

Net-Zero America - New York data

October 29, 2021 (updated November 17, 2023)

See the Data Sheet Guide for explanations of the contents of this document. The data herein underlie graphs and tables found in Princeton's Net-Zero America report:

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Table 1: E+ scenario - IMPACTS - Health

Table 1: E+ scenario - IMPACTS - Health							
Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		212	0.228	0.227	0.215	0.134	0.007
Fuel Comb - Electric Generation - Coal							
(deaths)							
Premature deaths from air pollution -		252	184	131	124	95.9	35.9
Fuel Comb - Electric Generation - Natural							
Gas (deaths)							
Premature deaths from air pollution -		823	813	653	397	188	74.4
Mobile - On-Road (deaths)		51.0	/0/	00.0	00.7	11./	
Premature deaths from air pollution - Gas		51.2	49.4	38.8	23.6	11.4	4.84
Stations (deaths)		/ 50	/10	007	100	00	0/1
Premature deaths from air pollution -		459	413	304	182	92	36.1
Fuel Comb - Residential - Natural Gas (deaths)							
Premature deaths from air pollution -		173	147	104	62.6	28.4	8.24
Fuel Comb - Residential - Oil (deaths)		113	141	104	02.0	20.4	0.24
Premature deaths from air pollution -		27	25.6	20.7	14.6	8.51	4.56
Fuel Comb - Residential - Other (deaths)		21	23.0	20.1	14.0	6.51	4.50
Premature deaths from air pollution -		4.39	4.3	4.2	4.08	3.94	3.78
Fuel Comb - Comm/Institutional - Coal		4.57	4.5	4.2	4.00	3.74	3.10
(deaths)							
Premature deaths from air pollution -		210	203	168	121	79.4	44.3
Fuel Comb - Comm/Institutional - Natural		210	200	100	121	17.4	77.0
Gas (deaths)							
Premature deaths from air pollution -		45.9	39.2	29.1	18.8	13	9.75
Fuel Comb - Comm/Institutional - Oil		10.7	07.2	27	10.0	.0	7.1.0
(deaths)							
Premature deaths from air pollution -		9.23	8.13	6.93	5.63	4.29	2.91
Fuel Comb - Comm/Institutional - Other		7.20	00	0.70	0.00	,	,.
(deaths)							
Premature deaths from air pollution -		1.92	1.04	1.06	1.08	1.13	1.15
Industrial Processes - Coal Mining							
(deaths)							
Premature deaths from air pollution -		147	138	123	97.4	70.7	43.2
Industrial Processes - Oil & Gas							
Production (deaths)							
Monetary damages from air pollution -		1,881	2.02	2.01	1.9	1.18	0.064
Fuel Comb - Electric Generation - Coal							
(million \$2019)							
Monetary damages from air pollution -		2,231	1,632	1,159	1,101	849	318
Fuel Comb - Electric Generation - Natural							
Gas (million \$2019)							
Monetary damages from air pollution -		7,317	7,231	5,804	3,530	1,675	662
Mobile - On-Road (million \$2019)				0.10	200	101	
Monetary damages from air pollution -		453	437	343	209	101	42.9
Gas Stations (million \$2019)		/ 0/0	0.770	0.400	1 /1/	015	000
Monetary damages from air pollution -		4,068	3,662	2,692	1,616	815	320
Fuel Comb - Residential - Natural Gas							
(million \$2019) Monetary damages from air pollution -		1,534	1,303	924	555	252	73.1
Fuel Comb - Residential - Oil (million		1,554	1,303	924	555	252	13.1
\$2019)							
Monetary damages from air pollution -		240	227	184	129	75.4	40.4
Fuel Comb - Residential - Other (million		240	221	104	127	13.4	40.4
\$2019)							
Monetary damages from air pollution -		38.8	38.1	37.2	36.1	34.9	33.5
Fuel Comb - Comm/Institutional - Coal		30.0	30.1	31.2	30.1	54.7	50.0
(million \$2019)							
Monetary damages from air pollution -		1,861	1,795	1,488	1,070	703	393
Fuel Comb - Comm/Institutional - Natural		,	,	,	, , , , ,		
Gas (million \$2019)							
• ,							

Table 1: E+ scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		406	347	258	166	115	86.3
Fuel Comb - Comm/Institutional - Oil							
(million \$2019)							
Monetary damages from air pollution -		81.7	72	61.3	49.9	37.9	25.8
Fuel Comb - Comm/Institutional - Other							
(million \$2019)							
Monetary damages from air pollution -		16.9	9.17	9.39	9.53	9.95	10.2
Industrial Processes - Coal Mining							
(million \$2019)							
Monetary damages from air pollution -		1,307	1,222	1,089	865	627	384
Industrial Processes - Oil & Gas							
Production (million \$2019)							

Table 2: E+ scenario - IMPACTS - Jobs

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Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		481	669	432	268	106	400
By economic sector - Construction (jobs)		20,440	21,337	26,486	31,946	38,153	45,770
By economic sector - Manufacturing		6,921	8,482	10,733	10,260	11,877	16,371
(jobs)							
By economic sector - Mining (jobs)		4,807	3,439	2,289	1,447	864	516
By economic sector - Other (jobs)		2,528	2,816	3,215	4,424	6,277	8,091
By economic sector - Pipeline (jobs)		1,235	1,063	877	669	460	416
By economic sector - Professional (jobs)		8,877	9,709	12,299	15,433	19,282	26,494
By economic sector - Trade (jobs)		6,740	6,787	7,866	9,610	12,131	15,960
By economic sector - Utilities (jobs)		16,075	16,512	26,590	32,247	37,657	60,547
By resource sector - Biomass (jobs)		1,481	1,701	1,050	700	400	1,756
By resource sector - CO2 (jobs)		0	120	359	357	356	1,028
By resource sector - Coal (jobs)		481	139	10.1	9.64	9.2	3.53
By resource sector - Grid (jobs)		16,450	21,706	44,364	54,262	63,369	76,676
By resource sector - Natural Gas (jobs)		14,747	10,460	8,380	9,432	7,326	5,695
By resource sector - Nuclear (jobs)		2,016	1,688	1,661	1,635	3,961	26,080
By resource sector - Oil (jobs)		10,343	8,327	6,120	4,320	3,031	2,063
By resource sector - Solar (jobs)		18,963	19,121	16,124	21,661	32,068	39,329
By resource sector - Wind (jobs)		3,620	7,552	12,719	13,925	16,288	21,934
By education level - All sectors - High		28,841	30,149	38,510	44,810	53,157	71,550
school diploma or less (jobs)		-,-		,	, -	, -	,
By education level - All sectors -		21,434	22,374	29,204	34,507	41,155	55,487
Associates degree or some college (jobs)			-				
By education level - All sectors -		13,932	14,277	18,000	20,970	25,183	36,712
Bachelors degree (jobs)							
By education level - All sectors - Masters		3,398	3,501	4,453	5,271	6,389	9,425
or professional degree (jobs)							
By education level - All sectors - Doctoral		496	513	620	745	923	1,390
degree (jobs)							
Related work experience - All sectors -		9,895	10,294	13,246	15,547	18,491	25,046
None (jobs)							
Related work experience - All sectors - Up		13,600	14,292	18,101	21,088	25,244	34,603
to 1 year (jobs)							
Related work experience - All sectors - 1		24,505	25,409	32,602	38,203	45,577	62,989
to 4 years (jobs)							
Related work experience - All sectors - 4		15,945	16,501	21,269	24,990	29,770	41,004
to 10 years (jobs)							
Related work experience - All sectors -		4,157	4,317	5,568	6,474	7,724	10,922
Over 10 years (jobs)							
On-the-Job Training - All sectors - None		3,759	3,875	4,820	5,642	6,821	9,699
(jobs)							
On-the-Job Training - All sectors - Up to 1		44,389	46,250	59,021	68,747	82,069	114,023
year (jobs)							

Table 2. F+	scenario	- IMPACTS -	Inhe	(continued))
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Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 1 to 4		14,494	15,047	19,607	23,143	27,509	37,199
years (jobs)					_		
On-the-Job Training - All sectors - 4 to 10 years (jobs)		4,788	4,947	6,483	7,786	9,228	11,998
On-the-Job Training - All sectors - Over 10 years (jobs)		671	696	854	985	1,180	1,645
On-Site or In-Plant Training - All sectors - None (jobs)		11,040	11,484	14,514	17,007	20,427	28,552
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		40,381	42,041	53,774	62,683	74,792	103,710
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		11,218	11,658	15,152	17,843	21,213	28,680
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		4,874	5,013	6,524	7,791	9,219	12,130
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		590	618	823	978	1,154	1,493
Wage income - All (million \$2019)		4,314	4,508	5,889	7,005	8,449	11,957

Table 3: E+ scenario - IMPACTS - Fossil fuel industries

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		230	202	160	122	91.3	66.3
Oil consumption - Cumulative (million							4,947
bbls)							
Oil production - Annual (million bbls)		0.286	0.287	0.287	0.227	0.185	0.123
Natural gas consumption - Annual (tcf)		1,045	881	707	532	335	232
Natural gas consumption - Cumulative							21,286
(tcf)							
Natural gas production - Annual (tcf)		14.4	13.6	11.9	10	7.95	6.18

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,161	1,104	995	858	731	647	604
Final energy use - Residential (PJ)	880	819	735	612	496	413	364
Final energy use - Commercial (PJ)	690	677	650	604	560	538	533
Final energy use - Industry (PJ)	488	505	512	521	523	530	532

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		7.59	7.79	18.2	19.6	18.4	19.5
Cumulative 5-yr (billion \$2018)							

Table 6: E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	156	1,087	2,018	5,278	8,537	11,141	13,746
Vehicle stocks - LDV - All others (1000	11,462	10,914	10,366	7,554	4,742	2,683	624
units)							
Light-duty vehicle capital costs vs. REF -		2,187	5,658	9,084	13,794	14,977	14,299
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.56		3.54		15		24.1
units)							
Public EV charging plugs - L2 (1000 units)	4.23		85.1		360		579

Table 7: E+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	3.63	16.2	66.1	89	91.7	91.9	92
Heat Pump (%)							
Sales of space heating units - Electric	8.47	10.5	6.04	3.28	2.89	2.96	3.08
Resistance (%)							
Sales of space heating units - Gas (%)	63.7	41.2	17.6	3.03	0.991	0.876	0.88
Sales of space heating units - Fossil (%)	24.2	32.1	10.3	4.74	4.39	4.24	4.06
Sales of water heating units - Electric	0	6.54	37.2	51.7	53.5	53.6	53.6
Heat Pump (%)							
Sales of water heating units - Electric	18.7	35.7	39.8	45.4	46.3	46.4	46.3
Resistance (%)							
Sales of water heating units - Gas Furnace	71.1	52	21.9	2.85	0.155	0	0
(%)							
Sales of water heating units - Other (%)	10.3	5.8	1.12	0.083	0.037	0.038	0.038
Sales of cooking units - Electric	34.6	48.6	91.2	99.6	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	65.4	51.4	8.8	0.443	0	0	0
Residential HVAC investment in 2020s vs.		14.3	15.2				
REF - Cumulative 5-yr (billion \$2018)							

