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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

4 November 1983

MEMORANDUM FOR: Mr. Stephen Griffith
Office of Technical Cooperation
International Affairs
Department of Energy

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FROM :
Chief, German Nordic Branch
European Analysis

SUBJECT : Finnish Energy Developments

In response to your 28 October telephone request, attached are papers on recent Finnish energy developments and current energy problems facing the government.

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Attachment: As stated


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EUR M 83-10263

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4 November 1983

MEMORANDUM

Finland: Future Energy Needs

Natural Gas Pipeline Extension

Finnish officials are wrestling with the question of whether to extend the existing Finnish-Soviet gas pipeline westward to allow for greater consumption of Soviet natural gas. Sweden is also considering the feasibility of buying Soviet natural gas through a further extension of the pipeline. The key issue has been the pricing formula for the Soviet gas. The Soviets are pressing the Finns to buy the gas, arguing that it would help close the bilateral trade gap. [redacted]

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Finnish imports of Soviet natural gas grew throughout the 1970s, but more recently high prices have forced the Finns to cut back on purchases. Thus far in the 1980s, the Finns have been importing only 700 million cubic meters (mcm) of gas per year compared with one billion cubic meters (bcm) in 1979. The 1983 Finnish-Soviet Trade Protocol calls for an annual import level of 1.4 bcm, but Finnish imports are running well below that level.

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[redacted] A Ministry of Trade and Industry report completed last summer recommends increased natural gas purchases primarily for "commercial-political" reasons. The report concludes:

[redacted] 25X1

- Increased Soviet gas imports would further diversify Finnish energy supplies and foster bilateral trade with the USSR in the long run.
- Although political, commercial, and environmental factors favor increasing Finnish use of Soviet gas, the companies will have to commit about \$140 million to extending the line to Helsinki. If the line is extended to the West Coast for Sweden's use, the pipeline cost would rise to \$270 million.
- Cheaper alternative fuels make Soviet gas less attractive. In any case, Soviet gas prices should be related to the price of coal.
- Gas would be a practical substitute only for heavy fuel oil. The total potential demand in the Helsinki metropolitan area would be about 1 bcm of gas. The greatest potential for expanding gas consumption is in industry rather than residential heating.
- An increase in natural gas imports from the USSR should not replace the construction of a fifth nuclear power plant. 25X1

Bilateral negotiations so far have not produced a solution that would make it economically feasible to increase Finnish gas purchases from the USSR, nor does Sweden appear to be in a rush to make a decision. Helsinki may have to take a position on the pipeline extension issue that would be based less on economic factors than on broader considerations of trade policy. The gas issue will no doubt be on the agenda at the meeting of the

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[redacted]

Finnish-Soviet Joint Economic Commission which meets this month, and we expect the Soviets to push for a final decision on Finnish plans. [redacted] 25X1

Fifth Nuclear Power Plant

The government-controlled electric company, IVO, published a report in August that claimed a 1,000 megawatt plant would be the best alternative for the 1990s in terms of Finnish energy policy, industry, national economy, and environmental protection. IVO is also studying the alternative of building two smaller nuclear plants. [redacted] 25X1

Finnish industry launched a campaign in September in support of nuclear power. The Confederation of Finnish Industries is demanding a favorable decision on a 1,000 megawatt nuclear power plant before the end of the year. The Confederation describes the new plant as the inevitable choice because the real price of electricity must be reduced to ensure the competitiveness of Finnish industry. [redacted] 25X1

Any decision on the fifth plant, however, may be delayed until next year while the government decides between coal and nuclear power. The political parties are undecided about the fifth nuclear power plant. Various environmentalist groups in Finland oppose construction of a new nuclear power station. In June, Prime Minister Sorsa intervened to discourage several members of Parliament from signing a petition that would have called for a resolution against a possible fifth nuclear power plant. [redacted] 25X1

[redacted] 25X1

[REDACTED]

