

Net-Zero America - missouri state report

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

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Notes

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	16,269	17,611	0	0	0	0
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric Heat Pump (%)	4.52	24.4	70.6	87.7	89.7	89.7	89.7
Sales of space heating units - Electric Resistance (%)	8.06	5.73	7.1	9.32	9.79	9.8	9.8
Sales of space heating units - Fossil (%)	0	1.75	0.337	0.014	0	0	0
Sales of space heating units - Gas Furnace (%)	87.4	68.1	22	2.94	0.553	0.458	0.459
Sales of water heating units - Electric Heat Pump (%)	1.19	10.6	53.1	64.2	65	65	65
Sales of water heating units - Electric Resistance (%)	10.1	11	28.4	33.8	34.3	34.3	34.3
Sales of water heating units - Gas Furnace (%)	87.7	77.5	17.8	1.26	0.041	0	0
Sales of water heating units - Other (%)	0.996	0.947	0.735	0.688	0.685	0.688	0.687

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.82	3.92	6.23	6.6	6.19	6.47
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	182	178	169	158	147	141	138
Final energy use - Industry (PJ)	241	249	271	274	290	326	330
Final energy use - Residential (PJ)	241	227	206	178	155	141	134
Final energy use - Transportation (PJ)	669	623	550	461	380	331	311

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	5.85	7.79	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	76.5	81.5	96.8	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	23.5	18.5	3.16	0.159	0	0	0
Sales of space heating units - Electric	7.5	22.5	72.3	86.1	87.5	87.8	87.4
Heat Pump (%)							
Sales of space heating units - Electric	19.7	22.4	10	6.61	6.36	6.55	6.72
Resistance (%)							
Sales of space heating units - Fossil (%)	9.34	13.6	7.39	5.58	5.03	4.63	4.86
Sales of space heating units - Gas (%)	63.5	41.4	10.2	1.69	1.08	1.04	1.02
Sales of water heating units - Electric	0	8.7	46.5	56.1	56.7	56.7	56.7
Heat Pump (%)							
Sales of water heating units - Electric	42.5	55.5	45.3	43.3	43.3	43.3	43.3
Resistance (%)							
Sales of water heating units - Gas Furnace	57.4	35.7	8.23	0.581	0.019	0	0
(%)							
Sales of water heating units - Other (%)	0.034	0.035	0.036	0.035	0.035	0.036	0.036

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	1,055	2,704	4,381	6,637	7,223	6,887
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.178	0	1.98	0	8.67	0	14
units)							
Public EV charging plugs - L2 (1000 units)	1.67	0	47.5	0	208	0	337
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 (%)	1.59	1.85	1.27	0.408	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.79	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.5	49.4	16.8	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.3	4.45	3.17	1.18	0.287	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.111	0.342	0.206	0.064	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	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	0.003	0.021	0	0.003	0	0
Capital invested - Biomass w/ccu allam	0	0	0	0	0	0.009	0
power plant (billion \$2018)	U	U	U	U	U	0.009	U
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	1.19	0.005	0
Capital invested - Solar PV - Base (billion \$2018)	0	13.2	10.6	18.6	21	5.54	2.17
Capital invested - Solar PV - Constrained (billion \$2018)	0	9.58	11.6	13.9	23.7	1.24	0.374
Capital invested - Wind - Base (billion \$2018)	0	28.5	22.8	22	35.2	34.7	36.6
Capital invested - Wind - Constrained (billion \$2018)	0	31.6	32.5	34.5	16.2	1.98	80.4
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed (cumulative) - Rooftop PV (MW)	153	269	400	605	898	1,277	1,767
Installed (cumulative) - Solar - Base land use assumptions (MW)	33.6	9,863	18,696	35,534	55,733	61,382	63,727
Installed (cumulative) - Wind - Base land use assumptions (MW)	5,547	24,947	42,054	59,780	89,561	120,496	155,043

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	5.97	46.4	46.4	52.4	52.4	52.4
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	9.08	9.08
Biomass w/ccu power plant (GWh)	0	0	0	0	1,335	1,341	1,341
Solar - Base land use assumptions (GWh)	72.4	18,469	16,652	31,637	37,857	10,625	4,455
Solar - Constrained land use assumptions (GWh)	0	13,674	19,673	27,380	30,793	6,753	1,946

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

	-	•	-				
Item	2020	2025	2030	2035	2040	2045	2050
Wind - Base land use assumptions (GWh)	19,737	63,826	55,654	57,087	95,569	97,330	105,726
Wind - Constrained land use assumptions	17,665	69,321	74,871	88,977	43,756	7,268	237,161
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	38.3	97	98	192	298	656
Conversion capital investment -	0	3.44	23	19.7	1,705	1,881	6,256
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	1	4	11
(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	1	2	2
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu	0	0	0	0	1	2	2
(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 9: E+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	3.24	3.35	5.37	14.7	23.1
Annual - BECCS (MMT)		0	0	0	2.05	4.46	12.5
Annual - Cement and lime (MMT)		0	3.24	3.35	3.32	10.3	10.6
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	3.24	6.59	12	26.7	49.8
Cumulative - BECCS (MMT)		0	0	0	2.05	6.51	19
Cumulative - Cement and lime (MMT)		0	3.24	6.59	9.91	20.2	30.8
Cumulative - NGCC (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	420	589	687	959	1,557
Cumulative investment - All (million \$2018)		0	1,962	2,109	2,192	2,337	2,845
Cumulative investment - Spur (million \$2018)		0	11.9	160	242	387	895
Cumulative investment - Trunk (million \$2018)		0	1,950	1,950	1,950	1,950	1,950
Spur (km)		0	10.4	180	278	550	1,148
Trunk (km)		0	409	409	409	409	409

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	0.88	1.81	3.44	3.73
Injection wells (wells)		0	1	2	4	7	9
Resource characterization, appraisal, permitting costs (million \$2020)		27.9	78.2	101	101	101	101
Wells and facilities construction costs (million \$2020)		0	18.6	72.5	129	216	268