Table 8: E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	0.625	15.6	51.1	76.3	79.8	80.3	80.2
Heat Pump (%)							
Sales of space heating units - Electric	2.13	4.73	12.8	18	19.1	18.8	18.9
Resistance (%)							
Sales of space heating units - Gas (%)	78.2	65.2	33.3	5.6	1.11	0.87	0.863
Sales of space heating units - Fossil (%)	19.1	14.5	2.85	0.124	0	0	0
Sales of water heating units - Electric	0.224	7.35	41	58.7	61	61.2	61.2
Heat Pump (%)							
Sales of water heating units - Electric	1.34	5.14	22.3	36.4	38.5	38.7	38.7
Resistance (%)							
Sales of water heating units - Gas (%)	97	86.3	36.3	4.73	0.256	0	0
Sales of water heating units - Other (%)	1.45	1.19	0.377	0.184	0.175	0.176	0.176
Sales of cooking units - Electric	18.5	33.7	75.3	83.5	83.9	84	84
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s -		89,684	98,037				
Cumulative 5-yr (million \$2018)							

Table 9: E+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	993	28.6	28.6	28.6	28.6	0
Installed thermal - Natural gas (MW)	22,655	14,488	15,963	18,699	34,255	30,475	28,214
Installed thermal - Nuclear (MW)	4,410	3,398	3,398	3,398	3,399	3,830	14,525
Installed renewables - Rooftop PV (MW)	2,262	3,350	4,275	5,350	6,543	7,836	9,243
Installed renewables - Solar - Base land use assumptions (MW)	2,155	6,680	11,974	14,471	20,687	35,011	43,162
Installed renewables - Wind - Base land use assumptions (MW)	2,381	3,284	5,438	8,739	9,320	11,024	11,567
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	139	309	8,081	13,377	20,097	28,635
Installed renewables - Solar - Constrained land use assumptions (MW)	502	6,292	16,239	20,774	27,836	37,360	43,108
Installed renewables - Wind - Constrained land use assumptions (MW)	3,284	3,284	5,424	8,833	9,661	11,413	11,966
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	276	448	7,937	13,288	19,102	28,495

Table 9: E+ scenario - PILLAR 2: Clean Electricity - Generating capacity (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)		6.82	6.34	2.75	6.46	14.1	7.55
Capital invested - Wind - Base (billion \$2018)		0	5.05	7.37	1.23	3.44	1.04
Capital invested - Offshore Wind - Base (billion \$2018)		0.393	0.409	15.9	10.9	11	11.3
Capital invested - Solar PV - Constrained (billion \$2018)		11.5	11.2	5.23	7.17	8.6	3.67
Capital invested - Wind - Constrained (billion \$2018)		0	8.47	7.67	1.8	3.59	1.05
Capital invested - Offshore Wind - Constrained (billion \$2018)		0.782	0.412	15.4	10.8	9.53	12.4
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	0.005	0.001	0	0.013
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.008	0	0.001	0	0

Table 10: E+ scenario - PILLAR 2: Clean Electricity - Generation

Thomas	0000						
Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,912	11,655	20,663	24,823	35,288	59,625	73,457
Wind - Base land use assumptions (GWh)	14,244	14,244	22,135	34,055	36,123	42,123	44,018
OffshoreWind - Base land use assumptions (GWh)	0	562	1,250	32,760	54,963	83,187	119,377
Solar - Constrained land use assumptions (GWh)	935	10,867	27,846	35,424	47,307	63,297	72,937
Wind - Constrained land use assumptions (GWh)	14,244	14,244	22,057	34,233	37,112	43,214	45,113
OffshoreWind - Constrained land use assumptions (GWh)	0	562	1,250	32,760	54,963	83,187	119,377
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	8.55	8.55	9.28	9.28	9.28
Biomass w/ccu allam power plant (GWh)	0	0	0	4.5	5.42	5.42	18.8

Table 11: E+ scenario - PILLAR 3: Clean fuels - Bioenergy

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	1	1	1	1	1
(quantity)							
Number of facilities - Allam power w ccu	0	0	0	1	1	1	2
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	1	1	1	3
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	2
Number of facilities - Pyrolysis ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	2
Conversion capital investment -		0	7.03	19.2	4.22	0	4,926
Cumulative 5-yr (million \$2018)							
Biomass purchases (million \$2018/y)		0	0.322	0.902	1.04	1.04	235

Table 12: E+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	3.38	3.35	3.45	7.35
Annual - BECCS (MMT)		0	0.01	0.02	0.02	0.02	3.8
Annual - NGCC (MMT)		0	0	0.01	0.01	0.01	0.01
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Cumulative - All (MMT)		0	0.01	3.39	6.74	10.2	17.5
Cumulative - BECCS (MMT)		0	0.01	0.03	0.05	0.07	3.87
Cumulative - NGCC (MMT)		0	0	0.01	0.02	0.03	0.04
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6

Table 13: E+ scenario - PILLAR 4: CCUS - CO2 pipelines

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	63	63	63	63	63
Spur (km)		0	216	374	549	549	1,246
All (km)		0	279	437	612	612	1,309
Cumulative investment - Trunk (million		0	114	114	114	114	114
\$2018)							
Cumulative investment - Spur (million		0	111	288	379	382	791
\$2018)							
Cumulative investment - All (million		0	225	402	493	496	905
\$2018)							

Table 14: E+ scenario - PILLAR 4: CCUS - CO2 storage

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

Table 15: E+ scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate							-192
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-459
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,555
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-307
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,821
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-375
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-136
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-418
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,184
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-9,448
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-287
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,605
deforestation (1000 tCO2e/y)							

Table 15: E+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item Cappen sink notantial Mid Extend	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,206
Carbon sink potential - Mid - Improve plantations (1000 tC02e/y)							-450
Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y)							-3,642
Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y)							-724
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-205
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,967
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,349
Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y)							-20,436
Carbon sink potential - High - Accelerate regeneration (1000 tC02e/y)							-383
Carbon sink potential - High - Avoid deforestation (1000 tC02e/y)							-2,752
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,858
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-604
Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y)							-5,464
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)							-1,072
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-273
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,516
Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y)							-31,435
Carbon sink potential - High - Restore productivity (1000 tC02e/y)							-3,513
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31.3
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							350
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,317
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							111
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							53.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.02
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							705

Table 15: E+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -	2020	2020	2000	2000	2040	2040	3,603
Low - Total impacted (over 30 years)							•
(1000 hectares)							
Land impacted for carbon sink potential -							47
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							361
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,182
Mid - Extend rotation length (1000							
hectares)							167
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							167
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -		+					77.7
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							13.5
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							196
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,419
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,464
Mid - Total impacted (over 30 years) (1000							
hectares)							(0.4
Land impacted for carbon sink potential -							62.6
High - Accelerate regeneration (1000 hectares)							
Land impacted for carbon sink potential -							373
High - Avoid deforestation (over 30 years)							313
(1000 hectares)							
Land impacted for carbon sink potential -							6,047
High - Extend rotation length (1000							-,-
hectares)							
Land impacted for carbon sink potential -							223
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 -							102
High - Increase trees outside forests							
(1000 hectares) Land impacted for carbon sink potential -							18
High - Reforest cropland (1000 hectares)							10
Land impacted for carbon sink potential -							157
High - Reforest pasture (1000 hectares)							151
Land impacted for carbon sink potential -						+	1,164
High - Restore productivity (1000							1,10-7
hectares)							
Land impacted for carbon sink potential -							8,146
High - Total impacted (over 30 years)							-,
(1000 hectares)							
<u> </u>							

Table 16: E+ scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate					-	-	-264
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,224
deployment - Cropland measures (1000							.,
tCO2e/y)							
Carbon sink potential - Moderate							-44.8
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,532
deployment - Total (1000 tCO2e/y)							.,
Carbon sink potential - Aggressive						+	-264
deployment - Corn-ethanol to energy							_0 .
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,322
deployment - Cropland measures (1000							2,022
tCO2e/y)							
Carbon sink potential - Aggressive						+	-89.7
deployment - Permanent conservation							07.1
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,675
deployment - Total (1000 tCO2e/y)							_,0.0
Land impacted for carbon sink - Moderate							85.7
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate						+	785
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							81.5
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							953
deployment - Total (1000 hectares)							
Land impacted for carbon sink -							85.7
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,489
Aggressive deployment - Cropland							.,
measures (1000 hectares)							
Land impacted for carbon sink -							163
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,738
Aggressive deployment - Total (1000							.,. 00
hectares)							

Table 17: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		212	0.228	0.227	0.215	0.134	0.007
Fuel Comb - Electric Generation - Coal							
(deaths)							
Premature deaths from air pollution -		248	140	63.4	25	6.42	8.81
Fuel Comb - Electric Generation - Natural							
Gas (deaths)							
Premature deaths from air pollution -		838	898	923	874	730	526
Mobile - On-Road (deaths)							
Premature deaths from air pollution - Gas		52.4	55.7	56.4	52.8	43.6	31.1
Stations (deaths)							

Table 17: E- scenario - IMPACTS - Health (continued)

Table 17: E- scenario - IMPACIS - Health (C		0005	0000	0005	0070	00/5	0050
Item	2020	2025	2030	2035 439	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		463	461	439	385	305	214
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		176	179	181	167	131	87.5
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		27.4	28.9	30	28.8	24.1	18
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		211	224	232	226	204	170
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.2	43.9	41.4	36.4	31.6	26.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.72	8.12	7.45	6.71	5.93
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.86	1.04	1.07	1.1	1.13	1.12
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		147	130	108	90.4	78	57.4
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,199	1,243	562	221	56.9	78.1
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,451	7,988	8,203	7,769	6,492	4,675
Monetary damages from air pollution - Gas Stations (million \$2019)		464	493	500	468	386	275
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,102	4,088	3,893	3,409	2,700	1,897
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,561	1,585	1,605	1,477	1,159	775
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		243	256	266	255	213	160
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		38.8	38.1	37.2	36.1	34.9	33.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,870	1,983	2,054	2,001	1,803	1,502
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		409	389	367	323	280	235
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		81.7	77.2	71.9	65.9	59.4	52.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		16.4	9.19	9.47	9.67	9.96	9.87

Table 17: E- scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,303	1,157	957	803	693	510

