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Energy 2020

"Energy 2020 is an integrated, multi-region, multi-sector North American model that simulates the supply, price and demand for all fuels. The model can determine energy output and prices for each sector, both in regulated and unregulated markets. It simulates how such factors as energy prices and government measures affect the choices that consumers and businesses make when they buy and use energy. The model's outputs include changes in energy use, energy prices, greenhouse gas emissions, investment costs and possible cost savings from measures, which are used to identify the direct effects stemming from greenhouse gas reduction measures" (Environment Canada 2013).

Energy 2020 is based on a representation of all existing power plants in Canada and the US. It models Ontario, Québec and Alberta as well as their interconnections with US states and other Canadian provinces and territories. Its energy demand structure makes it possible to model data centers power demand independently of the rest of the energy demand. It models the future evolution of the Canadian energy sector based on economic assumptions and optimization rules. It has been used by many governmental agencies in the US and Canada (including the US EPA and Environment Canada) to analyze various energy and GHG emissions policies (Amlin 2015). There are several versions of the model with varying levels of regional detail. In this study, the version is regionally aggregated for the US and provincially disaggregated for Canada. This version is used by Environment Canada in its Energy, Emissions and Economy Model for Canada (E3MC).

Parameter	Value
Annual Growth (2011-2020):	
Gross domestic product	2.1%
Price index (inflation)	1.8%
Population	1.1%
Household formation	1.3%
Labor force	0.8%
Labor productivity	1.2%
Price (2020):	
World crude oil price	102 (US)\$/barrel
Henry Hub natural gas price	5.30 (CAN)\$/GJ
Crude oil and natural gas production (2020):	
Crude and condensates	1,441×10 ³ barrels/day
Oil sands	3,315×10 ³ barrels/day
Natural gas (shale gas included)	4,861×10 ⁹ cubic feet
Electricity generation (2020):	
Coal and Petroleum Coke	58 TWh
Refined Petroleum Products	3 TWh
Natural Gas	40 TWh
Hydro	397 TWh
Nuclear	84 TWh
Other Renewables	28 TWh
Total generation	609 TWh

Table S1: Business as usual scenario assumptions (adapted from Environment Canada, Canada's
Emissions Trends. 2013. p. 1-80)

Table S2: Electric demand of extra data centres per year and scenario

						- ·									
2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.8	0.8	0.9	0.9
0.2	0.2	0.4	0.4	0.6	0.6	0.8	0.8	1.0	1.0	1.3	1.3	1.5	1.5	1.7	1.7
0.4	0.7	1.0	1.2	1.5	1.8	2.0	2.3	2.6	2.9	3.1	3.4	3.7	3.9	4.2	4.5
	2015 0.2 0.3 0.2 0.2 0.2 0.4	2015 2016 0.2 0.2 0.3 0.3 0.2 0.2 0.2 0.2 0.4 0.7	2015 2016 2017 0.2 0.2 0.2 0.3 0.3 0.3 0.2 0.2 0.2 0.3 0.3 0.3 0.2 0.2 0.2 0.4 0.7 1.0	2015 2016 2017 2018 0.2 0.2 0.2 0.2 0.3 0.3 0.3 0.3 0.2 0.2 0.2 0.2 0.3 0.3 0.3 0.3 0.2 0.2 0.2 0.2 0.2 0.2 0.4 0.4 0.4 0.7 1.0 1.2	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2015 2016 2017 2018 2019 2020 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.3 0.3 0.3 0.3 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.3 0.3 0.3 0.3 0.2 0.2 0.2 0.4 0.4 0.2 0.2 0.4 0.4 0.6 0.4 0.7 1.0 1.2 1.5 1.8	2015 2016 2017 2018 2019 2020 2021 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.2 0.2 0.2 0.2 0.4 0.4 0.4 0.2 0.2 0.4 0.4 0.6 0.6 0.8 0.4 0.7 1.0 1.2 1.5 1.8 2.0	2015 2016 2017 2018 2019 2020 2021 2022 0.2 0.3 0.4 0	2015 2016 2017 2018 2019 2020 2021 2022 2023 0.2 0.4 0.4 0.4 0.6 0.6 0.8 0.8 1.0 0.4 0.7 1.0 1.2 1.5 1.8 2.0 2.3 2.6	2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 0.2 0.4 0.4 0.4 0.4 0.4 0.6 0.6 0.8 0.8 1.0 1.0 0.4 0.7 1.0 1.2 1.5 1.8 2.0 2.3 2.6 2.9	2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 0.2 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.6 0.6 0.6 0.8 0.8 1.0 1.0 1.3 0.40.71.01.2 <th>2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 0.2 0.3 0.3 0.3 0.3 0.4 <</th> <th>2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 0.2 0.4<th>2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 0.2 0.3<th>2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 0.2<!--</th--></th></th></th>	2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 0.2 0.3 0.3 0.3 0.3 0.4 <	2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 0.2 0.4 <th>2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 0.2 0.3<th>2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 0.2<!--</th--></th></th>	2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 0.2 0.3 <th>2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 0.2<!--</th--></th>	2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 0.2 </th

Note: while table S2 and totals in table S4 should be the same, some differences can be

seen. These differences are due to the imperfect convergence of the solutions computed by

Energy2020.