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							-13,495
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-313
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-13,808
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-7,068
deployment - Cropland measures (1000							,
tCO2e/y)							
Carbon sink potential - Moderate							-157
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-7,225
deployment - Total (1000 tC02e/y)							1,220
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							O
energy grasses (1000 hectares)							
Land impacted for carbon sink -							5,748
Aggressive deployment - Cropland							3,140
measures (1000 hectares)							
Land impacted for carbon sink -							570
Aggressive deployment - Permanent							570
conservation cover (1000 hectares)							/ 010
Land impacted for carbon sink -							6,318
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							3,016
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							285
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							3,301
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							-164
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-51,213
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,274
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,741
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-151
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-3,212
retention of HWP (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-2,247
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-10,656
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-21,079
pasture (1000 tC02e/y)							
Carbon sink potential - High - Restore							-3,690
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-82
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-13,537
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-379
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-2,973
rotation length (1000 tC02e/y)							
Carbon sink potential - Low - Improve							-77
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,071
retention of HWP (1000 tC02e/y)							
Carbon sink potential - Low - Increase							-787
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-5,328
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-1,597
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,244
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-123
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-32,374
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,326
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,357
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-113
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,141
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-1,517
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-7,992
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-11,338
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-2,467
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							26.8
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							308
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -						T	3,947
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							55.7
High - Improve plantations (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares)							
Land impacted for carbon sink potential -							214
High - Increase trees outside forests							
(1000 hectares)							705
Land impacted for carbon sink potential -							705
High - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							599
High - Reforest pasture (1000 hectares)							399
Land impacted for carbon sink potential -		+					1,223
High - Restore productivity (1000							1,220
hectares)							
Land impacted for carbon sink potential -							7,077
High - Total impacted (over 30 years)							.,
(1000 hectares)							
Land impacted for carbon sink potential -							13.4
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							289
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,512
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							27.9
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 -							112
Low - Increase trees outside forests							112
(1000 hectares)							
Land impacted for carbon sink potential -							352
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							104
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							740
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,151
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							20.1
Mid - Accelerate regeneration (1000							
hectares)							000
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years)							298
(1000 hectares)							
Land impacted for carbon sink potential -							2,730
Mid - Extend rotation length (1000							2,130
hectares)							
Land impacted for carbon sink potential -							41.9
Mid - Improve plantations (1000 hectares)							1117
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							,
hectares)							
Land impacted for carbon sink potential -							163
Mid - Increase trees outside forests (1000							
hectares)							

Table 13: E+ scenario - PILLAR 6	Land sinks - Forests I	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							528
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							751
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,490
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,022
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)		249	210	169	127	79.8	55.4
Natural gas consumption - Cumulative (tcf)		0	0	0	0	0	5,077
Natural gas production - Annual (tcf)		0	0	0	0	0	0
Oil consumption - Annual (million bbls)		121	106	83.7	62.4	45.6	32.5
Oil consumption - Cumulative (million bbls)		0	0	0	0	0	2,577
Oil production - Annual (million bbls)		0.117	0.117	0.117	0.093	0.075	0.05

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		556	0.464	0.445	0.372	0.247	0.01
Coal (million 2019\$)							
Monetary damages from air pollution -		207	110	54.9	43.2	22.9	11.1
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,300	1,208	916	529	246	103
Transportation (million 2019\$)							
Premature deaths from air pollution -		62.8	0.052	0.05	0.042	0.028	0.001
Coal (deaths)							
Premature deaths from air pollution -		23.4	12.4	6.2	4.87	2.59	1.25
Natural Gas (deaths)							
Premature deaths from air pollution -		146	136	103	59.5	27.6	11.6
Transportation (deaths)							

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		441	515	610	545	438	734
By economic sector - Construction (jobs)		24,232	29,825	40,936	53,855	53,148	58,830
By economic sector - Manufacturing		8,268	10,342	13,920	14,930	13,555	17,080
(jobs)							
By economic sector - Mining (jobs)		2,224	1,584	1,073	699	468	322
By economic sector - Other (jobs)		3,011	3,744	6,020	8,467	7,691	8,637
By economic sector - Pipeline (jobs)		404	504	279	221	179	217
By economic sector - Professional (jobs)		12,914	16,867	23,916	32,989	36,250	42,699
By economic sector - Trade (jobs)		7,818	9,644	13,648	18,886	20,379	24,221
By economic sector - Utilities (jobs)		14,201	19,173	26,240	37,258	42,241	49,482
By education level - All sectors -		23,298	29,432	40,627	54,161	56,338	65,293
Associates degree or some college (jobs)							
By education level - All sectors -		14,948	18,745	25,637	34,102	36,078	42,175
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		605	766	1,062	1,435	1,542	1,803
degree (jobs)							
By education level - All sectors - High		30,893	38,476	52,721	69,260	70,862	81,788
school diploma or less (jobs)							

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

Table 10. L+ Scellal 10 - IMPACIS - 3003 (cui	•						
Item	2020	2025	2030	2035	2040	2045	2050
By education level - All sectors - Masters		3,770	4,780	6,594	8,891	9,529	11,164
or professional degree (jobs)							
By resource sector - Biomass (jobs)		1,042	1,210	1,474	1,486	1,618	3,207
By resource sector - CO2 (jobs)		14.7	1,318	91.3	194	438	1,118
By resource sector - Coal (jobs)		1,495	345	151	132	119	105
By resource sector - Grid (jobs)		21,309	31,638	47,437	69,141	80,149	94,229
By resource sector - Natural Gas (jobs)		3,513	2,388	2,008	2,340	1,045	796
By resource sector - Nuclear (jobs)		624	614	356	0	0	0
By resource sector - Oil (jobs)		5,419	4,356	3,168	2,195	1,500	1,003
By resource sector - Solar (jobs)		18,264	19,292	31,168	39,241	26,325	26,730
By resource sector - Wind (jobs)		21,834	31,036	40,787	53,120	63,156	75,034
Median wages - Annual - All (\$2019 per		58,825	59,744	60,424	61,583	63,065	64,083
job)			-		-		
On-Site or In-Plant Training - Total jobs - 1		12,061	15,181	20,867	27,762	28,841	33,341
to 4 years (jobs)		,			•	,	•
On-Site or In-Plant Training - Total jobs - 4		5,261	6,631	9,101	12,233	12,763	14,660
to 10 years (jobs)			,	•	•		·
On-Site or In-Plant Training - Total jobs -		12,107	15,167	20,861	27,598	28,597	33,179
None (jobs)		,	,				
On-Site or In-Plant Training - Total jobs -		646	822	1,133	1,519	1,590	1,842
Over 10 years (jobs)				,	,-	, -	•-
On-Site or In-Plant Training - Total jobs -		43,440	54,398	74,680	98,737	102,558	119,201
Up to 1 year (jobs)		,	.,	.,,,,,,	,	102,000	,
On-the-Job Training - All sectors - 1 to 4		15,610	19,683	27,057	36,063	37,539	43,389
years (jobs)		,	,		22,222	3.753	,
On-the-Job Training - All sectors - 4 to 10		5,223	6,602	9,093	12,257	12,772	14,647
years (jobs)			5,55=	,,,,,,	,	,	, -
On-the-Job Training - All sectors - None		4,076	5,060	6,956	9,192	9,466	10,954
(iobs)		,	,	.,	,	,	-, -
On-the-Job Training - All sectors - Over 10		739	911	1,239	1,598	1,605	1,840
years (jobs)				, -	,-	,	,
On-the-Job Training - All sectors - Up to 1		47,866	59,943	82,296	108,739	112,967	131,392
year (jobs)		,	- , -	- , -		, -	- ,-
Related work experience - All sectors - 1		26,270	32,976	45,303	60,227	62,836	72,957
to 4 years (jobs)			, -	.,	,	,	, -
Related work experience - All sectors - 4		17,219	21,667	29,726	39,556	41,364	47,987
to 10 years (jobs)					•	,	·
Related work experience - All sectors -		10,540	13,227	18,195	24,170	25,038	29,025
None (jobs)			-,	-,	,	,,,,,,,	,
Related work experience - All sectors -		4,465	5,615	7,688	10,150	10,599	12,334
Over 10 years (jobs)							•
Related work experience - All sectors - Up		15,020	18,713	25,730	33,746	34,512	39,920
to 1 year (jobs)		,	-, -	,	, -	,-	, -
Wage income - All (million \$2019)		4,325	5,509	7,653	10,338	10,997	12,961
		.,==0	-,,	.,	,	,	,

