



Net-Zero America - Kansas 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:

E. Larson, C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala, R. Socolow, EJ Baik, R. Birdsey, R. Duke, R. Jones, B. Haley, E. Leslie, K. Paustian, and A. Swan, Net-Zero America: Potential Pathways, Infrastructure, and Impacts, Final Report, Princeton University, Princeton, NJ, 29 October 2021. Report available at <https://net-zeroamerica.princeton.edu>.

Contents

1	E+ scenario - IMPACTS - Health	1
2	E+ scenario - IMPACTS - Jobs	2
3	E+ scenario - IMPACTS - Fossil fuel industries	3
4	E+ scenario - PILLAR 1: Efficiency/Electrification - Overview	3
5	E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	3
6	E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	3
7	E+ scenario - PILLAR 1: Efficiency/Electrification - Residential	4
8	E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	4
9	E+ scenario - PILLAR 2: Clean Electricity - Generating capacity	4
10	E+ scenario - PILLAR 2: Clean Electricity - Generation	5
11	E+ scenario - PILLAR 3: Clean fuels - Bioenergy	5
12	E+ scenario - PILLAR 4: CCUS - CO2 capture	5
13	E+ scenario - PILLAR 4: CCUS - CO2 pipelines	6
14	E+ scenario - PILLAR 4: CCUS - CO2 storage	6
15	E+ scenario - PILLAR 6: Land sinks - Forests	6
16	E+ scenario - PILLAR 6: Land sinks - Agriculture	8
17	E- scenario - IMPACTS - Health	9
18	E- scenario - IMPACTS - Jobs	10
19	E- scenario - PILLAR 1: Efficiency/Electrification - Overview	12
20	E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	12
21	E- scenario - PILLAR 1: Efficiency/Electrification - Transportation	12
22	E- scenario - PILLAR 1: Efficiency/Electrification - Residential	12
23	E- scenario - PILLAR 1: Efficiency/Electrification - Commercial	12
24	E- scenario - PILLAR 2: Clean Electricity - Generating capacity	13
25	E- scenario - PILLAR 6: Land sinks - Forests	13
26	E- scenario - PILLAR 6: Land sinks - Agriculture	15
27	E+RE+ scenario - IMPACTS - Health	16
28	E+RE+ scenario - IMPACTS - Jobs	17
29	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview	18
30	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	18
31	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	19
32	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential	19
33	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	19
34	E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity	19
35	E+RE+ scenario - PILLAR 2: Clean Electricity - Generation	20
36	E+RE+ scenario - PILLAR 6: Land sinks - Forests	20
37	E+RE+ scenario - PILLAR 6: Land sinks - Agriculture	23
38	E+RE- scenario - IMPACTS - Health	23
39	E+RE- scenario - IMPACTS - Jobs	25
40	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview	26
41	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	26
42	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation	26
43	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential	26

44	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial	27
45	E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity	27
46	E+RE- scenario - PILLAR 2: Clean Electricity - Generation	27
47	E+RE- scenario - PILLAR 6: Land sinks - Forests	28
48	E+RE- scenario - PILLAR 6: Land sinks - Agriculture	30
49	E-B+ scenario - IMPACTS - Health	31
50	E-B+ scenario - IMPACTS - Jobs	32
51	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview	33
52	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand . . .	33
53	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	33
54	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential	34
55	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	34
56	E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity	34
57	E-B+ scenario - PILLAR 2: Clean Electricity - Generation	34
58	E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy	35
59	E-B+ scenario - PILLAR 4: CCUS - CO2 capture	35
60	E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines	35
61	E-B+ scenario - PILLAR 4: CCUS - CO2 storage	35
62	E-B+ scenario - PILLAR 6: Land sinks - Forests	36
63	E-B+ scenario - PILLAR 6: Land sinks - Agriculture	38
64	REF scenario - IMPACTS - Health	39
65	REF scenario - IMPACTS - Jobs	40
66	REF scenario - PILLAR 1: Efficiency/Electrification - Overview	41
67	REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand . . .	42
68	REF scenario - PILLAR 1: Efficiency/Electrification - Residential	42
69	REF scenario - PILLAR 1: Efficiency/Electrification - Commercial	42
70	REF scenario - PILLAR 2: Clean Electricity - Generating capacity	42
71	REF scenario - PILLAR 2: Clean Electricity - Generation	43
72	REF scenario - PILLAR 6: Land sinks - Forests - REF only	43
73	REF scenario - PILLAR 6: Land sinks - Forests	43

Table 1: *E+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		22.2	0.022	0.021	0.018	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		14	6.93	3.27	2.48	1.53	0.776
Premature deaths from air pollution - Mobile - On-Road (deaths)		45.8	42.9	32.7	19	8.81	3.67
Premature deaths from air pollution - Gas Stations (deaths)		4.87	4.51	3.43	2.07	1.05	0.537
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		7.75	6.28	4.12	2.22	1.01	0.406
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		0.124	0.103	0.072	0.043	0.02	0.007
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.43	1.29	0.99	0.641	0.32	0.131
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.714	0.687	0.656	0.623	0.588	0.551
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		5.21	4.46	3.26	2.06	1.21	0.67
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.768	0.626	0.495	0.374	0.267	0.173
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.427	0.36	0.294	0.23	0.169	0.112
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.04	0.381	0.371	0.359	0.356	0.349
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		84.7	80.7	74.7	58.6	44.2	27.8
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		197	0.195	0.187	0.156	0.102	0.002
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		124	61.4	29	22	13.5	6.88
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		408	381	291	169	78.3	32.6
Monetary damages from air pollution - Gas Stations (million \$2019)		43.1	39.9	30.4	18.3	9.27	4.76
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		68.6	55.7	36.5	19.7	8.96	3.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1.1	0.916	0.641	0.381	0.173	0.066
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		12.6	11.5	8.77	5.68	2.84	1.16
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		6.32	6.08	5.81	5.51	5.2	4.88
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		46.1	39.5	28.8	18.3	10.7	5.93

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		6.8	5.54	4.39	3.31	2.36	1.53
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		3.78	3.18	2.6	2.04	1.5	0.988
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		9.21	3.36	3.28	3.17	3.14	3.08
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		752	717	664	520	392	247

Table 2: *E+ scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		859	862	1,795	1,224	1,152	942
By economic sector - Construction (jobs)		8,809	13,744	17,724	21,027	24,936	29,970
By economic sector - Manufacturing (jobs)		5,555	6,225	7,477	6,970	6,529	7,031
By economic sector - Mining (jobs)		5,896	4,715	3,680	2,449	1,671	1,018
By economic sector - Other (jobs)		734	1,105	1,700	2,342	3,014	4,073
By economic sector - Pipeline (jobs)		462	898	638	333	282	285
By economic sector - Professional (jobs)		6,054	8,646	13,150	16,448	20,535	25,118
By economic sector - Trade (jobs)		4,533	5,581	7,322	8,943	10,973	13,748
By economic sector - Utilities (jobs)		6,227	10,323	13,023	15,246	19,023	23,139
By resource sector - Biomass (jobs)		2,016	1,965	4,598	3,381	4,241	4,165
By resource sector - CO2 (jobs)		40.2	4,051	2,478	673	946	1,523
By resource sector - Coal (jobs)		375	0	0	0	0	0
By resource sector - Grid (jobs)		7,620	12,322	19,346	25,789	33,023	40,896
By resource sector - Natural Gas (jobs)		4,634	3,727	3,007	2,479	1,988	1,344
By resource sector - Nuclear (jobs)		640	630	365	0.013	0.015	0.026
By resource sector - Oil (jobs)		11,916	10,519	9,106	6,609	4,912	3,139
By resource sector - Solar (jobs)		2,311	2,491	3,485	4,318	4,959	7,431
By resource sector - Wind (jobs)		9,577	16,395	24,126	31,733	38,045	46,826
By education level - All sectors - High school diploma or less (jobs)		16,117	21,486	27,414	30,340	35,260	41,846
By education level - All sectors - Associates degree or some college (jobs)		11,587	16,013	20,445	23,476	27,829	33,558
By education level - All sectors - Bachelors degree (jobs)		8,879	11,313	14,337	16,181	19,059	22,745
By education level - All sectors - Masters or professional degree (jobs)		2,206	2,846	3,709	4,270	5,102	6,131
By education level - All sectors - Doctoral degree (jobs)		340	442	605	715	866	1,044
Related work experience - All sectors - None (jobs)		5,526	7,432	9,502	10,672	12,550	15,014
Related work experience - All sectors - Up to 1 year (jobs)		7,805	10,325	13,357	14,867	17,324	20,646
Related work experience - All sectors - 1 to 4 years (jobs)		14,215	18,837	24,017	27,129	31,937	38,154
Related work experience - All sectors - 4 to 10 years (jobs)		9,113	12,263	15,564	17,728	20,937	25,101
Related work experience - All sectors - Over 10 years (jobs)		2,470	3,243	4,070	4,585	5,366	6,409
On-the-Job Training - All sectors - None (jobs)		2,206	2,859	3,636	4,099	4,817	5,771
On-the-Job Training - All sectors - Up to 1 year (jobs)		26,267	34,373	44,017	49,228	57,630	68,671

