.7	29.5	26.6
Sales of water heating units - Gas Furnace (%)	49.7	33.6	30.9	23.3	11.7	3.86	1.03
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.25	3.25	3.24	3.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	188	371	1,276	3,945	5,771
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.323	0	0.669	0	2.89	0	7.8
units)							
Public EV charging plugs - L2 (1000 units)	1.11	0	16.1	0	69.5	0	188
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 (%)	1.53	1.95	2.05	1.63	1.04	0.534	0.229

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	1.92	4.75	12	26.1	48.6	72.2	87.6
Vehicle sales - Light-duty - gasoline (%)	91.6	87.3	79.4	66.4	45.9	24.7	10.9
Vehicle sales - Light-duty - hybrid (%)	4.68	5.48	6.15	5.58	4.17	2.46	1.19
Vehicle sales - Light-duty - hydrogen FC	0.113	0.379	0.324	0.247	0.175	0.097	0.045
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.105	0.095	0.083	0.06	0.033	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-450
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-9.92
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-460
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-227
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-4.96
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-232
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							506
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							15.2
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							521
Aggressive deployment - Total (1000							_
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							_
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							257
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							7.61
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 - Moderate							264
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							-1,802
regeneration (1000 tC02e/y)							•
Carbon sink potential - High - All (not							-16,318
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,857
deforestation (1000 tCO2e/y)							•
Carbon sink potential - High - Extend							-7,019
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-144
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-410
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-96.6
pasture (1000 tC02e/y)							
Carbon sink potential - High - Restore							-4,989
productivity (1000 tCO2e/y)							.,
Carbon sink potential - Low - Accelerate							-903
regeneration (1000 tCO2e/y)							, , ,
Carbon sink potential - Low - All (not							-5,789
counting overlap) (1000 tCO2e/y)							07.07
Carbon sink potential - Low - Avoid							-310
deforestation (1000 tCO2e/y)							0.0
Carbon sink potential - Low - Extend							-2,696
rotation length (1000 tCO2e/y)							_,0,0
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							•
Carbon sink potential - Low - Increase							-48.1
retention of HWP (1000 tCO2e/y)							10
Carbon sink potential - Low - Increase							-143
trees outside forests (1000 tCO2e/y)							1-10
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							O O
Carbon sink potential - Low - Reforest							-7.32
pasture (1000 tC02e/y)							1.02
Carbon sink potential - Low - Restore							-1,682
productivity (1000 tC02e/y)							-1,002
Carbon sink potential - Mid - Accelerate				+			-1,352
regeneration (1000 tCO2e/y)							-1,002
Carbon sink potential - Mid - All (not							-11,053
counting overlap) (1000 tC02e/y)							-11,000
Carbon sink potential - Mid - Avoid							-1,083
deforestation (1000 tCO2e/y)							-1,003
Carbon sink potential - Mid - Extend							-4,858
rotation length (1000 tCO2e/y)							-4,008
Carbon sink potential - Mid - Improve							0
plantations (1000 tCO2e/y)							U
Carbon sink potential - Mid - Increase							-96.2
retention of HWP (1000 tCO2e/y)							-96.2
							-277
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-211
ti ees outside iorests (1000 to02e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest							0
cropland (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-52
Carbon sink potential - Mid - Restore							-3,335
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							295
High - Accelerate regeneration (1000							
hectares)							0.51
Land impacted for carbon sink potential -							251
High - Avoid deforestation (over 30 years)							
(1000 hectares) Land impacted for carbon sink potential -							3,579
High - Extend rotation length (1000							3,319
hectares)							
Land impacted for carbon sink potential -		+					0
High - Improve plantations (1000							U
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							O
hectares)							
Land impacted for carbon sink potential -							38.9
High - Increase trees outside forests							00.7
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							_
Land impacted for carbon sink potential -							2.74
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,654
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,821
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							147
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							236
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							1.071
Land impacted for carbon sink potential -							1,371
Low - Extend rotation length (1000							
hectares) Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							U
hectares)							
Land impacted for carbon sink potential -		+			+		0
Low - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							20.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.476
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,001
Low - Restore productivity (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							2,776
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							221
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							244
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,475
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							29.7
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.44
Mid - Reforest pasture (1000 hectares)							0.015
Land impacted for carbon sink potential -							2,015
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							4,988
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		154	0.207	0.206	0.126	0.076	0
Monetary damages from air pollution - Natural Gas (million 2019\$)		208	132	89.2	45.1	19.5	3.06
Monetary damages from air pollution - Transportation (million 2019\$)		1,471	1,506	1,485	1,353	1,087	750
Premature deaths from air pollution - Coal (deaths)		17.4	0.023	0.023	0.014	0.009	0
Premature deaths from air pollution - Natural Gas (deaths)		23.5	14.9	10.1	5.09	2.2	0.346
Premature deaths from air pollution - Transportation (deaths)		165	169	167	152	122	84.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	15,691	17,430	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	54.6	83	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	9.42	24.7	74.5	91.3	93	93.1	93.1
Heat Pump (%)							
Sales of space heating units - Electric	8.85	3.72	4.18	5.96	6.38	6.41	6.34
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.191	0.037	0.002	0	0	0