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	16,266	17,675	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	44.8	49.3	53.1	63	76.9	85.5	88.5
Resistance (%)							
Sales of cooking units - Gas (%)	55.2	50.7	46.9	37	23.1	14.5	11.5
Sales of space heating units - Electric	4.52	15.9	21.2	36.6	61.3	79.5	86.8
Heat Pump (%)							
Sales of space heating units - Electric	8.06	5.57	5.72	6.25	7.38	8.69	9.45
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.02	1.9	1.42	0.689	0.224	0.059
Sales of space heating units - Gas Furnace	87.4	76.5	71.1	55.7	30.6	11.6	3.64
(%)							

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	1.19	2.53	7.36	21.3	43.1	57.7	63
Heat Pump (%)							
Sales of water heating units - Electric	10.1	7.76	9.75	15.5	24.6	31	33.4
Resistance (%)							
Sales of water heating units - Gas Furnace	87.7	88.7	81.9	62.3	31.6	10.6	2.88
(%)							
Sales of water heating units - Other (%)	0.996	0.987	0.962	0.892	0.786	0.72	0.695

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.2	3.23	3.9	4.01	5.79	6.1
Cumulative 5-yr (billion \$2018)							

Table 19: E- scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	182	179	174	169	162	155	149
Final energy use - Industry (PJ)	241	250	272	277	295	331	335
Final energy use - Residential (PJ)	241	228	218	206	189	170	154
Final energy use - Transportation (PJ)	670	628	574	531	498	459	413

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	5.81	7.68	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	76.4	77	79.2	84.9	92.8	97.7	99.4
Resistance (%)							
Sales of cooking units - Gas (%)	23.6	23	20.8	15.1	7.21	2.33	0.626
Sales of space heating units - Electric	7.5	13	18.7	35.2	61.1	79	85.2
Heat Pump (%)							
Sales of space heating units - Electric	19.7	24.8	23.3	19.2	12.8	8.51	7.04
Resistance (%)							
Sales of space heating units - Fossil (%)	9.34	14.9	14.4	12.2	8.46	5.78	5.24
Sales of space heating units - Gas (%)	63.5	47.3	43.7	33.5	17.6	6.67	2.55
Sales of water heating units - Electric	0	1.51	5.81	18.2	37.5	50.4	55
Heat Pump (%)							
Sales of water heating units - Electric	42.5	57.5	56.3	52.9	47.8	44.7	43.6
Resistance (%)							
Sales of water heating units - Gas Furnace	57.4	40.9	37.8	28.9	14.7	4.93	1.34
(%)							
Sales of water heating units - Other (%)	0.034	0.035	0.036	0.036	0.036	0.036	0.036

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	171	359	1,211	3,810	5,551
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.178	0	0.611	0	3.21	0	8.98
units)							
Public EV charging plugs - L2 (1000 units)	1.67	0	14.7	0	77.3	0	216
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 (%)	1.6	2.01	2.06	1.64	1.05	0.542	0.232

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	1.84	4.58	11.7	25.5	48	71.8	87.5
Vehicle sales - Light-duty - gasoline (%)	91.9	87.7	79.9	67.1	46.6	25.1	11.1
Vehicle sales - Light-duty - hybrid (%)	4.45	5.27	5.93	5.41	4.08	2.42	1.18
Vehicle sales - Light-duty - hydrogen FC	0.113	0.381	0.328	0.251	0.179	0.1	0.046
(%)							
Vehicle sales - Light-duty - other (%)	0.105	0.108	0.098	0.086	0.062	0.034	0.016
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							-13,495
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-313
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-13,808
deployment - Total (1000 tC02e/y)							•
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-7,068
deployment - Cropland measures (1000							,
tC02e/y)							
Carbon sink potential - Moderate							-157
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-7,225
deployment - Total (1000 tCO2e/y)							.,0
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							Ū
energy grasses (1000 hectares)							
Land impacted for carbon sink -							5,748
Aggressive deployment - Cropland							0,1 10
measures (1000 hectares)							
Land impacted for carbon sink -							570
Aggressive deployment - Permanent							510
conservation cover (1000 hectares)							
Land impacted for carbon sink -							6,318
Aggressive deployment - Total (1000							0,010
hectares)							
Land impacted for carbon sink - Moderate						+	0
deployment - Corn-ethanol to energy							O
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate						+	3,016
deployment - Cropland measures (1000							3,010
hectares)							
Land impacted for carbon sink - Moderate							285
deployment - Permanent conservation							200
cover (1000 hectares)							
cover (1000 nectares)							

