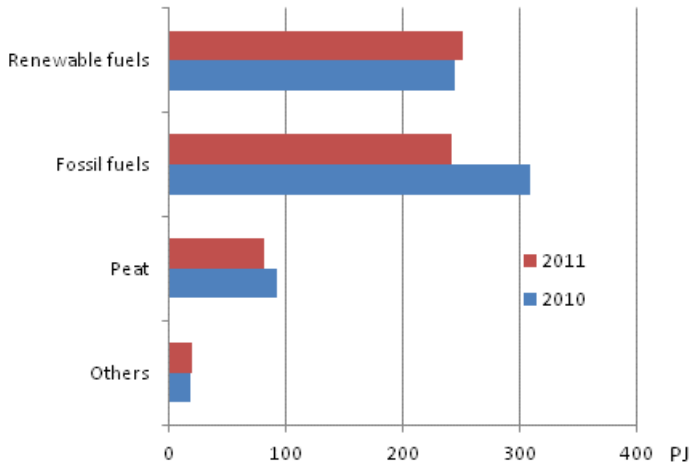
Production of electricity and heat 2011

Production of energy and use of fossil fuels in decline in 2011

Domestic production of electricity amounted to 70.4 TWh. Production decreased by nine per cent from the previous year. The production of district heat decreased by 13 per cent and that of industrial heat by four per cent in 2011. The use of fossil fuels in the production of electricity and heat decreased by 21 per cent and the use of peat by 12 per cent. By contrast, the use of renewable fuels increased by three per cent and exceeded the use of fossil fuels. These data derive from the statistics on the production of electricity and heat compiled by Statistics Finland.

Use of fuels in electricity and heat production 2010–2011



In 2011, production of electricity in Finland amounted to 70.4 terawatt hours (TWh) or billion kilowatt hours (kWh). Production decreased by nine per cent from the previous year. Total electricity consumption diminished by four per cent and amounted to 84.2 TWh. Of the total electricity consumption, 84 per cent was covered by domestic production and 16 per cent by net imports of electricity from Russia, the Nordic countries and Estonia. Net imports of electricity increased by 32 per cent due to the improved water situation in the Nordic countries. The cold weather in the early part of the year and high capacity utilisation rates in manufacturing kept the demand for electricity high. In the autumn, in turn, the demand for electricity was lower than at the beginning of the year due to the exceptionally mild weather and the waning growth of manufacturing caused by the euro crisis.

Altogether 33 per cent of electricity produced in Finland was produced with renewable energy sources. Around one-half of this was produced with hydro power and almost all of the remainder with wood. Thirty-two per cent of the production of electricity was covered with nuclear power, 27 per cent with fossil fuels and seven per cent with peat. The amounts of electricity produced with fossil fuels and peat decreased from the previous year. The biggest decrease was seen in electricity produced with coal.

Electricity and heat production by production mode in 2011

	Electricity, TWh	District heat, TWh	Industrial heat, TWh	Total fuels used, PJ[1)]
Separate production of electricity				
- Hydro power	12.3	–	–	–
- Wind power	0.5	–	–	–
- Nuclear power	22.3	–	–	–
- Condensing power[2)]	9.8	–	–	100.4
- Total	44.8	–	–	100.4
Combined heat and power production	25.5	26.0	44.8	426.0
Separate heat production	–	8.0	7.8	68.4
Total production	**70.4**	**34.0**	**52.6**	**594.8**
Net imports of electricity	13.9	–	–	–
Total	**84.2**	**34.0**	**52.6**	**594.8**

1) In calculating total primary energy used, hydro power, wind power and net imports of electricity are made commensurate with fuels according to directly obtained electricity (3.6 PJ/TWh). Total nuclear energy used is calculated at the efficiency ratio of 33 per cent from produced nuclear power (10.91 PJ/TWh).

2) Condensing power includes condensing power plants, shares of condensing electricity of combined heat and power production plants, and peak gas turbines and similar separate electricity production plants.

Production of district heat amounted to 34.0 TWh in 2011. Production decreased by 13 per cent from the previous year. The consumption of district heat diminished from the previous year as the autumn was exceptionally mild according to the Finnish Meteorological Institute. More than half of the district heat was produced with fossil fuels, although the amount of district heat produced with fossil fuels decreased by almost 20 per cent from the previous year. The individual fuel that was used most in the production of district heat was natural gas.

Production of industrial heat amounted to 56.2 TWh in 2011. Production decreased by four per cent from the previous year. As in the previous years, lower than normal amounts of industrial heat were used. Over 60 per cent of the heat used by industry was produced with renewable fuels. The individual fuel that was used most was black liquor from the forest industry.

The statistics on the production of electricity and heat cover almost the entire production of electricity connected to the grid. Solar electricity has not yet been added to the statistics. The statistics do not cover small district heating plants or the heat production of small industrial enterprises.

Links:

Statistics Finland's inquiry on production of electricity and heat

Finnish Energy Industries

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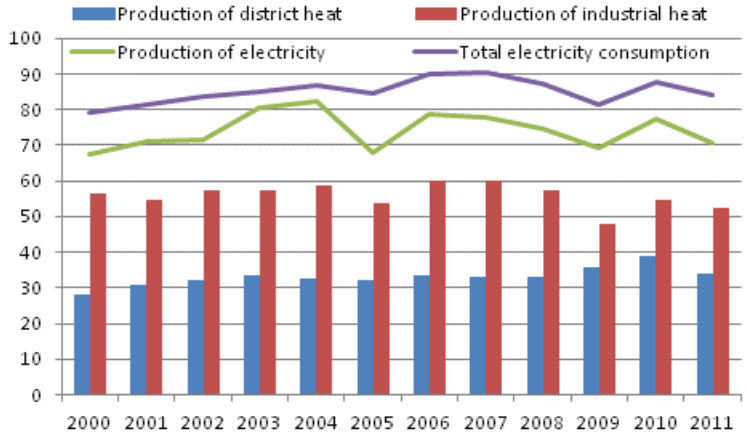
Electricity and heat production and fuels 2011

Production and consumption of electricity in decline

Total electricity consumption fell by four per cent from the previous year and amounted to 84.2 terawatt hours (TWh), or billion kilowatt hours (kWh). Of this consumption, 84 per cent was covered by domestic production and 16 per cent with net imports of electricity. Electricity is imported to Finland from the Nordic countries, Russia and Estonia. Electricity is also exported from Finland to other Nordic countries and Estonia. The net exports of electricity to the Nordic countries of the past few years turned into net imports in summer 2011. The availability of hydro power grew from the previous years in Sweden and Norway and the production of nuclear power also increased in Sweden. Relatively standard amounts of electricity have been imported from Russia in recent years but towards the end of 2011, the amount of electricity imported from Russia decreased due to the deregulation of the electricity market and risen prices. Net imports of electricity grew by 32 per cent from the previous year. Net imports are calculated by deducting exports from imports.