Table 18: E- scenario - IMPACTS - Jobs

Table 18: E- scenario - IMPACTS - Jobs							
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		520	586	401	229	89.1	400
By economic sector - Construction (jobs)		20,559	21,028	22,609	26,502	39,381	46,704
By economic sector - Manufacturing (jobs)		7,006	8,574	9,393	9,190	14,039	19,083
By economic sector - Mining (jobs)		4,877	3,523	2,583	1,870	1,307	795
By economic sector - Other (jobs)		2,577	2,845	2,862	3,847	6,536	8,240
By economic sector - Pipeline (jobs)		1,239	1,043	905	776	655	646
By economic sector - Professional (jobs)		8,955	9,515	10,736	14,042	20,787	25,962
By economic sector - Trade (jobs)		6,837	6,833	7,246	8,834	13,063	16,236
By economic sector - Utilities (jobs)		15,741	15,313	20,431	28,694	41,553	48,786
By resource sector - Biomass (jobs)		1,541	1,451	1,015	673	379	1,701
By resource sector - CO2 (jobs)		0	206	615	612	610	1,762
By resource sector - Coal (jobs)		651	225	10.1	3.66	0	0
By resource sector - Grid (jobs)		15,576	19,775	32,051	37,475	61,567	76,247
By resource sector - Natural Gas (jobs)		14,789	9,210	6,942	5,761	5,617	4,508
By resource sector - Nuclear (jobs)		2,016	1,908	1,922	9,828	11,264	11,150
By resource sector - Oil (jobs)		10,452	8,869	7,534	6,164	4,842	3,259
By resource sector - Solar (jobs)		19,555	19,757	15,081	19,926	34,318	39,600
By resource sector - Wind (jobs)		3,731	7,861	11,994	13,543	18,813	28,625
By education level - All sectors - High		28,954	29,496	32,684	38,966	57,127	69,385
school diploma or less (jobs)							•
By education level - All sectors -		21,472	21,811	24,584	29,782	44,032	53,609
Associates degree or some college (jobs)							
By education level - All sectors -		13,977	14,016	15,517	19,557	28,082	33,963
Bachelors degree (jobs)							
By education level - All sectors - Masters		3,408	3,429	3,830	4,947	7,123	8,629
or professional degree (jobs)							
By education level - All sectors - Doctoral		500	507	549	734	1,046	1,268
degree (jobs)							
Related work experience - All sectors -		9,921	10,045	11,214	13,518	19,846	24,133
None (jobs)							
Related work experience - All sectors - Up		13,670	14,025	15,455	18,673	27,373	33,364
to 1 year (jobs)							
Related work experience - All sectors - 1		24,577	24,844	27,721	33,882	49,466	60,000
to 4 years (jobs)							
Related work experience - All sectors - 4		15,979	16,120	18,042	22,078	32,238	39,065
to 10 years (jobs)							
Related work experience - All sectors -		4,165	4,227	4,733	5,834	8,487	10,291
Over 10 years (jobs)							
On-the-Job Training - All sectors - None		3,778	3,817	4,164	5,191	7,530	9,107
(jobs)							
On-the-Job Training - All sectors - Up to 1		44,552	45,292	50,336	61,307	89,425	108,815
year (jobs)							
On-the-Job Training - All sectors - 1 to 4		14,514	14,663	16,504	20,046	29,477	35,700
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		4,792	4,800	5,420	6,542	9,673	11,656
years (jobs)							
On-the-Job Training - All sectors - Over 10		676	688	739	900	1,304	1,574
years (jobs)							
On-Site or In-Plant Training - All sectors -		11,088	11,261	12,418	15,299	22,324	27,140
None (jobs)				. =			
On-Site or In-Plant Training - All sectors -		40,518	41,158	45,807	55,773	81,392	98,958
Up to 1 year (jobs)							

Table 18: E- scenario - IMPACTS - Jobs (continued)

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors -		11,237	11,370	12,774	15,475	22,751	27,570
1 to 4 years (jobs)							
On-Site or In-Plant Training - All sectors -		4,878	4,872	5,479	6,627	9,734	11,713
4 to 10 years (jobs)							
On-Site or In-Plant Training - All sectors -		589	599	685	812	1,208	1,473
Over 10 years (jobs)							
Wage income - All (million \$2019)		4,322	4,400	4,992	6,229	9,183	11,248

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,163	1,112	1,033	964	905	837	757
Final energy use - Residential (PJ)	880	823	783	735	664	579	494
Final energy use - Commercial (PJ)	690	679	673	667	654	636	618
Final energy use - Industry (PJ)	488	505	514	526	531	538	538

Table 20: E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.03	6.04	8.86	9.2	14.7	15.6
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	121	394	667	1,933	3,200	6,002	8,804
Vehicle stocks - LDV – All others (1000 units)	11,509	11,509	11,509	10,916	10,324	7,956	5,588
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	363	742	2,526	7,889	11,514
Public EV charging plugs - DC Fast (1000 units)	0.56		1.17		5.61		15.4
Public EV charging plugs - L2 (1000 units)	4.23		28.1		135		371

Table 22: E- scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	3.63	7.47	12.9	28.9	55.2	75.3	83.7
Heat Pump (%)							
Sales of space heating units - Electric	8.47	11.2	10.6	9.22	6.74	4.65	3.8
Resistance (%)							
Sales of space heating units - Gas (%)	63.7	45.1	42.4	34.7	21.5	10.4	5.47
Sales of space heating units - Fossil (%)	24.2	36.3	34	27.2	16.6	9.64	6.99
Sales of water heating units - Electric	0	1.21	4.63	14.7	31.2	43.9	49.3
Heat Pump (%)							
Sales of water heating units - Electric	18.7	35.3	35.6	36.9	39.6	42.6	44.2
Resistance (%)							
Sales of water heating units - Gas Furnace	71.1	56.8	53.6	43.7	26.7	12.4	5.95
(%)							
Sales of water heating units - Other (%)	10.3	6.7	6.2	4.75	2.54	1.09	0.587
Sales of cooking units - Electric	34.4	36.1	42.1	57.9	80	93.5	98.3
Resistance (%)							
Sales of cooking units - Gas (%)	65.6	63.9	57.9	42.1	20	6.47	1.74
Residential HVAC investment in 2020s vs.		14.3	16.3				
REF - Cumulative 5-yr (billion \$2018)							

Table 23: E- scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	0.625	10	13.9	25.5	45.9	63.9	72.2
Heat Pump (%)							
Sales of space heating units - Electric	2.13	3.41	4.29	6.96	11.7	15.4	17.3
Resistance (%)							
Sales of space heating units - Gas (%)	78.2	69.8	65.6	54.7	35.3	17.8	8.88
Sales of space heating units - Fossil (%)	19.1	16.8	16.2	12.8	7.04	2.9	1.58
Sales of water heating units - Electric	0.224	1.65	5.4	16.4	34.9	49.5	55.9
Heat Pump (%)							
Sales of water heating units - Electric	1.34	2.6	4.47	10.1	20.3	29.6	34
Resistance (%)							
Sales of water heating units - Gas (%)	97	94.4	88.8	72.4	44.1	20.6	9.85
Sales of water heating units - Other (%)	1.45	1.35	1.33	1.05	0.642	0.377	0.282
Sales of cooking units - Electric	18.5	21.6	27.5	43	64.5	77.7	82.3
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Commercial HVAC investment in 2020s -		89,637	97,820				
Cumulative 5-yr (million \$2018)							

Table 24: E- scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
1(6)))	2020	2023	2030	2033	2040	2043	2030
Installed thermal - Coal (MW)	1,642	993	28.6	28.6	28.6	28.6	0
Installed thermal - Natural gas (MW)	22,658	14,293	13,298	12,830	12,846	9,237	10,654
Installed thermal - Nuclear (MW)	4,410	3,398	3,489	3,580	7,039	9,889	12,767

Table 25: E- scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate							-192
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-459
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,555
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-307
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,821
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-375
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-136
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-418
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,184
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-9,448
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-287
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,605
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-8,206
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-450
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-3,642
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-724
trees outside forests (1000 tCO2e/y)							

Table 25: E- scenario - PILLAR 6: Land sinks - Forests (continued)

Item Carbon sink potential - Mid - Reforest	2020	2025	2030	2035	2040	2045	2050 -205
carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-205
1 1							-2,967
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,961
Carbon sink potential - Mid - Restore							-2,349
productivity (1000 tCO2e/y)							-2,349
Carbon sink potential - Mid - All (not							-20,436
counting overlap) (1000 tC02e/y)							-20,436
Carbon sink potential - High - Accelerate							-383
regeneration (1000 tCO2e/y)							-303
Carbon sink potential - High - Avoid							-2,752
deforestation (1000 tCO2e/y)							-2,752
Carbon sink potential - High - Extend							-11,858
rotation length (1000 tC02e/y)							-11,000
							-604
Carbon sink potential - High - Improve							-604
plantations (1000 tC02e/y)							F / / /
Carbon sink potential - High - Increase							-5,464
retention of HWP (1000 tC02e/y)							1.070
Carbon sink potential - High - Increase							-1,072
trees outside forests (1000 tC02e/y)							070
Carbon sink potential - High - Reforest							-273
cropland (1000 tCO2e/y)							·
Carbon sink potential - High - Reforest							-5,516
pasture (1000 tC02e/y)							04 / 05
Carbon sink potential - High - All (not							-31,435
counting overlap) (1000 tC02e/y)							
Carbon sink potential - High - Restore							-3,513
productivity (1000 tC02e/y)							
Land impacted for carbon sink potential -							31.3
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							350
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,317
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							111
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 -							53.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							9.02
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							27.2
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							705
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,603
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							47
Mid - Accelerate regeneration (1000							
hectares)		1	1		1	I	

Table 25: E- scenario - PILLAR 6: Land sinks - Forests (continued)

Table 25: E- scenario - PILLAR 6: Lana sink	KS - FORESTS	s (continuec	1)				
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							361
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,182
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							167
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 -							77.7
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							13.5
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							196
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,419
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,464
Mid - Total impacted (over 30 years) (1000							
hectares)							
Land impacted for carbon sink potential -							62.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							373
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							6,047
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							223
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 -							102
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							18
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							157
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,164
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,146
High - Total impacted (over 30 years)							
(1000 hectares)							

Table 26: E- scenario - PILLAR 6: Land sinks - Agriculture

	•						
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-264
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							

Table 26: E- scenario - PILLAR 6: Land sinks - Agriculture (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,224
Carbon sink potential - Moderate							-44.8
deployment - Permanent conservation cover (1000 tCO2e/y)							
Carbon sink potential - Moderate deployment - Total (1000 tC02e/y)							-1,532
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-264
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tC02e/y)							-2,322
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-89.7
Carbon sink potential - Aggressive deployment - Total (1000 tC02e/y)							-2,675
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							785
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							81.5
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							953
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,489
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							163
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,738

Table 27: E+RE+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal		212	0.228	0.227	0.215	0.134	0.007
(deaths)							
Premature deaths from air pollution -		239	174	98.7	81.2	34.1	7.95
Fuel Comb - Electric Generation - Natural							
Gas (deaths)							
Premature deaths from air pollution -		823	813	653	397	188	74.4
Mobile - On-Road (deaths)							
Premature deaths from air pollution - Gas		51.2	49.4	38.8	23.6	11.4	4.84
Stations (deaths)							
Premature deaths from air pollution -		459	413	304	182	92	36.1
Fuel Comb - Residential - Natural Gas							
(deaths)							
Premature deaths from air pollution -		173	147	104	62.6	28.4	8.24
Fuel Comb - Residential - Oil (deaths)							

Table 27: E+RE+ scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		27	25.6	20.7	14.6	8.51	4.56
Fuel Comb - Residential - Other (deaths)							
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution -		210	203	168	121	79.4	44.3
Fuel Comb - Comm/Institutional - Natural Gas (deaths)							
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		45.9	39.2	29.1	18.8	13	9.75
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.13	6.93	5.63	4.29	2.91
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.07	1.04	1.06	1.08	1.13	1.08
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		144	135	112	81.3	47	4.74
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,116	1,541	875	719	302	70.4
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,317	7,231	5,804	3,530	1,675	662
Monetary damages from air pollution - Gas Stations (million \$2019)		453	437	343	209	101	42.9
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,068	3,662	2,692	1,616	815	320
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,534	1,303	924	555	252	73.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		240	227	184	129	75.4	40.4
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		38.8	38.1	37.2	36.1	34.9	33.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,861	1,795	1,488	1,070	703	393
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		406	347	258	166	115	86.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		81.7	72	61.3	49.9	37.9	25.8
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		18.2	9.17	9.38	9.52	9.94	9.52
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,276	1,197	996	722	417	42.1