Table 22: E- scenario - PILLAR 6: Land sinks - Agriculture (continued)

	-	•	-				
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate							3,301
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							-164
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-51,213
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,274
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,741
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-151
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-3,212
retention of HWP (1000 tCO2e/y)							,
Carbon sink potential - High - Increase							-2,247
trees outside forests (1000 tCO2e/y)							_,
Carbon sink potential - High - Reforest							-10,656
cropland (1000 tCO2e/y)							10,000
Carbon sink potential - High - Reforest							-21,079
pasture (1000 tC02e/y)							-21,019
Carbon sink potential - High - Restore							-3,690
•							-3,690
productivity (1000 tC02e/y)							
Carbon sink potential - Low - Accelerate							-82
regeneration (1000 tC02e/y)							40.507
Carbon sink potential - Low - All (not							-13,537
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-379
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,973
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-77
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,071
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-787
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest			+				-5,328
cropland (1000 tCO2e/y)							0,020
Carbon sink potential - Low - Reforest							-1,597
pasture (1000 tCO2e/y)							1,071
Carbon sink potential - Low - Restore				+			-1,244
productivity (1000 tCO2e/y)							-1,244
Carbon sink potential - Mid - Accelerate							-123
							-123
regeneration (1000 tC02e/y)							00.07/
Carbon sink potential - Mid - All (not							-32,374
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,326
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,357
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-113
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,141
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-1,517
trees outside forests (1000 tCO2e/y)							•
(

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest							-7,992
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-11,338
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-2,467
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							26.8
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							308
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,947
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							55.7
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							214
High - Increase trees outside forests							214
(1000 hectares)							
							705
Land impacted for carbon sink potential -							705
High - Reforest cropland (1000 hectares)							500
Land impacted for carbon sink potential -							599
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,223
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,077
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							13.4
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							289
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,512
Low - Extend rotation length (1000							•
hectares)							
Land impacted for carbon sink potential -							27.9
Low - Improve plantations (1000							2117
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							112
							112
Low - Increase trees outside forests							
(1000 hectares)							050
Land impacted for carbon sink potential -							352
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							104
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -		Τ		T		T	740
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 -							3,151
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							20.1
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							298
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,730
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							41.9
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 -							163
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							528
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							751
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,490
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,022
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
	2020						
Monetary damages from air pollution -		556	0.464	0.445	0.372	0.247	0.01
Coal (million 2019\$)							
Monetary damages from air pollution -		201	92.7	41.3	19.8	7.64	5.99
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,321	1,328	1,290	1,161	924	634
Transportation (million 2019\$)							
Premature deaths from air pollution -		62.8	0.052	0.05	0.042	0.028	0.001
Coal (deaths)							
Premature deaths from air pollution -		22.7	10.5	4.66	2.24	0.862	0.676
Natural Gas (deaths)							
Premature deaths from air pollution -		149	149	145	131	104	71.3
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	16,269	17,611	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	44.8	57.1	84	89.3	89.6	89.6	89.6
Resistance (%)							
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric	4.52	24.4	70.6	87.7	89.7	89.7	89.7
Heat Pump (%)							
Sales of space heating units - Electric	8.06	5.73	7.1	9.32	9.79	9.8	9.8
Resistance (%)							
Sales of space heating units - Fossil (%)	0	1.75	0.337	0.014	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 (%)	87.4	68.1	22	2.94	0.553	0.458	0.459
Sales of water heating units - Electric Heat Pump (%)	1.19	10.6	53.1	64.2	65	65	65
Sales of water heating units - Electric Resistance (%)	10.1	11	28.4	33.8	34.3	34.3	34.3
Sales of water heating units - Gas Furnace (%)	87.7	77.5	17.8	1.26	0.041	0	0
Sales of water heating units - Other (%)	0.996	0.947	0.735	0.688	0.685	0.688	0.687

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.82	3.92	6.23	6.6	6.19	6.47
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)	182	178	169	158	147	141	138
Final energy use - Industry (PJ)	241	249	271	274	290	326	330
Final energy use - Residential (PJ)	241	227	206	178	155	141	134
Final energy use - Transportation (PJ)	669	623	550	461	380	331	311

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	5.85	7.79	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	76.5	81.5	96.8	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	23.5	18.5	3.16	0.159	0	0	0
Sales of space heating units - Electric	7.5	22.5	72.3	86.1	87.5	87.8	87.4
Heat Pump (%)							
Sales of space heating units - Electric	19.7	22.4	10	6.61	6.36	6.55	6.72
Resistance (%)							
Sales of space heating units - Fossil (%)	9.34	13.6	7.39	5.58	5.03	4.63	4.86
Sales of space heating units - Gas (%)	63.5	41.4	10.2	1.69	1.08	1.04	1.02
Sales of water heating units - Electric	0	8.7	46.5	56.1	56.7	56.7	56.7
Heat Pump (%)							
Sales of water heating units - Electric	42.5	55.5	45.3	43.3	43.3	43.3	43.3
Resistance (%)							
Sales of water heating units - Gas Furnace	57.4	35.7	8.23	0.581	0.019	0	0
(%)							
Sales of water heating units - Other (%)	0.034	0.035	0.036	0.035	0.035	0.036	0.036

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	1,055	2,704	4,381	6,637	7,223	6,887
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.178	0	1.98	0	8.67	0	14
units)							
Public EV charging plugs - L2 (1000 units)	1.67	0	47.5	0	208	0	337
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+ scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)

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 (%)	1.59	1.85	1.27	0.408	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.79	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.5	49.4	16.8	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.3	4.45	3.17	1.18	0.287	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.111	0.342	0.206	0.064	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	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	11.8	14.4	21.1	17.8	44.8	27.5
Capital invested - Wind - Base (billion \$2018)	0	29	22.7	41.1	51.8	57.2	30.3
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed (cumulative) - Solar - Base land use assumptions (MW)	110	8,903	20,953	40,065	57,163	102,834	132,465
Installed (cumulative) - Wind - Base land use assumptions (MW)	5,547	25,250	42,336	75,470	119,284	170,306	198,927