Production of electricity, district heat and industrial heat in 2000 - 2011



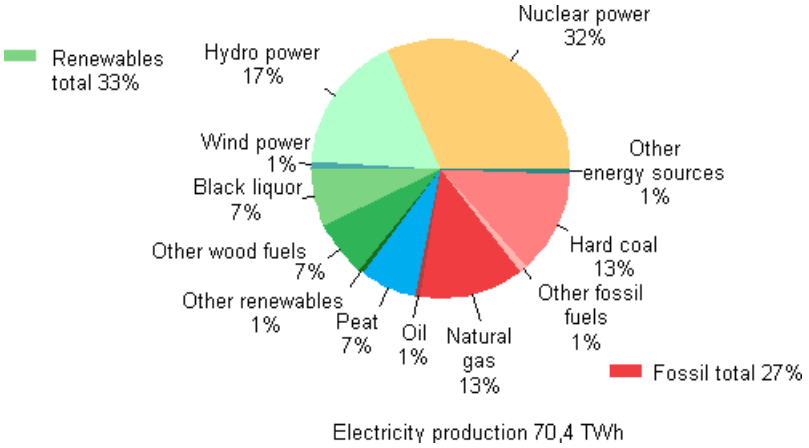
With regard to electricity consumption, the year divided into two. The cold weather in the early part of the year and high capacity utilisation rates in manufacturing kept the demand for electricity high. According to the Finnish Meteorological Institute, autumn 2011 was exceptionally mild, and the euro crisis slowed down and partly reversed growth in manufacturing. According to Statistics Finland's Volume Index of Industrial Output, total industrial output grew by barely one per cent in Finland in 2011. Among the electricity-intensive industries, preliminary year-on-year change indicated decline for the forest industry. By contrast, the year-on-year changes of the indices for the chemical and metal industries showed growth from the previous year.

In 2011, the volume of electricity produced in Finland amounted to 70.4 TWh. Production decreased by nine per cent from the previous year. Separate production of electricity by condensing plants decreased by 31 per cent. The volume of the production of condensing electricity fluctuates according to the demand for electricity and the availability of hydro power in the Nordic countries. Nine per cent less electricity was produced with combined heat and power production and four per cent less with hydro power. The amount of electricity produced with nuclear power remained quite constant at 22 TWh in Finland. Thirty-two per cent of the electricity produced in Finland was produced with nuclear power in 2011, which was two per cent more than in the year before. The amount of wind power, in turn, grew to 0.481 TWh due to new wind power plants. The growth from the previous year was 64 per cent but the share of wind power of all electricity production is just under one per cent.

The amount of electricity produced with fossil fuels diminished by one-quarter. Electricity produced with coal declined most, by 33 per cent. The share of electricity produced with fossil fuels fell to 27 per cent.

Electricity produced with peat accounted for seven per cent of electricity production. Thirty-three per cent of the electricity produced in Finland was produced with renewable energy sources. Around one-half of this was produced with hydro power and almost all of the remainder with wood. Wood, or wood-based fuels comprise wood fuels, so-called black liquor from the forest industry that originates from the processes of the pulp industry, and other wood-based fuels such as odour gases from of paper and forest industries. Seven per cent of electricity was produced with both black liquor and with other wood fuels, i.e. 14 per cent in all.

Electricity production by energy source 2000–2011

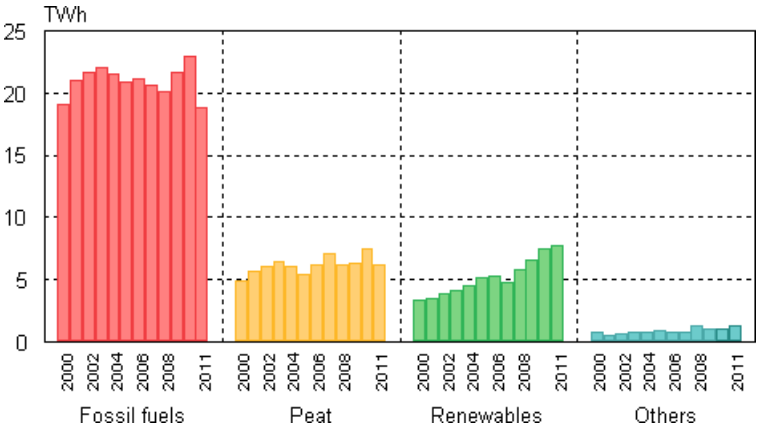


Mild autumn reduced demand for district heat

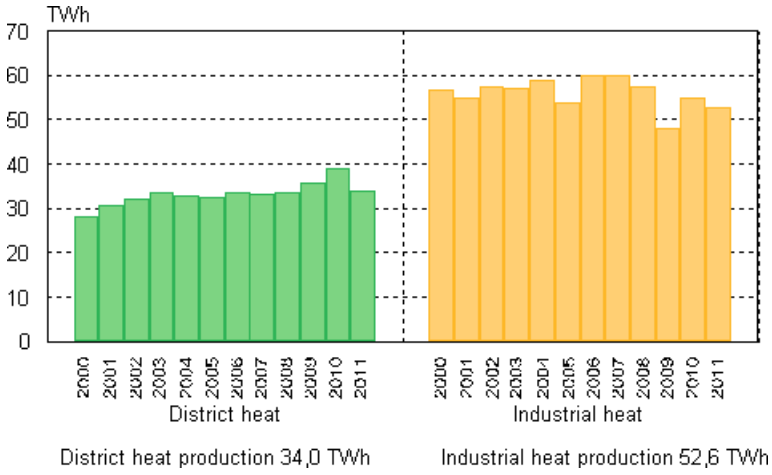
Production of district heat amounted to 34.0 TWh in 2011. Production decreased by 13 per cent from the previous year. As in the previous year, the need for space heating energy was high due to the cold early part of the year. In 2011, the consumption of district heat diminished from the previous year as, in deviation from the previous year, the autumn was exceptionally mild according to the Finnish Meteorological Institute. In 2010, the demand for district heat was record high, for the autumn was also cold.

