

Tilastokeskus
Tilastoarkisto

Energy

IN FINLAND

1998

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**Tilastokeskus
Tilastoarkisto**

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Helsinki 1999

Finland in Brief

Area

Situated in northern Europe with an area of 338,145 km² of which 68% forest, 10% water, 6% cultivated land

Population

5.2 million, with average density of 17 persons per square kilometre. More than two-thirds of the population reside in the southern third of the country.

Average Temperatures

Town	Degree of Latitude	January	July
Helsinki (south)	60°	-5.7°C	+17.0°C
Rovaniemi (north)	66°	-14.5°C	+14.7°C

Economy in 1998

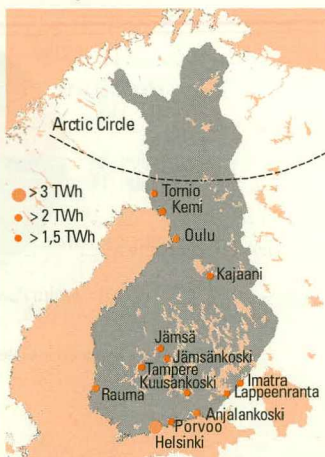
GDP totalled 686 FIM bil. (128.4 USD bil.), i.e. 131,212 FIM/capita (24,924 USD/capita), of which services 62.4%, secondary production 33.8%, and primary production 3.8%.

Structure of Industry in 1998,

Value Added Gross in Production

	FIM bil.	%
Total Industry	167.0	
Mining and Quarrying	1.6	1
Forest Industry	32.0	19
Chemical Industry	16.6	10
Metal Industry	16.1	10
Machinery and Equipment	17.4	10
Electrical Equipment	30.6	18
Other Manufacturing Ind.	38.9	23
Electricity, Gas and Water Industry	13.9	8

Municipalities with High Electricity Consumption 1998



Natural Resources

Productive forestland is the most valuable natural resource of Finland. The only natural fuels in the country are wood and peat. Finland also has some rich deposits of metallic ores from which copper, zinc, iron, and nickel are extracted.

Total Energy Consumption in 1998

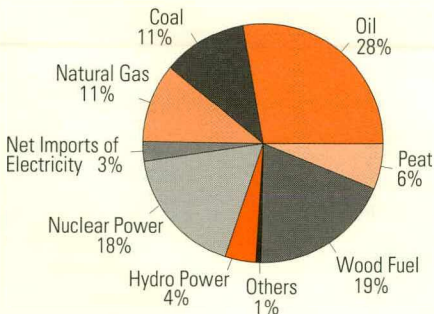
1,298 PJ (31 Mtoe)
251.6 GJ/capita (6.01 Mtoe/capita)
1,893 GJ/FIM mil. (42.20 toe/FIM mil.)

Electricity Consumption in 1998

76.6 TWh
14,852 kWh/capita

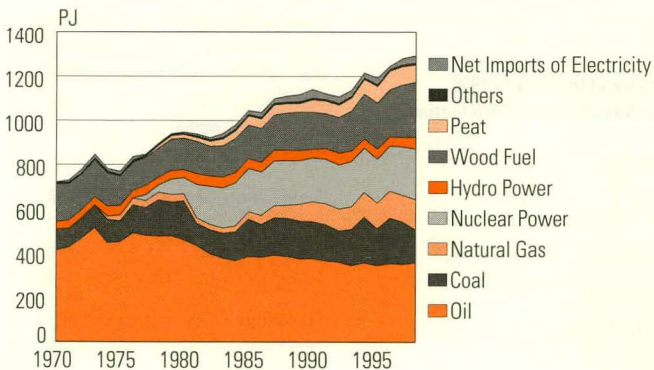
Total Energy Consumption

Total Energy Consumption by Energy Source 1998

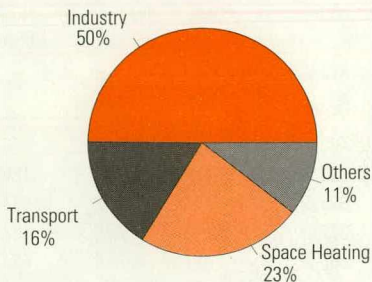


Total energy consumption in 1998 was 1 298 PJ.

Total Energy Consumption by Energy Source 1970–1998

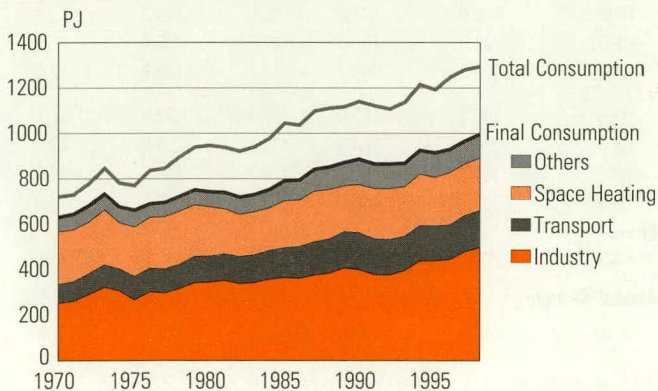


Final Energy Consumption by End-Sector 1998



Final energy consumption in 1998 was 1 016 PJ.

Total Energy Consumption and Final Energy Consumption by End-Use Sector 1970–1998



Total Energy Consumption

Total Energy Consumption by Energy Source, PJ

	Oil	Coal	Natural Gas	Nuclear Power	Hydro Power
1970	412,9	94,8	—	—	33,9
1975	451,0	94,8	26,5	—	43,5
1980	460,3	176,2	32,2	72,3	36,4
1981	433,9	100,0	25,6	150,9	48,7
1982	396,6	108,5	24,2	172,6	46,6
1983	377,2	112,7	23,5	182,4	48,4
1984	365,9	130,1	26,9	194,2	47,2
1985	385,3	167,8	34,1	196,1	44,0
1986	382,1	147,7	41,3	196,3	44,2
1987	391,6	168,5	54,6	202,2	49,2
1988	385,9	172,7	58,8	201,2	47,6
1989	375,0	170,1	77,0	196,5	46,4
1990	375,8	166,8	90,8	197,8	38,7
1991	365,6	164,0	95,7	200,8	47,0
1992	360,0	141,6	99,3	198,2	53,9
1993	344,3	163,8	102,6	205,1	48,0
1994	358,2	204,7	112,8	199,9	42,0
1995	345,2	166,6	117,2	197,8	46,1
1996	354,5	204,8	122,5	203,8	42,2
1997	351,5	190,8	120,3	218,7	42,5
1998	357,8	147,7	138,0	228,8	53,3

Share

1998	27,7 %	11,4 %	10,7 %	17,7 %	4,1 %
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Annual Change

98/97	1,8 %	−22,6 %	14,7 %	4,6 %	25,3 %
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Wind power is included in hydro power. Total wind power in 1998 was 0,083 PJ.