Table S3: Elect	ricity ge	nerated ir	uUS and	l Canada ł	by sourc	e, by yea	r and by	scenario	
Flectricity (GWh)									

Electric	city (GWh)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Biomass	BAU Sc1 Sc2 Sc3 Sc4 Sc5	4710 4710 4710 4710 4710 4710	4804 4804 4804 4804 4804 4804	5192 5229 5229 5223 5250 5322	5354 5393 5390 5384 5412 5518	5399 5401 5401 5405 5429 5545	5128 5128 5128 5128 5128 5128 5129	5329 5329 5329 5329 5329 5329 5329	5407 5407 5407 5407 5407 5445	5784 5784 5784 5784 5784 5784 5784	8602 8602 8603 8603 8604 8607	9220 9220 9220 9221 9222 9222 9224	9798 9798 9798 9798 9799 9800	9835 9835 9835 9836 9837 9838	9934 9934 9934 9935 9937 10244	10675 10676 10676 10677 10679 10685	11072 11072 11073 11074 11074 11080
Coal	BAU Sc1 Sc2 Sc3 Sc4 Sc5	1679294 1679332 1679331 1679329 1679330 1679360	$\begin{array}{c} 1660258\\ 1660349\\ 1660349\\ 1660337\\ 1660340\\ 1660500 \end{array}$	1662659 1662695 1662695 1662689 1662716 1662790	$\begin{array}{c} 1667756 \\ 1667808 \\ 1667814 \\ 1667808 \\ 1667854 \\ 1668072 \end{array}$	1679885 1679963 1679965 1680017 1680053 1680233	1691570 1691659 1691664 1691734 1691802 1692263	1695203 1695300 1695295 1695367 1695516 1696001	1707310 1707406 1707408 1707482 1707631 1708201	1708937 1709036 1709098 1709184 1709339 1709778	1712049 1712148 1712208 1712300 1712451 1713192	1720484 1720569 1720620 1720688 1720883 1721401	1725842 1725924 1725973 1726043 1726232 1726836	1731380 1731462 1731511 1731652 1731842 1732469	1736559 1736639 1736687 1736827 1737021 1737432	1736553 1736641 1736688 1736822 1737086 1737883	1728192 1728278 1728322 1728458 1728639 1729341
Heavy Fuel Oil	BAU Sc1 Sc2 Sc3 Sc4 Sc5	427 429 429 429 429 429 431	626 633 633 632 633 645	222 225 225 225 225 228 239	153 153 153 153 153 153	155 155 155 155 155 155	154 154 154 154 154 154	155 155 155 155 155 155	153 153 153 153 153 153	151 151 151 151 151 151	147 147 147 147 147 147 147	150 150 150 150 150 150	189 189 189 189 189 189	189 189 189 189 189 189	187 187 187 187 187 187	186 186 186 186 186 186	156 156 156 156 156 156
Diesel- Gazoline	BAU Sc1 Sc2 Sc3 Sc4 Sc5	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	359 359 359 359 359 359 359	358 358 358 358 358 358 358	357 357 357 357 357 357 357	357 357 357 357 357 357 357	354 354 354 354 354 355	330 330 330 330 330 330 330
Hydro	BAU Sc1 Sc2 Sc3 Sc4 Sc5	751830 751830 751830 751830 751830 751830 751829	756178 756178 756178 756178 756178 756178 756178	781651 781663 781663 781666 781678 781718	788557 788557 788557 788557 788557 788557 788557	793002 793001 793001 793002 793002 793002	795622 795622 795622 795622 795622 795622 795622	796995 796995 796995 796995 796995 796995 796996	801696 801696 801696 801696 801696 801697	817145 817145 817145 817145 817145 817145 817427	830003 830003 830002 830003 830003 830003	838052 838052 838052 838052 838052 838052 838333	840444 840444 840445 840445 840445 840445 840726	841150 841150 841150 841150 841150 841431	848072 848084 848097 848129 848176 848556	854313 854326 854338 854370 854438 854617	859175 859188 859203 859235 859499 859699
Natural Gas	BAU Sc1 Sc2 Sc3 Sc4 Sc5	786408 786607 786613 786598 786607 786767	853323 853373 853382 853375 853382 853647	878532 878588 878602 878592 878709 879017	918744 918794 918805 918795 918903 919320	946074 946141 946152 946268 946348 946855	966106 966166 966176 966277 966349 966948	994120 994186 994196 994298 994482 995085	1020838 1020912 1020918 1021023 1021205 1021897	1041483 1041557 1041665 1041780 1041971 1042578	1056195 1056275 1056379 1056497 1056686 1057569	$\begin{array}{c} 1079781 \\ 1079864 \\ 1079969 \\ 1080086 \\ 1080395 \\ 1081191 \end{array}$	1106573 1106663 1106765 1106881 1107188 1108132	1128162 1128255 1128356 1128588 1128903 1129872	1144695 1144789 1144891 1145122 1145438 1146557	1161039 1161137 1161238 1161465 1161898 1163155	1181434 1181532 1181635 1181866 1182187 1183777
Nuclear	BAU Sc1 Sc2 Sc3 Sc4 Sc5	869150 869150 869150 869150 869150 869150	866110 866110 866110 866110 866110 866110	874149 874149 874149 874149 874149 874149 874149	866478 866478 866478 866478 866478 866478 866478	858123 858123 858123 858123 858123 858123 858123	851771 851771 851771 851771 851771 851771	858379 858379 858379 858379 858379 858379 858379	858379 858379 858379 858379 858379 858379 858379	865825 865825 865825 865825 865825 865825 865825	865825 865825 865825 865825 865825 865825 865825	865825 865825 865825 865825 865825 865825 865825	865825 865825 865825 865825 865825 865825 865825	865825 865825 865825 865825 865825 865825 865825	866957 866957 866957 866957 866957 866957	868409 868409 868409 868409 868409 868409 868409	868409 868409 868409 868409 868409 868409 868409
Wind	BAU Sc1 Sc2 Sc3 Sc4 Sc5	256084 256084 256084 256084 256084 256083	259216 259216 259216 259216 259216 259216	262406 262406 262407 262406 262407 262408	265305 265305 265305 265305 265306 265305	267524 267524 267524 267524 267524 267524 267528	269004 269004 269004 269004 269004 269008	270796 270796 270796 270796 270796 270796 270830	272515 272515 272515 272515 272515 272515 272520	274348 274348 274348 274348 274348 274348 274352	276937 276937 276937 276937 276937 276937 276941	279184 279184 279184 279184 279184 279184 279189	281567 281567 281567 281568 281568 281572	285563 285563 285563 285563 285563 285563	288691 288691 288692 288693 288695 288704	291586 291587 291587 291589 291591 291604	294696 294697 294697 294699 294699 294699 294718
Total	BAU Sc1 Sc2 Sc3 Sc4 Sc5	4348261 4348501 4348505 4348489 4348498 4348690	4400874 4401022 4401030 4401010 4401021 4401458	4465170 4465314 4465328 4465309 4465496 4466001	4512706 4512847 4512860 4512839 4513021 4513762	4550521 4550668 4550681 4550853 4550993 4551799	4579714 4579863 4579878 4580050 4580190 4581255	4621336 4621499 4621504 4621678 4622011 4623135	4666657 4666828 4666837 4667016 4667346 4668653	4714033 4714205 4714375 4714576 4714923 4716253	4750117 4750296 4750461 4750672 4751012 4752644	4793056 4793224 4793381 4793566 4794072 4795673	4830597 4830769 4830920 4831106 4831603 4833439	4862462 4862636 4862787 4863161 4863666 4865550	4895452 4895637 4895802 4896207 4896768 4898994	4923116 4923315 4923477 4923874 4924641 4926895	4943464 4943662 4943824 4944226 4944993 4947509