Table 28: E+RE+ scenario - IMPACTS - Jobs

Table 28: E+RE+ Scendrio - IMPAGIS - Jobs							
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		482	679	431	247	97.3	394
By economic sector - Construction (jobs)		22,033	23,286	35,004	39,377	46,754	59,277
By economic sector - Manufacturing (jobs)		7,251	9,176	14,974	12,703	15,735	20,776
By economic sector - Mining (jobs)		4,752	3,355	2,100	1,201	588	76.7
By economic sector - Other (jobs)		2,823	3,235	4,746	5,728	7,538	9,278
By economic sector - Pipeline (jobs)		1,201	1,005	711	470	273	105
By economic sector - Professional (jobs)		9,476	10,614	16,276	19,579	24,530	32,400
By economic sector - Trade (jobs)		7,098	7,312	10,217	11,961	15,045	19,595
By economic sector - Utilities (jobs)		16,674	16,878	32,461	37,552	43,448	59,861
By resource sector - Biomass (jobs)		1,412	1,753	1,025	662	374	1,784
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		481	139	10.1	9.64	3.59	0
By resource sector - Grid (jobs)		17,792	23,118	58,153	67,750	81,191	117,419
By resource sector - Natural Gas (jobs)		14,462	9,887	7,024	7,049	5,589	4,349
By resource sector - Nuclear (jobs)		2,016	1,557	1,347	1,326	1,015	346
By resource sector - Oil (jobs)		10,345	8,231	5,909	3,842	2,119	9.43
By resource sector - Solar (jobs)		21,459	22,696	26,292	28,785	37,059	37,862
By resource sector - Wind (jobs)		3,823	8,159	17,159	19,395	26,659	39,993
By education level - All sectors - High		30,459	32,205	49,730	54,272	64,565	84,493
school diploma or less (jobs)		30,439	32,203	47,130	54,212	04,303	
By education level - All sectors -		22,632	23,891	37,709	41,830	50,165	65,826
Associates degree or some college (jobs)		1/ /0/	45475	00.000	05.000	00./1/	00.010
By education level - All sectors -		14,606	15,165	22,989	25,383	30,416	39,813
Bachelors degree (jobs)		0.570	0.707	F (01	((1)	770 (10 171
By education level - All sectors - Masters		3,568	3,727	5,691	6,414	7,736	10,171
or professional degree (jobs)		50/	550	000	000	1107	1 / 50
By education level - All sectors - Doctoral degree (jobs)		524	552	800	922	1,126	1,459
Related work experience - All sectors -		10,430	10,973	17,036	18,798	22,442	29,433
None (jobs)		10, 100	10,710	11,000	10,170	,	27,100
Related work experience - All sectors - Up		14,387	15,323	23,517	25,693	30,738	40,175
to 1 year (jobs)		1 1,001	10,020	20,011	20,070	00,100	10,110
Related work experience - All sectors - 1		25,806	27,070	41,891	46,249	55,298	72,488
to 4 years (jobs)		20,000	,	,67.	.5,2 .5	00,270	,
Related work experience - All sectors - 4		16,794	17,579	27,316	30,245	36,163	47,377
to 10 years (jobs)		.0,. 7 .	,	2.,0.0	33,2.3	33,.33	,
Related work experience - All sectors -		4,372	4,595	7,159	7,835	9,368	12,289
Over 10 years (jobs)		.,0	.,070	.,	.,555	7,000	,,
On-the-Job Training - All sectors - None		3,966	4,147	6,231	6,863	8,230	10,679
(jobs)		0,700	.,	5,25.	3,333	0,200	.0,0.7
On-the-Job Training - All sectors - Up to 1		46,747	49,318	76,030	83,347	99,688	130,749
year (jobs)		.0,	17,010	10,000	00,0 11	77,000	10071 17
On-the-Job Training - All sectors - 1 to 4		15,296	16,044	25,221	27,993	33,434	43,823
years (jobs)		10,270	10,044	20,221	21,770	00,404	40,020
On-the-Job Training - All sectors - 4 to 10		5,070	5,284	8,323	9,419	11,228	14,681
years (jobs)		0,010	0,20 .	0,020	,,,	,220	1 1,001
On-the-Job Training - All sectors - Over 10		711	747	1,113	1,197	1,429	1,830
years (jobs)			1-71	1,110	1,121	1,727	1,000
On-Site or In-Plant Training - All sectors -		11,650	12,281	18,764	20,673	24,811	32,366
None (jobs)		11,000	12,201	10,104	20,010	24,011	02,000
On-Site or In-Plant Training - All sectors -		42,529	44,821	69,242	75,965	90,808	119,113
Up to 1 year (jobs)		72,027	77,021	07,242	10,700	70,000	117,110
On-Site or In-Plant Training - All sectors -		11,838	12,433	19,504	21,591	25,782	33,793
1 to 4 years (jobs)		11,000	12,700	17,004	21,071	20,102	30,1 70
On-Site or In-Plant Training - All sectors -		5,150	5,345	8,350	9,408	11,193	14,624
4 to 10 years (jobs)		5,150	5,545	0,000	7,700	11,175	17,024
On-Site or In-Plant Training - All sectors -		623	659	1,058	1,184	1,415	1,866
Over 10 years (jobs)		320	307	1,000	1,104	1,-410	1,000
Wage income - All (million \$2019)		4,540	4,795	7,533	8,464	10,222	13,599
Trago moomo An (minon 42017)		7,040	7,1 70	1,000	5,704	10,222	10,077

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,161	1,104	995	858	731	647	604
Final energy use - Residential (PJ)	880	819	735	612	496	413	364
Final energy use - Commercial (PJ)	690	677	650	604	560	538	533
Final energy use - Industry (PJ)	488	505	512	521	523	530	532

Table 30: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		7.59	7.79	18.2	19.6	18.4	19.5
Cumulative 5-yr (billion \$2018)							

Table 31: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	156	1,087	2,018	5,278	8,537	11,141	13,746
Vehicle stocks - LDV – All others (1000 units)	11,462	10,914	10,366	7,554	4,742	2,683	624
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,187	5,658	9,084	13,794	14,977	14,299
Public EV charging plugs - DC Fast (1000 units)	0.56		3.54		15		24.1
Public EV charging plugs - L2 (1000 units)	4.23		85.1		360		579

Table 32: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	3.63	16.2	66.1	89	91.7	91.9	92
Heat Pump (%)							
Sales of space heating units - Electric	8.47	10.5	6.04	3.28	2.89	2.96	3.08
Resistance (%)							
Sales of space heating units - Gas (%)	63.7	41.2	17.6	3.03	0.991	0.876	0.88
Sales of space heating units - Fossil (%)	24.2	32.1	10.3	4.74	4.39	4.24	4.06
Sales of water heating units - Electric	0	6.54	37.2	51.7	53.5	53.6	53.6
Heat Pump (%)							
Sales of water heating units - Electric	18.7	35.7	39.8	45.4	46.3	46.4	46.3
Resistance (%)							
Sales of water heating units - Gas Furnace	71.1	52	21.9	2.85	0.155	0	0
(%)							
Sales of water heating units - Other (%)	10.3	5.8	1.12	0.083	0.037	0.038	0.038
Sales of cooking units - Electric	34.6	48.6	91.2	99.6	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	65.4	51.4	8.8	0.443	0	0	0
Residential HVAC investment in 2020s vs.		14.3	15.2				
REF - Cumulative 5-yr (billion \$2018)							

Table 33: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	0.625	15.6	51.1	76.3	79.8	80.3	80.2
Heat Pump (%)							
Sales of space heating units - Electric	2.13	4.73	12.8	18	19.1	18.8	18.9
Resistance (%)							
Sales of space heating units - Gas (%)	78.2	65.2	33.3	5.6	1.11	0.87	0.863
Sales of space heating units - Fossil (%)	19.1	14.5	2.85	0.124	0	0	0
Sales of water heating units - Electric	0.224	7.35	41	58.7	61	61.2	61.2
Heat Pump (%)							
Sales of water heating units - Electric	1.34	5.14	22.3	36.4	38.5	38.7	38.7
Resistance (%)							
Sales of water heating units - Gas (%)	97	86.3	36.3	4.73	0.256	0	0
Sales of water heating units - Other (%)	1.45	1.19	0.377	0.184	0.175	0.176	0.176

Table 33: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric	18.5	33.7	75.3	83.5	83.9	84	84
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s -		89,684	98,037				
Cumulative 5-yr (million \$2018)							

Table 34: E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	993	28.6	28.6	28.6	0	0
Installed thermal - Natural gas (MW)	22,780	14,968	15,595	17,729	28,320	24,804	22,239
Installed thermal - Nuclear (MW)	4,410	3,398	2,757	2,757	2,757	1,259	0
Installed renewables - Rooftop PV (MW)	2,262	3,350	4,275	5,350	6,543	7,836	9,243
Installed renewables - Solar - Base land use assumptions (MW)	2,251	8,767	15,348	24,283	32,896	45,191	49,822
Installed renewables - Wind - Base land use assumptions (MW)	3,284	3,284	5,438	9,320	10,718	14,723	17,362
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	139	309	12,773	21,321	32,657	54,102
Installed renewables - Solar - Constrained land use assumptions (MW)	1,695	10,801	18,130	25,729	34,147	44,054	48,474
Installed renewables - Wind - Constrained land use assumptions (MW)	3,772	3,772	5,867	10,104	11,586	15,429	17,782
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	276	448	12,684	19,162	19,162	48,394
Capital invested - Solar PV - Base (billion \$2018)		8.73	8.17	9.85	8.95	12.1	4.29
Capital invested - Wind - Base (billion \$2018)		0	5.05	8.67	2.98	8.08	5.03
Capital invested - Offshore Wind - Base (billion \$2018)		0.393	0.409	25.7	17.3	18.6	28.4

Table 35: E+RE+ scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	4,001	15,206	26,732	41,754	56,384	77,233	85,092
Wind - Base land use assumptions (GWh)	14,244	14,244	22,135	36,123	41,060	54,852	63,691
OffshoreWind - Base land use assumptions (GWh)	0	562	1,250	52,451	88,396	136,296	230,708
Solar - Constrained land use assumptions (GWh)	6,158	37,136	61,989	87,519	115,785	149,206	164,118
Wind - Constrained land use assumptions (GWh)	28,488	28,488	44,113	74,224	84,489	110,679	126,529
OffshoreWind - Constrained land use assumptions (GWh)	0	2,243	3,631	103,763	158,978	158,978	413,290

Table 36: E+RE+ scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-192
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-459
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,555
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-307
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,821