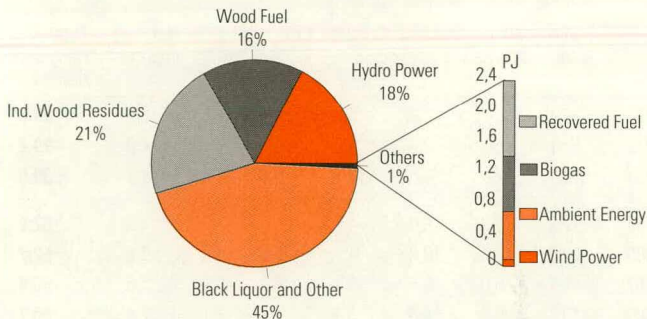
Total Energy Consumption

Wood Fuel	Peat	Others	Net Imports of Electricity	Total	
170,1	0,9	6,0	1,9	720,5	1970
130,7	1,7	7,2	14,4	769,8	1975
142,1	17,1	5,6	4,4	946,5	1980
145,1	18,8	6,9	8,1	938,0	1981
133,7	23,3	7,4	8,3	921,3	1982
141,3	30,4	7,4	17,2	940,5	1983
153,2	34,7	7,5	18,8	978,4	1984
151,3	41,1	7,7	17,0	1 044,5	1985
152,5	43,3	7,8	20,9	1 036,1	1986
158,4	45,4	7,6	20,1	1 097,7	1987
167,7	41,5	8,3	26,6	1 110,2	1988
172,0	39,5	8,5	31,9	1 117,0	1989
167,2	55,9	8,4	38,7	1 139,9	1990
158,6	56,4	7,4	25,9	1 121,3	1991
161,2	55,3	8,1	29,6	1 107,1	1992
180,5	58,4	7,1	27,1	1 137,0	1993
201,8	66,7	7,1	21,9	1 215,1	1994
207,5	74,3	7,4	30,3	1 192,3	1995
212,8	84,8	7,8	13,2	1 246,2	1996
237,3	83,3	8,8	27,6	1 280,7	1997
248,0	78,3	8,4	33,5	1 293,8	1998
					Share
19,2 %	6,1 %	0,6 %	2,6 %	100 %	1998
					Annual Change
4,5 %	-6,0 %	-4,2 %	21,6 %	1,0 %	98/97

Consumption of Renewable Energy Sources, PJ

	Hydro Power	Ind. Wood Residues and By- Products	Black Liquor and Others	Small Combustion of Wood	Others	Total	Peat	Total
1970	33,9	20,2	57,7	92,2	..	204,0	0,9	204,9
1975	43,5	14,8	48,3	67,6	..	174,3	1,7	176,0
1980	36,4	31,1	67,4	43,6	..	178,5	17,1	195,5
1981	48,7	33,1	68,2	43,7	..	193,7	18,8	212,5
1982	46,6	29,4	60,5	43,8	..	180,4	23,3	203,6
1983	48,4	30,7	66,6	44,0	..	189,7	30,4	220,1
1984	47,2	34,4	74,7	44,0	..	200,4	34,7	235,1
1985	44,0	31,6	75,5	44,1	..	195,2	41,1	236,4
1986	44,2	31,1	77,2	44,2	..	196,7	43,3	240,0
1987	49,2	32,4	81,6	44,4	..	207,6	45,4	253,0
1988	47,6	35,0	88,1	44,5	..	215,3	41,5	256,8
1989	46,4	36,3	91,1	44,6	..	218,5	39,5	257,9
1990	38,7	36,5	86,1	44,7	..	205,9	55,9	261,8
1991	47,0	32,9	80,9	44,8	..	205,7	56,4	262,0
1992	53,8	32,8	83,5	44,9	..	215,0	55,3	270,3
1993	48,0	<u>40,4</u>	95,1	45,0	..	228,5	58,4	286,9
1994	42,0	52,4	104,4	45,0	..	243,7	66,7	310,4
1995	46,0	53,9	109,0	44,7	<u>1,8</u>	255,4	74,3	329,7
1996	42,1	56,2	109,6	46,9	2,2	257,1	84,8	341,9
1997	42,5	61,6	128,5	47,1	2,3	282,0	83,3	365,3
1998	53,2	64,9	135,4	47,7	2,3	303,5	78,3	381,8

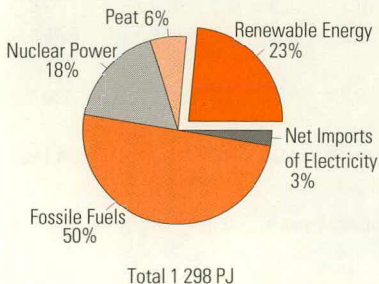
Consumption of Renewable Energy Sources 1998



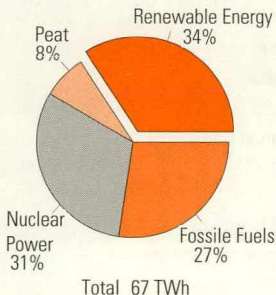
The total consumption of renewable energy sources in 1998 was 304 PJ which is 23 % of total energy consumption.

Share of Renewable Energy 1998

In Total Energy Consumption



In Electricity Generation



Supplies and Total Consumption of Electricity, TWh

	Hydro Power	Wind Power	Nuclear Power	Condens- ing Power ¹⁾	CHP Industry	CHP District Heat	Net Imports	Total Consump- tion
1970	9,4	—	—	5,9	4,9	1,0	0,5	21,8
1975	12,1	—	—	6,3	4,8	2,1	4,0	29,2
1980	10,1	—	6,6	11,1	6,6	4,2	1,2	39,9
1985	12,2	—	18,0	4,9	6,4	5,9	4,7	52,0
1986	12,3	0,0	18,0	4,1	6,3	6,2	5,8	52,7
1987	13,7	0,0	18,5	5,1	6,8	6,8	5,6	56,4
1988	13,2	0,0	18,4	5,4	7,1	7,1	7,4	58,7
1989	12,9	0,0	18,0	5,1	7,5	7,7	8,9	60,0
1990	10,8	0,0	18,1	6,6	7,7	8,5	10,7	62,3
1991	13,1	0,0	18,4	7,0	7,3	9,3	7,2	62,3
1992	15,0	0,0	18,2	4,6	7,7	9,5	8,2	63,2
1993	13,3	0,0	18,8	7,4	8,7	9,8	7,5	65,5
1994	11,7	0,0	18,3	12,0	9,5	10,7	6,1	68,3
1995	12,8	0,0	18,1	8,9	9,5	11,3	8,4	68,9
1996	11,7	0,0	18,7	13,8	9,7	12,5	3,7	70,0
1997	11,8	0,0	20,1	10,9	10,9	12,3	7,7	73,6
1998	14,8	0,0	21,0	6,3	12,0	13,2	9,3	76,6

Share

1998	19,3 %	0,0 %	27,4 %	8,2 %	15,6 %	17,3 %	12,1 %	100 %
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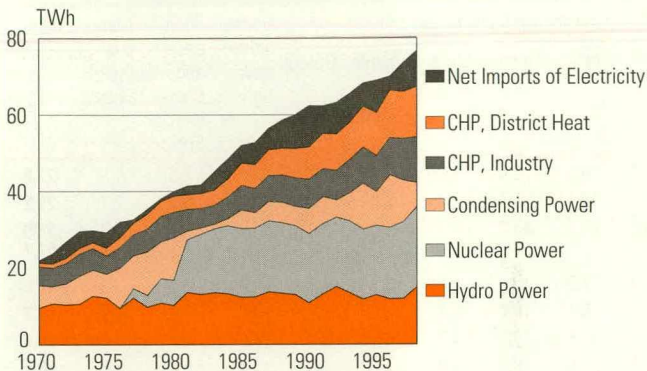
Annual Change

98/97	25,3 %	38,3 %	4,6 %	-41,9 %	9,5 %	8,0 %	21,6 %	4,1 %
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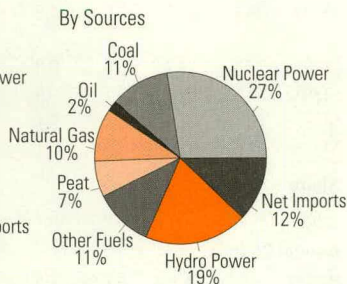
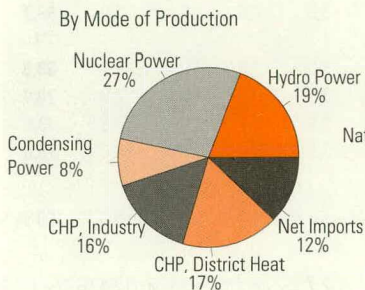
¹⁾ Condensing power includes conventional condensing power, peak gas turbine power and gas engines.