Table 2: *E+ scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,880	10,866	13,758	15,731	18,600	22,349
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,396	3,499	4,476	5,230	6,269	7,585
On-the-Job Training - All sectors - Over 10 years (jobs)		379	503	623	694	798	948
On-Site or In-Plant Training - All sectors - None (jobs)		6,376	8,472	10,923	12,368	14,572	17,445
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,747	31,145	39,767	44,510	52,116	62,137
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,156	8,418	10,657	12,129	14,303	17,155
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,539	3,621	4,593	5,316	6,340	7,639
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		311	445	571	659	784	947
Wage income - All (million \$2019)		2,053	2,755	3,545	4,046	4,824	5,833

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		82.3	73.3	59.2	45.7	35.1	26.3
Oil consumption - Cumulative (million bbls)							1,813
Oil production - Annual (million bbls)		45	45.1	45.1	35.7	29	19.3
Natural gas consumption - Annual (tcf)		240	202	162	122	76.7	53.2
Natural gas consumption - Cumulative (tcf)							4,880
Natural gas production - Annual (tcf)		223	211	184	155	123	95.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	286	268	235	195	160	139	131
Final energy use - Residential (PJ)	120	113	102	86.8	74.3	66.4	62.6
Final energy use - Commercial (PJ)	110	107	101	92.6	85.5	81	78.6
Final energy use - Industry (PJ)	174	182	189	190	195	204	206

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		1.98	2.05	3.35	3.56	3.35	3.52

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	13.8	233	452	1,220	1,987	2,600	3,213
Vehicle stocks - LDV – All others (1000 units)	2,679	2,551	2,423	1,766	1,109	627	146
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		515	1,320	2,139	3,240	3,527	3,363
Public EV charging plugs - DC Fast (1000 units)	0.119		0.964		4.24		6.85
Public EV charging plugs - L2 (1000 units)	0.786		23.3		102		165

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	4.79	20.7	76.2	90.8	91.9	91.9	91.7
Sales of space heating units - Electric Resistance (%)	11.9	15	6.62	4.42	4.27	4.39	4.55
Sales of space heating units - Gas (%)	77.4	55.1	13.1	2.17	1.44	1.41	1.38
Sales of space heating units - Fossil (%)	5.87	9.2	4.05	2.66	2.42	2.31	2.37
Sales of water heating units - Electric Heat Pump (%)	0	9.31	49.7	59.7	60.3	60.3	60.3
Sales of water heating units - Electric Resistance (%)	27.3	41.9	39.5	39.6	39.7	39.7	39.7
Sales of water heating units - Gas Furnace (%)	72.7	48.8	10.7	0.692	0.019	0	0
Sales of water heating units - Other (%)	0.024	0.027	0.027	0.027	0.027	0.027	0.027
Sales of cooking units - Electric Resistance (%)	66.4	73.6	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.6	26.4	4.52	0.228	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.01	4.04				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.13	24.7	71.3	88	89.8	89.9	89.8
Sales of space heating units - Electric Resistance (%)	4.54	5.67	7.02	9.23	9.68	9.7	9.71
Sales of space heating units - Gas (%)	93.3	67.9	21.4	2.81	0.539	0.45	0.45
Sales of space heating units - Fossil (%)	0	1.73	0.333	0.014	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.677	10.7	53.8	64.7	65.3	65.3	65.3
Sales of water heating units - Electric Resistance (%)	5.85	10.9	28.5	33.6	34	34	34
Sales of water heating units - Gas (%)	92.9	77.4	17	1.1	0.03	0	0
Sales of water heating units - Other (%)	0.567	0.935	0.728	0.68	0.677	0.679	0.679
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		8,255	8,955				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	2,770	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	3,646	2,546	3,789	4,389	4,692	5,516	5,241
Installed thermal - Nuclear (MW)	1,268	1,268	1,268	0	0.006	0.011	0.02
Installed renewables - Rooftop PV (MW)	318	560	817	1,203	1,752	2,467	3,398
Installed renewables - Solar - Base land use assumptions (MW)	22.2	22.2	22.2	22.2	22.2	22.2	99.9
Installed renewables - Wind - Base land use assumptions (MW)	7,584	7,584	7,907	9,178	11,486	14,792	14,988
Installed renewables - Solar - Constrained land use assumptions (MW)	17.1	17.1	17.1	227	227	227	227
Installed renewables - Wind - Constrained land use assumptions (MW)	7,584	7,584	8,075	9,870	14,212	19,327	19,693
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0.072
Capital invested - Wind - Base (billion \$2018)		0	0.43	1.58	2.73	3.71	0.208

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Constrained (billion \$2018)		0.03	0	0.231	0	0	0.072
Capital invested - Wind - Constrained (billion \$2018)		0.552	0.572	3.14	5.93	6.23	0.442
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0.042
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0.171

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	58.5	58.5	58.5	58.5	58.5	58.5	209
Wind - Base land use assumptions (GWh)	31,394	31,394	32,596	37,276	45,638	57,527	58,220
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	45.5	45.5	45.5	450	450	450	450
Wind - Constrained land use assumptions (GWh)	31,394	31,394	33,202	39,664	55,059	72,775	74,048
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	192
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	41.8

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 (quantity)	0	0	0	0	0	0	1
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	6	6	11	13
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	6,624	0	5,640	2,843
Biomass purchases (million \$2018/y)		0	0	461	461	853	1,051

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	8.54	11.9	19.2	23
Annual - BECCS (MMT)		0	0	8.51	8.51	15.8	19.4
Annual - NGCC (MMT)		0	0.01	0.03	0.02	0.02	0.02
Annual - Cement and lime (MMT)		0	0	0	3.32	3.42	3.53
Cumulative - All (MMT)		0	0.01	8.55	20.4	39.6	62.6
Cumulative - BECCS (MMT)		0	0	8.51	17	32.8	52.2
Cumulative - NGCC (MMT)		0	0.01	0.04	0.06	0.08	0.1
Cumulative - Cement and lime (MMT)		0	0	0	3.32	6.74	10.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	997	1,361	1,361	1,361	1,361
Spur (km)		0	58.5	659	926	1,283	1,902
All (km)		0	1,055	2,020	2,287	2,644	3,263
Cumulative investment - Trunk (million \$2018)		0	4,953	6,879	6,879	6,879	6,879
Cumulative investment - Spur (million \$2018)		0	30.9	494	715	971	1,456
Cumulative investment - All (million \$2018)		0	4,984	7,372	7,594	7,850	8,335

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	1.76	2.71	4.3	5.59
Injection wells (wells)		0	1	3	6	10	12
Resource characterization, appraisal, permitting costs (million \$2020)		77.2	185	216	216	216	216
Wells and facilities construction costs (million \$2020)		0	25.7	100	178	298	371

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-74.7
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-283
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-378
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-22.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-179
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-1,263
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-13,386
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-503
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-227
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-16,316
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-112
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-992
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-680
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-33.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-357
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-2,435
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-20,079

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-3,575
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-451
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-28,714
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-149
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-1,700
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-983
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-44.9
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-536
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-3,607
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-26,772
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-6,646
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-41,112
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-674
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							216
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							192
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.26
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)							180
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							885
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							135
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,662
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							18.3
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							223

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							347
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							12.4
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							262
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							1,328
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							237
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							272
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,699
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							24.4
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							230
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							501
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							16.5
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							343
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							1,770
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							189
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							223
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,297

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-696
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-5,387

Table 16: *E+ scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-312
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-6,395
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-696
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-10,263
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-624
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-11,583
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							413
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							5,430
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							524
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							6,366
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							413
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							10,336
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							1,047
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							11,796