Fifty-five per cent of district heat was produced with fossil fuels. One-half of this was produced with natural gas. District heat produced with peat accounted for 18 per cent of total production. The amounts of district heat produced with fossil fuels and peat diminished by more than average; by 18 per cent each. The share of district heat produced with renewable fuels rose to 23 per cent. The change from the year before was three per cent. Less district heat was produced especially with oil, natural gas and peat.

District heat production 2000-2011



Heat production 2000-2011

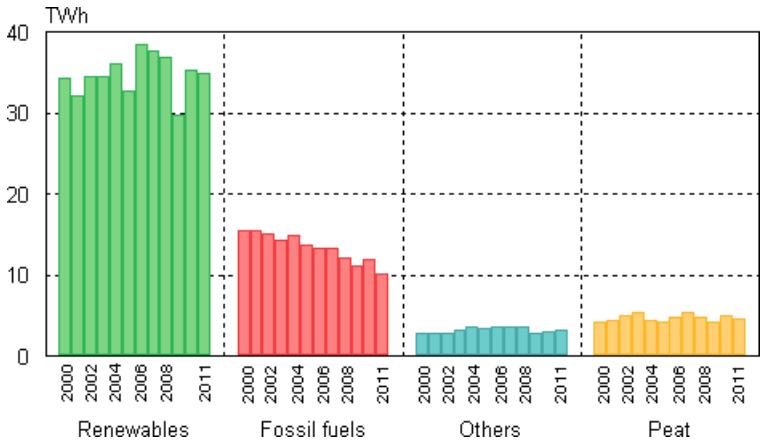


Industrial trends decreased demand for industrial heat

Production of industrial heat amounted to 56.2 TWh in 2011. Production decreased by four per cent from the previous year. As in the previous years, the use of industrial heat remained below normal although at the beginning of the year industrial trends indicated that the recovery of the year before would continue. Towards the end of the year, industrial growth slowed down and turned to decline in the forest industry where processes exploit heat intensively.

Over 60 per cent of the heat used by industry was produced with renewable fuels. The majority of renewable fuels was covered with black liquor from the forest industry - 45 per cent of the total in 2011 - and the rest with other wood fuels. Nineteen per cent of the heat was produced with fossil fuels. The main fossil fuel in the production of industrial heat was natural gas, which accounted for 11 per cent of the total. Nine per cent of the heat was produced with peat.

Industrial heat production 2000-2011



Black liquor from the forest industry became the main fuel while use of other fuels diminished

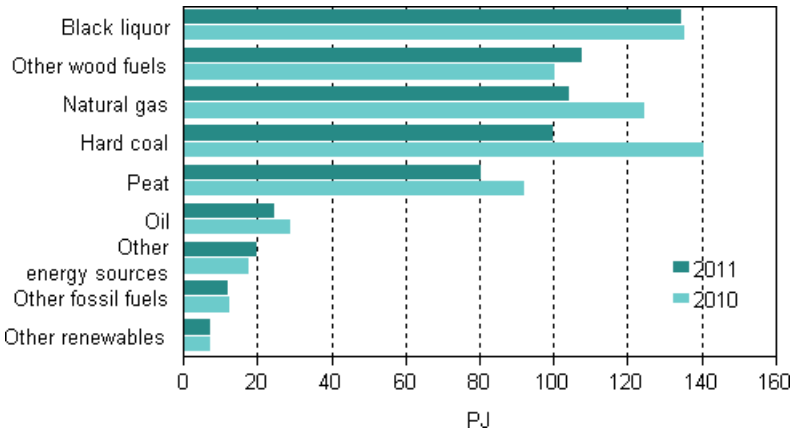
The use of fuels in the production of electricity and heat decreased by 10 per cent in 2011. Renewable fuels rose above fossil fuels in fuel use. Of the used fuels, 42 per cent were renewable fuels, 41 per cent fossil fuels and 14 per cent peat. The use of renewable fuels increased by only three per cent from the previous year but the use of fossil fuels decreased by 21 per cent and the use of peat by 12 per cent.

This examination of fuels excludes so-called non-fuel modes of energy production, i.e. hydro and wind power. Nuclear power is also not regarded as equal with fuels in this examination. According to the

international statistical convention, the efficiency ratio of nuclear power is assumes to be 33 per cent, i.e. three-fold amount compared to the produced electricity is counted as primary energy.

The use of black liquor from the forest industry remained almost unchanged although according to the Volume Index of Industrial Output the moving year-on-year change in the forest industry's output was -3.8 per cent. The use of coal and natural gas decreased, that of coal outright plummeted. The use of peat diminished as the production of peat decreased from the previous years. A summer season that is ideal for peat production includes long rainless periods. Although summer 2011 was sunny and warm, rains were plentiful and came at regular intervals. The decreased amount of peat was compensated with the use of wood fuels.

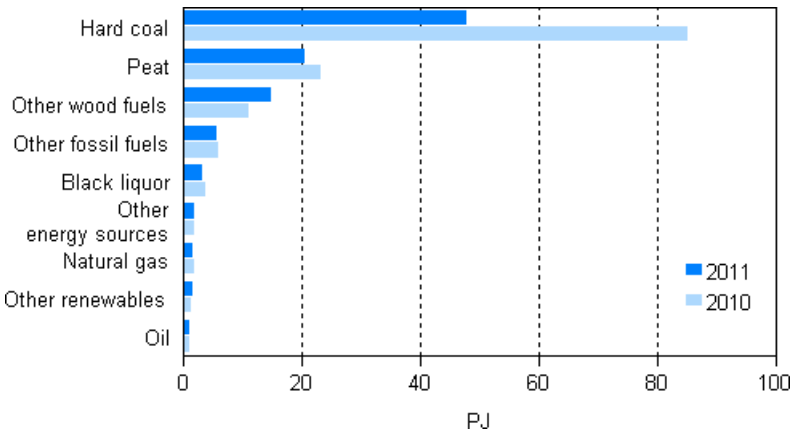
Use of fuels in electricity and heat production 2010-2011



The use of fuels in separate production of electricity means the use of fuels in the production of condensing power. Other separate production of electricity is regarded as being so-called non-fuel. The amount of produced condensing power decreased by nine per cent but the volume of fuel used for condensing power decreased by 27 per cent. The difference is explained by the efficiency ratio of production, i.e. the ratio between produced electricity and used amount of fuel. The efficiency ratio of condensing power typically varies from 35 to 40 per cent, while around 75 to 80 per cent of fuel energy can be utilised in combined heat and power production and some 80 to 90 per cent in separate heat and power production.