Electricity (GWh)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Biomass																
Sc1 Sc2 Sc3 Sc4 Sc5	0 0 0 0 0	0 0 0 0 0	36 36 30 57 130	39 36 30 57 164	2 6 30 146	0 0 0 0 0	0 0 0 0 0	0 0 0 38	0 0 0 0 0	0 1 1 2 5	$ \begin{array}{c} 0 \\ 1 \\ 2 \\ 4 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 2 \\ 3 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 2 \\ 3 \end{array} $	$0 \\ 1 \\ 2 \\ 3 \\ 310$	$ \begin{array}{c} 0 \\ 1 \\ 2 \\ 4 \\ 10 \end{array} $	0 1 2 2 8
Coal																
Sc1 Sc2 Sc3 Sc4 Sc5	38 37 35 36 66	91 91 79 82 242	35 36 30 56 131	52 58 52 98 316	78 81 132 169 348	89 94 164 231 693	97 92 164 313 798	96 99 173 322 892	99 161 247 402 841	99 159 252 402 1143	85 136 204 399 917	82 130 200 390 993	82 130 272 462 1089	79 128 267 462 873	87 135 269 532 1330	87 130 266 448 1149
Heavy Fuel Oil	1	7	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Sc2 Sc3 Sc4 Sc5	2 2 2 3	7 6 7 20	4 3 6 17	0 0 0 0	0 0 0 0 0	0 0 0 0	0 0 0 0	$ \begin{array}{c} 0\\ 0\\ 0\\ 0\\ 2 \end{array} $	0 0 0 0 0	0 0 0 0	0 0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
Diesel-Gazoline																
Sc1 Sc2 Sc3 Sc4 Sc5	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Sc1	0	0	12	0	0	0	0	0	0	0	0	0	0	12	13	12
Sc2 Sc3 Sc4 Sc5	0 0 0 0	0 0 0 0	12 15 27 67	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0		0 0 0 0	$ \begin{array}{c} 0\\ 0\\ 0\\ 281 \end{array} $	$ \begin{array}{c} 0\\ 0\\ 0\\ 281 \end{array} $	0 0 0 281	24 57 104 484	25 57 124 304	27 59 324 523
Natural Gas																
Sc1 Sc2 Sc3 Sc4 Sc5	199 204 190 199 359	50 58 51 59 323	56 70 60 178 485	50 61 51 158 576	67 78 194 274 781	60 70 171 244 843	67 76 179 362 966	75 81 186 367 1059	74 182 297 488 1095	80 184 302 491 1374	83 188 304 614 1410	90 192 308 615 1559	93 194 426 741 1710	93 196 426 743 1861	98 200 427 859 2116	98 201 432 753 2343
Nuclear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sc1 Sc2 Sc3 Sc4 Sc5	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 0\\ 0\end{array}$	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 0\\ 0\end{array}$	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 0\\ 0\end{array}$	0 0 0 0	0 0 0 0	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 0\\ 0\end{array}$	0 0 0 0	0 0 0 0 0	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 0\\ 0\end{array}$	0 0 0 0	0 0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0 0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Sc1 Sc2 Sc3 Sc4 Sc5	0 0 0 0 0	0 0 0 0 0	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \\ 2 \end{array} $	0 0 0 0 0	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 4\end{array}$		0 0 0 34	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 4\end{array}$	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 4\end{array}$	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 4\end{array}$	$\begin{array}{c} 0\\ 0\\ 0\\ 0\\ 4\end{array}$	0 0 0 5	0 0 0 5	0 1 2 4 13	1 3 5 18	$\begin{array}{c}0\\1\\2\\2\\22\end{array}$
Total																
Sc1 Sc2 Sc3 Sc4 Sc5	239 243 227 236 428	148 156 137 147 585	144 158 139 326 831	141 154 133 314 1055	147 160 332 472 1279	149 164 335 475 1540	163 168 342 676 1799	171 179 358 689 1996	173 343 544 890 2221	179 344 555 895 2528	$168 \\ 325 \\ 510 \\ 1016 \\ 2617$	$172 \\ 323 \\ 509 \\ 1006 \\ 2842$	175 325 699 1205 3088	185 350 755 1317 3542	199 361 757 1525 3778	198 360 762 1529 4045