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	216	16,549	22,677	35,949	32,069	85,895	55,774
Solar - Constrained land use assumptions	72.4	16,501	25,974	27,206	38,234	77,314	33,602
(GWh)							
Wind - Base land use assumptions (GWh)	19,737	64,803	55,632	107,139	138,943	158,757	86,300
Wind - Constrained land use assumptions	17,665	71,023	76,591	128,857	12,998	8,631	417,661
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-13,495
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-313
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-13,808
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-7,068
deployment - Cropland measures (1000							
tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-157
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-7,225
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							5,748
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							570
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							6,318
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							3,016
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							285
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							3,301
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-164
Carbon sink potential - High - All (not							-51,213
counting overlap) (1000 tC02e/y)							0.07/
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,274
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-7,741
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-151
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-3,212
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)							-2,247
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-10,656
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-21,079
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,690
Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)							-82
Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)							-13,537
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-379
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,973

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

Item	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - Low - Improve							-7
plantations (1000 tCO2e/y)							4.0=
Carbon sink potential - Low - Increase							-1,07
retention of HWP (1000 tC02e/y)							70
Carbon sink potential - Low - Increase							-78
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-5,32
cropland (1000 tCO2e/y)							4.50
Carbon sink potential - Low - Reforest							-1,59
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,24
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-12
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-32,37
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,32
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,35
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-11
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,14
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-1,51
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-7,99
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-11,33
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-2,46
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							26.
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							30
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,94
High - Extend rotation length (1000							-,
hectares)							
Land impacted for carbon sink potential -							55
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							21
High - Increase trees outside forests							۷-
(1000 hectares)							
Land impacted for carbon sink potential -							70
High - Reforest cropland (1000 hectares)							10
and impacted for carbon sink potential -							59
							לכ
High - Reforest pasture (1000 hectares)				-			1.00
Land impacted for carbon sink potential -							1,22
High - Restore productivity (1000							
hectares)							7.5-
Land impacted for carbon sink potential -							7,07
High - Total impacted (over 30 years)							

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

Table 33. LTRET Section 10 TILLAN 6. Lai	ia siins i o		Hucuj				
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							13.4
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							289
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,512
Low - Extend rotation length (1000							
hectares)							070
Land impacted for carbon sink potential -							27.9
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							112
Land impacted for carbon sink potential - Low - Increase trees outside forests							112
(1000 hectares)							
Land impacted for carbon sink potential -							352
Low - Reforest cropland (1000 hectares)							332
Land impacted for carbon sink potential -							104
Low - Reforest pasture (1000 hectares)							104
Land impacted for carbon sink potential -							740
Low - Restore productivity (1000							740
hectares)							
Land impacted for carbon sink potential -							3,151
Low - Total impacted (over 30 years)							3,131
(1000 hectares)							
Land impacted for carbon sink potential -							20.1
Mid - Accelerate regeneration (1000							20.1
hectares)							
Land impacted for carbon sink potential -							298
Mid - Avoid deforestation (over 30 years)							270
(1000 hectares)							
Land impacted for carbon sink potential -							2,730
Mid - Extend rotation length (1000							2,100
hectares)							
Land impacted for carbon sink potential -							41.9
Mid - Improve plantations (1000 hectares)							1117
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							J
hectares)							
Land impacted for carbon sink potential -							163
Mid - Increase trees outside forests (1000							100
hectares)							
Land impacted for carbon sink potential -							528
Mid - Reforest cropland (1000 hectares)							0_0
Land impacted for carbon sink potential -			-				751
Mid - Reforest pasture (1000 hectares)							.01
Land impacted for carbon sink potential -							1,490
Mid - Restore productivity (1000							1,770
hectares)							
Land impacted for carbon sink potential -	+		+	+			6,022
Mid - Total impacted (over 30 years) (1000							5,022
	1						

Table 34: E+RE+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		556	0.464	0.445	0.372	0.247	0.01
Coal (million 2019\$)							

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Table 34: <i>E</i> -	+RE+ scenario -	IMPACIS - F	teaith i	continueai

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		192	100	36.9	24.9	9.27	5.4
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,300	1,208	916	529	246	103
Transportation (million 2019\$)							
Premature deaths from air pollution -		62.8	0.052	0.05	0.042	0.028	0.001
Coal (deaths)							
Premature deaths from air pollution -		21.6	11.3	4.17	2.81	1.05	0.61
Natural Gas (deaths)							
Premature deaths from air pollution -		146	136	103	59.5	27.6	11.6
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	16,269	17,611	0	0	0	0
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric Heat Pump (%)	4.52	24.4	70.6	87.7	89.7	89.7	89.7
Sales of space heating units - Electric Resistance (%)	8.06	5.73	7.1	9.32	9.79	9.8	9.8
Sales of space heating units - Fossil (%)	0	1.75	0.337	0.014	0	0	0
Sales of space heating units - Gas Furnace (%)	87.4	68.1	22	2.94	0.553	0.458	0.459
Sales of water heating units - Electric Heat Pump (%)	1.19	10.6	53.1	64.2	65	65	65
Sales of water heating units - Electric Resistance (%)	10.1	11	28.4	33.8	34.3	34.3	34.3
Sales of water heating units - Gas Furnace (%)	87.7	77.5	17.8	1.26	0.041	0	0
Sales of water heating units - Other (%)	0.996	0.947	0.735	0.688	0.685	0.688	0.687

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

	,,		, ·				
Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.82	3.92	6.23	6.6	6.19	6.47
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)	182	178	169	158	147	141	138
Final energy use - Industry (PJ)	241	249	271	274	290	326	330
Final energy use - Residential (PJ)	241	227	206	178	155	141	134
Final energy use - Transportation (PJ)	669	623	550	461	380	331	311

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	5.85	7.79	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	76.5	81.5	96.8	99.8	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	23.5	18.5	3.16	0.159	0	0	0
Sales of space heating units - Electric	7.5	22.5	72.3	86.1	87.5	87.8	87.4
Heat Pump (%)							
Sales of space heating units - Electric	19.7	22.4	10	6.61	6.36	6.55	6.72
Resistance (%)							

Table 38: E+RE-	acanania DII	I AD 1. Eff	icionou/Floota	ification	Dooidontial	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Fossil (%)	9.34	13.6	7.39	5.58	5.03	4.63	4.86
Sales of space heating units - Gas (%)	63.5	41.4	10.2	1.69	1.08	1.04	1.02
Sales of water heating units - Electric Heat Pump (%)	0	8.7	46.5	56.1	56.7	56.7	56.7
Sales of water heating units - Electric Resistance (%)	42.5	55.5	45.3	43.3	43.3	43.3	43.3
Sales of water heating units - Gas Furnace (%)	57.4	35.7	8.23	0.581	0.019	0	0
Sales of water heating units - Other (%)	0.034	0.035	0.036	0.035	0.035	0.036	0.036