Table 25: <i>E+RE+</i>	scenario -	PTIIAR 1.	Efficiency/	Flectrification -	Commercial	(continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	81.7	71.4	21.3	2.75	0.604	0.53	0.531
Sales of water heating units - Electric Heat Pump (%)	0.083	10.5	56.1	67.4	68.1	68.1	68.1
Sales of water heating units - Electric Resistance (%)	4.09	5.98	25.6	31.1	31.5	31.5	31.5
Sales of water heating units - Gas Furnace (%)	94.7	83.1	18	1.12	0.029	0	0
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.56	5.85	7.13	7.54	7.14	7.45
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)	154	154	150	142	136	133	134
Final energy use - Industry (PJ)	138	138	137	143	157	161	165
Final energy use - Residential (PJ)	190	187	180	168	158	153	152
Final energy use - Transportation (PJ)	577	543	484	411	345	303	285

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	9.03	12.9	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	82.8	86.5	97.7	99.9	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	17.2	13.5	2.31	0.116	0	0	0
Sales of space heating units - Electric	20.5	39.8	77.9	87.9	88.7	88.6	88.5
Heat Pump (%)							
Sales of space heating units - Electric	25.1	29.4	12.9	8.67	8.4	8.53	8.6
Resistance (%)							
Sales of space heating units - Fossil (%)	3.8	4.75	2.83	2.2	1.94	1.88	1.97
Sales of space heating units - Gas (%)	50.6	26.1	6.34	1.28	0.966	0.96	0.955
Sales of water heating units - Electric	0	11.1	59.1	70.5	71.1	71.1	71.1
Heat Pump (%)							
Sales of water heating units - Electric	46.7	56.4	31.4	25.8	25.6	25.6	25.6
Resistance (%)							
Sales of water heating units - Gas Furnace	49.7	29.2	6.29	0.391	0.01	0	0
(%)							
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.24	3.23	3.24	3.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	1,096	2,868	4,551	6,933	7,503	7,177
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.323	0	1.88	0	7.6	0	12.2
units)							
Public EV charging plugs - L2 (1000 units)	1.11	0	45.2	0	183	0	293
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
(%)							

Table 29: E+RE+ scena	nio DILLAD 1. Efficience	v/Electrification	Transportation	(nontinued)
Table 29. E+RE+ Scellu	II IU - PILLAR I. EIIIUIEIIU	: 7/ = 12011 1110011011 -	Trunsbortution	COMUNICEUM

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.52	1.79	1.25	0.398	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.01	15.5	46.9	82	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.7	48.4	16.3	3.27	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.51	4.61	3.24	1.2	0.293	0.064	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.338	0.201	0.062	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.063	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	0	3.77	5.43	4.09
Capital invested - Wind - Base (billion \$2018)	0	0	0.196	0.451	0.325	0.263	1.53
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed (cumulative) - Solar - Base land use assumptions (MW)	5,833	5,833	5,833	5,833	9,455	14,992	19,411
Installed (cumulative) - Wind - Base land use assumptions (MW)	618	618	765	1,129	1,405	1,640	3,085

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	14,540	0	0	0	8,845	13,464	10,690
Solar - Constrained land use assumptions (GWh)	14,540	0	0	2,685	13,875	23,681	15,359
Wind - Base land use assumptions (GWh)	1,920	0	454	1,061	750	646	3,895
Wind - Constrained land use assumptions (GWh)	2,143	850	2,002	25,592	43,651	6,325	2,044