Source: Adato Energia Oy

Electricity Supplies 1970–1998



Electricity Supply 1998



Electricity supply in 1998 was 76,6 TWh

Electricity Consumption by End-Use Sector, TWh

	Industry and Construction					Households and Agriculture	Services and Commercial Sector	Transm. and Distrib. Losses	Total
	Total	Forest Industry	Metal Industry	Chemical Industry	Others				
1970	14,5	9,0	1,8	1,8	1,9	3,3	2,5	1,5	21,8
1975	17,1	9,4	2,8	2,3	2,6	6,0	3,9	2,1	29,2
1980	23,2	13,3	3,7	3,2	3,0	8,6	5,7	2,3	39,9
1985	27,8	15,7	4,6	3,7	3,8	12,8	8,4	3,1	52,0
1986	28,1	16,1	4,7	3,7	3,7	13,2	8,6	2,8	52,7
1987	29,6	17,0	4,7	4,0	3,9	14,5	9,4	3,0	56,4
1988	31,5	18,2	4,9	4,4	4,0	14,4	9,8	3,0	58,7
1989	32,4	18,8	4,9	4,5	4,2	14,5	10,2	2,9	60,0
1990	33,0	19,5	5,0	4,4	4,1	15,6	10,8	2,9	62,3
1991	31,9	19,0	5,0	4,2	3,7	16,5	11,2	2,7	62,3
1992	32,2	19,2	5,2	4,3	3,5	16,7	11,4	2,9	63,2
1993	34,2	20,8	5,4	4,5	3,5	17,2	11,5	2,7	65,5
1994	36,2	22,2	5,6	4,8	3,5	17,8	11,7	2,6	68,3
1995	37,0	22,7	5,8	5,0	3,5	17,0	11,9	3,0	68,9
1996	36,8	22,2	6,1	5,0	3,6	18,0	12,4	2,8	70,0
1997	40,1	24,8	6,4	5,1	3,8	18,2	12,6	2,6	73,6
1998	41,6	25,8	6,8	5,1	3,9	19,0	13,1	3,0	76,6

Share

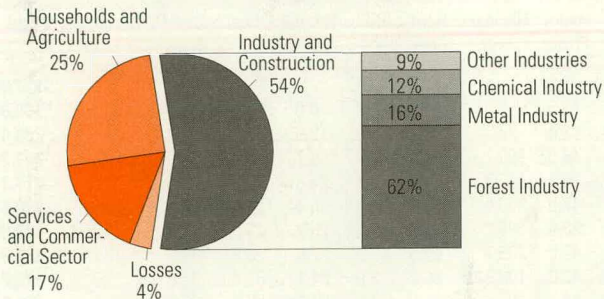
1998	54,3 %	33,7 %	8,8 %	6,7 %	5,1 %	24,7 %	17,1 %	3,9 %	100 %
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Annual Change

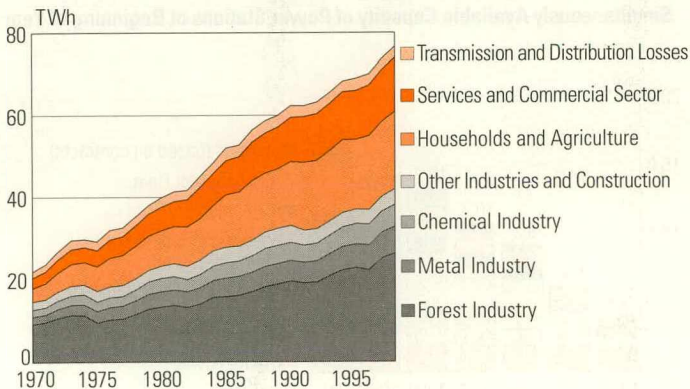
98/97	3,9 %	4,2 %	5,6 %	1,2 %	2,7 %	3,9 %	3,4 %	12,4 %	4,1 %
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Sources: Adato Energia Oy, Fortum Power and Heat Oy, Statistics Finland/Statistics on the Structure of Industry

Electricity Consumption by End-Use Sector 1998



Electricity Consumption by End-Use Sector 1970–1998



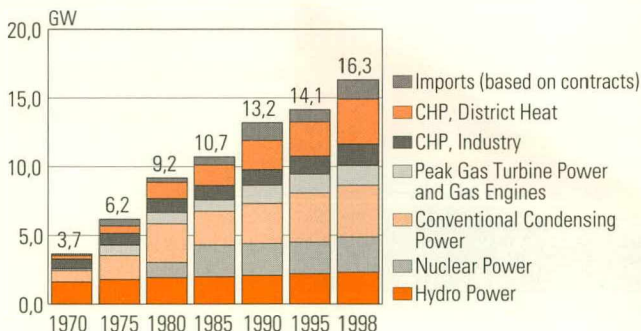
Energy Sources in Electricity Generation, PJ

	Hydro Power	Nuclear Power	Hard Coal	Oil	Natural Gas	Peat	Other Fuels	Net Imports of Electr.	Total
1970	33,9	—	41,8	32,1	—	..	17,9	1,9	127,6
1975	43,5	—	40,2	38,2	8,9	..	14,6	14,4	159,8
1980	36,4	72,3	102,7	26,8	12,6	..	29,2	4,4	284,4
1985	44,0	196,1	60,9	7,7	9,7	8,9	22,7	17,0	367,2
1990	38,7	197,8	61,3	9,7	24,8	17,2	29,1	38,7	417,3
1991	47,0	200,8	59,7	6,9	26,4	24,8	28,8	25,9	420,3
1992	53,8	198,2	43,9	7,3	25,2	21,8	28,1	29,6	408,0
1993	48,0	205,1	62,5	7,3	27,6	26,2	33,9	27,1	437,8
1994	42,0	199,9	96,2	8,9	34,1	32,4	36,6	21,9	472,2
1995	46,1	197,8	65,0	7,5	37,1	36,3	36,6	30,3	456,6
1996	42,2	203,8	106,1	8,7	40,4	40,8	38,1	13,2	493,2
1997	42,5	218,7	90,3	6,8	33,2	36,6	44,6	27,6	500,2
1998	53,3	228,8	57,8	8,8	36,0	33,1	47,3	33,5	498,6