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	1,055	2,704	4,381	6,637	7,223	6,887
Cumulative 5-yr (million \$2018)		·	,		•		•
Public EV charging plugs - DC Fast (1000	0.178	0	1.98	0	8.67	0	14
units)							
Public EV charging plugs - L2 (1000 units)	1.67	0	47.5	0	208	0	337
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 (%)	1.59	1.85	1.27	0.408	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.79	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.5	49.4	16.8	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.3	4.45	3.17	1.18	0.287	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.111	0.342	0.206	0.064	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	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

		•	<u> </u>	<i>,</i>			
Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion		13.4	11.2	11.2	14.8	7.82	0
\$2018)							
Capital invested - Solar PV - Constrained (billion \$2018)		12.7	12	9.51	12.8	6.74	0
Capital invested - Wind - Base (billion \$2018)		25.1	7.19	0	11.4	14.3	21.8
Capital invested - Wind - Constrained (billion \$2018)		27.8	8.28	0.338	16.4	24.2	26.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	72.4	18,861	17,603	19,131	26,769	14,932	0
Solar - Constrained land use assumptions	216	17,897	18,801	16,226	23,055	12,909	0
(GWh)							
Wind - Base land use assumptions (GWh)	16,617	56,482	17,482	0	31,462	41,572	65,303
Wind - Constrained land use assumptions	14,915	61,292	19,828	1,000	44,894	67,619	75,656
(GWh)							

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

Table 42: E+RE- scenario - PILLAR 6: Land							
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							-13,495
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-313
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-13,808
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-7,068
deployment - Cropland measures (1000							.,
tCO2e/v)							
Carbon sink potential - Moderate							-157
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-7,225
deployment - Total (1000 tCO2e/y)							1,220
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							Ū
energy grasses (1000 hectares)							
Land impacted for carbon sink -							5,748
Aggressive deployment - Cropland							0,140
measures (1000 hectares)							
Land impacted for carbon sink -							570
Aggressive deployment - Permanent							010
conservation cover (1000 hectares)							
Land impacted for carbon sink -							6,318
Aggressive deployment - Total (1000							0,510
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							U
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3,016
deployment - Cropland measures (1000							3,010
hectares)							005
Land impacted for carbon sink - Moderate							285
deployment - Permanent conservation							
cover (1000 hectares)							0.001
Land impacted for carbon sink - Moderate							3,301
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							-164
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-51,213
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,274
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,741
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-151
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-3,212
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							-2,247
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-10,656
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-21,079
Carbon sink potential - High - Restore productivity (1000 tC02e/y)							-3,690
Carbon sink potential - Low - Accelerate							-82
regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not							-13,537
counting overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid							-379
deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend							-2,973
rotation length (1000 tCO2e/y) Carbon sink potential - Low - Improve							-77
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,071
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)							-787
Carbon sink potential - Low - Reforest cropland (1000 tC02e/y)							-5,328
Carbon sink potential - Low - Reforest							-1,597
pasture (1000 tC02e/y) Carbon sink potential - Low - Restore							-1,244
productivity (1000 tCO2e/y) Carbon sink potential - Mid - Accelerate							-123
regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not							-32,374
counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid							-1,326
deforestation (1000 tC02e/y)							
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-5,357
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-113
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-2,141
Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y)							-1,517
Carbon sink potential - Mid - Reforest							-7,992
cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest							-11,338
pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore							-2,467
productivity (1000 tCO2e/y) Land impacted for carbon sink potential -							26.8
High - Accelerate regeneration (1000							20.0
hectares)							200
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							308
(1000 hectares)							0.07
Land impacted for carbon sink potential - High - Extend rotation length (1000							3,947
hectares) Land impacted for carbon sink potential -							55.7
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)							01/
Land impacted for carbon sink potential -							214
High - Increase trees outside forests							
(1000 hectares)							705
Land impacted for carbon sink potential -							705
High - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							599
High - Reforest pasture (1000 hectares)							595
Land impacted for carbon sink potential -							1,223
High - Restore productivity (1000							1,223
hectares)							
Land impacted for carbon sink potential -							7,07
High - Total impacted (over 30 years)							1,011
(1000 hectares)							
Land impacted for carbon sink potential -							13.4
Low - Accelerate regeneration (1000							10
hectares)							
Land impacted for carbon sink potential -							289
Low - Avoid deforestation (over 30 years)							20.
(1000 hectares)							
Land impacted for carbon sink potential -							1,512
Low - Extend rotation length (1000							1,011
hectares)							
Land impacted for carbon sink potential -							27.9
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							112
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							352
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							104
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							740
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,15
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							20.
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							298
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,730
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							41.9
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							(
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000							163
naid increase traces suitaide terresta (1000	1						

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 -							528
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							751
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,490
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,022
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 -		556	0.464	0.445	0.372	0.247	0.01
Coal (million 2019\$)							
Monetary damages from air pollution -		213	107	114	85.7	32.6	11.6
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,300	1,208	916	529	246	103
Transportation (million 2019\$)							
Premature deaths from air pollution -		62.8	0.052	0.05	0.042	0.028	0.001
Coal (deaths)							
Premature deaths from air pollution -		24.1	12.1	12.8	9.67	3.68	1.31
Natural Gas (deaths)							
Premature deaths from air pollution -		146	136	103	59.5	27.6	11.6
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	16,266	17,675	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	44.8	49.3	53.1	63	76.9	85.5	88.5
Resistance (%)							
Sales of cooking units - Gas (%)	55.2	50.7	46.9	37	23.1	14.5	11.5
Sales of space heating units - Electric	4.52	15.9	21.2	36.6	61.3	79.5	86.8
Heat Pump (%)							
Sales of space heating units - Electric	8.06	5.57	5.72	6.25	7.38	8.69	9.45
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.02	1.9	1.42	0.689	0.224	0.059
Sales of space heating units - Gas Furnace	87.4	76.5	71.1	55.7	30.6	11.6	3.64
(%)							
Sales of water heating units - Electric	1.19	2.53	7.36	21.3	43.1	57.7	63
Heat Pump (%)							
Sales of water heating units - Electric	10.1	7.76	9.75	15.5	24.6	31	33.4
Resistance (%)							
Sales of water heating units - Gas Furnace	87.7	88.7	81.9	62.3	31.6	10.6	2.88
(%)							
Sales of water heating units - Other (%)	0.996	0.987	0.962	0.892	0.786	0.72	0.695