Table 17: *E- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		22.2	0.022	0.021	0.018	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		13.8	5.77	2.87	1.52	0.604	0.459
Premature deaths from air pollution - Mobile - On-Road (deaths)		46.6	47.1	46.1	41.7	33.4	23
Premature deaths from air pollution - Gas Stations (deaths)		4.97	5.03	4.87	4.4	3.52	2.47
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		7.83	7.2	6.42	5.28	3.87	2.51
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		0.127	0.123	0.119	0.108	0.088	0.068
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.44	1.48	1.48	1.36	1.08	0.755

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.714	0.687	0.656	0.623	0.588	0.551
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		5.24	5.03	4.69	4.09	3.28	2.43
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.768	0.676	0.594	0.513	0.434	0.361
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.427	0.386	0.345	0.305	0.265	0.227
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1	0.383	0.377	0.37	0.357	0.329
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		84.6	78.2	69.7	62.4	56	39.1
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		197	0.195	0.187	0.156	0.102	0.002
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		122	51.1	25.4	13.5	5.35	4.06
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		414	419	410	371	297	205
Monetary damages from air pollution - Gas Stations (million \$2019)		44	44.5	43.2	38.9	31.2	21.9
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		69.4	63.8	56.9	46.8	34.3	22.2
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1.12	1.09	1.05	0.956	0.782	0.599
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		12.8	13.1	13.1	12.1	9.55	6.69
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		6.32	6.08	5.81	5.51	5.2	4.88
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		46.4	44.5	41.5	36.2	29	21.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		6.8	5.99	5.26	4.54	3.84	3.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		3.78	3.41	3.05	2.7	2.35	2.01
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		8.84	3.38	3.33	3.26	3.15	2.9
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		751	694	619	554	498	347

Table 18: *E- scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		860	861	2,628	1,855	1,592	942
By economic sector - Construction (jobs)		8,880	14,916	18,146	21,085	27,781	35,692

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		5,631	6,295	7,544	7,713	8,559	9,010
By economic sector - Mining (jobs)		5,905	4,725	3,772	2,998	2,394	1,531
By economic sector - Other (jobs)		741	1,116	1,678	2,317	3,261	4,689
By economic sector - Pipeline (jobs)		463	1,240	847	422	422	460
By economic sector - Professional (jobs)		6,123	8,771	14,056	17,692	23,585	29,877
By economic sector - Trade (jobs)		4,570	5,664	7,606	9,496	12,554	16,465
By economic sector - Utilities (jobs)		6,188	11,330	13,231	14,813	21,179	27,587
By resource sector - Biomass (jobs)		2,017	1,961	7,818	6,963	6,777	4,028
By resource sector - CO2 (jobs)		40.4	6,916	4,256	1,175	1,623	2,585
By resource sector - Coal (jobs)		375	0	0	0	0	0
By resource sector - Grid (jobs)		7,489	11,866	18,391	24,870	36,499	48,137
By resource sector - Natural Gas (jobs)		4,639	3,269	2,442	1,906	2,027	1,591
By resource sector - Nuclear (jobs)		640	630	365	0.015	0.017	0.03
By resource sector - Oil (jobs)		11,952	10,712	9,618	8,447	7,255	4,769
By resource sector - Solar (jobs)		2,341	2,525	3,293	4,172	5,095	7,470
By resource sector - Wind (jobs)		9,865	17,040	23,324	30,857	42,047	57,673
By education level - All sectors - High school diploma or less (jobs)		16,206	22,720	28,904	31,842	40,638	50,073
By education level - All sectors - Associates degree or some college (jobs)		11,656	16,999	21,112	24,148	31,743	40,244
By education level - All sectors - Bachelors degree (jobs)		8,934	11,793	14,966	17,114	22,061	27,342
By education level - All sectors - Masters or professional degree (jobs)		2,220	2,952	3,884	4,518	5,881	7,347
By education level - All sectors - Doctoral degree (jobs)		343	453	642	768	1,000	1,247
Related work experience - All sectors - None (jobs)		5,556	7,865	9,984	11,165	14,426	17,971
Related work experience - All sectors - Up to 1 year (jobs)		7,854	10,850	14,120	15,702	20,002	24,661
Related work experience - All sectors - 1 to 4 years (jobs)		14,297	19,834	25,063	28,351	36,722	45,772
Related work experience - All sectors - 4 to 10 years (jobs)		9,167	12,958	16,138	18,402	23,997	30,138
Related work experience - All sectors - Over 10 years (jobs)		2,485	3,409	4,203	4,771	6,179	7,711
On-the-Job Training - All sectors - None (jobs)		2,220	2,994	3,813	4,329	5,557	6,906
On-the-Job Training - All sectors - Up to 1 year (jobs)		26,423	36,072	46,247	51,890	66,589	82,310
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,925	11,555	14,191	16,146	21,192	26,820
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,409	3,762	4,613	5,307	7,069	9,076
On-the-Job Training - All sectors - Over 10 years (jobs)		382	533	643	719	917	1,141
On-Site or In-Plant Training - All sectors - None (jobs)		6,419	8,913	11,448	12,969	16,758	20,898
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,885	32,713	41,709	46,825	60,163	74,483
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,191	8,936	11,017	12,492	16,330	20,584
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,552	3,880	4,743	5,429	7,181	9,153
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		312	476	590	675	892	1,135
Wage income - All (million \$2019)		2,065	2,902	3,701	4,230	5,548	6,999

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	287	270	245	226	212	195	175
Final energy use - Residential (PJ)	120	114	109	103	93.6	83.1	73.8
Final energy use - Commercial (PJ)	110	107	104	99.9	95.2	90.4	86.3
Final energy use - Industry (PJ)	174	182	190	193	200	209	211

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		1.64	1.66	2.05	2.12	3.02	3.19

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	10.7	75.1	140	438	737	1,397	2,058
Vehicle stocks - LDV – All others (1000 units)	2,690	2,690	2,690	2,552	2,413	1,860	1,306
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	83.3	175	591	1,861	2,710
Public EV charging plugs - DC Fast (1000 units)	0.119		0.298		1.57		4.39
Public EV charging plugs - L2 (1000 units)	0.786		7.18		37.9		106

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	4.79	10.1	16.5	34.7	63.2	82.5	89.3
Sales of space heating units - Electric Resistance (%)	11.9	16.6	15.6	12.9	8.54	5.65	4.74
Sales of space heating units - Gas (%)	77.4	63	58.2	44.5	23.1	8.65	3.34
Sales of space heating units - Fossil (%)	5.87	10.2	9.69	7.94	5.1	3.2	2.63
Sales of water heating units - Electric Heat Pump (%)	0	1.62	6.21	19.5	40	53.6	58.5
Sales of water heating units - Electric Resistance (%)	27.3	42.3	42	41.2	40.3	39.8	39.7
Sales of water heating units - Gas Furnace (%)	72.7	56	51.8	39.3	19.8	6.56	1.76
Sales of water heating units - Other (%)	0.024	0.027	0.027	0.027	0.027	0.027	0.027
Sales of cooking units - Electric Resistance (%)	66.3	67.2	70.2	78.4	89.7	96.7	99.1
Sales of cooking units - Gas (%)	33.7	32.8	29.8	21.6	10.3	3.33	0.895
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		2.99	4.02				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.13	16	21.4	36.9	61.7	79.8	87
Sales of space heating units - Electric Resistance (%)	4.54	5.5	5.66	6.18	7.29	8.59	9.36
Sales of space heating units - Gas (%)	93.3	76.5	71.1	55.5	30.3	11.4	3.55
Sales of space heating units - Fossil (%)	0	2	1.88	1.4	0.684	0.222	0.059
Sales of water heating units - Electric Heat Pump (%)	0.677	2.54	7.44	21.6	43.5	58.2	63.4
Sales of water heating units - Electric Resistance (%)	5.85	7.67	9.68	15.4	24.5	30.8	33.1
Sales of water heating units - Gas (%)	92.9	88.8	81.9	62.1	31.2	10.4	2.79
Sales of water heating units - Other (%)	0.567	0.974	0.953	0.882	0.777	0.711	0.687

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	44.8	49.3	53.1	63	76.9	85.5	88.5
Sales of cooking units - Gas (%)	55.2	50.7	46.9	37	23.1	14.5	11.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		8,253	8,961				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	2,770	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	3,652	2,606	2,610	2,425	2,162	4,286	4,865
Installed thermal - Nuclear (MW)	1,268	1,268	1,268	0	0.007	0.013	0.023