Table S4: Marginal electricity generated in US and Canada by source, by year and by scenario

Table S5: econvent processes used to model Energy 2020 electricity generation technologies

Energy2020	Ecoinvent	
Technology	Fraction	Process
		US
Coal	6.30%	{WECC, US only} electricity production, hard coal
	4.54%	{MRO, US only} electricity production, hard coal
	0.26%	{NPCC, US only} electricity production, hard coal
	15.42%	{RFC} electricity production, hard coal
	13.48%	{SERC} electricity production, hard coal
	1.81%	{SPP} electricity production, hard coal
	4.43%	{TRE} electricity production, hard coal
	1.40%	{FRCC} electricity production, hard coal
	0.93%	(WECC, US only) electricity production, lignite
	4.90%	{NPCC_US_only} electricity production, lignite
	16.95%	{RFC} electricity production lignite
	14 82%	{SERC} electricity production lignite
	1.98%	{SPP} electricity production, lignite
	4.87%	{TRE} electricity production, lignite
	1.54%	{FRCC} electricity production, lignite
Hydro	0.52%	{WECC, US only} electricity production, hydro, pumped storage
-	0.82%	{NPCC, US only} electricity production, hydro, pumped storage
	1.57%	{RFC} electricity production, hydro, pumped storage
	3.63%	{SERC} electricity production, hydro, pumped storage
	0.13%	{SPP} electricity production, hydro, pumped storage
	12.98%	{WECC, US only} electricity production, hydro, reservoir, alpine region
	0.84%	{MRO, US only} electricity production, hydro, reservoir, alpine region
	2.15%	{NPCC, US only} electricity production, hydro, reservoir, alpine region
	0.47%	{RFC} electricity production, hydro, reservoir, alpine region
	1.98%	{SERC} electricity production, hydro, reservoir, alpine region
	0.08%	{SPP} electricity production, hydro, reservoir, non-alpine region
	0.04%	[TRE] electricity production, hydro, reservoir, non-alpine region
	51.03%	{WECC US only determined by production hydro, run-of-river
	3 37%	{MRO US only} electricity production hydro run-of-river
	8.59%	{NPCC, US only} electricity production, hydro, run-of-river
	1.89%	{RFC} electricity production, hydro, run-of-river
	7.93%	{SERC} electricity production, hydro, run-of-river
	0.32%	{SPP} electricity production, hydro, run-of-river
	0.16%	{TRE} electricity production, hydro, run-of-river
	0.04%	{FRCC} electricity production, hydro, run-of-river
Natural Cas	6.22%	{WECC, US only} electricity production, natural gas, combined cycle power plant
	0.06%	{MRO, US only} electricity production, natural gas, combined cycle power plant
	3.56%	{NPCC, US only} electricity production, natural gas, combined cycle power plant
	4.80%	{RFC} electricity production, natural gas, combined cycle power plant
	7.85%	{SERC} electricity production, natural gas, combined cycle power plant
	1.26%	{SPP} electricity production, natural gas, combined cycle power plant
	5.32%	{TRE} electricity production, natural gas, combined cycle power plant
	4.48%	{FRCC} electricity production, natural gas, combined cycle power plant
	8.81%	{WECC, US only} electricity production, natural gas, conventional power plant
	0.90%	{MRO, US only} electricity production, natural gas, conventional power plant
	5.04%	{NPCC, US only} electricity production, natural gas, conventional power plant
	6.80%	[RFC] electricity production, natural gas, conventional power plant
	11.12%	{SERC} electricity production, natural gas, conventional power plant
	1.78%	SPP} electricity production, natural gas, conventional power plant
	7.53%	{IKE} electricity production, natural gas, conventional power plant
	6.35%	[FRCC] electricity production, natural gas, conventional power plant
	0.13%	{WECC, US only} neat and power co-generation, natural gas, combined cycle power plant, 400MW electrical {MRO, US only} heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical

	0./1%	{NPCC, US only} heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical
	0.95%	{RFC} heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical
	1.56%	{SERC} heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical
	0.25%	{SPP} heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical
	1.05%	{TRE} heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical
	0.89%	{FRCC} heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical
	2.07%	{WECC, US only} heat and power co-generation, natural gas, conventional power plant, 100MW electrical
	0.21%	{MRO, US only} heat and power co-generation, natural gas, conventional power plant, 100MW electrical
	1.18%	{NPCC, US only} heat and power co-generation, natural gas, conventional power plant, 100MW electrical
	1.60%	{RFC} heat and power co-generation, natural gas, conventional power plant, 100MW electrical
	2.61%	{SERC} heat and power co-generation, natural gas, conventional power plant, 100MW electrical
	0.42%	{SPP} heat and power co-generation, natural gas, conventional power plant, 100MW electrical
	1.77%	{TRE} heat and power co-generation, natural gas, conventional power plant, 100MW electrical
	1.49%	{FRCC} heat and power co-generation, natural gas, conventional power plant, 100MW electrical
	5.000/	
Nuclear	5.09%	{WECC, US only} electricity production, nuclear, boiling water reactor
	1.91%	{MRO, US only} electricity production, nuclear, boiling water reactor
	5.5470 11.450/	{NPCC, US only} electricity production, nuclear, boiling water reactor
	11.45%	{KFC} electricity production, nuclear, boiling water reactor
	0 260/	{SERC} electricity production, nuclear, boiling water reactor
	0.30%	{SPP} electricity production, nuclear, boiling water reactor
	1.0/%	[TRE] electricity production, nuclear, boiling water reactor
	0./8%	{FRCC} electricity production, nuclear, boiling water reactor
	2.60%	{WECC, US only} electricity production, nuclear, pressure water reactor
	5./0%0	{MRO, US only} electricity production, nuclear, pressure water reactor
	0.33%	{NPCC, US only} electricity production, nuclear, pressure water reactor
	22.44%	{KFC} electricity production, nuclear, pressure water reactor
	22.8070	{SERC} electricity production, nuclear, pressure water reactor
	0./170	{SPF} electricity production, nuclear, pressure water reactor
	5.2070 1.520/	{TRE} electricity production, nuclear, pressure water reactor
	1.3270	{FRCC}] electricity production, nuclear, pressure water reactor
Harry Frad	5.07%	{WECC_US only} electricity production_oil
Oil Diesel and	1.53%	{MRO. US only} electricity production, oil
Oil, Diesel and Gazoline	1.53% 4.40%	{MRO, US only} electricity production, oil {NPCC, US only} electricity production, oil
Oil, Diesel and Gazoline	1.53% 4.40% 16.57%	{MRO, US only} electricity production, oil {NPCC, US only} electricity production, oil {RFC} electricity production, oil
Gazoline	1.53% 4.40% 16.57% 28.44%	<pre>{MRO, US only} electricity production, oil {NPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil</pre>
Gazoline	1.53% 4.40% 16.57% 28.44% 0.25%	<pre>{MRO, US only} electricity production, oil {NPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil</pre>
Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78%	<pre>{MRO, US only} electricity production, oil {NPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil</pre>
Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21%	<pre>{MRO, US only} electricity production, oil {MPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil</pre>
Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71%	<pre>{MRO, US only} electricity production, oil {MPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil</pre>
Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86%	<pre>{MRO, US only} electricity production, oil {MPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil</pre>
Heavy Fuel Oil, Diesel and Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45%	<pre>{MRO, US only} electricity production, oil {MRO, US only} electricity production, oil {NPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil</pre>
Heavy Fuel Oil, Diesel and Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25%	<pre>{MRO, US only} electricity production, oil {MPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {RFC} heat and power co-generation, oil</pre>
Heavy Fuel Oil, Diesel and Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25% 15.87%	<pre>{MRO, US only} electricity production, oil {MPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {RFC} heat and power co-generation, oil {RFC} heat and power co-generation, oil {SERC} heat and power co-generation, oil</pre>
Heavy Fuel Oil, Diesel and Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25% 15.87% 0.14%	<pre>{MRO, US only} electricity production, oil {MPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {RFC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil</pre>
Heavy Fuel Oil, Diesel and Gazoline	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \end{array}$	<pre>{MRO, US only} electricity production, oil {MPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {MPCC, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {RFC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {TRE} heat and power co-generation, oil</pre>
Gazoline	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \end{array}$	<pre>{MRO, US only} electricity production, oil {NPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {SPP} heat and power co-generation, oil {FRCC} heat and power co-generation, oil</pre>
Gazoline	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25% 15.87% 0.14% 0.44% 4.03%	<pre>{MRO, US only} electricity production, oil {MPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {TRE} heat and power co-generation, oil {TRE} heat and power co-generation, oil {TRE} heat and power co-generation, oil</pre>
Wind and	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25% 15.87% 0.14% 0.44% 4.03% 1.96%	<pre>{MRO, US only} electricity production, oil {MRO, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {TRC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {TRE} heat and power co-generation, oil {WECC, US only} electricity production, wind, <1MW turbine, onshore {WECC, US only} electricity production, wind, <1MW turbine, onshore</pre>
Wind and other	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25% 15.87% 0.14% 0.44% 4.03% 1.96% 1.61% 0.21%	<pre>{MRO, US only} electricity production, oil {MRO, US only} electricity production, oil {NPCC, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {FRCC} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {RFC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {TRE} heat and power co-generation, oil {FRCC} heat and power co-generation, oil {FRCC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {SPP} heat and power co-generation, oil {FRCC} heat and power co-generatio</pre>
Wind and other	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25% 15.87% 0.14% 0.44% 4.03% 1.96% 1.61% 0.21% 0.82%	<pre>{MRO, US only} electricity production, oil {MRO, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {TRE} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {RFC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {SPP} heat and power co-generation, oil {FRCC} heat and power co-generation, oil {FRCC}, US only} electricity production, wind, <1MW turbine, onshore {MRO, US only} electricity production, wind, <1MW turbine, onshore {MPCC, US only} electricity production, wind, <1MW turbine, onshore {NPCC, US only} electricity production, wind, <1MW turbine, onshore {NPCC}</pre>
Wind and other	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \\ \hline 1.96\% \\ 1.61\% \\ 0.21\% \\ 0.83\% \\ 0.06\% \end{array}$	<pre>{MRO, US only} electricity production, oil {MRO, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SERC} electricity production, oil {TRE} electricity production, oil {TRE} electricity production, oil {MRO, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {SERC} heat and power co-generation, oil {FRCC} heat and power co-generation, wind, <1MW turbine, onshore {FRC} electricity production, wind, <1MW turbine, onshore {FRC} heat power co-generation, wind, <1MW turbi</pre>