The Ministry of Trade and Industry has drafted a legislative proposal that is scheduled to be introduced during the current session of Parliament that would transfer decision-making power for ordering new nuclear power stations to Parliament. The proposal includes a system for distributing nuclear waste disposal costs and provisions for strengthening the inspection of nuclear plants. Trade and Industry Minister Lindblom anticipates problems with the bill and has suggested that it might have to be treated as a constitutional bill, which would require approval by two successive sessions of Parliament. [REDACTED]

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[REDACTED]

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EUROPEAN ENERGY PROFILE

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FINLAND

TRADE IMBALANCE CREATES DELICATE ENERGY RELATIONS WITH USSR

Finland's success in cutting its energy use was accelerated last year by a downturn in industrial activity. But this success has also presented Finland with a delicate problem - balancing its trade with the USSR. Finland, with a highly-developed manufacturing base, has a population of only 4.8m. Domestic demand is far from sufficient to support its industry.

Thus export markets are vital to the well-being of the Finnish economy - and the USSR is the Finns' biggest, most reliable such market. The USSR is also Finland's biggest energy supplier.

Finland's exports to the USSR have gone a long way towards insulating it from the full effects of the West European recession. In return, the USSR traditionally underpins these industries by providing energy - mainly oil but also coal, gas and electricity - at favourable prices under long-term agreements.

*Diversify
supplies*

But Finland's energy policy over the last few years has been to diversify its energy supply sources and to shift consumption away from oil to, mainly, nuclear power. Success here has significantly cut the relative value of its energy imports from the USSR. Whereas energy last year comprised over 90% of Finland's exports from the USSR, it comprises only 80% under the 1983 trade agreement.

However, Finland's long-term trade agreements with the USSR are based on a balanced trade by value. Any cutbacks in energy imports from the USSR or any cut in prices should reduce Finland's export ceiling to the USSR.

Because of such cutbacks in the last two years, Finland achieved a \$2.7m surplus in its trade with the USSR in 1981, against a \$1.1bn deficit with the OECD, and a \$700m surplus in 1982. That has not pleased the Soviets, who are now forced to pay interest on the excess amounts.

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FINLAND**FINLAND: TOTAL PRIMARY ENERGY REQUIREMENTS (million tonnes oil equivalent)**

	1980	1981	1982*	1982/81 % change
Solid fuels	8.36	6.54	5.50	-15.9
Oil	12.99	11.64	10.02	-13.9
Natural Gas	0.88	0.80	0.76	-5.0
Nuclear	1.75	3.65	4.28	+17.3
Hydro & Geothermal	2.49	3.33	3.50	+5.1
Net electricity imports (+)	0.05	0.19	0.13	+31.6
TOTAL	26.52	26.15	24.19	-7.5

Source: International Energy Agency

* EEP estimate based on IEA data for first half 1982

NB: This table is provided only for purposes of comparison on a uniform basis with other IEA countries. Analysis in the profile is based on data supplied by the Finnish energy department.

In order to maintain its export level to the USSR, Finland has been forced to:

- Increase imports of Soviet coal, oil and gas in 1983.
- Reverse its policy of cutting oil consumption.
- Cut oil imports from non-Soviet sources.
- Increase re-exports of oil and oil products.
- Increase its purchase of other Soviet products.

Falling
import bill

Finland's energy imports bill fell by 10.75% last year from FM18.6bn (\$3.4bn) to FM16.6bn, due to cuts in both the quantity and price of imports. The biggest percentage drop in value was a 16.7% fall in the hard coal bill from FM1.8bn to FM1.5bn followed by a 12.6% fall in the crude oil bill from FM15.1bn in 1981 to FM13.2bn. Crude oil imports fell by 13.1% from 10.7m tonnes (t) to 9.3mt, while hard coal imports fell by 12.7% from 5.5mt to 4.8mt.

Against the background of a GDP growth of just 0.6% in 1982 and a 0.6% fall in industrial output (compared with a 3.2% growth in 1981) primary energy use fell slightly from 25.1 tonnes of oil equivalent (toe) in 1981 to 25mtoe.