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-450
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-9.92
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-460
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-227
deployment - Cropland measures (1000							
tCO2e/y)							

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

-4.96
-232
-232
-232
0
506
15.2
521
0
257
7.61
264

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)							-1,802
Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y)							-16,318
Carbon sink potential - High - Avoid deforestation (1000 tC02e/y)							-1,857
Carbon sink potential - High - Extend rotation length (1000 tC02e/y)							-7,019
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-144
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)							-410
Carbon sink potential - High - Reforest cropland (1000 tC02e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-96.6
Carbon sink potential - High - Restore productivity (1000 tC02e/y)							-4,989
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-903
Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)							-5,789
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)							-310
Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)							-2,696

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Improve							0
plantations (1000 tC02e/y)							/ 0 1
Carbon sink potential - Low - Increase							-48.1
retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase							-143
trees outside forests (1000 tCO2e/y)							-143
Carbon sink potential - Low - Reforest						-	0
cropland (1000 tCO2e/y)							U
Carbon sink potential - Low - Reforest							-7.32
pasture (1000 tC02e/y)							-1.52
Carbon sink potential - Low - Restore							-1,682
productivity (1000 tCO2e/y)							-1,002
Carbon sink potential - Mid - Accelerate							-1,352
regeneration (1000 tCO2e/y)							-1,332
Carbon sink potential - Mid - All (not							-11,053
counting overlap) (1000 tC02e/y)							-11,055
Carbon sink potential - Mid - Avoid							-1,083
							-1,003
deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend							-4,858
rotation length (1000 tCO2e/y)							-4,000
							0
Carbon sink potential - Mid - Improve							U
plantations (1000 tCO2e/y)							0/.0
Carbon sink potential - Mid - Increase							-96.2
retention of HWP (1000 tCO2e/y)							077
Carbon sink potential - Mid - Increase							-277
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							0
cropland (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-52
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-3,335
productivity (1000 tC02e/y)							205
Land impacted for carbon sink potential -							295
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							251
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,579
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							38.9
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							2.74
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,654
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,821
High - Total impacted (over 30 years)							
(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 -							147
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							236
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,371
Low - Extend rotation length (1000							.,
hectares)							
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							·
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							Ū
hectares)							
Land impacted for carbon sink potential -							20.5
Low - Increase trees outside forests							20.0
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							U
Land impacted for carbon sink potential -							0.476
Low - Reforest pasture (1000 hectares)							0.410
Land impacted for carbon sink potential -			-				1,001
Low - Restore productivity (1000							1,001
hectares)							
Land impacted for carbon sink potential -							2,776
Low - Total impacted (over 30 years)							2,110
(1000 hectares)							
Land impacted for carbon sink potential -							221
Mid - Accelerate regeneration (1000							221
hectares)							
Land impacted for carbon sink potential -							244
Mid - Avoid deforestation (over 30 years)							244
(1000 hectares)							
Land impacted for carbon sink potential -							2,475
Mid - Extend rotation length (1000							2,413
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							U
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							29.7
Mid - Increase trees outside forests (1000							29.1
hectares)							
Land impacted for carbon sink potential -							0
							U
Mid - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							3.44
Mid - Reforest pasture (1000 hectares)							3.44
Land impacted for carbon sink potential -							2,015
							2,015
Mid - Restore productivity (1000							
hectares)							/. 000
Land impacted for carbon sink potential -							4,988
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 -		154	0.207	0.206	0.126	0.076	0
Coal (million 2019\$)							

Table 3/v F	+RE+ scenario -	TMDACTS -	Health	(continued)