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-74.7
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-283
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-378
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-22.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-179
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-1,263
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-13,386
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-503
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-227
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-16,316
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-112
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-992
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-680
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-33.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-357
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-2,435
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-20,079
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,575
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-451
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,714
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-149
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,700

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-983
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-44.9
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-536
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-3,607
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-26,772
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-6,646
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-41,112
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-674
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							216
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							192
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.26
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)							180
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							885
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							135
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,662
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							18.3
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							223
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							347
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							12.4
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							262

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							1,328
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							237
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							272
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,699
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							24.4
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							230
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							501
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							16.5
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							343
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							1,770
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							189
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							223
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,297

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-696
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-5,387
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-312
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-6,395
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-696
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-10,263

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-624
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-11,583
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							413
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							5,430
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							524
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							6,366
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							413
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							10,336
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							1,047
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							11,796

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 (deaths)		22.2	0.022	0.021	0.018	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		13.1	6.36	2	1.38	0.639	0.405
Premature deaths from air pollution - Mobile - On-Road (deaths)		45.8	42.9	32.7	19	8.81	3.67
Premature deaths from air pollution - Gas Stations (deaths)		4.87	4.51	3.43	2.07	1.05	0.537
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		7.75	6.28	4.12	2.22	1.01	0.406
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		0.124	0.103	0.072	0.043	0.02	0.007
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.43	1.29	0.99	0.641	0.32	0.131
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.714	0.687	0.656	0.623	0.588	0.551
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		5.21	4.46	3.26	2.06	1.21	0.67
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.768	0.626	0.495	0.374	0.267	0.173
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.427	0.36	0.294	0.23	0.169	0.112

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.15	0.381	0.371	0.358	0.354	0.303
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		83.5	79.8	70.4	51.2	32.1	5.22
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		197	0.195	0.187	0.156	0.102	0.002
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		116	56.4	17.7	12.2	5.66	3.59
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		408	381	291	169	78.3	32.6
Monetary damages from air pollution - Gas Stations (million \$2019)		43.1	39.9	30.4	18.3	9.27	4.76
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		68.6	55.7	36.5	19.7	8.96	3.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1.1	0.916	0.641	0.381	0.173	0.066
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		12.6	11.5	8.77	5.68	2.84	1.16
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		6.32	6.08	5.81	5.51	5.2	4.88
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		46.1	39.5	28.8	18.3	10.7	5.93
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		6.8	5.54	4.39	3.31	2.36	1.53
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		3.78	3.18	2.6	2.04	1.5	0.988
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		10.2	3.37	3.27	3.16	3.13	2.67
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		742	708	625	454	285	46.3

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		859	862	1,713	1,162	991	946
By economic sector - Construction (jobs)		9,020	12,754	20,069	27,860	37,624	51,775
By economic sector - Manufacturing (jobs)		5,715	6,682	8,722	9,025	10,527	11,949
By economic sector - Mining (jobs)		5,833	4,629	3,464	2,119	1,170	177
By economic sector - Other (jobs)		757	1,168	2,038	3,094	4,462	6,691
By economic sector - Pipeline (jobs)		453	400	314	221	138	34.6
By economic sector - Professional (jobs)		6,218	9,092	15,620	22,190	31,093	43,932
By economic sector - Trade (jobs)		4,607	5,794	8,519	11,777	16,422	23,669
By economic sector - Utilities (jobs)		5,969	7,950	13,593	20,109	29,215	41,956
By resource sector - Biomass (jobs)		2,015	1,966	4,225	3,378	3,719	4,303
By resource sector - CO2 (jobs)		0	0.001	0.001	0.001	0.001	0.001
By resource sector - Coal (jobs)		375	0	0	0	0	0
By resource sector - Grid (jobs)		7,456	12,360	23,070	35,265	52,534	77,156

Table 28: *E+RE+ scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Natural Gas (jobs)		4,493	3,395	2,404	1,900	1,661	1,213
By resource sector - Nuclear (jobs)		377	0	0	0	0	0
By resource sector - Oil (jobs)		11,917	10,491	8,874	6,072	3,831	610
By resource sector - Solar (jobs)		2,385	2,801	4,008	5,072	6,532	8,603
By resource sector - Wind (jobs)		10,413	18,318	31,472	45,871	63,368	89,246
By education level - All sectors - High school diploma or less (jobs)		16,248	20,233	30,289	39,186	52,329	71,495
By education level - All sectors - Associates degree or some college (jobs)		11,692	14,992	22,846	30,779	41,989	58,194
By education level - All sectors - Bachelors degree (jobs)		8,928	10,895	16,040	21,058	28,412	39,064
By education level - All sectors - Masters or professional degree (jobs)		2,219	2,765	4,183	5,590	7,621	10,580
By education level - All sectors - Doctoral degree (jobs)		344	445	696	945	1,292	1,797
Related work experience - All sectors - None (jobs)		5,567	6,972	10,515	13,841	18,687	25,755
Related work experience - All sectors - Up to 1 year (jobs)		7,880	9,878	14,892	19,306	25,809	35,368
Related work experience - All sectors - 1 to 4 years (jobs)		14,315	17,843	26,734	35,268	47,657	65,578
Related work experience - All sectors - 4 to 10 years (jobs)		9,183	11,560	17,367	23,162	31,425	43,361
Related work experience - All sectors - Over 10 years (jobs)		2,486	3,077	4,544	5,981	8,066	11,070
On-the-Job Training - All sectors - None (jobs)		2,222	2,742	4,064	5,336	7,176	9,877
On-the-Job Training - All sectors - Up to 1 year (jobs)		26,463	32,794	48,998	63,868	85,825	117,736
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,943	10,116	15,315	20,576	27,996	38,713
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,420	3,200	4,978	6,872	9,444	13,179
On-the-Job Training - All sectors - Over 10 years (jobs)		383	478	698	906	1,202	1,627
On-Site or In-Plant Training - All sectors - None (jobs)		6,434	8,083	12,228	16,149	21,813	30,023
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,918	29,647	44,239	57,753	77,649	106,585
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,204	7,862	11,854	15,833	21,483	29,651
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,561	3,326	5,095	6,959	9,515	13,226
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		314	412	636	864	1,183	1,647
Wage income - All (million \$2019)		2,065	2,599	3,936	5,255	7,191	10,032

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	286	268	235	195	160	139	131
Final energy use - Residential (PJ)	120	113	102	86.8	74.3	66.4	62.6
Final energy use - Commercial (PJ)	110	107	101	92.6	85.5	81	78.6
Final energy use - Industry (PJ)	174	182	189	190	195	204	206

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		1.98	2.05	3.35	3.56	3.35	3.52

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	13.8	233	452	1,220	1,987	2,600	3,213
Vehicle stocks - LDV – All others (1000 units)	2,679	2,551	2,423	1,766	1,109	627	146
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		515	1,320	2,139	3,240	3,527	3,363
Public EV charging plugs - DC Fast (1000 units)	0.119		0.964		4.24		6.85
Public EV charging plugs - L2 (1000 units)	0.786		23.3		102		165

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	4.79	20.7	76.2	90.8	91.9	91.9	91.7
Sales of space heating units - Electric Resistance (%)	11.9	15	6.62	4.42	4.27	4.39	4.55
Sales of space heating units - Gas (%)	77.4	55.1	13.1	2.17	1.44	1.41	1.38
Sales of space heating units - Fossil (%)	5.87	9.2	4.05	2.66	2.42	2.31	2.37
Sales of water heating units - Electric Heat Pump (%)	0	9.31	49.7	59.7	60.3	60.3	60.3
Sales of water heating units - Electric Resistance (%)	27.3	41.9	39.5	39.6	39.7	39.7	39.7
Sales of water heating units - Gas Furnace (%)	72.7	48.8	10.7	0.692	0.019	0	0
Sales of water heating units - Other (%)	0.024	0.027	0.027	0.027	0.027	0.027	0.027
Sales of cooking units - Electric Resistance (%)	66.4	73.6	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.6	26.4	4.52	0.228	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.01	4.04				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.13	24.7	71.3	88	89.8	89.9	89.8
Sales of space heating units - Electric Resistance (%)	4.54	5.67	7.02	9.23	9.68	9.7	9.71
Sales of space heating units - Gas (%)	93.3	67.9	21.4	2.81	0.539	0.45	0.45
Sales of space heating units - Fossil (%)	0	1.73	0.333	0.014	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.677	10.7	53.8	64.7	65.3	65.3	65.3
Sales of water heating units - Electric Resistance (%)	5.85	10.9	28.5	33.6	34	34	34
Sales of water heating units - Gas (%)	92.9	77.4	17	1.1	0.03	0	0
Sales of water heating units - Other (%)	0.567	0.935	0.728	0.68	0.677	0.679	0.679
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		8,255	8,955				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	2,770	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	3,652	2,549	2,760	2,908	3,606	5,664	6,941