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.2	3.23	3.9	4.01	5.79	6.1
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	182	179	174	169	162	155	149

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	241	250	272	277	295	331	335
Final energy use - Residential (PJ)	241	228	218	206	189	170	154
Final energy use - Transportation (PJ)	670	628	574	531	498	459	413

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	5.81	7.68	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	76.4	77	79.2	84.9	92.8	97.7	99.4
Resistance (%)							
Sales of cooking units - Gas (%)	23.6	23	20.8	15.1	7.21	2.33	0.626
Sales of space heating units - Electric	7.5	13	18.7	35.2	61.1	79	85.2
Heat Pump (%)							
Sales of space heating units - Electric	19.7	24.8	23.3	19.2	12.8	8.51	7.04
Resistance (%)							
Sales of space heating units - Fossil (%)	9.34	14.9	14.4	12.2	8.46	5.78	5.24
Sales of space heating units - Gas (%)	63.5	47.3	43.7	33.5	17.6	6.67	2.55
Sales of water heating units - Electric	0	1.51	5.81	18.2	37.5	50.4	55
Heat Pump (%)							
Sales of water heating units - Electric	42.5	57.5	56.3	52.9	47.8	44.7	43.6
Resistance (%)							
Sales of water heating units - Gas Furnace	57.4	40.9	37.8	28.9	14.7	4.93	1.34
(%)							
Sales of water heating units - Other (%)	0.034	0.035	0.036	0.036	0.036	0.036	0.036

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	171	359	1,211	3,810	5,551
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.178	0	0.611	0	3.21	0	8.98
_units)							
Public EV charging plugs - L2 (1000 units)	1.67	0	14.7	0	77.3	0	216
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 (%)	1.6	2.01	2.06	1.64	1.05	0.542	0.232
Vehicle sales - Light-duty - EV (%)	1.84	4.58	11.7	25.5	48	71.8	87.5
Vehicle sales - Light-duty - gasoline (%)	91.9	87.7	79.9	67.1	46.6	25.1	11.1
Vehicle sales - Light-duty - hybrid (%)	4.45	5.27	5.93	5.41	4.08	2.42	1.18
Vehicle sales - Light-duty - hydrogen FC	0.113	0.381	0.328	0.251	0.179	0.1	0.046
(%)							
Vehicle sales - Light-duty - other (%)	0.105	0.108	0.098	0.086	0.062	0.034	0.016
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0.01	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	3.67	21.9	3.22

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	9.64	9.64
Biomass w/ccu power plant (GWh)	0	0	0	0	4,118	28,723	32,333

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	0	549	1,075	3,318	3,802
Conversion capital investment -	0	0	0	6,005	6,222	27,270	5,804
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	7	10	18	21
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	3	23	26
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	1	1	2
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	3.24	11.1	18.8	59.3	66.5
Annual - BECCS (MMT)		0	0	7.72	15.5	49	55.9
Annual - Cement and lime (MMT)		0	3.24	3.35	3.32	10.3	10.6
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	3.24	14.3	33.1	92.3	159
Cumulative - BECCS (MMT)		0	0	7.72	23.2	72.2	128
Cumulative - Cement and lime (MMT)		0	3.24	6.59	9.91	20.2	30.8
Cumulative - NGCC (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	420	582	802	2,436	2,996
Cumulative investment - All (million \$2018)		0	1,962	2,301	2,695	4,822	5,266
Cumulative investment - Spur (million \$2018)		0	11.9	351	550	2,677	3,120
Cumulative investment - Trunk (million \$2018)		0	1,950	1,950	2,145	2,145	2,145
Spur (km)		0	10.4	173	393	2,027	2,587
Trunk (km)		0	409	409	409	409	409

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

		•					
Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0.92	4.28	7.13	10.8	10.9
Injection wells (wells)		0	2	7	13	22	27
Resource characterization, appraisal, permitting costs (million \$2020)		27.9	123	190	190	190	190
Wells and facilities construction costs (million \$2020)		0	55.8	217	387	648	804

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

Table 56: E-B+ scenario - PILLAR 6: Land	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive	2020	2020	2000	2000	2040	2040	-1,072
deployment - Corn-ethanol to energy							1,012
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-12,355
deployment - Cropland measures (1000							12,000
tCO2e/y)							
Carbon sink potential - Aggressive		+					0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Aggressive							-284
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-13,711
deployment - Total (1000 tCO2e/y)							•
Carbon sink potential - Moderate							-1,072
deployment - Corn-ethanol to energy							,
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-6,467
deployment - Cropland measures (1000							•
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-142
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-7,681
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							497
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							13,018
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							292
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							979
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							
Land impacted for carbon sink -							517
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							15,303
Aggressive deployment - Total (1000							,
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate							497
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							2,765
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							292
deployment - Cropland to woody energy							
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							979
deployment - Pasture to energy crops							
(1000 hectares)							
Land impacted for carbon sink - Moderate							259
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							4,793
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							-16
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-51,21
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,27
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-7,74
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-15
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-3,212
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-2,24
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							-10,656
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-21,079
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-3,690
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-82
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-13,53
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-379
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,973
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-7
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,07
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-78
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-5,328
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-1,59 ⁻
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,244
productivity (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Accelerate							-123
regeneration (1000 tC02e/y)							00.07/
Carbon sink potential - Mid - All (not							-32,374
counting overlap) (1000 tC02e/y)							1.007
Carbon sink potential - Mid - Avoid							-1,326
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,357
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-113
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,141
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-1,517
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-7,992
cropland (1000 tCO2e/y)							.,
Carbon sink potential - Mid - Reforest							-11,338
pasture (1000 tC02e/y)							11,000
Carbon sink potential - Mid - Restore							-2,467
productivity (1000 tC02e/y)							-2,401
Land impacted for carbon sink potential -							26.8
							26.8
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							308
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,947
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							55.7
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 -							214
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -	+					+	705
High - Reforest cropland (1000 hectares)							105
Land impacted for carbon sink potential -							599
·							599
High - Reforest pasture (1000 hectares)							1 000
Land impacted for carbon sink potential -							1,223
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,077
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							13.4
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							289
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,512
Low - Extend rotation length (1000							.,012
hectares)							
Land impacted for carbon sink potential -	+						27.9
Low - Improve plantations (1000							41.7
hectares)							
nicotai coj							