Wind and other	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \\ \hline 1.96\% \\ 1.61\% \\ 0.21\% \\ 0.83\% \\ 0.06\% \\ 0.66\% \end{array}$	<pre>{MRO, US only} electricity production, oil {MRO, US only} electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SERC} electricity production, oil {TRE} electricity production, oil {TRE} electricity production, oil {WECC, US only} heat and power co-generation, oil {MRO, US only} heat and power co-generation, oil {NPCC, US only} heat and power co-generation, oil {RFC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {WECC, US only} electricity production, wind, <1MW turbine, onshore {MRO, US only} electricity production, wind, <1MW turbine, onshore {NPCC, US only} electricity production, wind, <1MW turbine, onshore {SERC} electricity production, wind, <1</pre>
Wind and other	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \\ \hline 1.96\% \\ 1.61\% \\ 0.21\% \\ 0.83\% \\ 0.06\% \\ 0.66\% \\ 1.59\% \end{array}$	[MRO, US only] electricity production, oil [MRO, US only] electricity production, oil [RFC] electricity production, oil [SERC] electricity production, oil [SERC] electricity production, oil [SPP] electricity production, oil [FRCC] electricity production, oil [FRCC] electricity production, oil [WECC, US only] heat and power co-generation, oil [MRO, US only] heat and power co-generation, oil [MRO, US only] heat and power co-generation, oil [MRO, US only] heat and power co-generation, oil [NPCC, US only] heat and power co-generation, oil [SERC] heat and power co-generation, oil [SPP] heat and power co-generation, oil [SERC] electricity production, wind, <1MW turbine, onshore [SPP] electricity production, wind, <1MW turbine, onshore [SERC] electricity production, wind, <1MW turbine, onshore [SPP] electricity production, wind, <1MW turbine, onshore [SPP] electricity production, wind, <1MW turbi
Wind and other	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \\ 1.96\% \\ 1.61\% \\ 0.21\% \\ 0.83\% \\ 0.06\% \\ 0.66\% \\ 1.59\% \\ 0.20\% \end{array}$	[MRO, US only] electricity production, oil [MRO, US only] electricity production, oil [RFC] electricity production, oil [SERC] electricity production, oil [SERC] electricity production, oil [FRCC] electricity production, oil [FRCC] electricity production, oil [WECC, US only] heat and power co-generation, oil [MRO, US only] heat and power co-generation, oil [MRO, US only] heat and power co-generation, oil [MRO, US only] heat and power co-generation, oil [MRC, US only] heat and power co-generation, oil [RFC] heat and power co-generation, oil [SERC] heat and power co-generation, oil [SERC] heat and power co-generation, oil [FRCC] heat and power co-generation, oil [FRCC] heat and power co-generation, oil [SERC] heat and power co-generation, oil [FRCC] lectricity production, wind, <1MW turbine, onshore [MRO, US only] electricity production, wind, <1MW turbine, onshore [SPRC] electricity production, wind, <1MW turbine, onshore [SPR] electr
Wind and other	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \\ 1.96\% \\ 1.61\% \\ 0.21\% \\ 0.83\% \\ 0.06\% \\ 0.66\% \\ 1.59\% \\ 0.20\% \\ 0.17\% \end{array}$	[MRO, US only] electricity production, oil [MRC, US only] electricity production, oil [RFC] electricity production, oil [SERC] electricity production, oil [SERC] electricity production, oil [FRCC] electricity production, oil [WECC, US only] heat and power co-generation, oil [MRO, US only] heat and power co-generation, oil [MRO, US only] heat and power co-generation, oil [RFC] heat and power co-generation, oil [SERC] electricity production, wind, <1MW turbine, onshore [MRO, US only] electricity production, wind, <1MW turbine, onshore [SERC] electricity production, wind, <1MW turbine, onshore [WECC, US only] electricity production, wind, <3MW turbine, onshore [WECC, US only] electricity production, wind
Wind and other	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \\ 1.96\% \\ 1.61\% \\ 0.21\% \\ 0.83\% \\ 0.06\% \\ 0.66\% \\ 1.59\% \\ 0.20\% \\ 0.17\% \\ 0.02\% \end{array}$	(MRO, US only) electricity production, oil {MRO, US only} electricity production, oil {SERC} electricity production, oil {SERC} electricity production, oil {SERC} electricity production, oil {FRCC} electricity production, oil {FRCC, US only} heat and power co-generation, oil {FRCC} lectricity production, wind, <1MW turbine, onshore {MRO, US only} electricity production, wind, <1MW turbine, onshore {FRCC, lectricity production, wind, <1MW turbine, onshore {FRCC, lectricity production, wind, <1MW turbine, onshore {FRC} electricity production, wind, <1MW turbine, onshore
Wind and other	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \\ 1.96\% \\ 1.61\% \\ 0.21\% \\ 0.83\% \\ 0.06\% \\ 0.66\% \\ 1.59\% \\ 0.20\% \\ 0.17\% \\ 0.02\% \\ 0.08\% \\ \end{array}$	(MRO, US only] electricity production, oil {MRO, US only] electricity production, oil {RFC} electricity production, oil {SERC} electricity production, oil {SERC} electricity production, oil {RFC} electricity production, wind, <1MW turbine, onshore {RFC} electricity production, win
Wind and other	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25% 15.87% 0.14% 0.44% 4.03% 1.96% 1.61% 0.21% 0.83% 0.06% 0.66% 1.59% 0.20% 0.17% 0.20% 0.17% 0.02% 0.01%	(MRO, US only) [electricity production, oil {MRO, US only}] electricity production, oil {RFC}] electricity production, oil {SPP}] electricity production, oil {SPP}] electricity production, oil {RFC}] electricity production, oil {RFC, electricity production, wind, <1MW turbine, onshore {MRO, US only} electricity production, wind, <1MW turbine, onshore {RFC, electricity production, wind, <3MW turbine, onshore {RFC, electricity production, wind, >3MW turbine,
Wind and other	$\begin{array}{c} 1.53\% \\ 4.40\% \\ 16.57\% \\ 28.44\% \\ 0.25\% \\ 0.78\% \\ 7.21\% \\ 2.71\% \\ 0.86\% \\ 2.45\% \\ 9.25\% \\ 15.87\% \\ 0.14\% \\ 0.44\% \\ 4.03\% \\ 1.96\% \\ 1.61\% \\ 0.21\% \\ 0.83\% \\ 0.06\% \\ 0.66\% \\ 1.59\% \\ 0.20\% \\ 0.17\% \\ 0.02\% \\ 0.08\% \\ 0.01\% \\ 0.07\% \\ \end{array}$	[MRO, US only] electricity production, oil {MRO, US only] electricity production, oil {RFC} electricity production, oil {SPP} electricity production, oil {TRE} electricity production, oil {TRE} electricity production, oil {TRE} electricity production, oil {TRE} electricity production, oil {MRO, US only} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SERC} heat and power co-generation, oil {SPP} heat and power co-generation, oil {TRE} heat and power co-generation, oil {TRE} heat and power co-generation, oil {FRCC} lectricity production, wind, <1MW turbine, onshore {MRO, US only} electricity production, wind, <1MW turbine, onshore {SPP} electricity production, wind, <1MW turbine, onshore {SPP} electricity production, wind, <1MW turbine, onshore {TRE} electricity production, wind, <1MW turbine, onshore {TRE} electricity production, wind, <1MW turbine, onshore {MRO, US only} electricity production, wind, <3MW turbine, onshore {MRO, US only} electricity production, wind, >3MW turbine, onshore {SPP} electricity production, wind, >3MW turbine, onshore {SP
Wind and other	1.53% 4.40% 16.57% 28.44% 0.25% 0.78% 7.21% 2.71% 0.86% 2.45% 9.25% 15.87% 0.14% 0.44% 4.03% 1.96% 1.61% 0.21% 0.83% 0.06% 0.66% 1.59% 0.20% 0.17% 0.02% 0.01% 0.07% 0.16%	(MRO, US only] electricity production, oil {MRO, US only] electricity production, oil {RFC} electricity production, wind, <1MW turbine, onshore {NPC, US only} electricity production, wind, <1MW turbine, onshore {RFC} electricity production, wind, <3MW turbine, onshore {RFC} electricity production, wind, >3MW turbine, onshore {RFC} electricity production, wind, >3MW