Table 34: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Nuclear (MW)	1,268	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	318	560	817	1,203	1,752	2,467	3,398
Installed renewables - Solar - Base land use assumptions (MW)	22.2	22.2	22.2	22.2	22.2	22.2	122
Installed renewables - Wind - Base land use assumptions (MW)	7,584	7,664	8,301	11,773	22,479	47,304	81,898
Installed renewables - Solar - Constrained land use assumptions (MW)	22.2	22.2	22.2	22.2	22.2	522	1,195
Installed renewables - Wind - Constrained land use assumptions (MW)	8,454	8,676	9,223	15,669	29,591	57,059	83,147
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0.093
Capital invested - Wind - Base (billion \$2018)		0.117	0.849	4.31	12.7	27.9	36.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	58.5	58.5	58.5	58.5	58.5	58.5	274
Wind - Base land use assumptions (GWh)	31,394	31,691	34,060	46,683	84,776	171,754	291,098
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	117	117	117	117	117	2,193	4,951
Wind - Constrained land use assumptions (GWh)	62,787	64,440	68,416	114,196	210,095	394,449	561,516
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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)							-74.7
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-283
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-378
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-22.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-179
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-1,263
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-13,386
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-503
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-227
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-16,316
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-112
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-992
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-680

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)							-33.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)							-357
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)							-2,435
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-20,079
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-3,575
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-451
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-28,714
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-149
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-1,700
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-983
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-44.9
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-536
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-3,607
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-26,772
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-6,646
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-41,112
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-674
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							216
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							192
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.26
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)							180
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							885
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							135

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 - Low - Total impacted (over 30 years) (1000 hectares)							1,662
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							18.3
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							223
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							347
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							12.4
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							262
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							1,328
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							237
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							272
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,699
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							24.4
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							230
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							501
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							16.5
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							343
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							1,770
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							189
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							223
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,297

Table 37: *E+RE+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-696
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-5,387
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-312
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-6,395
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-696
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-10,263
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-624
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-11,583
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							413
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							5,430
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							524
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							6,366
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							413
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							10,336
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							1,047
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							11,796

Table 38: *E+RE- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		22.2	0.022	0.021	0.018	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		14.6	6.4	6.57	4.98	2.1	0.837
Premature deaths from air pollution - Mobile - On-Road (deaths)		45.8	42.9	32.7	19	8.81	3.67
Premature deaths from air pollution - Gas Stations (deaths)		4.87	4.51	3.43	2.07	1.05	0.537

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		7.75	6.28	4.12	2.22	1.01	0.406
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		0.124	0.103	0.072	0.043	0.02	0.007
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.43	1.29	0.99	0.641	0.32	0.131
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.714	0.687	0.656	0.623	0.588	0.551
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		5.21	4.46	3.26	2.06	1.21	0.67
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.768	0.626	0.495	0.374	0.267	0.173
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.427	0.36	0.294	0.23	0.169	0.112
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.936	0.38	0.371	0.359	0.356	0.303
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		85.6	83.6	82.3	69.2	57.7	42.9
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		197	0.195	0.187	0.156	0.102	0.002
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		129	56.7	58.2	44.1	18.6	7.41
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		408	381	291	169	78.3	32.6
Monetary damages from air pollution - Gas Stations (million \$2019)		43.1	39.9	30.4	18.3	9.27	4.76
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		68.6	55.7	36.5	19.7	8.96	3.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1.1	0.916	0.641	0.381	0.173	0.066
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		12.6	11.5	8.77	5.68	2.84	1.16
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		6.32	6.08	5.81	5.51	5.2	4.88
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		46.1	39.5	28.8	18.3	10.7	5.93
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		6.8	5.54	4.39	3.31	2.36	1.53
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		3.78	3.18	2.6	2.04	1.5	0.988
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		8.26	3.36	3.27	3.16	3.14	2.67

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		760	743	731	614	513	381

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		860	861	2,655	1,576	1,290	939
By economic sector - Construction (jobs)		8,413	12,763	13,586	13,606	14,938	16,343
By economic sector - Manufacturing (jobs)		5,244	5,100	5,803	5,154	4,644	3,949
By economic sector - Mining (jobs)		5,934	4,822	3,913	2,720	1,999	1,392
By economic sector - Other (jobs)		699	876	1,178	1,503	1,831	2,345
By economic sector - Pipeline (jobs)		471	1,372	956	459	442	509
By economic sector - Professional (jobs)		5,761	6,781	10,103	10,643	12,042	12,573
By economic sector - Trade (jobs)		4,403	4,713	5,626	5,922	6,526	7,066
By economic sector - Utilities (jobs)		6,013	10,748	11,127	10,500	11,643	12,618
By resource sector - Biomass (jobs)		2,016	1,961	8,106	5,263	5,073	4,044
By resource sector - CO2 (jobs)		40.7	7,828	4,824	1,315	1,817	2,913
By resource sector - Coal (jobs)		375	0	0	0	0	0
By resource sector - Grid (jobs)		7,209	9,792	14,049	16,579	18,741	19,917
By resource sector - Natural Gas (jobs)		4,773	4,203	3,688	3,523	2,918	2,520
By resource sector - Nuclear (jobs)		640	630	365	0.032	0.039	0.202
By resource sector - Oil (jobs)		11,915	10,519	9,106	6,609	5,027	3,552
By resource sector - Solar (jobs)		2,217	2,224	2,874	3,673	4,391	6,620
By resource sector - Wind (jobs)		8,612	10,881	11,934	15,120	17,388	18,169
By education level - All sectors - High school diploma or less (jobs)		15,575	20,021	23,219	21,502	22,558	23,416
By education level - All sectors - Associates degree or some college (jobs)		11,159	14,853	16,481	15,954	17,191	18,219
By education level - All sectors - Bachelors degree (jobs)		8,600	10,252	11,747	11,220	11,929	12,293
By education level - All sectors - Masters or professional degree (jobs)		2,135	2,537	3,016	2,926	3,150	3,263
By education level - All sectors - Doctoral degree (jobs)		328	375	483	481	526	544
Related work experience - All sectors - None (jobs)		5,341	6,932	7,973	7,488	7,948	8,317
Related work experience - All sectors - Up to 1 year (jobs)		7,531	9,434	11,215	10,462	10,992	11,402
Related work experience - All sectors - 1 to 4 years (jobs)		13,741	17,367	19,815	18,834	20,059	20,900
Related work experience - All sectors - 4 to 10 years (jobs)		8,798	11,327	12,645	12,143	13,006	13,633
Related work experience - All sectors - Over 10 years (jobs)		2,386	2,978	3,299	3,156	3,350	3,482
On-the-Job Training - All sectors - None (jobs)		2,134	2,600	2,997	2,851	3,029	3,161
On-the-Job Training - All sectors - Up to 1 year (jobs)		25,390	31,514	36,734	34,547	36,493	37,762
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,600	10,148	11,125	10,707	11,508	12,172
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,308	3,313	3,593	3,505	3,827	4,120
On-the-Job Training - All sectors - Over 10 years (jobs)		365	462	498	473	498	520
On-Site or In-Plant Training - All sectors - None (jobs)		6,151	7,723	8,967	8,531	9,102	9,493
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		22,956	28,620	33,135	31,203	32,974	34,181

Table 39: *E+RE- scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,940	7,850	8,665	8,305	8,894	9,378
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,450	3,426	3,717	3,597	3,901	4,168
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		299	418	462	448	483	515
Wage income - All (million \$2019)		1,986	2,549	2,937	2,817	3,033	3,196

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	286	268	235	195	160	139	131
Final energy use - Residential (PJ)	120	113	102	86.8	74.3	66.4	62.6
Final energy use - Commercial (PJ)	110	107	101	92.6	85.5	81	78.6
Final energy use - Industry (PJ)	174	182	189	190	195	204	206

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		1.98	2.05	3.35	3.56	3.35	3.52