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 -							112
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							352
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							104
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							740
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,151
Low - Total impacted (over 30 years)							-, -
(1000 hectares)							
Land impacted for carbon sink potential -							20.1
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							298
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,730
Mid - Extend rotation length (1000							,
hectares)							
Land impacted for carbon sink potential -							41.9
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 -							163
Mid - Increase trees outside forests (1000							.00
hectares)							
Land impacted for carbon sink potential -							528
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							751
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,490
Mid - Restore productivity (1000							1, 170
hectares)							
Land impacted for carbon sink potential -							6,022
Mid - Total impacted (over 30 years) (1000							0,022
hectares)							
nootal ooj							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		556	0.464	0.445	0.372	0.247	0.01
Coal (million 2019\$)		004	07.5	51.0	001	44.4	7.50
Monetary damages from air pollution - Natural Gas (million 2019\$)		201	87.5	51.2	33.1	14.6	7.52
Monetary damages from air pollution - Transportation (million 2019\$)		1,321	1,328	1,290	1,161	924	634
Premature deaths from air pollution - Coal (deaths)		62.8	0.052	0.05	0.042	0.028	0.001
Premature deaths from air pollution - Natural Gas (deaths)		22.7	9.88	5.78	3.74	1.65	0.849
Premature deaths from air pollution - Transportation (deaths)		149	149	145	131	104	71.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	16,080	16,491	0	0	0	0
Cumulative 5-yr (million \$2018)			·				
Sales of cooking units - Electric	44.8	47.8	47.9	47.8	47.9	47.9	48
Resistance (%)							
Sales of cooking units - Gas (%)	55.2	52.2	52.1	52.2	52.1	52.1	52
Sales of space heating units - Electric	4.52	20.5	48.3	71.1	74.8	75.2	75.2
Heat Pump (%)							
Sales of space heating units - Electric	8.06	6.43	10.8	18.4	23.5	24.2	24.3
Resistance (%)							
Sales of space heating units - Fossil (%)	0	1.98	1.55	0.695	0.102	0.009	0
Sales of space heating units - Gas Furnace	87.4	71.1	39.3	9.83	1.63	0.522	0.461
(%)							
Sales of water heating units - Electric	1.19	0.826	0.821	0.823	0.819	0.815	0.814
Heat Pump (%)							
Sales of water heating units - Electric	10.1	7.06	7.07	7.05	7.05	7.05	7.04
Resistance (%)							
Sales of water heating units - Gas Furnace	87.7	91.1	91.1	91.1	91.1	91.1	91.1
(%)							
Sales of water heating units - Other (%)	0.996	0.996	0.994	0.993	0.993	0.997	0.996

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.46	3.52	3.75	3.83	4.56	4.72
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)	182	183	183	181	179	181	187
Final energy use - Industry (PJ)	241	258	268	276	288	303	318
Final energy use - Residential (PJ)	241	227	219	214	212	213	214
Final energy use - Transportation (PJ)	670	629	580	552	553	571	593

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	5.54	5.98	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	76.2	76.2	76.2	76.2	76.2	76.2	76.2
Resistance (%)							
Sales of cooking units - Gas (%)	23.8	23.8	23.8	23.8	23.8	23.8	23.8
Sales of space heating units - Electric	4.86	29.6	30.8	32.6	34.1	35.7	37.6
Heat Pump (%)							
Sales of space heating units - Electric	20.4	20.8	20.3	19.8	19.4	18	15.9
Resistance (%)							
Sales of space heating units - Fossil (%)	9.54	10.9	11.1	11.1	10.6	10.2	10.6
Sales of space heating units - Gas (%)	65.2	38.7	37.8	36.4	35.8	36	36
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	42.5	58	57.9	57.7	57.7	57.6	57.5
Resistance (%)							
Sales of water heating units - Gas Furnace	57.4	42	42.1	42.3	42.3	42.4	42.4
(%)							
Sales of water heating units - Other (%)	0.034	0.035	0.036	0.036	0.036	0.036	0.036

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 (%)	1.59	2	2.19	2.04	1.84	1.71	1.63
Vehicle sales - Light-duty - EV (%)	3.44	5.43	6.2	7.62	9.29	10.8	11.9
Vehicle sales - Light-duty - gasoline (%)	90.4	86.9	84.8	83	81	79	77.4
Vehicle sales - Light-duty - hybrid (%)	4.32	5.17	6.33	6.9	7.48	8.08	8.55
Vehicle sales - Light-duty - hydrogen FC	0.111	0.378	0.348	0.31	0.307	0.308	0.319
(%)							
Vehicle sales - Light-duty - other (%)	0.104	0.108	0.104	0.105	0.104	0.103	0.106
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							-164
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-51,213
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,274
deforestation (1000 tC02e/y)							
Carbon sink potential - High - Extend							-7,741
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-151
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-3,212
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-2,247
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-10,656
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-21,079
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-3,690
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-82
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-13,537
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-379
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-2,973
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-77
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,071
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-787
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-5,328
cropland (1000 tCO2e/y)							-,

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

			-1,597
			4.07
			-1,24
			-123
			-32,374
			-1,326
			-5,357
			-113
			-2,141
			-1,517
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			13.4
			289
			1,512

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							27.9
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 -							112
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							352
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							104
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							740
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,151
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							20.1
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							298
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,730
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							41.9
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 -							163
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							528
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							751
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,490
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,022
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050	
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-4.2		-13.4				-12	
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.874		-1.57				-1.63	
Business-as-usual carbon sink - Total (Mt CO2e/y)	-5.07		-15				-13.6	

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		2,253	1,348	899	709	630	623
Monetary damages from air pollution - Natural Gas (million 2019\$)		219	197	209	152	131	117
Monetary damages from air pollution - Transportation (million 2019\$)		1,320	1,347	1,376	1,412	1,448	1,483
Premature deaths from air pollution - Coal (deaths)		255	152	102	80	71.1	70.3
Premature deaths from air pollution - Natural Gas (deaths)		24.7	22.2	23.6	17.2	14.8	13.2
Premature deaths from air pollution - Transportation (deaths)		149	152	155	159	163	167