Table 36: E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Increase							-375
trees outside forests (1000 tC02e/y)							10.
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-136
Carbon sink potential - Low - Reforest							-418
pasture (1000 tCO2e/y)							-410
Carbon sink potential - Low - Restore							-1,184
productivity (1000 tC02e/y)							-1,104
Carbon sink potential - Low - All (not							-9,448
counting overlap) (1000 tC02e/y)							-7,440
Carbon sink potential - Mid - Accelerate							-28
regeneration (1000 tCO2e/y)							-20
Carbon sink potential - Mid - Avoid		+					-1,60
deforestation (1000 tCO2e/y)							-1,00
Carbon sink potential - Mid - Extend							-8,20
rotation length (1000 tC02e/y)							-0,20
Carbon sink potential - Mid - Improve							-450
plantations (1000 tCO2e/y)							-401
Carbon sink potential - Mid - Increase							-3,64
retention of HWP (1000 tCO2e/y)							-5,04
Carbon sink potential - Mid - Increase							-72
trees outside forests (1000 tC02e/y)							-12
Carbon sink potential - Mid - Reforest							-20
cropland (1000 tCO2e/y)							-20
Carbon sink potential - Mid - Reforest							-2,96
pasture (1000 tCO2e/y)							-2,70
Carbon sink potential - Mid - Restore							-2,34
productivity (1000 tCO2e/y)							-2,34
Carbon sink potential - Mid - All (not							-20,43
counting overlap) (1000 tC02e/y)							-20,43
Carbon sink potential - High - Accelerate							-38
regeneration (1000 tCO2e/y)							-30
Carbon sink potential - High - Avoid							-2,75
deforestation (1000 tC02e/y)							-2,10
Carbon sink potential - High - Extend							-11,85
rotation length (1000 tCO2e/y)							-11,000
Carbon sink potential - High - Improve							-604
plantations (1000 tCO2e/y)							-00-
Carbon sink potential - High - Increase							-5,464
retention of HWP (1000 tCO2e/y)							-5,404
Carbon sink potential - High - Increase							-1,07
trees outside forests (1000 tC02e/y)							-1,07
Carbon sink potential - High - Reforest							-27
cropland (1000 tCO2e/y)							-21
Carbon sink potential - High - Reforest							-5,51
pasture (1000 tCO2e/y)							-5,51
Carbon sink potential - High - All (not							-31,43
counting overlap) (1000 tCO2e/y)							-31,43
Carbon sink potential - High - Restore							-3,51
productivity (1000 tCO2e/y)							-3,31
Land impacted for carbon sink potential -							31.
Land Impacted for carbon Sink potential - Low - Accelerate regeneration (1000							٥١.
= ,							
nectares)							0.5
Land impacted for carbon sink potential -							35
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							0.01
Land impacted for carbon sink potential -							2,31
Low - Extend rotation length (1000 hectares)							

Table 36: E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item Land impacted for carbon sink potential -	2020	2025	2030	2035	2040	2045	2050 111
Low - Improve plantations (1000							111
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							F0 /
Land impacted for carbon sink potential -							53.6
Low - Increase trees outside forests							
(1000 hectares)							0.00
Land impacted for carbon sink potential -							9.02
Low - Reforest cropland (1000 hectares)							07.0
Land impacted for carbon sink potential -							27.2
Low - Reforest pasture (1000 hectares)							705
Land impacted for carbon sink potential -							705
Low - Restore productivity (1000							
hectares)							0.700
Land impacted for carbon sink potential -							3,603
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							47
Mid - Accelerate regeneration (1000							
hectares)							0.44
Land impacted for carbon sink potential -							361
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							/ 100
Land impacted for carbon sink potential -							4,182
Mid - Extend rotation length (1000							
hectares)							4.7
Land impacted for carbon sink potential -							167
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							777
Land impacted for carbon sink potential -							77.7
Mid - Increase trees outside forests (1000							
hectares)							10 5
Land impacted for carbon sink potential -							13.5
Mid - Reforest cropland (1000 hectares)							10/
Land impacted for carbon sink potential -							196
Mid - Reforest pasture (1000 hectares)							1 / 10
Land impacted for carbon sink potential -							1,419
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,464
Mid - Total impacted (over 30 years) (1000							
hectares)							(0.4
Land impacted for carbon sink potential -							62.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							373
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							6,047
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							223
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							

Table 36: E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							102
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							18
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							157
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,164
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,146
High - Total impacted (over 30 years)							
(1000 hectares)							

Table 37: E+RE+ scenario - PILLAR 6: Land Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate		2020	2000	2000	20.0	2010	-264
deployment - Corn-ethanol to energy							20.
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,224
deployment - Cropland measures (1000							.,
tCO2e/y)							
Carbon sink potential - Moderate							-44.8
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,532
deployment - Total (1000 tCO2e/y)							.,
Carbon sink potential - Aggressive							-264
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,322
deployment - Cropland measures (1000							•
tCO2e/y)							
Carbon sink potential - Aggressive							-89.7
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,675
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink - Moderate							85.7
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							785
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							81.5
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							953
deployment - Total (1000 hectares)							
Land impacted for carbon sink -							85.7
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,489
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							163
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							

Table 37: E+RE+ scenario - PILLAR 6: Land sinks - Agriculture (continued)

			0				
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							1,738
Aggressive deployment - Total (1000							
hectares)							

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Table 38: E+RE- scenario - IMPACTS - Heali			2222		0010	2215	
Item Provident for the Control of th	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		212	0.228	0.227	0.215	0.134	0.007
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		240	147	178	157	109	17.6
Premature deaths from air pollution - Mobile - On-Road (deaths)		823	813	653	397	188	74.4
Premature deaths from air pollution - Gas Stations (deaths)		51.2	49.4	38.8	23.6	11.4	4.84
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		459	413	304	182	92	36.1
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		173	147	104	62.6	28.4	8.24
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		27	25.6	20.7	14.6	8.51	4.56
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		210	203	168	121	79.4	44.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		45.9	39.2	29.1	18.8	13	9.75
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.13	6.93	5.63	4.29	2.91
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.77	1.04	1.06	1.08	1.13	1.08
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		150	146	145	130	112	85.8
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,124	1,301	1,573	1,388	962	156
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,317	7,231	5,804	3,530	1,675	662
Monetary damages from air pollution - Gas Stations (million \$2019)		453	437	343	209	101	42.9
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,068	3,662	2,692	1,616	815	320
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,534	1,303	924	555	252	73.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		240	227	184	129	75.4	40.4

Table 38: E+RE- scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		38.8	38.1	37.2	36.1	34.9	33.5
Fuel Comb - Comm/Institutional - Coal							
(million \$2019)							
Monetary damages from air pollution -		1,861	1,795	1,488	1,070	703	393
Fuel Comb - Comm/Institutional - Natural							
Gas (million \$2019)							
Monetary damages from air pollution -		406	347	258	166	115	86.3
Fuel Comb - Comm/Institutional - Oil							
(million \$2019)							
Monetary damages from air pollution -		81.7	72	61.3	49.9	37.9	25.8
Fuel Comb - Comm/Institutional - Other							
(million \$2019)							
Monetary damages from air pollution -		15.6	9.16	9.38	9.52	9.95	9.51
Industrial Processes - Coal Mining							
(million \$2019)							
Monetary damages from air pollution -		1,329	1,296	1,290	1,152	991	762
Industrial Processes - Oil & Gas							
Production (million \$2019)							

Table 39: E+RE- scenario - IMPACTS - Jobs

2050
405
34,482
9,108
750
758
6,951
804
17,700
11,595
35,925
1,730
1,991
0.37
46,930
7,951
11,248
2,387
37,918
7,570
49,042
37,771
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23,899
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6,109
-, -
905
17,131
,
23,535
42,349
12,047
27,532
2.,002
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Table 39: E+RE- scenario - IMPACTS - Jobs (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors -		3,983	3,495	4,415	4,949	5,494	7,179
Over 10 years (jobs)							
On-the-Job Training - All sectors - None		3,503	3,072	3,794	4,277	4,801	6,532
(jobs)							
On-the-Job Training - All sectors - Up to 1		42,164	37,226	46,706	51,525	56,292	76,412
year (jobs)							
On-the-Job Training - All sectors - 1 to 4		13,661	12,153	15,628	17,239	18,569	25,263
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		4,404	3,985	5,195	5,697	6,000	8,408
years (jobs)							
On-the-Job Training - All sectors - Over 10		628	542	669	734	809	1,112
years (jobs)							
On-Site or In-Plant Training - All sectors -		10,385	9,135	11,421	12,737	14,073	19,189
None (jobs)							
On-Site or In-Plant Training - All sectors -		38,331	33,875	42,607	46,999	51,286	69,579
Up to 1 year (jobs)							
On-Site or In-Plant Training - All sectors -		10,579	9,406	12,067	13,263	14,262	19,490
1 to 4 years (jobs)							
On-Site or In-Plant Training - All sectors -		4,508	4,061	5,241	5,766	6,118	8,434
4 to 10 years (jobs)							
On-Site or In-Plant Training - All sectors -		556	501	657	706	732	1,034
Over 10 years (jobs)							
Wage income - All (million \$2019)		4,080	3,671	4,702	5,341	5,969	7,983

Table 40: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,161	1,104	995	858	731	647	604
Final energy use - Residential (PJ)	880	819	735	612	496	413	364
Final energy use - Commercial (PJ)	690	677	650	604	560	538	533
Final energy use - Industry (PJ)	488	505	512	521	523	530	532

Table 41: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		7.59	7.79	18.2	19.6	18.4	19.5
Cumulative 5-yr (billion \$2018)							

Table 42: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	156	1,087	2,018	5,278	8,537	11,141	13,746
Vehicle stocks - LDV – All others (1000 units)	11,462	10,914	10,366	7,554	4,742	2,683	624
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,187	5,658	9,084	13,794	14,977	14,299
Public EV charging plugs - DC Fast (1000 units)	0.56		3.54		15		24.1
Public EV charging plugs - L2 (1000 units)	4.23		85.1		360		579

Table 43: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	3.63	16.2	66.1	89	91.7	91.9	92
Heat Pump (%)							
Sales of space heating units - Electric	8.47	10.5	6.04	3.28	2.89	2.96	3.08
Resistance (%)							
Sales of space heating units - Gas (%)	63.7	41.2	17.6	3.03	0.991	0.876	0.88
Sales of space heating units - Fossil (%)	24.2	32.1	10.3	4.74	4.39	4.24	4.06

Table 43: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric	0	6.54	37.2	51.7	53.5	53.6	53.6
Heat Pump (%)							
Sales of water heating units - Electric	18.7	35.7	39.8	45.4	46.3	46.4	46.3
Resistance (%)							
Sales of water heating units - Gas Furnace	71.1	52	21.9	2.85	0.155	0	0
(%)							
Sales of water heating units - Other (%)	10.3	5.8	1.12	0.083	0.037	0.038	0.038
Sales of cooking units - Electric	34.6	48.6	91.2	99.6	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	65.4	51.4	8.8	0.443	0	0	0
Residential HVAC investment in 2020s vs.		14.3	15.2				
REF - Cumulative 5-yr (billion \$2018)							

Table 44: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	0.625	15.6	51.1	76.3	79.8	80.3	80.2
Heat Pump (%)							
Sales of space heating units - Electric	2.13	4.73	12.8	18	19.1	18.8	18.9
Resistance (%)							
Sales of space heating units - Gas (%)	78.2	65.2	33.3	5.6	1.11	0.87	0.863
Sales of space heating units - Fossil (%)	19.1	14.5	2.85	0.124	0	0	0
Sales of water heating units - Electric	0.224	7.35	41	58.7	61	61.2	61.2
Heat Pump (%)							
Sales of water heating units - Electric	1.34	5.14	22.3	36.4	38.5	38.7	38.7
Resistance (%)							
Sales of water heating units - Gas (%)	97	86.3	36.3	4.73	0.256	0	0
Sales of water heating units - Other (%)	1.45	1.19	0.377	0.184	0.175	0.176	0.176
Sales of cooking units - Electric	18.5	33.7	75.3	83.5	83.9	84	84
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s -		89,684	98,037				
Cumulative 5-yr (million \$2018)							