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Natural Gas (million 2019\$)		181	154	72	48.8	22.7	2.68
Monetary damages from air pollution - Transportation (million 2019\$)		1,446	1,367	1,051	610	275	101
Premature deaths from air pollution - Coal (deaths)		17.4	0.023	0.023	0.014	0.009	0
Premature deaths from air pollution - Natural Gas (deaths)		20.4	17.4	8.13	5.51	2.56	0.302
Premature deaths from air pollution - Transportation (deaths)		163	154	118	68.6	30.9	11.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	15,691	17,430	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	9.42	24.7	74.5	91.3	93	93.1	93.1
Sales of space heating units - Electric Resistance (%)	8.85	3.72	4.18	5.96	6.38	6.41	6.34
Sales of space heating units - Fossil (%)	0	0.191	0.037	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	81.7	71.4	21.3	2.75	0.604	0.53	0.531
Sales of water heating units - Electric Heat Pump (%)	0.083	10.5	56.1	67.4	68.1	68.1	68.1
Sales of water heating units - Electric Resistance (%)	4.09	5.98	25.6	31.1	31.5	31.5	31.5
Sales of water heating units - Gas Furnace (%)	94.7	83.1	18	1.12	0.029	0	0
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.56	5.85	7.13	7.54	7.14	7.45
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)	154	154	150	142	136	133	134
Final energy use - Industry (PJ)	138	138	137	143	157	161	165
Final energy use - Residential (PJ)	190	187	180	168	158	153	152
Final energy use - Transportation (PJ)	577	543	484	411	345	303	285

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	9.03	12.9	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	82.8	86.5	97.7	99.9	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	17.2	13.5	2.31	0.116	0	0	0
Sales of space heating units - Electric	20.5	39.8	77.9	87.9	88.7	88.6	88.5
Heat Pump (%)							
Sales of space heating units - Electric	25.1	29.4	12.9	8.67	8.4	8.53	8.6
Resistance (%)							

Table 20, F, DF	acanania DILLAD	1: Efficiency/Electrification	Desidential (continued)
1401E 30. E+KE-	SCEHULIO - PILLAR	1. EHICIENCY/EIECH HICUHUH	- Residential Icontinuear

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Fossil (%)	3.8	4.75	2.83	2.2	1.94	1.88	1.97
Sales of space heating units - Gas (%)	50.6	26.1	6.34	1.28	0.966	0.96	0.955
Sales of water heating units - Electric Heat Pump (%)	0	11.1	59.1	70.5	71.1	71.1	71.1
Sales of water heating units - Electric Resistance (%)	46.7	56.4	31.4	25.8	25.6	25.6	25.6
Sales of water heating units - Gas Furnace (%)	49.7	29.2	6.29	0.391	0.01	0	0
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.24	3.23	3.24	3.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	1,096	2,868	4,551	6,933	7,503	7,177
Cumulative 5-yr (million \$2018)		.,070	_,000	.,00.	37.55	.,000	.,
Public EV charging plugs - DC Fast (1000	0.323	0	1.88	0	7.6	0	12.2
units)							
Public EV charging plugs - L2 (1000 units)	1.11	0	45.2	0	183	0	293
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 (%)	1.52	1.79	1.25	0.398	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.01	15.5	46.9	82	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.7	48.4	16.3	3.27	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.51	4.61	3.24	1.2	0.293	0.064	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.338	0.201	0.062	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.063	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0.805	0.25	0	0
Capital invested - Wind - Base (billion \$2018)		0	0	0.09	0.214	0.166	0.116
Capital invested - Wind - Constrained (billion \$2018)		0.159	0.253	0.498	3.38	1.47	7.97

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	14,540	0	0	0	0	0	0
Solar - Constrained land use assumptions	14,540	0	0	1,738	578	0	0
(GWh)							
Wind - Base land use assumptions (GWh)	1,920	0	0	227	538	428	322
Wind - Constrained land use assumptions	1,920	330	506	971	6,160	2,781	15,721
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							C
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-450
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-9.92
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-460
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							C
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-22
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-4.96
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-232
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							C
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							506
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							15.2
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							52 ⁻
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							(
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							257
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							7.6
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							264
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							-1,802
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-16,318
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,857
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,019
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-144
retention of HWP (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-410
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest cropland (1000 tC02e/y)							0
Carbon sink potential - High - Reforest							-96.6
pasture (1000 tC02e/y)							-90.0
Carbon sink potential - High - Restore							-4,989
productivity (1000 tCO2e/y)							-4,707
Carbon sink potential - Low - Accelerate		+					-903
regeneration (1000 tCO2e/y)							700
Carbon sink potential - Low - All (not		+					-5,789
counting overlap) (1000 tCO2e/y)							-5,107
Carbon sink potential - Low - Avoid							-310
deforestation (1000 tC02e/y)							0.0
Carbon sink potential - Low - Extend							-2,696
rotation length (1000 tCO2e/y)							2,070
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							·
Carbon sink potential - Low - Increase							-48.1
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-143
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							·
Carbon sink potential - Low - Reforest		+					-7.32
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore		+					-1,682
productivity (1000 tCO2e/y)							.,002
Carbon sink potential - Mid - Accelerate							-1,352
regeneration (1000 tCO2e/y)							,
Carbon sink potential - Mid - All (not							-11,053
counting overlap) (1000 tCO2e/y)							,
Carbon sink potential - Mid - Avoid							-1,083
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-4,858
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-96.2
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-277
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-52
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-3,335
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							295
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							251
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,579
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)							