	23.39%	{WECC, US only} electricity production, wind, 1-3MW turbine, onshore
	19.20%	{MRO, US only} electricity production, wind, 1-3MW turbine, onshore
	2.51%	{NPCC, US only} electricity production, wind, 1-3MW turbine, onshore
	9.87%	{RFC} electricity production, wind, 1-3MW turbine, onshore
	0.76%	{SERC} electricity production, wind, 1-3MW turbine, onshore
	7.85%	{SPP} electricity production, wind, 1-3MW turbine, onshore
	18.95%	{TRE} electricity production, wind, 1-3MW turbine, onshore
	9.83%	{WECC, US only} electricity production, deep geothermal
	0.1(0/	
Biomass	8.16%	{WECC, US only} heat and power co-generation, biogas, gas engine
	5.93%	{MRO, US only} heat and power co-generation, biogas, gas engine
	12.83%	{NPCC, US only} heat and power co-generation, biogas, gas engine
	1/.94%	{RFC} heat and power co-generation, biogas, gas engine
	5.94%	{SERC} heat and power co-generation, blogas, gas engine
	0.21%	{SPP} heat and power co-generation, biogas, gas engine
	2.05%	{IRE} heat and power co-generation, biogas, gas engine
	6.90%	{FRCC} heat and power co-generation, biogas, gas engine
	13.02%	{WECC, US only} heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014
	3.12%	{MRO, US only} heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014
	11.41%	{NPCC, US only} heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014
	3.56%	{RFC} heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014
	7.07%	{SERC} heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014
	0.46%	{TRE} heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014
	1.42%	[FRCC] heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014
		Canada
]	Technology	Process
	Coal	{CA-X*} electricity production, lignite
		{CA-X} electricity production, hard coal
	Hydro	{CA-X} electricity production, hydro, pumped storage
	Hydro	{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region
	Hydro	<pre>{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region</pre>
	Hydro	<pre>{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river</pre>
	Hydro	<pre>{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river</pre>
Ν	Hydro Jatural gas	<pre>{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} beat and power co-generation_natural gas_conventional power plant</pre>
Ν	Hydro Jatural gas	<pre>{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production natural gas, conventional power plant</pre>
Ν	Hydro Jatural gas	<pre>{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant</pre>
Ν	Hydro atural gas Nuclear	<pre>{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated</pre>
Ν	Hydro Tatural gas Nuclear	 {CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated
N Heavy Fuel	Hydro atural gas Nuclear Oil, Diesel	 {CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated
N Heavy Fuel an	Hydro Jatural gas Nuclear Oil, Diesel d Gazoline	{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated {CA-X} electricity production, oil
N Heavy Fuel and	Hydro Jatural gas Nuclear Oil, Diesel d Gazoline Wind	{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated {CA-X} electricity production, oil {CA-X} electricity production, oil
N Heavy Fuel and	Hydro Jatural gas Nuclear Oil, Diesel d Gazoline Wind	{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated {CA-X} electricity production, oil {CA-X} electricity production, wind, <1MW turbine, onshore {CA-X} electricity production, wind, 1-3MW turbine, onshore
N Heavy Fuel and	Hydro Jatural gas Nuclear Oil, Diesel d Gazoline Wind	<pre>{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} electricity production, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated {CA-X} electricity production, oil {CA-X} electricity production, oil {CA-X} electricity production, wind, <1MW turbine, onshore {CA-X} electricity production, wind, 1-3MW turbine, onshore {CA-X} electricity production, wind >3MW turbine, onshore</pre>
N Heavy Fuel and	Hydro atural gas Nuclear Oil, Diesel d Gazoline Wind	{CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated {CA-X} electricity production, oil {CA-X} electricity production, wind, <1MW turbine, onshore {CA-X} electricity production, wind, 1-3MW turbine, onshore {CA-X} electricity production, wind, >3MW turbine, onshore {CA-X} electricity production, wind, >3MW turbine, precast concrete tower, onshore
N Heavy Fuel and	Hydro atural gas Nuclear Oil, Diesel d Gazoline Wind	 {CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated {CA-X} electricity production, oil {CA-X} electricity production, wind, <1MW turbine, onshore {CA-X} electricity production, wind, 1-3MW turbine, onshore {CA-X} electricity production, wind, 2.3MW turbine, precast concrete tower, onshore
N Heavy Fuel and	Hydro Tatural gas Nuclear Oil, Diesel d Gazoline Wind Biomass	 {CA-X} electricity production, hydro, pumped storage {CA-X} electricity production, hydro, reservoir, alpine region {CA-X} electricity production, hydro, reservoir, non-alpine region {CA-X} electricity production, hydro, run-of-river {CA-X} electricity production, natural gas, conventional power plant {CA-X} heat and power co-generation, natural gas, conventional power plant, 100MW electrical {CA-X} electricity production, natural gas, combined cycle power plant {CA-X} electricity production, nuclear, pressure water reactor, heavy water moderated {CA-X} electricity production, oil {CA-X} electricity production, wind, <1MW turbine, onshore {CA-X} electricity production, wind, 1-3MW turbine, onshore {CA-X} electricity production, wind, 2.3MW turbine, precast concrete tower, onshore {CA-X} heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014