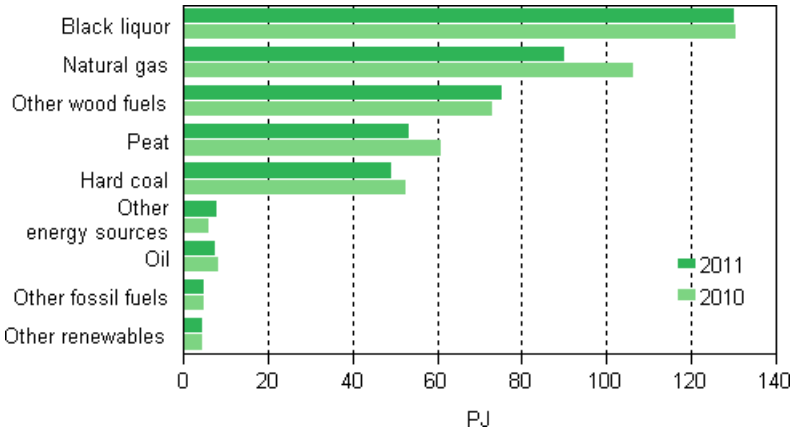
Sixty per cent of the fuels used in condensing power production were fossil fuels. The share of peat was good one-fifth. The use of coal, the most important fossil fuel, diminished by 44 per cent. The use of peat diminished. By contrast, the use of other wood fuels increased. As the use of fossil fuels and peat diminished the share of renewable fuels rose to 20 per cent.

Use of fuels in separate electricity production 2010-2011



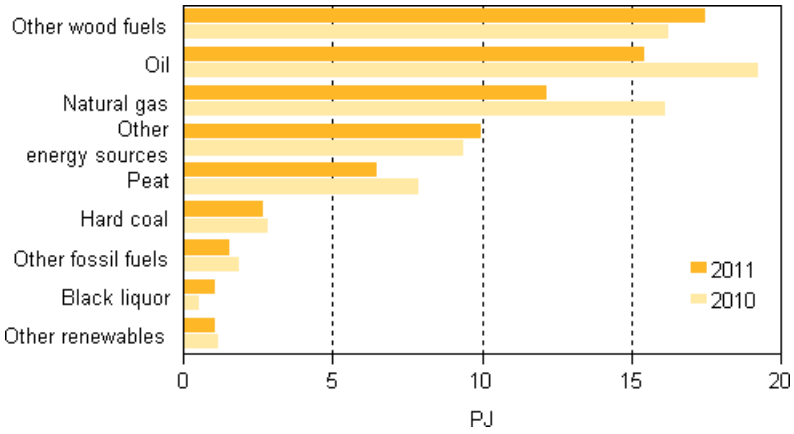
No major changes took place in the use of fuels in combined heat and power production. The main changes were reductions in the use of natural gas and peat. As the use of fossil fuels and peat diminished the share of renewable fuels rose to 50 per cent.

Use of fuels in combined heat and power production 2010-2011



The use of oil in separate heat production decreased by 20 per cent, making "other wood fuels" the largest fuel category. The use of fossil fuels decreased by 21 per cent and the use of peat by 18 per cent.

Use of fuels in separate heat production 2010-2011



Appendix tables

Appendix table 1. Electricity and heat production by production mode and fuel in 2011

Corrected on 18 October 2012. The corrections are indicated in red.

		Electricity, GWh	District heat, GWh	Industrial heat, GWh	Fuels used, GWh	Fuels used, TJ
Condensing power production[1)]	Oil	107	..	..	378	1 361
	Hard coal	5 187	..	..	13 331	47 992
	Natural gas	185	..	..	507	1 824
	Other fossil[2)3)]	437	..	..	1 659	5 974
	Peat	2 012	..	..	5 780	20 807
	Black liquor and other concentrated liquors	262	..	..	938	3 378
	Other wood fuels	1 352	..	..	4 225	15 209
	Other renewables[2)4)]	166	..	..	499	1 797
	Other energy sources[5)]	113	..	..	586	2 108
	Total	**9 822**	**..**	**..**	**27 903**	**100 450**
Combined heat and power production[6)]	Oil	274	164	1 248	2 229	8 025
	Hard coal	3 947	7 002	798	13 749	49 484
	Natural gas	9 017	7 095	5 024	25 137	90 493
	Other fossil[2)3)]	179	361	565	1 419	5 109
	Peat	3 041	5 214	3 909	14 924	53 726
	Black liquor and other concentrated liquors	4 806	179	23 603	36 244	130 477
	Other wood fuels	3 720	5 518	7 853	20 998	75 594
	Other renewables[2)4)]	251	310	501	1 382	4 976
	Other energy sources[5)]	307	202	1 301	2 244	8 078
	Total	**25 543**	**26 045**	**44 800**	**118 323**	**425 962**
Separate production of heat[7)]	Oil	..	1 442	1 241	4 318	15 544
	Hard coal	..	580	91	746	2 685
	Natural gas	..	1 994	1 023	3 391	12 206
	Other fossil[2)3)]	..	239	97	433	1 560
	Peat	..	940	592	1 796	6 465
	Black liquor and other concentrated liquors	..	16	238	318	1 144
	Other wood fuels	..	1 524	2 573	4 873	17 451
	Other renewables[2)4)]	..	152	95	301	1 085
	Other energy sources[5)]	..	1 097	1 884	2 816	10 138
	Total	**..**	**7 984**	**7 834**	**18 991**	**68 368**