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

Land impacted for carbon sink potential -	2020	2025	2030	2035	2040	2045	2050
High - Increase retention of HWP (1000							·
hectares)							
Land impacted for carbon sink potential -							38.9
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							C
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							2.74
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,654
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,82
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							147
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							236
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,37
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							C
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							C
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							20.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							C
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.476
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,00
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,776
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							22
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							244
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,475
Mid - Extend rotation length (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 -							29.7
Mid - Increase trees outside forests (1000							_,,,
hectares)							

Table 43: E+RE-	cconario	DTIIAD	6. Land sinks	Enrocte	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.44
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,015
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							4,988
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		154	0.207	0.206	0.126	0.076	0
Coal (million 2019\$)							
Monetary damages from air pollution -		236	168	145	151	82.7	9.62
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,446	1,367	1,051	610	275	101
Transportation (million 2019\$)							
Premature deaths from air pollution -		17.4	0.023	0.023	0.014	0.009	0
Coal (deaths)							
Premature deaths from air pollution -		26.7	19	16.3	17.1	9.34	1.09
Natural Gas (deaths)							
Premature deaths from air pollution -		163	154	118	68.6	30.9	11.4
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 - Cumulative 5-yr (million \$2018)	0	15,683	17,443	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump (%)	9.42	15.4	21.2	37.7	63.9	82.8	90.3
Sales of space heating units - Electric Resistance (%)	8.85	3.71	3.77	3.94	4.58	5.53	6.06
Sales of space heating units - Fossil (%)	0	0.221	0.208	0.157	0.076	0.024	0.007
Sales of space heating units - Gas Furnace (%)	81.7	80.6	74.8	58.2	31.5	11.7	3.68
Sales of water heating units - Electric Heat Pump (%)	0.083	1.86	7.04	22	45.1	60.6	66.1
Sales of water heating units - Electric Resistance (%)	4.09	2.3	4.52	11	21.1	28	30.5
Sales of water heating units - Gas Furnace (%)	94.7	95.5	88	66.6	33.4	11.1	2.96
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.08	5.31	5.56	5.79	6.91	7.24
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)	154	154	154	153	150	146	143

Table 47: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	138	139	137	144	160	164	168
Final energy use - Residential (PJ)	190	188	187	184	176	167	161
Final energy use - Transportation (PJ)	578	547	504	469	441	408	369