Source: Adato Energia Oy

Capacity of Electricity Supply 1970–1998

Simultaneously Available Capacity of Power Stations at Beginning of Year

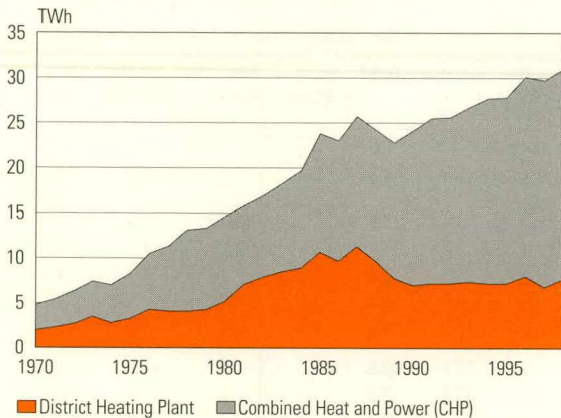


Production and Consumption of District Heat, TWh

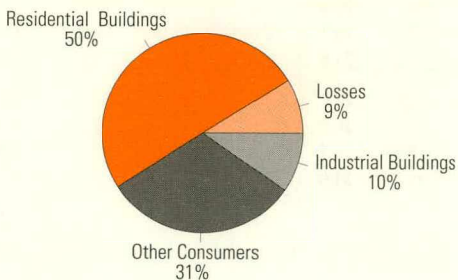
Net Production of District Heat				Network and Measuring Losses	Consumption of District Heat			
	District Heating Plants	Combined Heat and Power	Total		Residential Buildings	Industrial Buildings	Other Consumers	Total
1970	2,0	2,8	4,8	0,3	..	0,6	..	0,6
1975	3,3	5,0	8,2	0,6	4,7	0,9	2,0	7,7
1980	5,2	9,4	14,6	1,3	7,8	1,4	4,1	13,3
1981	7,1	8,7	15,7	1,5	8,5	1,4	4,4	14,3
1982	7,9	9,0	16,9	1,8	9,2	1,4	4,5	15,1
1983	8,5	9,7	18,2	2,0	9,6	1,5	5,1	16,2
1984	8,9	10,7	19,6	2,1	10,3	1,6	5,5	17,5
1985	10,7	13,1	23,8	2,2	12,6	2,1	7,0	21,7
1986	9,7	13,3	23,0	2,0	12,1	1,9	6,9	21,0
1987	11,3	14,4	25,7	2,1	13,5	2,2	7,8	23,6
1988	9,7	14,5	24,2	2,0	12,8	2,1	7,4	22,2
1989	7,8	15,0	22,8	2,0	11,9	1,9	7,0	20,9
1990	7,0	17,1	24,1	1,9	12,5	2,0	7,7	22,3
1991	7,2	18,3	25,5	2,0	13,0	2,1	8,4	23,5
1992	7,2	18,4	25,6	2,0	13,1	2,1	8,4	23,6
1993	7,4	19,3	26,7	2,0	13,9	2,3	8,5	24,6
1994	7,2	20,5	27,6	2,3	14,0	2,4	8,9	25,3
1995	7,2	20,6	27,8	2,4	14,3	2,7	8,4	25,4
1996	8,0	22,1	30,0	2,5	15,3	2,9	9,4	27,6
1997	6,8	22,9	29,7	2,6	15,1	2,9	9,1	27,1
1998	7,7	23,3	31,0	2,7	15,6	3,0	9,7	28,3

Sources: Finnish District Association and since 1995 also Association of Finnish Local and Regional Authorities

Production of District Heat 1970–1998

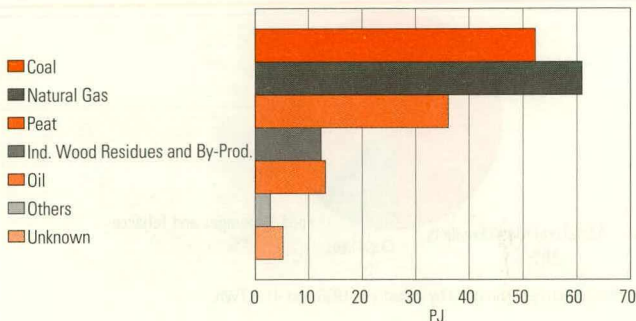


Consumption of District Heat 1998



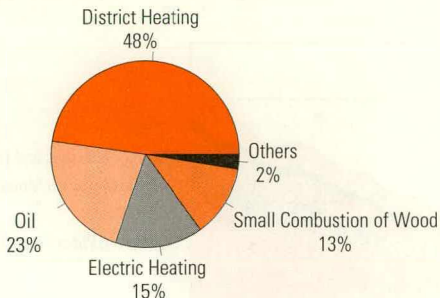
Total consumption of district heat in 1998 was 31,0 TWh.

Fuel Consumption in Production of District Heat and Combined Production of District Heat and Electricity 1998



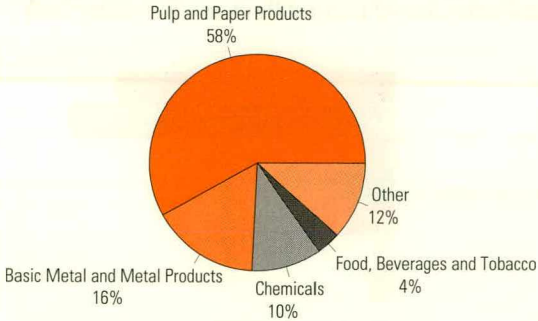
Total fuel consumption in production of district heat and combined production of district heat and electricity in 1998 was 183 PJ (51 TWh).

Heating Energy of Residential, Commercial and Public Buildings 1998



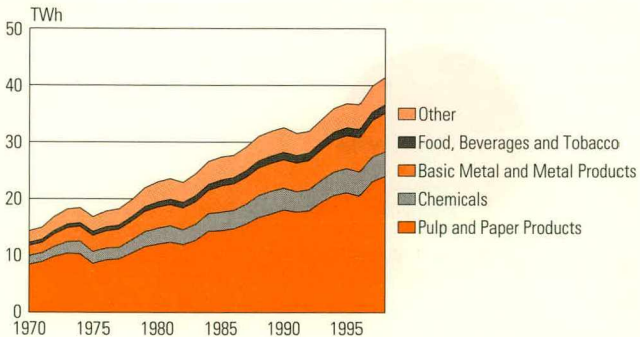
Total heating energy was 52,7 TWh. Heating energy for buildings was calculated by subtracting boiler losses from fuels according to their default efficiencies (see page 38).

Electricity Consumption by Branch of Industry 1998

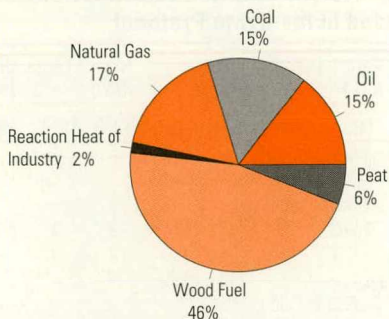


Total electricity consumption by industry in 1998 was 41,4 TWh.

Electricity Consumption by Branch of Industry 1970–1998

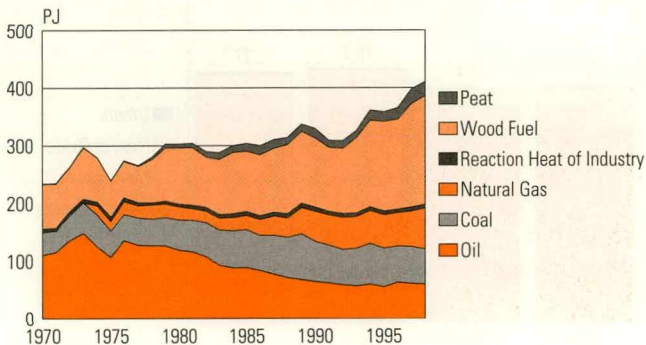


Fuel Consumption in Industry 1998



Total fuel consumption in industry 1998 was 410 PJ.

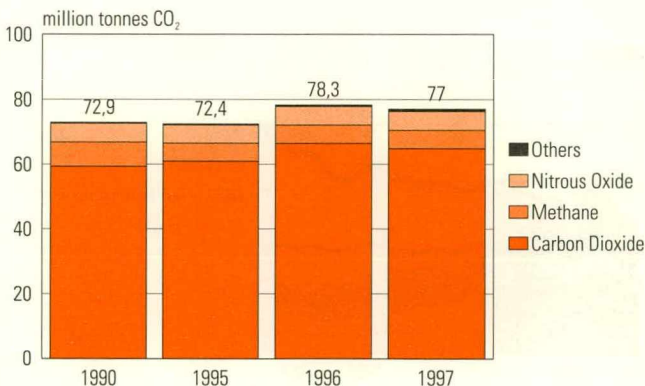
Fuel Consumption in Industry 1970–1998



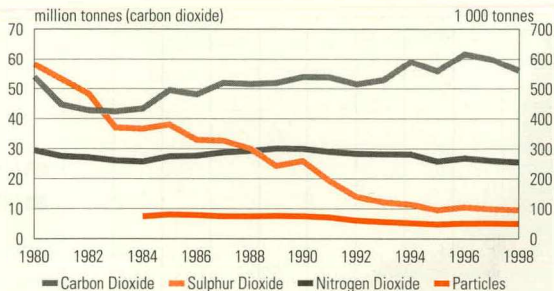
Greenhouse Gas Emissions 1990 and 1997 (1000 tonnes) The 6 Gases Included in the Kyoto Protocol