FINLAND: PRIMARY ENERGY CONSUMPTION 1981/82 (million tonnes oil equivalent)

	1981	1982	% change
Oil	10.7	10.4	-2.8
Coal	1.8	1.9	+5.6
Natural gas	0.6	0.6	0.0
Nuclear power	3.5	4.0	+14.3
Net import of electricity	0.6	0.6	0.0
Hydro power	3.4	3.2	-5.9
Black and sulphite liquors	1.6	1.7	+6.3
Industrial waste wood	0.9	0.9	0.0
Fire wood	1.1	0.7	-36.4
Peat	0.5	0.6	+20.0
Other domestic	0.4	0.4	0.0
TOTAL	25.1	25.0	-0.4

CONSUMPTION BY SECTORS IN 1982

	%	mtoe
Industry	47	11.6
Transport	13	3.1
Space heating	24	6.0
Other	16	4.1

Source: Finnish Energy Department

However, the government's aim of reducing the share of imported energy in total consumption to 65-70% by the mid-1990s stumbled a little last year. In 1981 Finland managed to increase the contribution of domestic fuels in total primary energy use from 6.8mtoe in 1980 to 7.9mtoe and, simultaneously to cut the use of imported fuels by 0.6mtoe. Together these moves brought the import share down from 72.1% of total consumption in 1980 to 68.5%. But last year an increase in nuclear power on the import side and a slight fall in hydro power and firewood on the domestic side pushed imports' share of total consumption back up to 70%.

*Problems
unresolved*

Moreover, Finland has entered 1983 with major energy problems unresolved. A decision is needed on whether the next power station should be nuclear or coal-fired. Government is keen to use more Soviet natural gas allowing fewer oil imports, but potential consumers are opposed on price grounds. No overall agreement has yet been reached on the best transport system for internal coal distribution - essential to the viability of the new coal ports and the fight for new coal customers.

Nor are decisions likely to be taken until mid-1983 at the earliest. With parliamentary elections set for March, major political decision-making has now been frozen.

Oil

*Falling
share*

Oil's share of Finland's total primary energy use fell again last year to 41.6%. While energy use fell by 0.4% from 25.1mtoe in 1981 to 25mtoe oil use fell by 2.8% from 10.7mtoe to 10.4mtoe. As a result crude oil imports fell yet again to 9.3mt from 10.7mt in 1981.

On the surface this looks like success for the government's aim to cut oil's share of oil of energy use to some 30% or 7-9mt by 1995. But Finland also had a policy of diversifying its sources of supply. It somehow overlooked the fact that rapid cuts in consumption, coupled with increased buying from other suppliers, would

FINLAND: ENERGY CONSUMPTION FORECAST (mtoe)

	1990	1995
Oil & natural gas	L 9.4	8.1
	H 10.5	9.3*
		9.5
Coal	L 3.8	4.4
	H 4.9	5.1*
		6.3**
Nuclear	L 3.4	3.4
	H 3.4	3.5**
		4.9*
Hydropower	L 3.1	3.1
Peat	L 1.7	2.2
	H 2.0	2.7
Other domestic	L 3.5	3.6
	H 4.0	4.2
Total import	L 17.6	16.9
	H 19.8	20.3
Total domestic	L 8.3	8.9
	H 9.1	10.0

Source: Finland's energy department

L - Low growth (2%/yr gdp)

H - High growth (3%/yr gdp)

* Additional power plant capacity to be nuclear

** Additional power plant capacity to be coal-fired

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adversely affect the major oil supplier (the USSR) in turn upsetting the trade balance between the USSR and Finland.

The shock result of a trade surplus with the USSR in both 1981 and 1982 brought about a sharp change in strategy, if not in policy. In 1981 Finland imported nearly a third of its crude oil from non-Soviet sources. But in 1982 the government started promoting oil as an alternative to electricity in the winter months and backed up the programme by tariff incentives and oil price cuts. It also increased oil imports from the USSR and cut back imports from other sources to 1.8mt (see table). Thus, while the aim is still to cut overall oil consumption there is now a concerted effort to increase consumption of Soviet oil.

This need to maintain relatively high oil imports from the USSR against falling demand at home has forced state company Neste OY, the sole crude oil importer, to increase its trading activities in crude and refined oil products. The latest step in this approach was the opening of a London office.