Corrected on 18 October 2012. The corrections are indicated in red.						
		Electricity, GWh	**District heat, GWh**	**Industrial heat, GWh**	**Fuels used, GWh**	**Fuels used, TJ**
Total	Oil	380	1 606	2 489	6 925	24 930
	Hard coal	9 134	7 581	888	27 823	100 161
	Natural gas	9 202	9 090	6 046	29 034	104 523
	Other fossil[2)3)]	616	599	662	3 512	12 643
	Peat	5 054	6 154	4 501	22 499	80 997
	Black liquor and other concentrated liquors	5 067	195	23 840	37 500	134 999
	Other wood fuels	5 073	7 042	10 425	30 095	108 344
	Other renewables[2)4)]	418	462	596	2 183	7 858
	Other energy sources[5)]	421	1 300	3 185	5 646	20 325
	Total	**35 365**	**34 029**	**52 634**	**165 217**	**594 780**

1) Condensate parts produced in connection with combined heat and power production were calculated with condensing power.

2) Mixed fuels (such as recycled fuel) are divided into renewable and fossil fuels in ratio to the fossil and biodegradable coal contained in them.

3) Other fossil fuels include blast furnace gas and coke oven gas and coke, and plastics fuels and other waste fuels and the fossil part of mixed fuels.

4) Other renewable fuels comprise the bio part of mixed fuels and biogas.

5) Other energy sources include hydrogen, electricity, and reaction and secondary heat of industry.

6) Combined heat and power production includes pure combined production.

7) Reduction heat produced in connection with condensate production and combined heat and power production were calculated in separate production of heat.

Appendix table 2. Fuel use in electricity and heat production, TJ

Corrected on 18 October 2012. The corrections are indicated in red.												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Fossil fuels												
- Oil	33 739	38 215	37 931	38 062	36 047	33 182	31 207	31 978	28 240	29 506	29 266	24 930
- Hard coal	94 966	114 741	131 811	190 250	166 911	77 136	163 511	138 006	90 027	112 545	141 046	100 161
- Natural gas	117 387	129 063	127 718	143 158	138 375	124 230	131 457	118 038	122 324	111 565	125 156	104 523
- Other, fossil	12 112	12 470	12 559	13 639	13 627	13 630	12 899	13 708	13 478	12 071	13 052	12 643
- Total	258 203	294 489	310 018	385 108	354 959	248 117	339 073	301 731	254 069	265 687	308 521	242 257
Peat	61 143	84 551	89 914	99 277	87 999	67 617	91 232	100 277	79 713	70 380	92 553	80 997
Renewable fuels												
- Black liquor and other concentrated liquors	137 929	126 744	140 115	141 194	148 217	132 127	156 030	153 060	143 746	110 131	135 590	134 999
- Other wood fuels	76 203	76 049	80 052	82 086	89 390	85 835	93 722	82 858	92 981	84 535	100 708	108 344
- Other renewables	2 914	3 578	3 587	4 337	5 083	6 471	5 713	6 705	7 632	7 869	7 759	7 858
- Renewable fuels total	217 046	206 371	223 755	227 616	242 630	224 434	242 624	242 624	244 358	202 535	244 058	251 201
Other energy sources	15 339	14 749	15 573	19 264	20 511	19 906	20 949	20 848	23 466	17 484	18 095	20 325
Total	**551 730**	**600 160**	**639 259**	**731 265**	**706 160**	**560 134**	**706 719**	**665 479**	**601 606**	**556 086**	**663 227**	**594 780**

Appendix table 3. Production and total consumption of electricity, GWh

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nuclear power	21 575	21 854	21 395	21 830	21 814	22 356	22 004	22 501	22 050	22 601	21 889	22 266
Fossil fuels												
- Oil	540	610	836	910	570	454	439	431	619	482	442	380
- Hard coal	7 981	9 950	11 834	17 929	15 416	6 074	15 211	12 972	7 955	10 405	13 571	9 134
- Natural gas	9 856	11 182	11 274	13 435	12 370	10 896	11 941	10 250	10 719	9 543	10 977	9 202
- Other, fossil	723	717	715	728	698	780	758	801	753	587	670	616
- Fossil, total	19 100	22 459	24 668	33 002	29 054	18 204	28 349	24 454	20 046	21 017	25 660	19 333
Peat	3 689	5 797	6 142	6 831	6 120	4 208	6 207	6 918	4 868	4 123	5 854	5 054
Renewable fuels												
- Hydro power	14 453	13 018	10 623	9 455	14 865	13 428	11 313	13 991	16 909	12 573	12 743	12 278
- Wind power	77	70	63	92	120	168	153	188	261	277	294	481
- Black liquor and other concentrated liquors	5 127	4 765	5 140	5 255	5 778	5 060	5 901	5 711	5 312	4 287	5 333	5 067
- Other wood fuels	2 900	2 863	3 174	3 354	3 815	3 643	4 054	3 391	4 183	3 610	4 630	5 073
- Other renewables	123	167	160	203	245	291	248	318	343	360	413	418
- Renewable fuels total	22 679	20 882	19 160	18 359	24 823	22 591	21 669	23 599	27 009	21 106	23 414	23 318
Other energy sources	234	237	252	355	360	298	395	345	503	360	386	421
Total production	67 278	71 229	71 618	80 377	82 171	67 657	78 623	77 817	74 475	69 207	77 203	70 390
Net imports of electricity	11 880	9 959	11 925	4 852	4 870	17 014	11 401	12 557	12 772	12 085	10 501	13 851
Total	**79 158**	**81 188**	**83 543**	**85 229**	**87 041**	**84 671**	**90 024**	**90 374**	**87 247**	**81 292**	**87 703**	**84 241**