	Carbon Dioxide (CO ₂)		Methane (CH ₄)		Nitrous Oxide (N ₂ O)		Others (HFC, PFC, SF ₆)	
	1990	1997	1990	1997	1990	1997	1990	1997
Fuel Combustion	53 900	59 800	19	22	6	7	—	—
Fugitive Emissions from Fuels	3 500	3 500	1	1	—	—	—	—
Industrial Processes	1 200	900	4	4	3	3	0,2	0,4
Agriculture	+	+	94	83	10	9	—	—
Waste	—	—	240	160	—	—	—	—
Other	600	600	—	—	—	—	—	—
Total	59 300	64 800	358	270	19	19	0,2	0,4
Emissions, million ton CO ₂ equivalent	59,3	64,8	7,5	5,7	5,8	5,8	0,3	0,7
+ not estimated								

Greenhouse Gas Emissions 1990 and 1995–1997

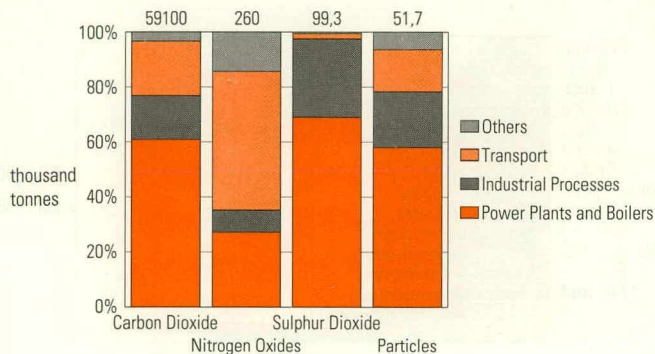


Emissions from Energy Production and Consumption 1980–1998



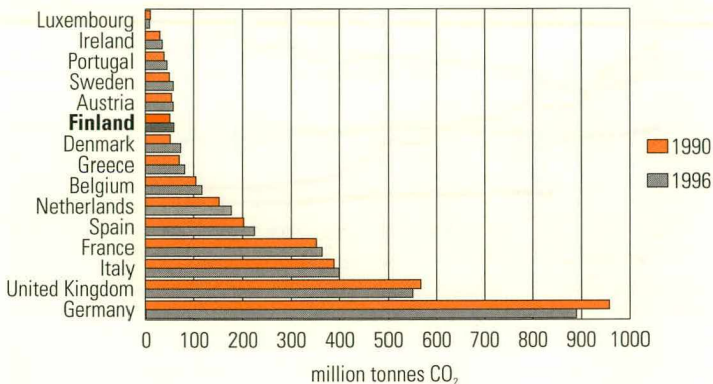
Sulphur dioxide and particles include also emissions from processes. The left-hand side scale is for carbon dioxide.

Air Emissions 1997

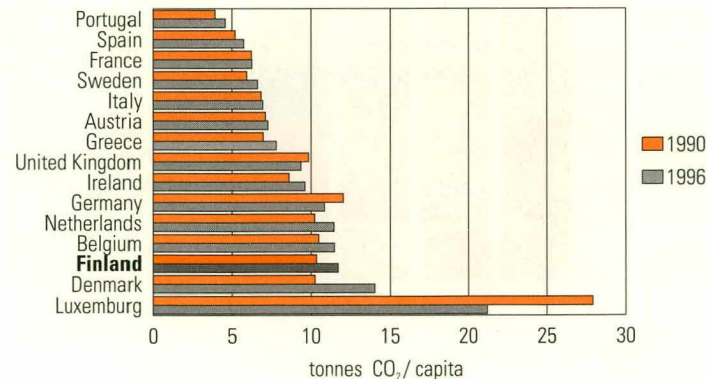


Sulphur dioxide and particles include also emissions from processes.

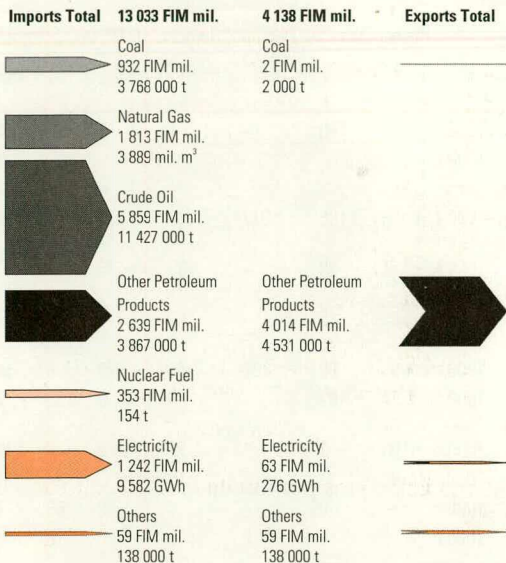
Carbon Dioxide Emissions in EU Countries 1990 and 1996



Carbon Dioxide Emissions per Capita in EU Countries 1990 and 1996



Imports and Exports of Energy 1998



Imports and Exports of Energy Technology 1998



Energy Imports 1998

		Russia	Norway	Denmark	Sweden	EU15	OECD	Total Imports	
								Amount	Value
								FIM mil.	
Hard Coal	1000 t	731	149	—	1	1 193	6	3 300	657
Coke	1000 t	..	—	—	..	..	..	468	275
Natural Gas	mill. m ³	3 889	—	—	—	—	—	3 889	1 813
Crude Oil	1000 t	4 466	3 185	2 317	—	3 116	6 412	11 427	5 859
Motor Gasoline	1000 t	4	38	—	35	36	74	78	80
Middle Distillates	1000 t	665	15	—	60	317	367	1 102	731
Heavy Fuel Oil	1000 t	385	30	182	346	528	558	952	433
LPG	1000 t	21	32	—	0	0	32	53	44
Other Petroleum Prod.	1000 t	1 193	1	1	92	226	396	1 682	1 351
Methanol	1000 t	100	34	—	0	0	34	134	82
MTBE	1000 t	—	0	—	4	68	68	68	111
Peat	1000 t	2	—	0	10	10	10	14	2
Nuclear Fuel Element	t	26	—	—	—	128	128	154	353
Electricity	GWh	4 818	72	—	4 692	4 692	4 764	9 582	..
Value	FIM mil.	6 130	1 953	1 322	924	3 664	6 269	13 033	

Source: Board of Customs/ Foreign Trade Statistics

In addition, energy technology imports totalled FIM 12,152 million in 1998.