Table 45: E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	993	3	3	3	3	0
Installed thermal - Natural gas (MW)	22,618	14,288	17,384	21,870	31,069	27,401	25,317
Installed thermal - Nuclear (MW)	4,410	3,398	3,398	3,399	6,604	12,838	14,592
Installed renewables - Rooftop PV (MW)	2,262	3,350	4,275	5,350	6,543	7,836	9,243
Installed renewables - Solar - Base land use assumptions (MW)	1,770	3,077	3,154	3,913	4,547	6,200	21,559
Installed renewables - Wind - Base land use assumptions (MW)	3,284	3,284	3,284	3,936	5,913	8,535	10,412
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	2,517	5,120	9,765	11,219	11,271	13,433
Installed renewables - Solar - Constrained land use assumptions (MW)	993	1,397	1,397	1,983	3,128	4,436	23,861
Installed renewables - Wind - Constrained land use assumptions (MW)	3,484	3,484	3,514	4,094	6,121	8,742	10,604
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	2,625	5,214	9,983	11,439	11,439	13,408
Capital invested - Solar PV - Base (billion \$2018)		1.75	0.092	0.837	0.659	1.62	14.5
Capital invested - Wind - Base (billion \$2018)		0	0	1.36	4.2	5.29	3.58
Capital invested - Offshore Wind - Base (billion \$2018)		7.13	6.26	9.69	2.94	0.085	2.86

Table 45: E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Constrained (billion \$2018)		0.54	0	0.646	1.19	1.28	18
Capital invested - Wind - Constrained (billion \$2018)		0	0.072	1.29	4.31	5.29	3.55
Capital invested - Offshore Wind - Constrained (billion \$2018)		7.43	6.23	9.75	2.95	0	2.61

Table 46: E+RE- scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	3,185	5,445	5,572	6,857	7,941	10,748	37,215
Wind - Base land use assumptions (GWh)	14,244	14,244	14,244	16,565	23,892	33,329	39,994
OffshoreWind - Base land use assumptions (GWh)	0	10,024	20,550	40,051	46,037	46,254	55,195
Solar - Constrained land use assumptions (GWh)	1,883	2,594	2,594	3,592	5,589	7,799	40,573
Wind - Constrained land use assumptions (GWh)	14,244	14,244	14,355	16,576	24,025	33,355	39,881
OffshoreWind - Constrained land use assumptions (GWh)	0	10,664	21,171	40,651	46,697	46,697	54,922

Table 47: E+RE- scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate							-192
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-459
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,555
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-307
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,821
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-375
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-136
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-418
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,184
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-9,448
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-287
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,605
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-8,206
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-450
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-3,642
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-724
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-205
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,967
pasture (1000 tCO2e/y)							

Table 47: E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)

Item Conhon sink potential Mid Postone	2020	2025	2030	2035	2040	2045	205 -2,34
Carbon sink potential - Mid - Restore							-2,34
productivity (1000 tC02e/y)							00.70
Carbon sink potential - Mid - All (not							-20,43
counting overlap) (1000 tC02e/y)							200
Carbon sink potential - High - Accelerate regeneration (1000 tC02e/y)							-38
							0.75
Carbon sink potential - High - Avoid							-2,75
deforestation (1000 tC02e/y)							11 OF
Carbon sink potential - High - Extend							-11,85
rotation length (1000 tC02e/y)							
Carbon sink potential - High - Improve							-60
plantations (1000 tC02e/y)							F / /
Carbon sink potential - High - Increase							-5,46
retention of HWP (1000 tC02e/y)							
Carbon sink potential - High - Increase							-1,07
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							-27
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,51
pasture (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-31,43
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-3,51
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							31.
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							350
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,31
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							11
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							53.
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							9.0
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							27.
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							70
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,60
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -	-						36
Mid - Avoid deforestation (over 30 years)							30
(1000 hectares)							
Land impacted for carbon sink potential -							4,18
Mid - Extend rotation length (1000							-+,10
hectares)							

Table 47: E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							167
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							77.7
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							13.5
Mid - Reforest cropland (1000 hectares)							196
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							196
Land impacted for carbon sink potential -							1,419
Mid - Restore productivity (1000							1,717
hectares)							
Land impacted for carbon sink potential -							6,464
Mid - Total impacted (over 30 years) (1000							
hectares)							
Land impacted for carbon sink potential -							62.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							373
High - Avoid deforestation (over 30 years)							
(1000 hectares) Land impacted for carbon sink potential -							6,047
High - Extend rotation length (1000							0,041
hectares)							
Land impacted for carbon sink potential -							223
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 -							102
High - Increase trees outside forests							
(1000 hectares)							10
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							18
Land impacted for carbon sink potential -							157
High - Reforest pasture (1000 hectares)							101
Land impacted for carbon sink potential -							1,164
High - Restore productivity (1000							1,134
hectares)							
Land impacted for carbon sink potential -							8,146
High - Total impacted (over 30 years)							-
(1000 hectares)							

Table 48: E+RE- scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-264
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,224
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-44.8
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,532
deployment - Total (1000 tCO2e/y)							

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-264
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							0.000
Carbon sink potential - Aggressive							-2,322
deployment - Cropland measures (1000							
tCO2e/y)							-89.7
Carbon sink potential - Aggressive deployment - Permanent conservation							-89.7
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,675
deployment - Total (1000 tCO2e/y)							-2,013
Land impacted for carbon sink - Moderate							85.7
deployment - Corn-ethanol to energy							00.1
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							785
deployment - Cropland measures (1000							100
hectares)							
Land impacted for carbon sink - Moderate							81.5
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							953
deployment - Total (1000 hectares)							
Land impacted for carbon sink -							85.7
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							1,489
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							163
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1,738
Aggressive deployment - Total (1000							
hectares)							

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		212	0.228	0.227	0.215	0.134	0.007
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		251	138	73.4	62.3	43.6	12.3
Premature deaths from air pollution - Mobile - On-Road (deaths)		838	898	923	874	730	526
Premature deaths from air pollution - Gas Stations (deaths)		52.4	55.7	56.4	52.8	43.6	31.1
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		463	461	439	385	305	214
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		176	179	181	167	131	87.5
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		27.4	28.9	30	28.8	24.1	18
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		211	224	232	226	204	170

Table 49: E-B+ scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.2	43.9	41.4	36.4	31.6	26.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.72	8.12	7.45	6.71	5.93
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.91	1.04	1.07	1.1	1.14	1.16
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		147	130	108	90.4	78	57.4
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,222	1,223	650	552	386	109
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,451	7,988	8,203	7,769	6,492	4,675
Monetary damages from air pollution - Gas Stations (million \$2019)		464	493	500	468	386	275
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,102	4,088	3,893	3,409	2,700	1,897
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,561	1,585	1,605	1,477	1,159	775
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		243	256	266	255	213	160
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		38.8	38.1	37.2	36.1	34.9	33.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,870	1,983	2,054	2,001	1,803	1,502
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		409	389	367	323	280	235
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		81.7	77.2	71.9	65.9	59.4	52.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		16.9	9.19	9.47	9.68	10.1	10.2
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,303	1,157	957	803	693	510

Table 50: E-B+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		502	584	396	236	94.1	928
By economic sector - Construction (jobs)		20,409	21,062	21,690	22,725	30,153	40,795
By economic sector - Manufacturing		6,965	8,618	8,628	6,867	9,673	16,068
(jobs)							
By economic sector - Mining (jobs)		4,821	3,520	2,597	1,939	1,302	756
By economic sector - Other (jobs)		2,558	2,839	2,732	3,288	4,957	7,391
By economic sector - Pipeline (jobs)		1,226	1,042	919	798	644	628
By economic sector - Professional (jobs)		8,884	9,534	10,250	11,141	15,021	24,038

Table 50: E-B+ scenario - IMPACTS - Jobs (continued)

The second	0000	0005	0000	0005	00/0	0015	0050
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		6,767	6,846	6,986	7,487	9,879	14,516
By economic sector - Utilities (jobs)		15,547	15,271	19,334	19,719	26,809	48,557
By resource sector - Biomass (jobs)		1,506	1,448	1,007	701	426	4,424
By resource sector - CO2 (jobs)		0	211	631	628	626	1,808
By resource sector - Coal (jobs)		481	139	10.1	9.64	9.2	3.53
By resource sector - Grid (jobs)		15,398	19,849	30,175	31,088	46,237	63,942
By resource sector - Natural Gas (jobs)		14,612	9,436	6,998	6,506	5,964	4,281
By resource sector - Nuclear (jobs)		2,016	1,688	1,661	1,635	1,486	18,943
By resource sector - Oil (jobs)		10,452	8,869	7,534	6,417	4,876	3,110
By resource sector - Solar (jobs)		19,398	19,587	14,342	16,977	25,561	37,275
By resource sector - Wind (jobs)		3,816	8,090	11,173	10,235	13,347	19,888
By education level - All sectors - High		28,675	29,524	31,157	31,254	41,469	63,462
school diploma or less (jobs)							
By education level - All sectors -		21,272	21,845	23,416	23,771	31,882	48,674
Associates degree or some college (jobs)							
By education level - All sectors -		13,857	14,013	14,785	14,889	19,538	32,097
Bachelors degree (jobs)		,	,	,	,	,	·
By education level - All sectors - Masters		3,379	3,427	3,651	3,736	4,927	8,214
or professional degree (jobs)			-,	,,,,,	-,	.,	-,-:
By education level - All sectors - Doctoral		497	506	524	549	718	1,228
degree (jobs)		.,,		52.	0.7		.,
Related work experience - All sectors -		9,827	10,057	10,694	10,812	14,382	22,114
None (jobs)		7,021	10,001	10,074	10,012	14,002	22,117
Related work experience - All sectors - Up		13,542	14,032	14,719	14,789	19,666	30,777
to 1 year (jobs)		10,042	14,002	17,117	14,107	17,000	50,111
Related work experience - All sectors - 1		24,347	24,862	26,422	26,695	35,415	55,331
to 4 years (jobs)		24,041	24,002	20,422	20,073	33,413	33,331
Related work experience - All sectors - 4		15,835	16,136	17,196	17,398	23,092	35,913
to 10 years (jobs)		10,000	10,100	11,170	11,070	20,072	00,710
Related work experience - All sectors -		4,128	4,229	4,501	4,505	5,978	9,541
Over 10 years (jobs)		4,120	4,227	4,301	4,303	3,710	7,541
On-the-Job Training - All sectors - None		3,745	3,816	3,970	4,022	5,313	8,547
(jobs)		3,143	3,010	3,710	4,022	3,313	0,541
On-the-Job Training - All sectors - Up to 1		44,136	45,319	47,943	48,153	63,844	100,695
		44,136	45,319	41,943	46,153	63,844	100,695
year (jobs) On-the-Job Training - All sectors - 1 to 4		14,381	14,683	15,732	15,966	01 200	20 505
		14,361	14,003	15,732	15,966	21,302	32,505
years (jobs)		, 7,7	/ 010	F 100	F 0F0	7150	10 /75
On-the-Job Training - All sectors - 4 to 10		4,747	4,810	5,183	5,358	7,150	10,475
years (jobs)		(70	(00	70/	701	000	1 / 50
On-the-Job Training - All sectors - Over 10		670	688	704	701	923	1,453
years (jobs)		10.000	11.0.	11.00=		15.050	
On-Site or In-Plant Training - All sectors -		10,990	11,267	11,827	11,952	15,870	25,171
None (jobs)							
On-Site or In-Plant Training - All sectors -		40,139	41,183	43,636	43,855	58,164	91,483
Up to 1 year (jobs)							
On-Site or In-Plant Training - All sectors -		11,134	11,385	12,176	12,335	16,449	25,114
1 to 4 years (jobs)							
On-Site or In-Plant Training - All sectors -		4,833	4,881	5,240	5,390	7,154	10,594
4 to 10 years (jobs)							
On-Site or In-Plant Training - All sectors -		584	600	654	666	895	1,314
Over 10 years (jobs)							
Wage income - All (million \$2019)		4,283	4,403	4,761	4,882	6,542	10,439