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	8.98	12.7	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	82.8	83.2	84.8	89	94.7	98.3	99.5
Resistance (%)							
Sales of cooking units - Gas (%)	17.2	16.8	15.2	11	5.27	1.7	0.457
Sales of space heating units - Electric	20.5	32.5	36.8	49.4	69.2	82.3	86.9
Heat Pump (%)							
Sales of space heating units - Electric	25.1	32.5	30.6	25.2	16.8	11.2	9.24
Resistance (%)							
Sales of space heating units - Fossil (%)	3.8	5.13	5.09	4.25	2.87	2.13	2.05
Sales of space heating units - Gas (%)	50.6	29.9	27.6	21.1	11.1	4.33	1.85
Sales of water heating units - Electric	0	1.92	7.38	23.1	47.4	63.4	69.1
Heat Pump (%)							
Sales of water heating units - Electric	46.7	61.2	58.5	50.3	37.7	29.5	26.6
Resistance (%)							
Sales of water heating units - Gas Furnace	49.7	33.6	30.9	23.3	11.7	3.86	1.03
(%)							
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.25	3.25	3.24	3.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	188	371	1,276	3,945	5,771
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.323	0	0.669	0	2.89	0	7.8
_units)							
Public EV charging plugs - L2 (1000 units)	1.11	0	16.1	0	69.5	0	188
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 (%)	1.53	1.95	2.05	1.63	1.04	0.534	0.229
Vehicle sales - Light-duty - EV (%)	1.92	4.75	12	26.1	48.6	72.2	87.6
Vehicle sales - Light-duty - gasoline (%)	91.6	87.3	79.4	66.4	45.9	24.7	10.9
Vehicle sales - Light-duty - hybrid (%)	4.68	5.48	6.15	5.58	4.17	2.46	1.19
Vehicle sales - Light-duty - hydrogen FC	0.113	0.379	0.324	0.247	0.175	0.097	0.045
(%)							
Vehicle sales - Light-duty - other (%)	0.102	0.105	0.095	0.083	0.06	0.033	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0.002	0.061	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0.007	0.02
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0.001	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	4.19	124	124	124	124	124
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	6.99	26.8
Biomass w/ccu power plant (GWh)	0	0	0	0	0	1.2	1.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0.513	8.84	10.5	10.6	30.4	39.8
Conversion capital investment -	0	2.42	68	21.8	2.59	253	166
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	1	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	1	1
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu	0	0	0	0	0	1	1
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu	0	0	0	0	0	1	1
(quantity)							
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0.15	3.44	3.83	4.06
Annual - BECCS (MMT)		0	0	0	0	0.31	0.44
Annual - Cement and lime (MMT)		0	0	0	3.32	3.42	3.53
Annual - NGCC (MMT)		0	0	0.15	0.12	0.1	0.08
Cumulative - All (MMT)		0	0	0.15	3.59	7.42	11.5
Cumulative - BECCS (MMT)		0	0	0	0	0.31	0.75
Cumulative - Cement and lime (MMT)		0	0	0	3.32	6.74	10.3
Cumulative - NGCC (MMT)		0	0	0.15	0.27	0.37	0.45

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	406	415	504	708	708
Cumulative investment - All (million \$2018)		0	440	445	531	643	646
Cumulative investment - Spur (million \$2018)		0	0	5.33	91.1	203	207
Cumulative investment - Trunk (million \$2018)		0	440	440	440	440	440
Spur (km)		0	0	9.36	98.6	303	303
Trunk (km)		0	406	406	406	406	406

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

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

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

Table 56: E-B+ scenario - PILLAR 6: Land s Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive	2020	2023	2030	2033	2040	2045	2030
deployment - Corn-ethanol to energy							U
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-450
deployment - Cropland measures (1000							-430
tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							U
crops (1000 tC02e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							U
(1000 tC02e/y)							
Carbon sink potential - Aggressive							-9.92
deployment - Permanent conservation							-7.72
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-460
deployment - Total (1000 tC02e/y)							-400
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							U
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-227
deployment - Cropland measures (1000							-221
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							U
crops (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							U
(1000 tC02e/y)							
Carbon sink potential - Moderate							-4.96
deployment - Permanent conservation							-4.70
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-232
deployment - Total (1000 tC02e/y)							-232
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							U
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,249
Aggressive deployment - Cropland							1,247
measures (1000 hectares)							
Land impacted for carbon sink -							0
Aggressive deployment - Cropland to							U
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							0
Aggressive deployment - Pasture to							U
energy crops (1000 hectares)							
Land impacted for carbon sink -							15.2
Aggressive deployment - Permanent							13.2
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,264
Aggressive deployment - Total (1000							1,204
hectares)							
nootal coj							

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							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							257
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Cropland to woody energy							
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Pasture to energy crops							
(1000 hectares)							
Land impacted for carbon sink - Moderate							7.61
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							264
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-1,80
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-16,318
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,85
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,019
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							C
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-144
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-410
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							C
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-96.6
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-4,989
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-903
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-5,789
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-310
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,696
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							C
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-48.
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-143
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							(
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-7.32
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,682
productivity (1000 tCO2e/y)							