Source: Etlatieto Oy

Energy Exports 1998

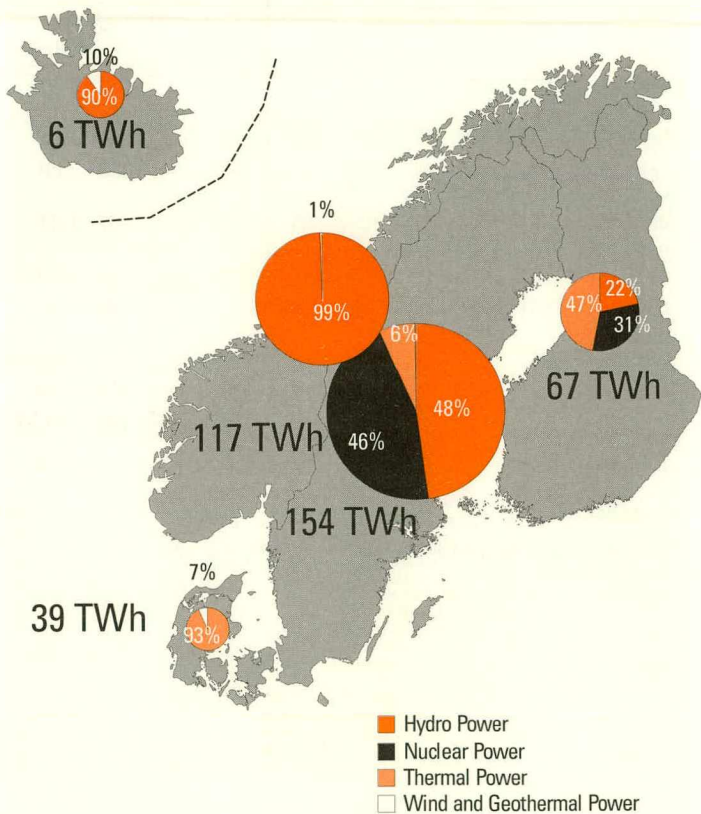
		Swe- den	Nether- lands	Estonia	United States	EU15	OECD	Total Exports	
								Amount	Value FIM mil.
Coke	1000 t	1	—	—	—	1	2	2	2
Motor Gasoline	1000 t	735	175	247	408	1 170	1 645	2 217	1 835
Je Fuel	1000 t	221	23	11	—	244	244	255	191
Middle Distillates	1000 t	848	329	152	45	1 255	1 504	1 722	1 328
Heavy Fuel Oil	1000 t	0	—	0	—	0	0	0	0
LPG	1000 t	15	—	0	—	24	36	36	27
Other Petro- leum Prod.	1000 t	67	63	6	0	216	254	301	633
Peat	1000 t	65	25	0	0	123	133	138	59
Electricity	GWh	184	—	—	—	184	276	276	..
Value	FIM mil.	1 729	464	357	324	2 626	3 216	4 138	

Source: Board of Customs/ Foreign Trade Statistics

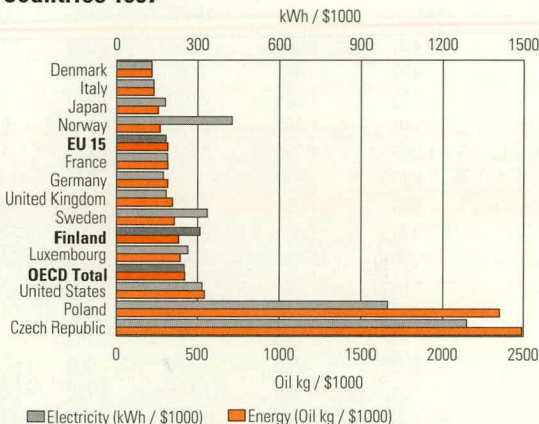
In addition, energy technology exports totalled FIM 16,250 million in 1998.

Source: Etlatieto Oy

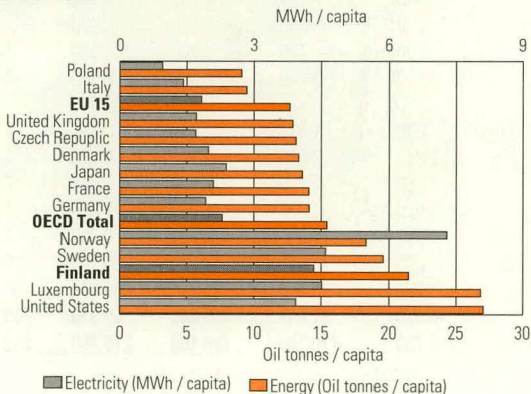
Electricity Generation in Nordic Countries, 1998



Consumption of Energy and Electricity per GDP-Unit in Some OECD Countries 1997



Consumption of Energy and Electricity per Capita in Some OECD Countries 1997



Total Consumption of Energy in OECD Countries, PJ

	1973	1980	1990	1996	1997
Australia	2 410	2 950	3 650	4 230	4 260
Austria	910	980	1 080	1 140	1 160
Belgium	1 940	1 930	2 030	2 360	2 390
Canada	6 740	8 080	8 780	9 840	9 960
Czech Republic	1 900	1 960	1 880	1 720	1 700
Denmark	830	830	770	960	880
Finland	890	1 060	1 210	1 340	1 380
France	7 390	7 960	9 530	10 650	10 360
Germany	14 150	15 090	14 890	14 710	14 540
Greece	910	980	1 080	1 140	1 160
Hungary	890	1 210	1 190	1 080	1 060
Iceland	50	60	90	100	100
Ireland	300	360	440	500	520
Italy	5 380	5 800	6 420	6 740	6 840
Japan	13 550	14 510	18 370	21 370	21 560
Luxembourg	190	150	150	140	140
Mexico	2 310	4 140	5 200	5 730	5 930
Netherlands	2 610	2 720	2 790	3 180	3 140
New Zealand	350	390	590	690	700
Norway	630	790	900	990	1 010
Poland	3 950	5 230	4 190	4 540	4 400
Portugal	300	430	690	800	850
Republic of Korea	880	1 830	3 830	6 860	7 380
Spain	2 220	2 870	3 790	4 280	4 490
Sweden	1 650	1 720	2 000	2 210	2 170
Switzerland	830	870	1 050	1 070	1 100
Turkey	1 020	1 310	2 200	2 830	2 980
United Kingdom	9 240	8 430	8 920	9 760	9 550
United States	72 700	75 850	80 620	89 600	90 530
EU 15	48 530	51 000	55 620	59 810	59 500
OECD Total	156 730	170 180	188 160	210 450	212 170

Source: Energy Balances of OECD Countries 1996–1997, IEA/OECD

Electricity Consumption in OECD Countries, TWh

	1973	1980	1990	1996	1997
Australia	52,5	82,1	134,3	155,2	160,4
Austria	25,9	33,7	44,0	49,0	49,8
Belgium	35,8	44,9	59,1	71,4	73,3
Canada	223,2	307,5	431,0	491,2	496,5
Czech Republic	34,1	43,1	53,0	54,1	53,2
Denmark	16,1	22,0	29,5	32,6	32,5
Finland	27,2	37,6	59,5	67,2	71,2
France	160,0	231,7	323,3	384,2	381,6
Germany	337,6	419,2	481,0	479,7	482,9
Greece	25,9	33,7	44,0	49,0	49,8
Hungary	18,6	26,9	33,0	29,8	29,8
Iceland	2,1	2,9	3,9	4,4	4,9
Ireland	6,2	8,7	12,0	15,9	16,8
Italy	125,8	163,6	218,8	246,0	253,7
Japan	421,7	520,2	765,1	901,7	923,9
Luxembourg	3,0	3,6	4,1	4,9	5,1
Mexico	31,6	57,2	100,2	131,3	142,8
Netherlands	46,1	58,9	75,5	88,8	92,0
New Zealand	15,9	19,5	27,8	31,1	31,6
Norway	61,0	75,1	97,4	104,0	104,3
Poland	69,0	99,7	112,5	107,3	108,8
Portugal	8,3	14,6	24,0	30,7	32,4
Republic of Korea	12,8	32,7	94,4	202,6	222,9
Spain	60,7	92,0	129,2	151,5	157,3
Sweden	69,4	86,1	130,7	128,3	127,4
Switzerland	29,0	35,3	47,0	48,9	48,8
Turkey	10,4	20,4	46,8	74,2	81,9
United Kingdom	242,5	243,3	284,4	314,3	317,5
United States	1 715,9	2 099,8	2 712,6	3 221,3	3 259,3
EU 15	1 177,7	1 480,2	1 904,6	2 101,7	2 131,8
OECD Total	3 875,6	4 902,6	6 563,7	7 658,9	7 800,9