Appendix table 4. District heat production, GWh

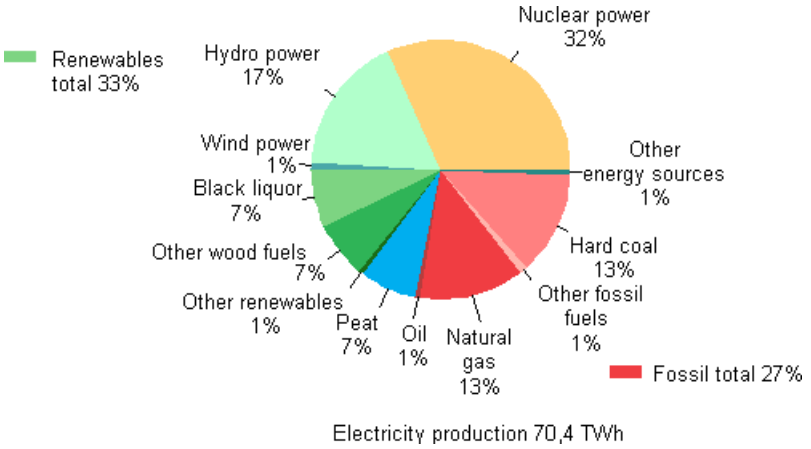
Corrected on 18 October 2012. The corrections are indicated in red.												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Fossil fuels												
- Oil	1 772	2 306	2 336	2 488	2 009	1 846	2 286	2 290	1 787	2 623	2 644	1 606
- Hard coal	7 307	8 212	8 503	9 051	8 233	7 710	8 882	8 262	7 188	8 048	7 997	7 581
- Natural gas	9 627	10 035	10 368	10 251	10 945	10 977	9 737	9 782	10 685	10 382	11 787	9 090
- Other, fossil	394	494	485	287	334	346	284	312	473	591	551	599
- Fossil, total	19 099	21 047	21 692	22 077	21 520	20 879	21 189	20 646	20 133	21 644	22 978	18 876
Peat	4 887	5 654	6 048	6 488	6 060	5 484	6 158	7 039	6 159	6 309	7 524	6 154
Renewable fuels												
- Black liquor and other concentrated liquors	380	406	291	296	298	276	388	218	239	226	251	195
- Other wood fuels	2 728	2 851	3 330	3 534	3 842	4 268	4 472	3 977	4 902	5 666	6 712	7 042
- Other renewables	211	231	230	280	365	598	440	526	672	676	532	462
- Renewable fuels total	3 319	3 488	3 851	4 109	4 505	5 142	5 300	4 721	5 813	6 568	7 494	7 700
Other energy sources	711	575	608	774	764	873	781	823	1 243	1 042	1 044	1 300
Total	**28 016**	**30 764**	**32 199**	**33 449**	**32 849**	**32 377**	**33 428**	**33 229**	**33 348**	**35 563**	**39 040**	**34 039**

Appendix table 5. Industrial heat production, GWh

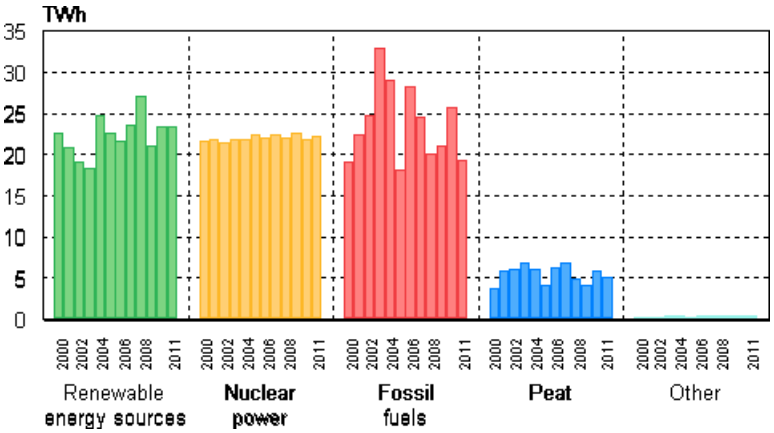
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Fossil fuels												
- Oil	4 787	4 656	4 665	4 247	4 396	4 196	3 755	3 754	3 256	2 993	3 142	2 489
- Hard coal	1 967	1 733	1 621	1 544	1 519	1 471	1 431	1 381	1 322	1 040	1 000	888
- Natural gas	7 961	8 362	7 838	7 574	8 062	7 354	7 616	7 509	6 908	6 440	6 932	6 046
- Other, fossil	690	748	875	806	840	727	533	632	590	690	736	662
- Fossil, total	15 405	15 499	14 999	14 172	14 816	13 749	13 335	13 277	12 075	11 172	11 811	10 086
Peat	4 182	4 414	5 011	5 270	4 411	4 067	4 741	5 254	4 809	4 228	4 943	4 501
Renewable fuels												
- Black liquor and other concentrated liquors	23 180	21 259	23 730	23 626	24 659	22 015	26 632	26 571	25 715	19 899	24 460	23 840
- Other wood fuels	10 781	10 502	10 479	10 389	11 027	10 152	11 216	10 616	10 600	9 228	10 180	10 425
- Other renewables	312	354	384	455	464	512	531	557	535	568	553	596
- Renewable fuels total	34 273	32 114	34 593	34 470	36 151	32 680	38 379	37 745	36 850	29 694	35 194	34 862
Other energy sources	2 757	2 741	2 765	3 245	3 489	3 352	3 615	3 593	3 632	2 721	2 896	3 185
Total	**56 617**	**54 768**	**57 368**	**57 158**	**58 867**	**53 847**	**60 069**	**59 868**	**57 366**	**47 816**	**54 844**	**52 634**

Appendix figures

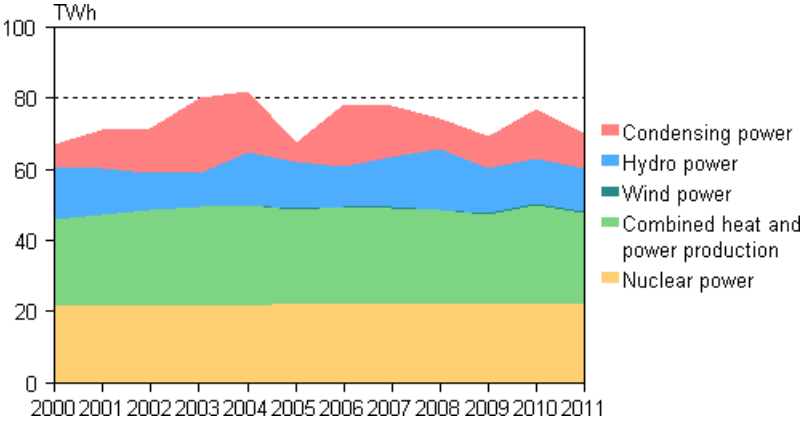
Appendix figure 1. Electricity generation by energy sources 2011