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	13.8	233	452	1,220	1,987	2,600	3,213
Vehicle stocks - LDV – All others (1000 units)	2,679	2,551	2,423	1,766	1,109	627	146
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		515	1,320	2,139	3,240	3,527	3,363
Public EV charging plugs - DC Fast (1000 units)	0.119		0.964		4.24		6.85
Public EV charging plugs - L2 (1000 units)	0.786		23.3		102		165

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	4.79	20.7	76.2	90.8	91.9	91.9	91.7
Sales of space heating units - Electric Resistance (%)	11.9	15	6.62	4.42	4.27	4.39	4.55
Sales of space heating units - Gas (%)	77.4	55.1	13.1	2.17	1.44	1.41	1.38
Sales of space heating units - Fossil (%)	5.87	9.2	4.05	2.66	2.42	2.31	2.37
Sales of water heating units - Electric Heat Pump (%)	0	9.31	49.7	59.7	60.3	60.3	60.3
Sales of water heating units - Electric Resistance (%)	27.3	41.9	39.5	39.6	39.7	39.7	39.7
Sales of water heating units - Gas Furnace (%)	72.7	48.8	10.7	0.692	0.019	0	0
Sales of water heating units - Other (%)	0.024	0.027	0.027	0.027	0.027	0.027	0.027
Sales of cooking units - Electric Resistance (%)	66.4	73.6	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.6	26.4	4.52	0.228	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.01	4.04				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.13	24.7	71.3	88	89.8	89.9	89.8
Sales of space heating units - Electric Resistance (%)	4.54	5.67	7.02	9.23	9.68	9.7	9.71
Sales of space heating units - Gas (%)	93.3	67.9	21.4	2.81	0.539	0.45	0.45
Sales of space heating units - Fossil (%)	0	1.73	0.333	0.014	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.677	10.7	53.8	64.7	65.3	65.3	65.3
Sales of water heating units - Electric Resistance (%)	5.85	10.9	28.5	33.6	34	34	34
Sales of water heating units - Gas (%)	92.9	77.4	17	1.1	0.03	0	0
Sales of water heating units - Other (%)	0.567	0.935	0.728	0.68	0.677	0.679	0.679
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		8,255	8,955				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	2,770	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	3,651	2,541	4,388	4,435	5,576	4,991	4,404
Installed thermal - Nuclear (MW)	1,268	1,268	1,268	0	0.014	0.028	0.111
Installed renewables - Rooftop PV (MW)	318	560	817	1,203	1,752	2,467	3,398
Installed renewables - Solar - Base land use assumptions (MW)	22.2	22.2	22.2	22.2	22.2	22.2	22.2
Installed renewables - Wind - Base land use assumptions (MW)	7,384	7,384	7,384	7,744	8,556	8,902	8,902
Installed renewables - Solar - Constrained land use assumptions (MW)	22.2	22.2	22.2	22.2	22.2	22.2	22.2
Installed renewables - Wind - Constrained land use assumptions (MW)	7,594	7,594	7,594	8,159	9,059	9,844	9,844
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Wind - Base (billion \$2018)		0	0	0.447	0.999	0.435	0
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0	0	0	0
Capital invested - Wind - Constrained (billion \$2018)		0	0	0.7	1.06	0.879	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Wind - Base land use assumptions (GWh)	31,394	31,394	31,394	32,737	35,854	37,276	37,276
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Wind - Constrained land use assumptions (GWh)	31,394	31,394	31,394	33,470	36,713	39,536	39,536
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)							-74.7
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)							-283
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)							-378
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)							-22.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)							-179
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)							-1,263
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)							-13,386
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)							-503
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)							-227
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)							-16,316
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)							-112
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)							-992
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)							-680
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)							-33.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)							-357
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)							-2,435
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-20,079
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-3,575
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-451
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-28,714
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-149
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-1,700
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-983
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-44.9
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-536
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-3,607
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-26,772
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-6,646
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-41,112
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-674

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 - Low - Accelerate regeneration (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							216
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							192
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.26
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)							180
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							885
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							135
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,662
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							18.3
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							223
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							347
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							12.4
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							262
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							1,328
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							237
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							272
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,699
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							24.4
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							230

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 - High - Extend rotation length (1000 hectares)							501
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							16.5
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							343
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							1,770
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							189
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							223
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,297

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-696
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-5,387
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-312
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-6,395
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-696
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-10,263
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-624
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-11,583
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							413
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							5,430
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							524
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							6,366

Table 48: *E+RE- scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							413
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							10,336
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							1,047
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							11,796

Table 49: *E-B+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		22.2	0.022	0.021	0.018	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		13.5	5.35	3.57	2.3	1.04	0.539
Premature deaths from air pollution - Mobile - On-Road (deaths)		46.6	47.1	46.1	41.7	33.4	23
Premature deaths from air pollution - Gas Stations (deaths)		4.97	5.03	4.87	4.4	3.52	2.47
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		7.83	7.2	6.42	5.28	3.87	2.51
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		0.127	0.123	0.119	0.108	0.088	0.068
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.44	1.48	1.48	1.36	1.08	0.755
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.714	0.687	0.656	0.623	0.588	0.551
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		5.24	5.03	4.69	4.09	3.28	2.43
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.768	0.676	0.594	0.513	0.434	0.361
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.427	0.386	0.345	0.305	0.265	0.227
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.04	0.383	0.377	0.37	0.366	0.355
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		84.6	78.2	69.7	62.4	56	39.1
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		197	0.195	0.187	0.156	0.102	0.002
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		120	47.4	31.6	20.3	9.2	4.77
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		414	419	410	371	297	205
Monetary damages from air pollution - Gas Stations (million \$2019)		44	44.5	43.2	38.9	31.2	21.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		69.4	63.8	56.9	46.8	34.3	22.2
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1.12	1.09	1.05	0.956	0.782	0.599
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		12.8	13.1	13.1	12.1	9.55	6.69
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		6.32	6.08	5.81	5.51	5.2	4.88
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		46.4	44.5	41.5	36.2	29	21.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		6.8	5.99	5.26	4.54	3.84	3.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		3.78	3.41	3.05	2.7	2.35	2.01
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		9.17	3.38	3.33	3.27	3.23	3.14
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		751	694	619	554	498	347

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		860	866	834	963	2,038	2,070
By economic sector - Construction (jobs)		8,962	15,215	16,762	17,403	22,311	28,310
By economic sector - Manufacturing (jobs)		5,661	6,346	6,279	5,863	7,380	8,278
By economic sector - Mining (jobs)		5,891	4,720	3,787	3,045	2,420	1,466
By economic sector - Other (jobs)		749	1,137	1,556	1,949	2,649	3,766
By economic sector - Pipeline (jobs)		460	1,261	864	431	423	458
By economic sector - Professional (jobs)		6,186	8,950	11,211	13,637	19,983	25,127
By economic sector - Trade (jobs)		4,598	5,746	6,792	7,799	10,452	13,262
By economic sector - Utilities (jobs)		6,217	11,548	11,843	11,838	16,813	21,954
By resource sector - Biomass (jobs)		2,017	1,974	1,862	3,210	9,405	9,902
By resource sector - CO2 (jobs)		40.4	7,092	4,368	1,229	1,684	2,612
By resource sector - Coal (jobs)		375	0	0	0	0	0
By resource sector - Grid (jobs)		7,562	12,095	15,756	19,402	28,831	38,018
By resource sector - Natural Gas (jobs)		4,579	3,250	2,460	1,999	1,644	1,310
By resource sector - Nuclear (jobs)		640	630	365	0.014	0.014	0.027
By resource sector - Oil (jobs)		11,953	10,712	9,618	8,520	7,290	4,603
By resource sector - Solar (jobs)		2,333	2,516	3,177	3,904	4,727	7,426
By resource sector - Wind (jobs)		10,085	17,519	22,321	24,663	30,888	40,820
By education level - All sectors - High school diploma or less (jobs)		16,296	23,075	24,529	25,443	34,120	42,057
By education level - All sectors - Associates degree or some college (jobs)		11,727	17,284	18,626	19,501	26,055	32,774
By education level - All sectors - Bachelors degree (jobs)		8,982	11,970	12,928	13,766	18,509	22,709
By education level - All sectors - Masters or professional degree (jobs)		2,233	2,998	3,312	3,611	4,937	6,103
By education level - All sectors - Doctoral degree (jobs)		345	461	532	606	849	1,047