Table 51: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,163	1,112	1,033	964	905	837	757
Final energy use - Residential (PJ)	880	823	783	735	664	579	494
Final energy use - Commercial (PJ)	690	679	673	667	654	636	618
Final energy use - Industry (PJ)	488	505	514	526	531	538	538

Table 52: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.03	6.04	8.86	9.2	14.7	15.6
Cumulative 5-yr (billion \$2018)							

Table 53: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	121	394	667	1,933	3,200	6,002	8,804
Vehicle stocks - LDV – All others (1000 units)	11,509	11,509	11,509	10,916	10,324	7,956	5,588
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	363	742	2,526	7,889	11,514
Public EV charging plugs - DC Fast (1000 units)	0.56		1.17		5.61		15.4
Public EV charging plugs - L2 (1000 units)	4.23		28.1		135		371

Table 54: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	3.63	7.47	12.9	28.9	55.2	75.3	83.7
Heat Pump (%)							
Sales of space heating units - Electric	8.47	11.2	10.6	9.22	6.74	4.65	3.8
Resistance (%)							
Sales of space heating units - Gas (%)	63.7	45.1	42.4	34.7	21.5	10.4	5.47
Sales of space heating units - Fossil (%)	24.2	36.3	34	27.2	16.6	9.64	6.99
Sales of water heating units - Electric	0	1.21	4.63	14.7	31.2	43.9	49.3
Heat Pump (%)							
Sales of water heating units - Electric	18.7	35.3	35.6	36.9	39.6	42.6	44.2
Resistance (%)							
Sales of water heating units - Gas Furnace	71.1	56.8	53.6	43.7	26.7	12.4	5.95
(%)							
Sales of water heating units - Other (%)	10.3	6.7	6.2	4.75	2.54	1.09	0.587
Sales of cooking units - Electric	34.4	36.1	42.1	57.9	80	93.5	98.3
Resistance (%)							
Sales of cooking units - Gas (%)	65.6	63.9	57.9	42.1	20	6.47	1.74
Residential HVAC investment in 2020s vs.		14.3	16.3				
REF - Cumulative 5-yr (billion \$2018)							

Table 55: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	0.625	10	13.9	25.5	45.9	63.9	72.2
Heat Pump (%)							
Sales of space heating units - Electric	2.13	3.41	4.29	6.96	11.7	15.4	17.3
Resistance (%)							
Sales of space heating units - Gas (%)	78.2	69.8	65.6	54.7	35.3	17.8	8.88
Sales of space heating units - Fossil (%)	19.1	16.8	16.2	12.8	7.04	2.9	1.58
Sales of water heating units - Electric	0.224	1.65	5.4	16.4	34.9	49.5	55.9
Heat Pump (%)							
Sales of water heating units - Electric	1.34	2.6	4.47	10.1	20.3	29.6	34
Resistance (%)							
Sales of water heating units - Gas (%)	97	94.4	88.8	72.4	44.1	20.6	9.85
Sales of water heating units - Other (%)	1.45	1.35	1.33	1.05	0.642	0.377	0.282
Sales of cooking units - Electric	18.5	21.6	27.5	43	64.5	77.7	82.3
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Commercial HVAC investment in 2020s -		89,637	97,820				
Cumulative 5-yr (million \$2018)							

Table 56.	F-R+ scenario	- PTIIAR 2. C	lean Electricity	- Generatina i	canacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	1,642	28.6	28.6	0	0	0
Installed thermal - Natural gas (MW)	22,657	14,490	13,442	13,449	16,736	13,344	11,703
Installed thermal - Nuclear (MW)	4,410	3,398	3,398	3,398	3,399	2,757	10,530
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	0.005	0.001	0	0.011
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.007	0	0.001	0	0.011

Table 57: 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 power plant (GWh)	0	0	8.38	8.38	9.01	9.12	21.7
Biomass w/ccu allam power plant (GWh)	0	0	0	4.49	5.23	5.45	16.9

Table 58: E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	1	1	1	1	1
(quantity)							
Number of facilities - Allam power w ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	1	13
Number of facilities - Pyrolysis ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1
Conversion capital investment -		0	6.95	22.2	4.22	47.7	12,245
Cumulative 5-yr (million \$2018)							
Biomass purchases (million \$2018/y)		0	0.652	1.94	2.2	6.27	1,070

Table 59: E-B+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	3.38	3.35	3.45	3.67
Annual - BECCS (MMT)		0	0.01	0.02	0.02	0.03	0.12
Annual - NGCC (MMT)		0	0	0.01	0.01	0.01	0.01
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Cumulative - All (MMT)		0	0.01	3.39	6.74	10.2	13.9
Cumulative - BECCS (MMT)		0	0.01	0.03	0.05	0.08	0.2
Cumulative - NGCC (MMT)		0	0	0.01	0.02	0.03	0.04
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6

Table 60: E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	63	63	63	63	63
Spur (km)		0	216	549	549	374	549
All (km)		0	279	612	612	437	612
Cumulative investment - Trunk (million \$2018)		0	114	114	114	114	114
Cumulative investment - Spur (million \$2018)		0	109	376	375	286	385

Table 60: E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines (continued)

		•	•				
Item	2020	2025	2030	2035	2040	2045	2050
Cumulative investment - All (million \$2018)		0	223	490	489	400	499

Table 61: E-B+ scenario - PILLAR 4: CCUS - CO2 storage

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

Table 62: E-B+ scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate							-192
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-459
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,555
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-307
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,821
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-375
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-136
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-418
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,184
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-9,448
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-287
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,605
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-8,206
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-450
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-3,642
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-724
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-205
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,967
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-2,349
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-20,436
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Accelerate							-383
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,752
deforestation (1000 tCO2e/y)							

Table 62: E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend							-11,858
rotation length (1000 tC02e/y)							
Carbon sink potential - High - Improve							-604
plantations (1000 tC02e/y)							F / / /
Carbon sink potential - High - Increase							-5,464
retention of HWP (1000 tC02e/y)							4.070
Carbon sink potential - High - Increase							-1,072
trees outside forests (1000 tCO2e/y)							070
Carbon sink potential - High - Reforest							-273
cropland (1000 tC02e/y)							F F1/
Carbon sink potential - High - Reforest							-5,516
pasture (1000 tC02e/y)							04 / 05
Carbon sink potential - High - All (not							-31,435
counting overlap) (1000 tC02e/y)							
Carbon sink potential - High - Restore							-3,513
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							31.3
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							350
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,317
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							111
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 -							53.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							9.02
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							27.2
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							705
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,603
Low - Total impacted (over 30 years)							-,
(1000 hectares)							
Land impacted for carbon sink potential -							47
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							361
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,182
Mid - Extend rotation length (1000							7,102
hectares)							
Land impacted for carbon sink potential -	+			-			167
Mid - Improve plantations (1000 hectares)							101
Land impacted for carbon sink potential -	+		-		-		0
·							U
Mid - Increase retention of HWP (1000							
hectares)							777
							((. (
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							77.

Table 62: E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)

1 12 16 1 11 1 11	l l	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							13.5
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							196
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,419
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,464
Mid - Total impacted (over 30 years) (1000							
hectares)							
Land impacted for carbon sink potential -							62.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							373
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							6,047
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							223
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 -							102
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							18
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							157
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,164
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,146
High - Total impacted (over 30 years)							
(1000 hectares)							

Table 63: E-B+ scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-414
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,160
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-42.4
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-1,616
deployment - Total (1000 tCO2e/y)							

Table 63: E-B+ scenario - PILLAR 6: Land sinks - Agriculture (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-414
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,200
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-84.9
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							-
crops (1000 tC02e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							Ū
(1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,698
deployment - Total (1000 tCO2e/y)							-2,070
Land impacted for carbon sink - Moderate							172
deployment - Corn-ethanol to energy							112
grasses (1000 hectares)							
• ,							71.1.
Land impacted for carbon sink - Moderate							744
deployment - Cropland measures (1000							
hectares)							77.0
Land impacted for carbon sink - Moderate							77.2
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1.31
deployment - Cropland to woody energy							
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							78.3
deployment - Pasture to energy crops							
(1000 hectares)							
Land impacted for carbon sink - Moderate							1,072
deployment - Total (1000 hectares)							
Land impacted for carbon sink -							172
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,483
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							154
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							1.31
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							78.3
Aggressive deployment - Pasture to							10.0
energy crops (1000 hectares)							
Land impacted for carbon sink -	+					+	3,889
Aggressive deployment - Total (1000							5,009
==							
hectares)							

Table 64: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		583	364	336	325	319	286

Table 64: REF scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		187	180	246	244	279	309
Premature deaths from air pollution - Mobile - On-Road (deaths)		836	909	981	1,061	1,143	1,231
Premature deaths from air pollution - Gas Stations (deaths)		52.1	56.1	60	64.4	68.8	73.1
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		454	459	470	490	513	531
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		170	150	113	79	53.2	38.1
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		26.4	27.3	28.1	29.2	30.2	31.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.58	4.71	4.82	4.92	5.02	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		213	231	242	251	272	306
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.4	43.4	38.2	30.1	25.1	22.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.65	10.3	11	11.7	12.4	13.1
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		3.61	2.71	2.36	2.32	2.34	2.29
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		148	163	172	169	173	17 1
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		5,166	3,222	2,981	2,884	2,824	2,537
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		1,653	1,596	2,181	2,162	2,472	2,733
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,434	8,078	8,725	9,431	10,167	10,949
Monetary damages from air pollution - Gas Stations (million \$2019)		462	497	531	571	609	647
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,026	4,069	4,169	4,340	4,544	4,706
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,503	1,331	1,005	700	472	338
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		234	242	249	258	268	277
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		40.6	41.7	42.7	43.6	44.5	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,889	2,049	2,138	2,221	2,410	2,710
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		410	384	338	267	222	197

Table 64: REF scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		85.4	91.6	97.8	104	110	116
Fuel Comb - Comm/Institutional - Other							
(million \$2019)							
Monetary damages from air pollution -		31.9	24	20.8	20.5	20.6	20.2
Industrial Processes - Coal Mining							
(million \$2019)							
Monetary damages from air pollution -		1,313	1,444	1,530	1,496	1,539	1,515
Industrial Processes - Oil & Gas							
Production (million \$2019)							