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

regeneration (1000 CC02e/y) Carbon sink potential - Mid - Ali (not counting overlap) (1000 CC02e/y) Carbon sink potential - Mid - Avoid deforestation (1000 CC02e/y) Carbon sink potential - Mid - Extend rotation length (1000 CC02e/y) Carbon sink potential - Mid - Extend rotation length (1000 CC02e/y) Carbon sink potential - Mid - Improve plantations (1000 CC02e/y) Carbon sink potential - Mid - Improve plantations (1000 CC02e/y) Carbon sink potential - Mid - Increase retention of HwP (1000 CC02e/y) Carbon sink potential - Mid - Increase retended for earbon sink potential - Mid - Reforest cropland (1000 CC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 CC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 CC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 CC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 CC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 CC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 CC02e/y) Carbon sink potential - Mid - Restore productivity (1000 tc02e/y) Carbon sink potential - Mid - Restore productivity (1000 tc02e/y) Carbon sink potential - Mid - Restore productivity (1000 tc02e/y) Carbon sink potential - Mid - Restore productivity (1000 tc02e/y) Carbon sink potential - Mid - Restore productivity (1000 hectares) Land impacted for carbon sink potential - Migh - Extend rotation length (1000 hectares) Land impacted for carbon sink potential - Migh - Extend rotation length (1000 hectares) Land impacted for carbon sink potential - Migh - Increase retention of HWP (1000 hectares) Land impacted for carbon sink potential - Migh - Increase retention of HWP (1000 hectares) Land impacted for carbon sink potential - Migh - Reforest cropland (1000 hectares) Land impacted for carbon sink potential - Migh - Reforest cropland (1000 hectares) Land impacted for carbon sink potential - Migh - Reforest carbon sink potential - Migh - Reforest carbon sink potential - Migh - Reforest pasture (1000 hectares) Land impacted for carbon sink potential	Iable 57: E-B+ scenario - PILLAR 6: Land s Item	2020	2025	2030	2035	2040	2045	2050
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Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)								
Low - Accelerate regeneration (1000 hectares)								147
hectares)								
	Land impacted for carbon sink potential -		+	+				236
Low - Avoid deforestation (over 30 years)								230
(1000 hectares)								
								1 071
								1,371
Low - Extend rotation length (1000								
hectares)								
Land impacted for carbon sink potential -								0
Low - Improve plantations (1000								
hectares)	nectaresj							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							20.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.476
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,001
Low - Restore productivity (1000							,
hectares)							
Land impacted for carbon sink potential -							2,776
Low - Total impacted (over 30 years)							,
(1000 hectares)							
Land impacted for carbon sink potential -							221
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							244
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,475
Mid - Extend rotation length (1000							, -
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							29.7
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.44
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,015
Mid - Restore productivity (1000							_,
hectares)							
Land impacted for carbon sink potential -		+				+	4,988
Mid - Total impacted (over 30 years) (1000							.,, 00
hectares)							
nootal ooj							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		154	0.207	0.206	0.126	0.076	0
Coal (million 2019\$)							
Monetary damages from air pollution -		196	128	93.2	70.6	43.5	7.16
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,471	1,506	1,485	1,353	1,087	750
Transportation (million 2019\$)							
Premature deaths from air pollution -		17.4	0.023	0.023	0.014	0.009	0
Coal (deaths)							
Premature deaths from air pollution -		22.2	14.5	10.5	7.97	4.91	0.808
Natural Gas (deaths)							
Premature deaths from air pollution -		165	169	167	152	122	84.4
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	15,479	16,145	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	44.7	44.7	44.6	44.4	44.5	44.6
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	55.3	55.3	55.4	55.6	55.5	55.4
Sales of space heating units - Electric	9.42	27.3	68.2	78	78.7	78.8	78.8
Heat Pump (%)							
Sales of space heating units - Electric	8.85	5.52	11.3	16.2	20	20.6	20.6
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.189	0.074	0.026	0.004	0	0
Sales of space heating units - Gas Furnace	81.7	67	20.4	5.76	1.23	0.588	0.532
(%)							
Sales of water heating units - Electric	0.083	0.031	0.031	0.031	0.031	0.031	0.031
Heat Pump (%)							
Sales of water heating units - Electric	4.09	1.51	1.51	1.53	1.5	1.51	1.5
Resistance (%)							
Sales of water heating units - Gas Furnace	94.7	98.1	98.1	98.1	98.1	98.1	98.1
(%)							
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.57	5.85	6.55	6.89	7.44	7.8
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)	154	157	160	162	165	172	181
Final energy use - Industry (PJ)	138	144	147	154	162	173	185
Final energy use - Residential (PJ)	190	190	195	202	212	222	230
Final energy use - Transportation (PJ)	577	551	515	496	500	516	538