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - None (jobs)		5,587	7,990	8,546	8,941	12,059	14,975
Related work experience - All sectors - Up to 1 year (jobs)		7,900	11,021	11,865	12,453	16,874	20,856
Related work experience - All sectors - 1 to 4 years (jobs)		14,377	20,147	21,655	22,815	30,581	37,839
Related work experience - All sectors - 4 to 10 years (jobs)		9,221	13,169	14,163	14,863	19,839	24,689
Related work experience - All sectors - Over 10 years (jobs)		2,499	3,462	3,699	3,856	5,116	6,332
On-the-Job Training - All sectors - None (jobs)		2,233	3,041	3,283	3,473	4,671	5,772
On-the-Job Training - All sectors - Up to 1 year (jobs)		26,569	36,627	39,340	41,448	55,940	68,933
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,972	11,748	12,589	13,098	17,361	21,764
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,425	3,831	4,143	4,326	5,742	7,286
On-the-Job Training - All sectors - Over 10 years (jobs)		384	542	573	584	756	934
On-Site or In-Plant Training - All sectors - None (jobs)		6,457	9,056	9,788	10,360	13,987	17,356
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		24,016	33,217	35,642	37,473	50,461	62,245
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,227	9,083	9,725	10,122	13,426	16,779
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,568	3,949	4,250	4,428	5,865	7,386
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		314	484	523	545	731	924
Wage income - All (million \$2019)		2,076	2,947	3,199	3,404	4,625	5,793

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	287	270	245	226	212	195	175
Final energy use - Residential (PJ)	120	114	109	103	93.6	83.1	73.8
Final energy use - Commercial (PJ)	110	107	104	99.9	95.2	90.4	86.3
Final energy use - Industry (PJ)	174	182	190	193	200	209	211

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		1.64	1.66	2.05	2.12	3.02	3.19

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	10.7	75.1	140	438	737	1,397	2,058
Vehicle stocks - LDV – All others (1000 units)	2,690	2,690	2,690	2,552	2,413	1,860	1,306
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	83.3	175	591	1,861	2,710
Public EV charging plugs - DC Fast (1000 units)	0.119		0.298		1.57		4.39
Public EV charging plugs - L2 (1000 units)	0.786		7.18		37.9		106

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	4.79	10.1	16.5	34.7	63.2	82.5	89.3
Sales of space heating units - Electric Resistance (%)	11.9	16.6	15.6	12.9	8.54	5.65	4.74
Sales of space heating units - Gas (%)	77.4	63	58.2	44.5	23.1	8.65	3.34
Sales of space heating units - Fossil (%)	5.87	10.2	9.69	7.94	5.1	3.2	2.63
Sales of water heating units - Electric Heat Pump (%)	0	1.62	6.21	19.5	40	53.6	58.5
Sales of water heating units - Electric Resistance (%)	27.3	42.3	42	41.2	40.3	39.8	39.7
Sales of water heating units - Gas Furnace (%)	72.7	56	51.8	39.3	19.8	6.56	1.76
Sales of water heating units - Other (%)	0.024	0.027	0.027	0.027	0.027	0.027	0.027
Sales of cooking units - Electric Resistance (%)	66.3	67.2	70.2	78.4	89.7	96.7	99.1
Sales of cooking units - Gas (%)	33.7	32.8	29.8	21.6	10.3	3.33	0.895
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		2.99	4.02				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.13	16	21.4	36.9	61.7	79.8	87
Sales of space heating units - Electric Resistance (%)	4.54	5.5	5.66	6.18	7.29	8.59	9.36
Sales of space heating units - Gas (%)	93.3	76.5	71.1	55.5	30.3	11.4	3.55
Sales of space heating units - Fossil (%)	0	2	1.88	1.4	0.684	0.222	0.059
Sales of water heating units - Electric Heat Pump (%)	0.677	2.54	7.44	21.6	43.5	58.2	63.4
Sales of water heating units - Electric Resistance (%)	5.85	7.67	9.68	15.4	24.5	30.8	33.1
Sales of water heating units - Gas (%)	92.9	88.8	81.9	62.1	31.2	10.4	2.79
Sales of water heating units - Other (%)	0.567	0.974	0.953	0.882	0.777	0.711	0.687
Sales of cooking units - Electric Resistance (%)	44.8	49.3	53.1	63	76.9	85.5	88.5
Sales of cooking units - Gas (%)	55.2	50.7	46.9	37	23.1	14.5	11.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		8,253	8,961				

Table 56: E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	2,770	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	3,651	2,551	2,559	2,623	2,237	2,191	2,809
Installed thermal - Nuclear (MW)	1,268	1,268	1,268	0	0.006	0.011	0.021
Capital invested - Biomass power plant (billion \$2018)	0	0.004	0.02	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0.009	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	13.7	21.5	9.82

Table 57: E-B+ scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	7.3	46.3	46.3	46.3	46.3	46.3
Biomass w/ccu power plant (GWh)	0	0	0	0	15,353	39,484	50,500
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	8.96	8.96

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	0	0	12	32	40
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	14	14
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		4.25	22.2	27.7	12,551	31,594	9,940
Biomass purchases (million \$2018/y)		60	154	156	1,144	3,772	4,531

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0.03	18.5	57.7	69
Annual - BECCS (MMT)		0	0	0	15.2	54.3	65.5
Annual - NGCC (MMT)		0	0	0.03	0.03	0.02	0.02
Annual - Cement and lime (MMT)		0	0	0	3.32	3.42	3.53
Cumulative - All (MMT)		0	0	0.03	18.6	76.3	145
Cumulative - BECCS (MMT)		0	0	0	15.2	69.5	135
Cumulative - NGCC (MMT)		0	0	0.03	0.06	0.08	0.1
Cumulative - Cement and lime (MMT)		0	0	0	3.32	6.74	10.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	997	1,361	1,725	1,725	1,725
Spur (km)		0	58.5	117	1,026	2,994	3,323
All (km)		0	1,055	1,478	2,751	4,720	5,048
Cumulative investment - Trunk (million \$2018)		0	5,174	7,488	9,761	9,761	9,761
Cumulative investment - Spur (million \$2018)		0	30.8	61.8	951	2,889	3,347
Cumulative investment - All (million \$2018)		0	5,205	7,550	10,712	12,651	13,109

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0.92	3.21	7.13	9.85	10
Injection wells (wells)		0	2	7	12	20	25
Resource characterization, appraisal, permitting costs (million \$2020)		77.2	216	278	278	278	278
Wells and facilities construction costs (million \$2020)		0	51.4	200	357	597	741

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-74.7
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-283
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-378
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-22.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-179
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-1,263
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-13,386
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-503
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-227
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-16,316
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-112
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-992
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-680
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-33.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-357
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-2,435
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-20,079
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,575
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-451
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,714
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-149
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,700
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-983
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-44.9
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-536
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-3,607
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-26,772
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-6,646
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-41,112
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-674

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							216
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							192
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.26
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)							180
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							885
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							135
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,662
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							18.3
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							223
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							347
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							12.4
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							262
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							1,328
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							237
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							272
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,699
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							24.4
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							230

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							501
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							16.5
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							343
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							1,770
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							189
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							223
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,297

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-2,596
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-4,848
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-278
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO ₂ e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO ₂ e/y)							0
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-7,721
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-2,596
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-9,241
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-556
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO ₂ e/y)							0
Carbon sink potential - Aggressive deployment - Pasture to energy crops (1000 tCO ₂ e/y)							0
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-12,393

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							1,528
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							4,878
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							466
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							496
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							1,272
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							8,639
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							1,528
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							22,937
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							931
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							496
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							1,272
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							27,165

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)		77.6	39	24.5	19.5	17	16.6
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		14.4	12.7	13.2	9.19	8.31	7.03
Premature deaths from air pollution - Mobile - On-Road (deaths)		46.6	47.8	49.2	50.8	52.3	53.9
Premature deaths from air pollution - Gas Stations (deaths)		4.95	5.07	5.18	5.32	5.44	5.55
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		7.68	7.05	6.48	6.14	5.99	5.9
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		0.125	0.109	0.082	0.055	0.033	0.021
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.34	1.32	1.32	1.34	1.34	1.34
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.746	0.751	0.753	0.752	0.749	0.743