Table 65: REF scenario - IMPACTS - Jobs

Table 65: REF scenario - IMPACTS - Jobs							
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		491	471	469	437	437	449
By economic sector - Construction (jobs)		9,942	13,759	16,430	16,835	18,156	23,849
By economic sector - Manufacturing (jobs)		4,560	4,945	7,383	5,162	5,450	8,355
By economic sector - Mining (jobs)		4,948	4,059	3,353	2,735	2,328	1,947
By economic sector - Other (jobs)		451	1,363	1,699	1,887	2,113	3,951
By economic sector - Pipeline (jobs)		1,265	1,323	1,345	1,271	1,287	1,278
By economic sector - Professional (jobs)		5,098	5,892	7,006	7,339	8,049	10,808
By economic sector - Trade (jobs)		4,396	4,806	5,265	5,407	5,809	7,920
By economic sector - Utilities (jobs)		14,507	12,859	16,665	17,055	19,185	21,418
By resource sector - Biomass (jobs)		1,442	1,375	1,308	1,224	1,223	1,220
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		651	458	352	335	319	123
By resource sector - Grid (jobs)		13,388	14,028	21,572	22,621	25,335	30,463
By resource sector - Natural Gas (jobs)		15,382	12,318	12,950	12,615	14,401	14,178
By resource sector - Nuclear (jobs)		1,883	1,369	1,224	1,031	843	587
By resource sector - Oil (jobs)		10,559	9,139	8,128	7,577	7,245	7,010
By resource sector - Solar (jobs)			7,974	8,679	9,069	9,297	20,041
By resource sector - Wind (jobs)		2,354	2,817	5,403	3,657	4,150	6,354
By education level - All sectors - High		18,911	20,980	25,375	24,688	26,637	34,025
school diploma or less (jobs)		,			,		,
By education level - All sectors -		14,218	15,502	18,946	18,562	20,199	25,814
Associates degree or some college (jobs)		, -	-,	,		-,	-,-
By education level - All sectors -		9,836	10,184	12,002	11,628	12,478	15,706
Bachelors degree (jobs)		1,000	,	,	,	,	,
By education level - All sectors - Masters		2,376	2,466	2,899	2,856	3,077	3,883
or professional degree (jobs)		,	,		,	.	
By education level - All sectors - Doctoral		317	345	394	395	422	547
degree (jobs)							
Related work experience - All sectors -		6,652	7,223	8,726	8,551	9,269	11,796
None (jobs)							
Related work experience - All sectors - Up		8,681	9,745	11,773	11,417	12,290	15,925
to 1 year (jobs)							
Related work experience - All sectors - 1		16,663	17,881	21,484	20,974	22,664	28,745
to 4 years (jobs)							
Related work experience - All sectors - 4		10,813	11,597	13,966	13,654	14,780	18,684
to 10 years (jobs)							
Related work experience - All sectors -		2,850	3,032	3,667	3,532	3,810	4,825
Over 10 years (jobs)							
On-the-Job Training - All sectors - None		2,446	2,686	3,173	3,089	3,311	4,283
(jobs)							
On-the-Job Training - All sectors - Up to 1		30,027	32,338	38,909	37,723	40,670	51,877
year (jobs)							•
On-the-Job Training - All sectors - 1 to 4		9,676	10,526	12,786	12,562	13,648	17,269
years (jobs)					·		•
On-the-Job Training - All sectors - 4 to 10		3,095	3,456	4,181	4,216	4,608	5,795
years (jobs)							•

Table 4E	REF scenario -	TMDMCTC	John Coont	inuadi
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Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - Over 10 years (jobs)		414	472	566	539	576	751
On-Site or In-Plant Training - All sectors -		7,249	7,912	9,493	9,219	9,940	12,790
None (jobs) On-Site or In-Plant Training - All sectors -		27,320	29,442	35,438	34,405	37,109	47,279
Up to 1 year (jobs) On-Site or In-Plant Training - All sectors -		7,483	8,154	9,898	9,706	10,532	13,353
1 to 4 years (jobs)		·	,	·	·		
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,212	3,539	4,255	4,270	4,654	5,825
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		394	431	531	527	578	730
Wage income - All (million \$2019)		2,964	3,198	3,879	3,858	4,226	5,371

Table 66: REF scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,162	1,127	1,072	1,042	1,053	1,087	1,129
Final energy use - Residential (PJ)	880	816	779	749	730	718	709
Final energy use - Commercial (PJ)	690	686	690	689	696	725	772
Final energy use - Industry (PJ)	488	516	537	550	569	586	604

Table 67: REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.35	6.41	12.1	12.8	14.6	15.5
Cumulative 5-yr (billion \$2018)							

Table 68: REF scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	1.94	19.2	20	21	21.5	22.1	22.9
Heat Pump (%)							
Sales of space heating units - Electric	8.69	9.88	9.71	9.54	9.43	8.85	8.05
Resistance (%)							
Sales of space heating units - Gas (%)	64.8	40.9	54.3	61.9	62.2	62.3	62.3
Sales of space heating units - Fossil (%)	24.6	30	16	7.63	6.8	6.76	6.79
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	18.7	35.1	35	35	35	34.9	34.9
Resistance (%)							
Sales of water heating units - Gas Furnace	71.1	58	58.1	58.1	58.1	58.2	58.2
(%)							
Sales of water heating units - Other (%)	10.3	6.88	6.87	6.87	6.88	6.87	6.87
Sales of cooking units - Electric	33.8	33.8	33.8	33.8	33.8	33.8	33.8
Resistance (%)							
Sales of cooking units - Gas (%)	66.2	66.2	66.2	66.2	66.2	66.2	66.2
Residential HVAC investment in 2020s vs.		13.5	14.1				
REF - Cumulative 5-yr (billion \$2018)							

Table 69: REF scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	0.625	14.7	40.7	61.9	65.1	65.7	65.5
Heat Pump (%)							
Sales of space heating units - Electric	2.13	4.03	8.89	21.3	31.8	33.3	33.6
Resistance (%)							
Sales of space heating units - Gas (%)	78.2	65	37.7	11	2.19	0.952	0.86
Sales of space heating units - Fossil (%)	19.1	16.3	12.8	5.74	0.874	0.07	0

Table 40: DEF acanania	- PILLAR 1: Efficiency/Electrification -	Commonaid (continued)
Table 69: KFF scendrin	- PII I AR I' FMICIENCY/FIECTRITICATION -	Linmmerciai icontiniieai

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric	0.224	0.326	0.327	0.328	0.329	0.331	0.331
Heat Pump (%)							
Sales of water heating units - Electric	1.34	1.93	1.92	1.93	1.93	1.92	1.93
Resistance (%)							
Sales of water heating units - Gas (%)	97	96.4	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	1.45	1.38	1.45	1.44	1.45	1.49	1.49
Sales of cooking units - Electric	18.5	19.4	19.4	19.6	19.7	19.8	19.9
Resistance (%)							
Sales of cooking units - Gas (%)	81.5	80.6	80.6	80.4	80.3	80.2	80.1
Commercial HVAC investment in 2020s -		88,595	91,263				
Cumulative 5-yr (million \$2018)							

Table 70: REF scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	1,642	993	993	993	993	0
Installed thermal - Natural gas (MW)	20,926	16,044	15,600	17,565	21,630	27,691	35,070
Installed thermal - Nuclear (MW)	4,410	2,757	2,757	2,143	2,143	1,259	1,259
Installed renewables - Rooftop PV (MW)	2,262	3,350	4,275	5,350	6,543	7,836	9,243
Installed renewables - Solar - Base land	692	692	692	692	692	692	692
use assumptions (MW)							
Installed renewables - Wind - Base land	3,274	3,274	3,274	4,239	5,070	5,858	5,858
use assumptions (MW)							
Installed renewables - Offshore Wind -	0	675	2,100	4,641	5,528	5,828	7,073
Base land use assumptions (MW)							
Installed renewables - Solar -	21.3	21.3	21.3	21.3	21.3	21.3	21.3
Constrained land use assumptions (MW)							
Installed renewables - Wind - Constrained	9.6	9.6	9.6	54.6	54.6	54.6	54.6
land use assumptions (MW)							

Table 71: REF scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,394	1,394	1,394	1,394	1,394	1,394	1,394
Wind - Base land use assumptions (GWh)	14,244	14,244	14,244	17,903	20,983	23,892	23,892
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							

Table 72: REF scenario - PILLAR 6: Land sinks - Forests - REF only

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural	-10.2		-16.4				-14.7
uptake (Mt CO2e/y)							
Business-as-usual carbon sink - Retained	-1.49		-2.67				-2.78
in Hardwood Products (Mt CO2e/y)							
Business-as-usual carbon sink - Total (Mt	-11.7		-19.1				-17.5
CO2e/y)							

Table 73: REF scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate							-192
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-459
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-4,555
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-307
plantations (1000 tCO2e/y)							

Table 73: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item Corbon sink notantial Low Increase	2020	2025	2030	2035	2040	2045	2050 -1,821
Carbon sink potential - Low - Increase							-1,821
retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase							-375
trees outside forests (1000 tC02e/y)							-375
Carbon sink potential - Low - Reforest							-136
cropland (1000 tC02e/y)							-130
Carbon sink potential - Low - Reforest							-418
pasture (1000 tC02e/y)							-410
Carbon sink potential - Low - Restore							-1,184
productivity (1000 tC02e/y)							-1,104
Carbon sink potential - Low - All (not							-9,448
counting overlap) (1000 tCO2e/y)							-7,440
Carbon sink potential - Mid - Accelerate							-287
regeneration (1000 tC02e/y)							-201
Carbon sink potential - Mid - Avoid							-1,605
deforestation (1000 tCO2e/y)							-1,000
Carbon sink potential - Mid - Extend							-8,206
rotation length (1000 tCO2e/y)							-0,200
Carbon sink potential - Mid - Improve							-450
plantations (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Increase							-3,642
							-3,042
retention of HWP (1000 tC02e/y)							-724
Carbon sink potential - Mid - Increase							-724
trees outside forests (1000 tC02e/y)							-205
Carbon sink potential - Mid - Reforest							-205
cropland (1000 tC02e/y)							0.07
Carbon sink potential - Mid - Reforest							-2,967
pasture (1000 tC02e/y)							0.040
Carbon sink potential - Mid - Restore							-2,349
productivity (1000 tC02e/y)							00 / 0/
Carbon sink potential - Mid - All (not							-20,436
counting overlap) (1000 tC02e/y)							000
Carbon sink potential - High - Accelerate							-383
regeneration (1000 tC02e/y)							0.750
Carbon sink potential - High - Avoid							-2,752
deforestation (1000 tC02e/y)							11.050
Carbon sink potential - High - Extend							-11,858
rotation length (1000 tC02e/y)							
Carbon sink potential - High - Improve							-604
plantations (1000 tC02e/y)							
Carbon sink potential - High - Increase							-5,464
retention of HWP (1000 tC02e/y)							
Carbon sink potential - High - Increase							-1,072
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							-273
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,516
pasture (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-31,435
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-3,513
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							31.3
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							350
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,317
Low - Extend rotation length (1000 hectares)	1		I		1	I	

Table 73: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Improve plantations (1000							111
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							_
hectares)							
Land impacted for carbon sink potential -							53.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							9.02
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							27.2
Low - Reforest pasture (1000 hectares) Land impacted for carbon sink potential -							705
Low - Restore productivity (1000							705
hectares)							
Land impacted for carbon sink potential -							3,603
Low - Total impacted (over 30 years)							0,000
(1000 hectares)							
Land impacted for carbon sink potential -							47
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							361
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,182
Mid - Extend rotation length (1000							
hectares) Land impacted for carbon sink potential -							167
Mid - Improve plantations (1000 hectares)							101
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							77.7
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							13.5
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							196
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,419
Mid - Restore productivity (1000							
hectares)							/ / / /
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000							6,464
hectares)							
Land impacted for carbon sink potential -							62.6
High - Accelerate regeneration (1000							02.0
hectares)							
Land impacted for carbon sink potential -							373
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							6,047
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							223
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000		I .					

Table 73: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							102
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							18
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							157
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,164
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							8,146
High - Total impacted (over 30 years)							
(1000 hectares)							