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	8.41	8.88	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	82.6	82.6	82.6	82.6	82.6	82.6	82.6
Resistance (%)							
Sales of cooking units - Gas (%)	17.4	17.4	17.4	17.4	17.4	17.4	17.4
Sales of space heating units - Electric	19.5	39.9	40.6	41.7	43.2	45.2	47.9
Heat Pump (%)							
Sales of space heating units - Electric	25.4	29.6	29.2	28.6	27.5	25.7	23
Resistance (%)							
Sales of space heating units - Fossil (%)	3.83	3.9	4.03	3.98	3.57	3.36	3.58
Sales of space heating units - Gas (%)	51.3	26.5	26.2	25.7	25.7	25.7	25.6
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	46.7	62.2	62.4	62.4	62.4	62.5	62.5
Resistance (%)							
Sales of water heating units - Gas Furnace	49.7	34.5	34.4	34.3	34.3	34.3	34.2
(%)							
Sales of water heating units - Other (%)	3.58	3.23	3.23	3.25	3.26	3.26	3.26

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 (%)	1.53	1.94	2.18	2.03	1.83	1.7	1.62
Vehicle sales - Light-duty - EV (%)	3.65	5.72	6.51	8.01	9.74	11.3	12.4
Vehicle sales - Light-duty - gasoline (%)	90.1	86.5	84.3	82.4	80.3	78.4	76.8
Vehicle sales - Light-duty - hybrid (%)	4.53	5.37	6.57	7.13	7.7	8.26	8.69
Vehicle sales - Light-duty - hydrogen FC	0.111	0.376	0.344	0.305	0.302	0.302	0.313
(%)							
Vehicle sales - Light-duty - other (%)	0.101	0.105	0.101	0.101	0.101	0.1	0.102
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen	0.175	0.208	0.242	0.285	0.339	0.409	0.487
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-1,802
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-16,318
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,857
deforestation (1000 tC02e/y)							
Carbon sink potential - High - Extend							-7,019
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-144
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-410
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-96.6
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-4,989
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-903
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-5,789
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-310
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,696
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							0
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-48.1
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-143
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							0
cropland (1000 tCO2e/y)							_

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Reforest							-7.32
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,682
productivity (1000 tC02e/y)							1.050
Carbon sink potential - Mid - Accelerate							-1,352
regeneration (1000 tC02e/y)							44.050
Carbon sink potential - Mid - All (not							-11,053
counting overlap) (1000 tC02e/y)							1.000
Carbon sink potential - Mid - Avoid							-1,083
deforestation (1000 tC02e/y)							,
Carbon sink potential - Mid - Extend							-4,858
rotation length (1000 tC02e/y)							
Carbon sink potential - Mid - Improve							0
plantations (1000 tC02e/y)							0/0
Carbon sink potential - Mid - Increase							-96.2
retention of HWP (1000 tC02e/y)							077
Carbon sink potential - Mid - Increase							-277
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							0
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-52
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-3,335
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							295
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							251
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,579
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							38.9
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							2.74
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,654
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,821
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							147
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							236
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,371
Low - Extend rotation length (1000							•
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							20.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Reforest cropland (1000 hectares)							0.17/
Land impacted for carbon sink potential -							0.476
Low - Reforest pasture (1000 hectares) Land impacted for carbon sink potential -							1,001
Low - Restore productivity (1000							1,001
hectares)							
Land impacted for carbon sink potential -							2,776
Low - Total impacted (over 30 years)							2,110
(1000 hectares)							
Land impacted for carbon sink potential -							221
Mid - Accelerate regeneration (1000							221
hectares)							
Land impacted for carbon sink potential -							244
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,475
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							29.7
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.44
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,015
Mid - Restore productivity (1000							
hectares)							/ 000
Land impacted for carbon sink potential -							4,988
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	7.56		2.19				0.629
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.039		-0.082				-0.086
Business-as-usual carbon sink - Total (Mt CO2e/y)	7.52		2.11				0.543

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		262	148	78.2	59.2	54.8	51.4
Coal (million 2019\$)							
Monetary damages from air pollution -		294	286	260	195	204	99
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,469	1,526	1,582	1,645	1,708	1,772
Transportation (million 2019\$)							
Premature deaths from air pollution -		29.6	16.7	8.83	6.68	6.18	5.81
Coal (deaths)							
Premature deaths from air pollution -		33.2	32.3	29.3	22	23	11.2
Natural Gas (deaths)							
Premature deaths from air pollution -		165	172	178	185	192	199
Transportation (deaths)							