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		5.3	5.16	4.72	4.25	4	4.01
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.801	0.792	0.783	0.771	0.762	0.758
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.446	0.457	0.469	0.48	0.49	0.502
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.3	1.59	1.27	1.2	1.15	1.07
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		85	89.3	91.4	88	87.3	81.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		687	345	217	172	151	147
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		127	113	117	81.4	73.6	62.3
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		414	425	437	452	465	479
Monetary damages from air pollution - Gas Stations (million \$2019)		43.8	44.9	45.8	47.1	48.2	49.1
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		68.1	62.4	57.4	54.4	53.1	52.3
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1.1	0.969	0.73	0.49	0.297	0.187
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		11.9	11.7	11.7	11.9	11.9	11.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		6.6	6.65	6.67	6.66	6.63	6.57
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		47	45.6	41.8	37.6	35.4	35.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		7.09	7.01	6.93	6.83	6.74	6.71
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		3.95	4.05	4.15	4.25	4.34	4.44
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		20.3	14	11.2	10.6	10.2	9.48
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		754	793	812	782	775	721

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		860	859	859	859	859	859
By economic sector - Construction (jobs)		5,800	7,374	7,919	9,473	10,950	12,454
By economic sector - Manufacturing (jobs)		4,185	4,465	4,513	4,728	4,691	4,522
By economic sector - Mining (jobs)		6,031	5,018	4,165	3,379	2,800	2,180

Table 65: REF scenario - IMPACTS - Jobs (continued)

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		344	642	794	1,092	1,384	1,905
By economic sector - Pipeline (jobs)		470	487	493	472	476	465
By economic sector - Professional (jobs)		4,312	4,933	5,211	6,411	7,436	8,449
By economic sector - Trade (jobs)		3,781	3,920	3,948	4,507	5,068	5,744
By economic sector - Utilities (jobs)		5,392	6,026	6,066	7,026	8,468	8,992
By resource sector - Biomass (jobs)		2,016	1,960	1,909	1,863	1,823	1,786
By resource sector - CO2 (jobs)		0	0.046	0.058	0.063	0.07	0.074
By resource sector - Coal (jobs)		910	446	93.8	0	0	0
By resource sector - Grid (jobs)		6,175	7,402	7,876	9,804	12,491	14,336
By resource sector - Natural Gas (jobs)		4,731	4,992	4,767	4,426	4,901	4,523
By resource sector - Nuclear (jobs)		640	630	620	610	354	0.034
By resource sector - Oil (jobs)		11,978	10,778	9,779	8,871	8,157	7,070
By resource sector - Solar (jobs)			1,977	2,737	3,510	4,257	6,599
By resource sector - Wind (jobs)		4,723	5,540	6,185	8,862	10,148	11,256
By education level - All sectors - High school diploma or less (jobs)		12,841	14,001	14,157	15,766	17,475	18,910
By education level - All sectors - Associates degree or some college (jobs)		9,027	9,963	10,120	11,481	12,939	14,153
By education level - All sectors - Bachelors degree (jobs)		7,255	7,595	7,528	8,282	9,049	9,633
By education level - All sectors - Masters or professional degree (jobs)		1,786	1,881	1,875	2,090	2,306	2,480
By education level - All sectors - Doctoral degree (jobs)		265	284	286	327	362	395
Related work experience - All sectors - None (jobs)		4,408	4,802	4,854	5,434	6,067	6,594
Related work experience - All sectors - Up to 1 year (jobs)		6,152	6,706	6,787	7,593	8,400	9,125
Related work experience - All sectors - 1 to 4 years (jobs)		11,406	12,272	12,329	13,743	15,247	16,456
Related work experience - All sectors - 4 to 10 years (jobs)		7,231	7,829	7,881	8,830	9,835	10,632
Related work experience - All sectors - Over 10 years (jobs)		1,976	2,115	2,117	2,346	2,583	2,763
On-the-Job Training - All sectors - None (jobs)		1,758	1,883	1,885	2,096	2,305	2,497
On-the-Job Training - All sectors - Up to 1 year (jobs)		21,122	22,656	22,749	25,270	27,893	30,041
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,177	6,790	6,877	7,759	8,715	9,481
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,827	2,077	2,136	2,464	2,828	3,132
On-the-Job Training - All sectors - Over 10 years (jobs)		290	318	321	357	390	419
On-Site or In-Plant Training - All sectors - None (jobs)		5,013	5,429	5,467	6,129	6,793	7,366
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		19,102	20,506	20,593	22,880	25,278	27,237
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		4,848	5,313	5,376	6,048	6,774	7,359
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,971	2,205	2,252	2,570	2,922	3,207
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		240	271	278	319	365	401
Wage income - All (million \$2019)		1,657	1,800	1,829	2,060	2,313	2,520

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	286	270	247	233	233	241	250

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Residential (PJ)	120	113	109	106	105	106	106
Final energy use - Commercial (PJ)	110	110	109	108	107	108	111
Final energy use - Industry (PJ)	174	186	192	198	205	212	220

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		1.74	1.77	1.9	1.95	2.5	2.61

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.8	27.6	29.1	31.3	32.6	33.7	35
Sales of space heating units - Electric Resistance (%)	12.4	13.9	13.6	13.3	13.1	12.1	10.6
Sales of space heating units - Gas (%)	78.7	51.5	50.2	48.4	47.5	47.5	47.5
Sales of space heating units - Fossil (%)	6.08	6.99	7.07	7.06	6.83	6.72	6.86
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	27.3	42.4	42.3	42.2	42.2	42.2	42.1
Sales of water heating units - Gas Furnace (%)	72.7	57.5	57.6	57.7	57.7	57.8	57.8
Sales of water heating units - Other (%)	0.024	0.027	0.027	0.027	0.027	0.027	0.027
Sales of cooking units - Electric Resistance (%)	66	66	66	66	66	66	66
Sales of cooking units - Gas (%)	34	34	34	34	34	34	34
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		2.83	3.07				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.13	20.6	48.3	71.1	74.8	75.3	75.3
Sales of space heating units - Electric Resistance (%)	4.54	6.37	10.8	18.4	23.4	24.2	24.3
Sales of space heating units - Gas (%)	93.3	71.1	39.4	9.85	1.63	0.515	0.452
Sales of space heating units - Fossil (%)	0	1.96	1.54	0.687	0.101	0.009	0
Sales of water heating units - Electric Heat Pump (%)	0.677	0.816	0.812	0.813	0.809	0.806	0.805
Sales of water heating units - Electric Resistance (%)	5.85	6.96	6.99	6.96	6.96	6.97	6.97
Sales of water heating units - Gas (%)	92.9	91.2	91.2	91.2	91.2	91.2	91.2
Sales of water heating units - Other (%)	0.567	0.983	0.985	0.982	0.982	0.985	0.986
Sales of cooking units - Electric Resistance (%)	44.8	47.8	47.9	47.8	47.9	47.9	48
Sales of cooking units - Gas (%)	55.2	52.2	52.1	52.2	52.1	52.1	52
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		8,160	8,377				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	2,770	2,050	720	0	0	0	0
Installed thermal - Natural gas (MW)	3,635	2,556	5,255	5,257	5,016	7,758	8,316
Installed thermal - Nuclear (MW)	1,268	1,268	1,268	1,268	1,268	0	0.015
Installed renewables - Rooftop PV (MW)	318	560	817	1,203	1,752	2,467	3,398

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed renewables - Wind - Base land use assumptions (MW)	7,188	7,188	7,188	7,188	7,188	7,426	7,426
Installed renewables - Solar - Constrained land use assumptions (MW)	22.2	22.2	22.2	22.2	22.2	22.2	22.2
Installed renewables - Wind - Constrained land use assumptions (MW)	196	196	196	196	196	196	196

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	58.5	58.5	58.5	58.5	58.5	58.5	58.5
Wind - Base land use assumptions (GWh)	31,394	31,394	31,394	31,394	31,394	32,282	32,282
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

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 uptake (Mt CO2e/y)	-6.75		0.507				0.145
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.146		-0.303				-0.319
Business-as-usual carbon sink - Total (Mt CO2e/y)	-6.9		0.204				-0.174

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-74.7
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-283
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-378
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-22.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-179
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-1,263
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-13,386
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-503
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-227
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-16,316
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-112
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-992
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-680
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-33.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-357
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-2,435

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-20,079
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-3,575
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-451
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-28,714
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-149
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-1,700
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-983
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-44.9
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-536
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-3,607
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-26,772
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-6,646
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-41,112
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-674
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							216
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							192
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.26
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)							180
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							885
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							135
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,662
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							18.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							223
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							347
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							12.4
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							262
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							1,328
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							237
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							272
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,699
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							24.4
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							230
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							501
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							16.5
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							343
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							1,770
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							189
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							223
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,297