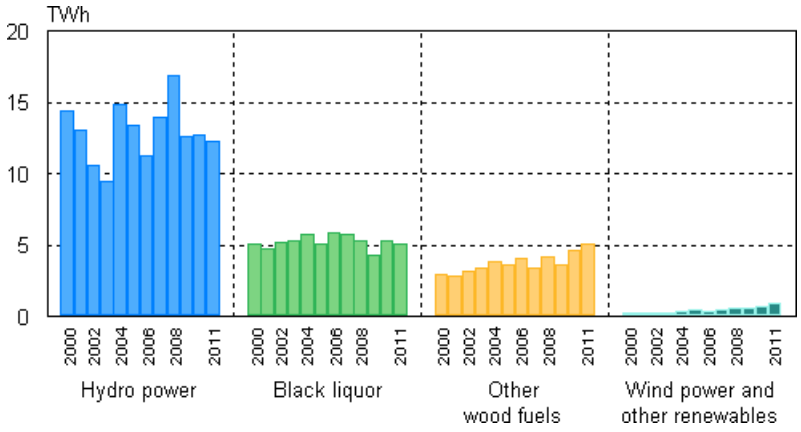
Appendix figure 2. Electricity generation by energy type 2000–2011



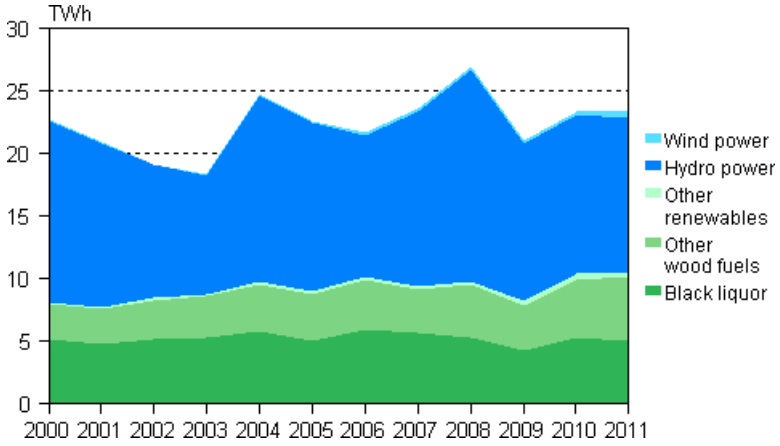
Appendix figure 3. Electricity generation by production mode 2000–2011



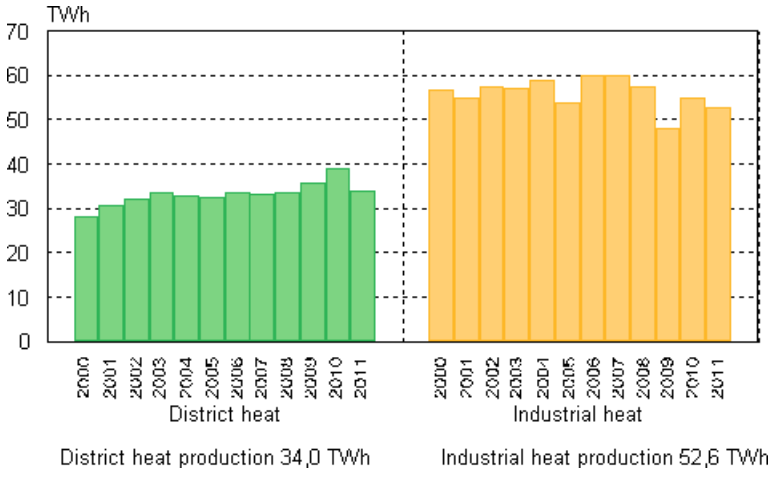
Appendix figure 4. Electricity generation with renewables 2000–2011



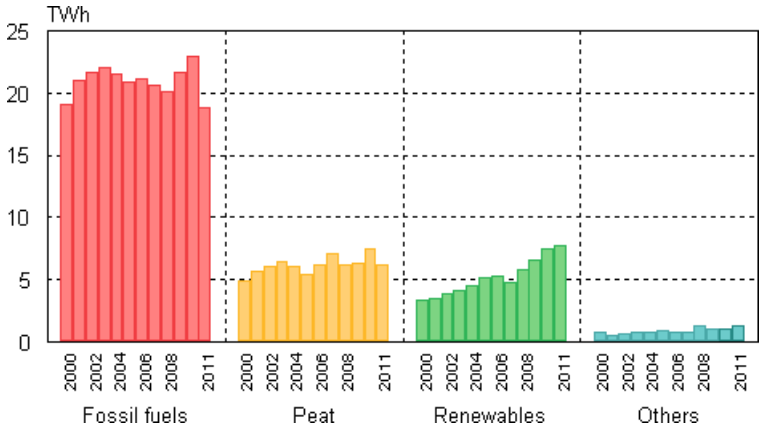
Appendix figure 5. Electricity generation with renewables 2000–2011



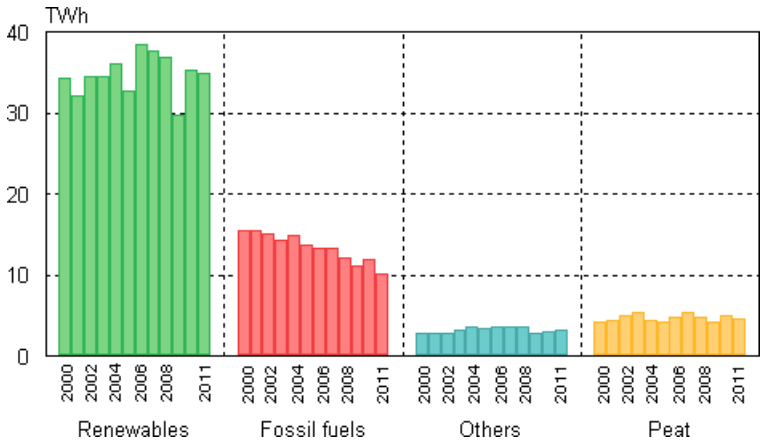
Appendix figure 6. Heat production 2000–2011