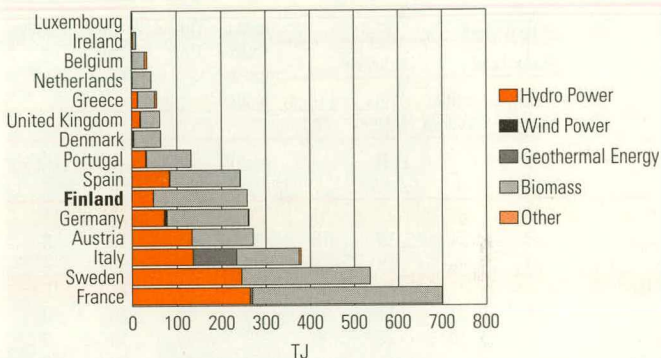
Sources: Electricity Information 1992, 1994, 1996, 1997 and Energy Statistics of OECD Countries 1996–1997, IEA/OECD

Renewable Energy Sources in EU Countries 1996, TJ Production

	Hydro Power	Wind Power	Solar Energy	Geo- thermal Energy	Biomass	Other	Total
Austria	133 430	0	0	0	137 960	0	271 400
Belgium	1 220	30	40	60	26 610	5 340	33 300
Denmark	110	4 230	210	50	58 430	0	63 020
Finland	46 490	40	0	0	211 770	0	258 300
France	264 400	0	610	5 520	428 810	0	699 340
Germany	71 090	6 160	1 690	360	182 860	0	262 160
Greece	12 700	120	4 430	110	36 750	0	54 120
Ireland	2 570	60	0	0	6 750	0	9 380
Italy	136 020	40	300	97 260	141 150	4 190	378 950
Luxembourg	300	0	0	0	1 650	0	1 950
Netherlands	320	1 150	160	0	40 610	0	42 240
Portugal	30 030	60	630	1 570	99 610	0	131 900
Spain	83 200	970	1 030	270	157 480	0	242 960
Sweden	245 170	360	200	0	289 280	0	535 010
United Kingdom	17 420	1 410	240	30	41 780	0	60 880
EU 15	1 044 460	14 620	9 540	105 240	1 861 510	9 530	3 044 910

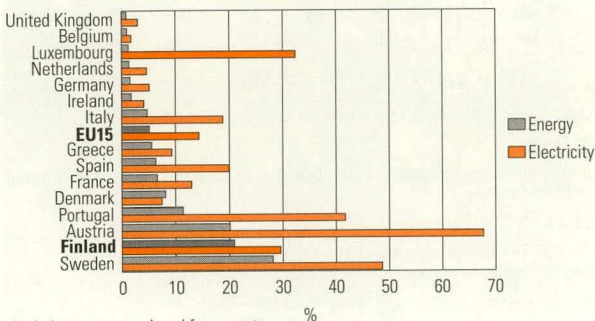
Source: Energy in Europe 1998 – Annual Energy Review, EU Commission (CD-ROM)

Production of Renewable Energy in EU Countries 1996



Renewable Energy in EU Countries 1997

Share in Primary Energy Supply and Electricity Generation



Includes energy produced from waste.

Source: Energy Balances of OECD Countries 1996-1997, IEA/OECD

Consumer Prices of Fuel in Some European Countries in December 1998

	Natural Gas ¹⁾				Motor Gasoline un- leaded	Diesel Oil ²⁾	Light Fuel Oil	Heavy Fuel Oil ³⁾
	Household	Industry						
	4652 kWh/a	34890 kWh/a	11,63 GWh/a	116,30 GWh/a				
	EUR /MWh		EUR /MWh		cent/l ⁴⁾	cent/l	cent/l	cent/kg
Austria	40	38	23	21	76	60	26	11
Belgium	55	31	19	15	83	57	15	8
Denmark	121	88	18	15	80	59	55	38
Finland	..	..	18	16	87	63	23	15
France	50	31	17	14	89	62	28	9
Germany	49	30	22	18	79	56	19	9
Greece	..	..	..	..	59	44	20	13
Ireland	62	29	12	..	73	68	22	13
Italy	43	61	18	16	88	69	68	11
Luxembourg	41	22	19	18	61	49	16	9
Netherlands	40	30	18	14	92	62	31	14
Norway	..	..	..	..	94	82	38	..
Portugal	56	56	22	..	81	56	..	14
Spain	49	37	15	15	63	50	24	13
Sweden	56	45	26	..	83	64	41	29
United Kingdom	33	24	15	13	91	93	16	10

¹⁾ Price on 1st January

²⁾ The considerable fluctuations in diesel oil prices depend on different taxation systems for heavy traffic in different countries.

³⁾ The price of heavy fuel oil does not include value added tax or sales tax if any.

⁴⁾ 1 cent = 0,01 EUR. The fixed exchange rate 1 EUR = 5,945730 FIM has been used when converting prices from marks to euros.

Sources: Finnish Oil and Gas Federation and Energy Prices 1980–1998, Eurostat

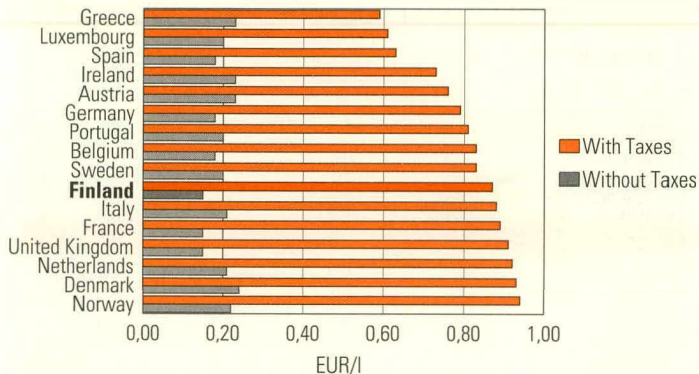
Consumer Prices of Electricity in Some European Countries 1999, cent/kWh

Annual Consumption Power	Household	Industry		
	3500 kWh	1,25 GWh	10 GWh	24 GWh
		0,5 MW	2,5 MW	4 MW
Austria	12,6	12,3	9,6	8,1
Belgium	14,5	10,6	8,2	6,7
Canada	..	..	..	..
Denmark	18,4	8,9	8,7	8,4
Finland	8,9	5,9	5,2	3,9
France	12,2	8,0	6,8	5,9
Germany	13,1	10,1	8,3	6,9
Greece	6,7	6,8	6,3	5,3
Iceland	..	..	..	..
Ireland	9,0	9,1	7,0	6,0
Italy	21,1	11,7	9,2	7,4
Japan	..	..	..	..
Luxembourg	11,4	9,2	6,1	5,0
Netherlands	12,8	9,0	7,1	6,1
Norway	61,2	29,3	21,6	17,4
Portugal	12,7	7,7	6,8	5,5
Spain	11,3	8,6	7,1	6,4
Sweden	9,6	5,5	4,0	3,5
Switzerland	..	..	..	..
United Kingdom	9,7	7,8	..	..