Neste denies that its expansion of crude oil trading has been forced on the company by the need to maintain Soviet crude oil imports. It argues that the vast majority of oil to be traded will come from the North Sea, and points out that the first consignment through the new office came from that source.

However, it is also true that the second consignment traded came from the USSR and that at least a third of the 3mt traded last year came from the source. Also, of course, it is increased imports from the USSR which have forced Neste to cut back on imports from the North Sea.

With a further rise in oil imports from the USSR planned for next year, it seems likely that imports from other sources will have to be cut back even further and that Neste's new crude oil trading company is in for a busy time.

Gas

Natural gas, all imported from the USSR, presents a quandary for Finland. On the one hand, substitution of oil by gas could enable Finland to maintain the value of its overall imports from the USSR

FINLAND: CRUDE OIL IMPORTS 1982 ('000 tons)

USSR	8,000
Saudi Arabia	700
Qatar	200
England	250
Norway	100
Iran	350
TOTAL	9,600

Source: Nest Oy

FINLAND: OIL IMPORTS BY SOURCE

	1981	1982
<u>Crude oil (m/t)</u>		
USSR	7.3	7.5
Saudi Arabia	2.4	1.5
Other	1.0	0.3
Total, crude	10.7	9.3
<u>Middle distillates</u>		
USSR	1.0	1.0
<u>Heavy fuel oil</u>		
USSR	1.0	1.3
TOTAL OIL VALUE bn/FM	15.1	13.2

Source: Finnish Energy Department

FINLAND: NATURAL GAS IMPORTS (million cubic metres)

Year	at 0° C	at 20° C	Cost m FM	Average price FM/1000 m ³ /0°C	Consumption m toe
1974	412	(466)	105	254	3.94
1975	670	(761)	169	252	6.53
1976	817	(892)	207	253	7.66
1977	759	(902)	211	278	7.78
1978	902	(981)	262	290	8.44
1979	924	(986)	265	287	8.49
1980	905	(927)	488	540	7.92
1981	718	(736)	545	759	6.29
1982	694	(715)	513	739	6.00
1983	na	900*	-	-	-

* Forecast

Source: Finnish Energy Department

whilst enabling a cut in oil imports and further diversification of energy sources. On the other, the importer, state oil company Neste Oy, faces falling consumer demand through uncompetitive pricing and inadequate distribution.

Prices
rocket

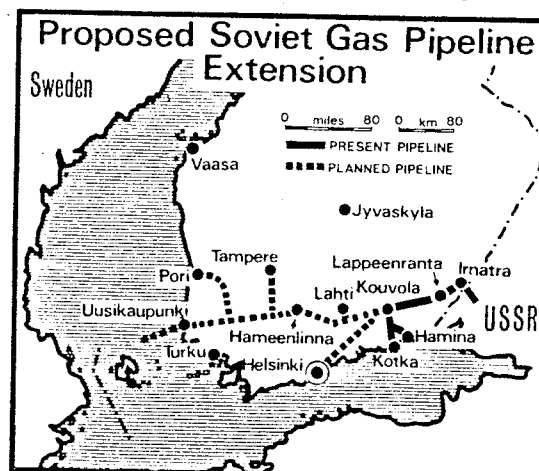
Natural gas imports from the USSR peaked in 1979 when a total of 924m m³ (at 0°C) was imported at an average price of FM287 per 1,000m³. But in 1980, the average price leapt to FM540 and imports fell to 905m m³. By 1982, imports had slumped to 694m m³ but the average price per 1,000m³ had risen to FM739. Under the long-term agreement with the USSR, however, Finland should have imported some 900m m³ (1bn m³ at 20°C).

The major natural gas user in Finland is industry, where it has to compete in price with coal, heavy fuel oil and domestic fuels like peat and wood. But the USSR prices gas sales to Western Europe to compete with light fuel oil. The effect of this relatively high price, coupled with falling prices for competing fuels and a generally lower demand for fuels by an industry moving into recession, has been to slash natural gas imports from a peak of 924m m³ at 0°C (986m m³ at 20°C) in 1979 to 694m m³ (715m) last year.