*X refers to the abbreviation of the Canadian province in econvent (e.g. QC for Quebec, ON for Ontario, etc.)

Note: since the electricity generation processes are modeled at the power plant level in ecoinvent, the electric

losses and emissions occurring during the transport and distribution of electricity were added (based on regional

data of ecoinvent) to each electric process so the transport and distribution is included.

Technology innovation

Finally, past tendencies observed in electricity generation were used to represent future evolution of technology efficiencies. The annual efficiencies of thermal power plants (coal, oil, natural gas and biomass) were computed on the basis of the amount of fuel burned and the electricity generated per fuel from 1996 to 2015. For that purpose, data have been collected from the US Energy Information Administration (EIA) database (US Energy Information Administration 2013b) for US thermal power plants. Then an extrapolation (linear regression) was made for 2015-2030 and the average annual change in efficiency was computed for each thermal technology. It was intended to follow the same approach for Canadian thermal power plants using data from Statistics Canada (Statistics Canada 2013). However, the too short period (nine years) covered by the Canadian database made the results quite uncertain. Therefore it was preferred to use US data to model the future efficiencies of the Canadian thermal technologies. Regarding nuclear power plants, the amounts of nuclear fuels consumed annually were not found, thus it was anticipated the future efficiency of Canadian nuclear power plants would follow the trend observed during 2003-2013 among the US nuclear power plants (US Energy Information Administration 2013a). The efficiency trend of wind power was computed with the annual electricity generation by wind farms and the installed capacity of wind power. The US EIA database (US Energy Information Administration 2013b) was used to compute the US wind farms efficiency trend but also for the Canadian one (due to the too short period covered by Statistics Canada). Then, following the same approach than for thermal technologies, the average annual change in efficiency of wind power technology was calculated for the 2015-2030 period. No efficiency trend data were found for hydropower. Therefore it was assumed this technology would not improve in the near future. Regarding this assumption, it should be noted that hydropower efficiency is already close to its theoretical limit (Liu et al. 2015) and is not expected to change significantly in the future. The annual efficiency changes of each technology are presented in table S7. Then, the substances inventory was computed based on the amount of electricity generated by each energy source, as modeled by Energy 2020 each year for each scenario. Finally, each data center deployment scenario was

compared to the BAU scenario to determine the differential energy sources used to power the additional

Canadian data centers.

Table S7: Annual efficiency cha	anges in US and Canada electric	ity generation a	anticipated for	2015-2030

Technology	Annual efficiency changes*
Coal	-0.48 %
Oil (heavy fuel oil and diesel)	-0.02 %
Natural gas	1.15 %
Biomass	-0.67 %
Nuclear	-0.03 %
Hydro	0.00 %
Wind	0.02 %

* Negative efficiency changes are interpreted as the aging of equipment and infrastructures.