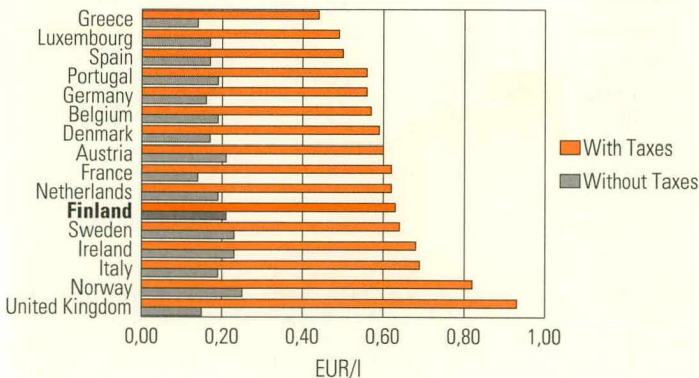
1 cent = 0,01 EUR

Sources: Electricity prices for EU industry on 1 January 1999: downward trend, Eurostat and Electricity prices for EU households on 1 January 1999: slight downward trend, Eurostat

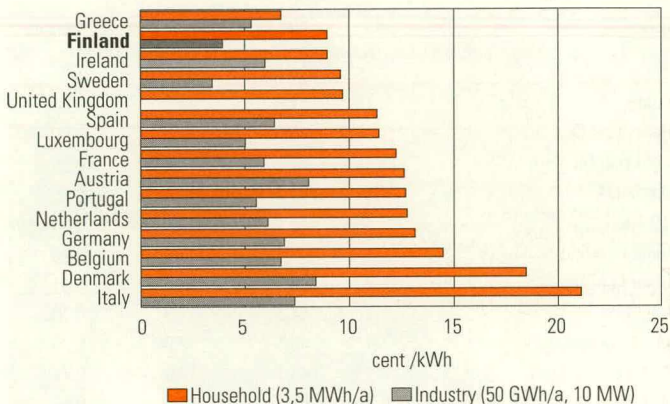
Consumer Prices of Unleaded Petrol in Some European Countries in December 1998



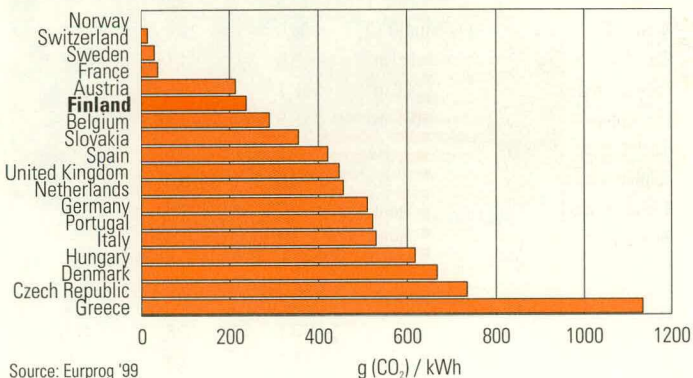
Consumer Prices of Diesel Oil in Some European Countries in December 1998



Consumer Prices for Electricity in Some Countries 1999



Carbon Dioxide Intensity in Power Generation in Some European Countries 1997



Source: Eurprog '99

Net Heat Contents and Densities of Fuels

Fuels	Unit	Net Heat Content		Density
		GJ	MWh	t/m ³
Crude Oil	t	41,8	11,6	0,86
Heavy Fuel Oil	t	40,6	11,3	0,99
Light Fuel Oil	t	42,3	11,7	0,85
Diesel Oil	t	42,5	11,8	0,85
Jet Fuel	t	43,1	12,0	0,80
Lamp Kerosine	t	43,1	12,0	0,80
Other Kerosines	t	43,1	12,0	0,81
Naphtha	t	44,3	12,3	0,70
Motor Gasolines	t	43,1	12,0	0,75
Aviation Gasolines	t	43,1	12,0	0,71
LPG	t	45,6	12,7	0,51
Refinery Gases	t	51,9	14,4	
Hard Coal	t	25,5	7,1	
Coke	t	29,3	8,1	
Anthracite	t	33,5	9,3	
Natural Gas	1 000 m ³ (0°C)	36,0	10,0	
Blast Furnace Gas	1 000 m ³	3,8	1,1	
Coke Oven Gas	1 000 m ³	16,7	4,6	
Town Gas	1 000 m ³	15,5	4,3	
Black Liquor	tka	11,7	3,3	
Sulphite Liquors	tka	12,0	3,3	
Birch Firewood	p-m ³	5,4	1,5	
Pine and Spruce	p-m ³	4,4	1,2	
Mixed Firewood	p-m ³	4,5	1,3	
Chips	i- m ³	3,3	0,9	
Milled Peat	t	10,1	2,8	0,32
Sod Peat	t	12,3	3,4	0,38

Conversion Factors between Energy Units

	toe	MWh	GJ	Gcal
toe	1	11,63	41,868	10
MWh	0,086	1	3,6	0,86
GJ	0,02388	0,2778	1	0,2388
Gcal	0,1	1,163	4,1868	1

Example: 1 toe = 11,63 MWh

Prefix

k = kilo	$= 10^3$	= 1 000
M = mega	$= 10^6$	= 1 000 000
G = giga	$= 10^9$	= 1 000 000 000
T = tera	$= 10^{12}$	= 1 000 000 000 000
P = peta	$= 10^{15}$	= 1 000 000 000 000 000

Carbon Dioxide Factors for Some Fuels

	g (CO ₂) / MJ
Motor Gasoline	72,5
Diesel Fuel	73,5
Light Fuel Oil	74,1
Residual Fuel Oil	77,4
Jet Fuel	71,5
LPG	63,1
Other Fuels	60–77,4
Hard Coal	94,6
Coke	108
Natural Gas	56,1
Peat	106
Bark, Wood Fuel	109,6
Industrial Waste Wood	109,6
Black Liquor	110

Note

Hydro power, wind power and imported electricity have been made commensurate with fuels according to directly obtained electricity (at the efficiency ratio of 100 per cent) and nuclear power at the efficiency ratio of 33 per cent.

Calculation Method for Heating Energy

Net efficiency heating energy for buildings was calculated by subtracting boiler losses from fuels according to the following default efficiencies:

Small Combustion of Wood	55 %
Peat	60 %
Coal	60 %
Heavy Fuel Oil	83 %
Light Fuel Oil	78 %
Natural Gas	90 %
District Heating	100 %
Electric Heating	100 %

Source: Technical Research Centre of Finland (VTT) and Tampere University of Technology

Conventions

- .. Data not available
- Magnitude zero
- 0 Magnitude less than half of unit employed
- * Preliminary
- — — Break in the time series

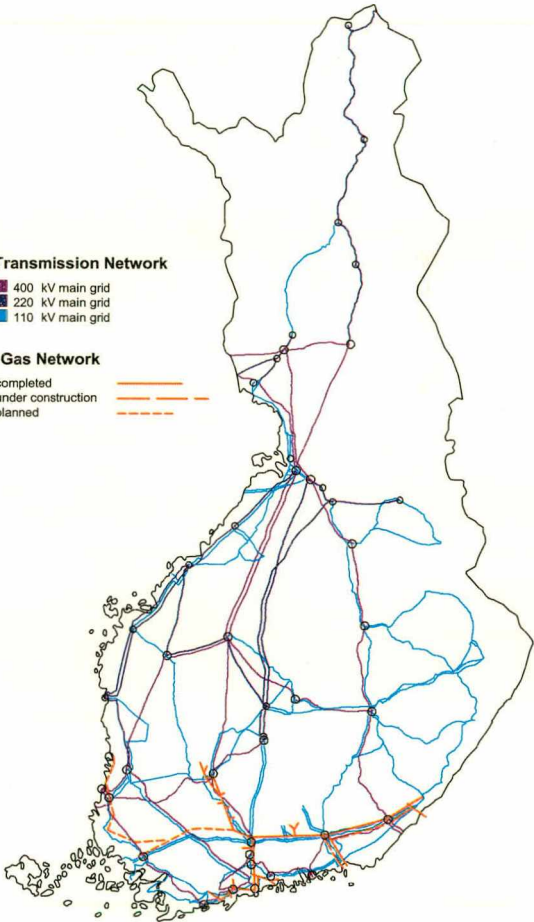
Power Transmission and Natural Gas Networks 1999

Power Transmission Network

- 400 kV main grid
- 220 kV main grid
- 110 kV main grid

Natural Gas Network

- completed
- under construction
- planned



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