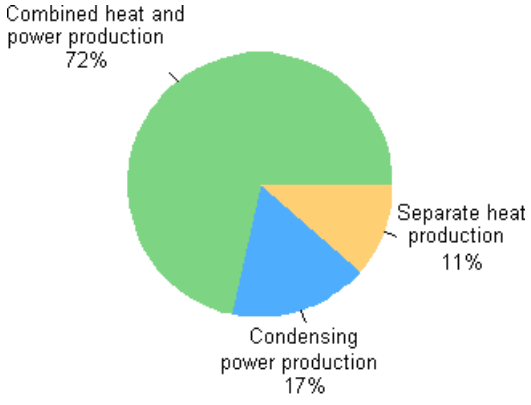
Appendix figure 7. District heat production by fuels 2000–2011



Appendix figure 8. Industrial heat production by fuels 2000–2011

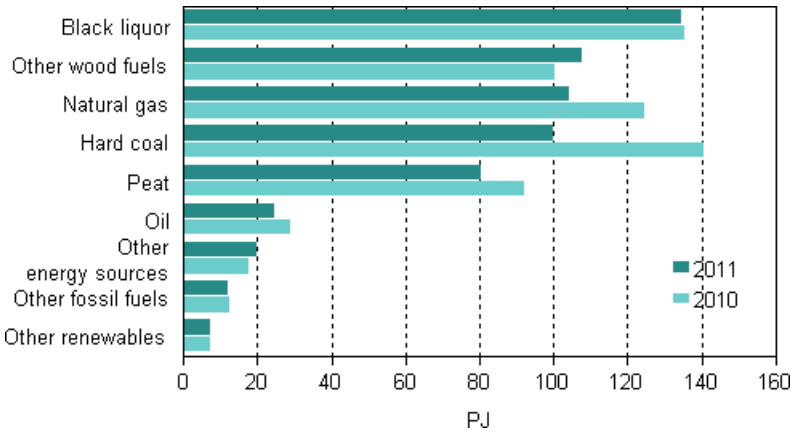


Appendix figure 9. Fuel use by production mode in electricity and heat production 2011

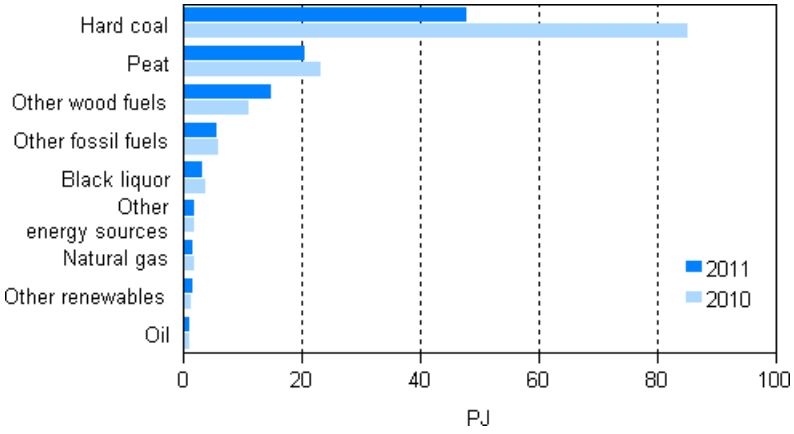


Total use of fuels 595 PJ or 165 TWh

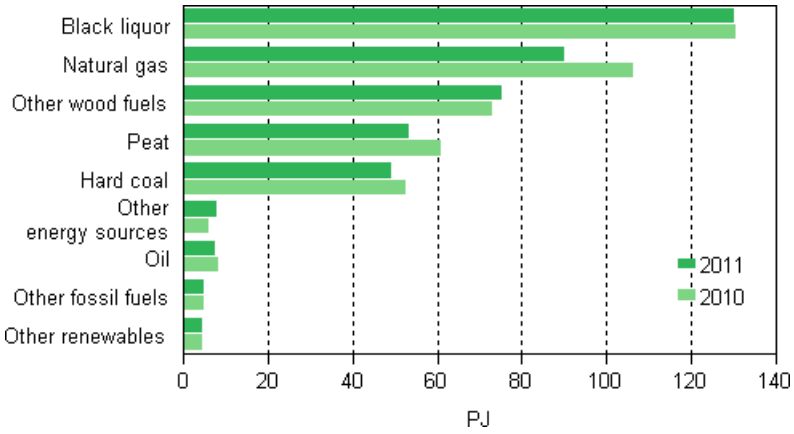
Appendix figure 10. Fuel use in electricity and heat production 2010–2011



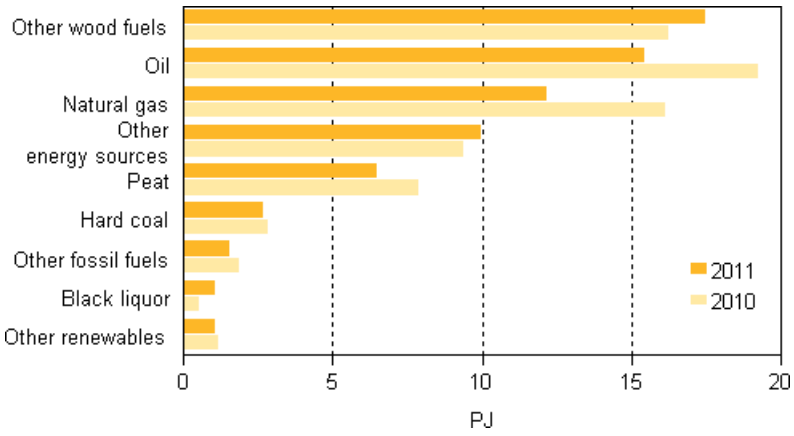
Appendix figure 11. Fuel use in separate electricity production 2010–2011



Appendix figure 12. Fuel use in combined heat and power production 2010–2011



Appendix figure 13. Fuel use in separate heat production 2010–2011



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Inquiries

Minna Niininen 09 1734 3549
Director in charge:
Leena Storgårds
energia@stat.fi
www.stat.fi

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