Significant
contribution

Under these agreements with the USSR, however, Finland should have imported 1bn m³ (at 20°C) in 1982 and 1981 and its failure to do so has made a significant contribution to its embarrassing trade surplus. This year, Finland has agreed to raise its natural gas imports to 900m m³ (at 20°C) in its effort to reduce its surplus.

This leaves Neste with a chicken-and-egg problem. To import 900m m³ it will have to increase consumption. However, consumers say they will not buy more gas until the price comes down. The Soviets are ready to



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make significant cuts in their prices (a figure of 20% has been mentioned) but are not prepared to do so until Finland's imports reach at least the level specified in the trade agreement.

Yet another hurdle is the inadequate distribution system. The present pipeline can only serve the extreme south east corner of the country. To bring gas to new consumers will require a pipeline extension plus the development of a distribution network to other areas.

*Extension to
Helsinki*

With this in mind, Neste is arguing for an extension of the pipeline to bring natural gas within reach of Helsinki. This would bring a whole new set of industries into the gas catchment area and, possibly, the Helsinki conurbation as well. The city is currently assessing its future energy needs and gas, along with coal, is under consideration. But price could be the critical factor, with potential gas consumers talking of a 25% cut in current gas prices before its use can be considered.

There is political pressure for the pipeline. Trade and industry minister Esko Ollila and a majority in parliament are arguing for the pipeline as a means of increasing gas imports from the USSR to ease the embarrassing trade surplus. Also, the concept of extending the pipeline across the Gulf of Bothnia to Sweden could give a major boost to gas consumption by making it available right across the southern half of the country. A decision on either or both of these schemes should be made shortly after the general elections in March.

Coal

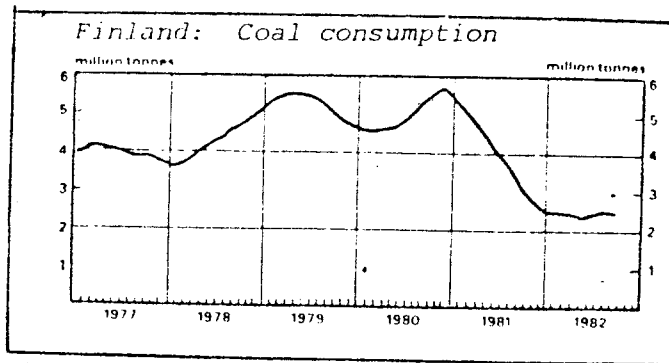
Lack of infrastructure, the continuing recession and a related downturn in industrial output are the problems Finland faces as it tries to diversify its fuel base and sources through increased coal use.

*Soaring
stocks*

Despite a fall in hard coal imports of 12.7% last year - from 5.5m tonnes (t) to 4.8mt - coal use rose from 2.6mt to 2.7mt; Finland is still importing far more coal than it needs. And coal stocks, which increased by 3mt in 1981, grew by a further 2.1mt to bring total stocks to over 5mt - or one year's imports - by year-end.

Coal's 7.6% share of 1982 total primary energy consumption, although a rise on 1981's 7.2%, is significantly below the 15.4% share in 1980. The fall is almost wholly due to the increased share taken by hydro and nuclear power, and to increased electricity imports from the USSR. All of these have outstripped the pace at which coal can be developed as an alternative fuel for industry and the municipalities.

The bulk of these stocks have been built up by Neste and the power companies like Imatran Voima. Neste has developed its own coal port at Porvoo and started international coal trading from January 1 this year.



Falling coal prices encouraged stockpiling. The average imported coal price fell from FM345/t (\$62.7) (at coast) in October 1981 to FM316/t a year later, and was FM320 at the start of 1983. Thus, although hard coal imports in 1982 were 12.7% down on 1981, the value fell by 16.7% from FM1.8bn to FM1.5bn.

To maintain anything like current import levels, Finland's coal traders will have to find new consumers. With little scope for significant expansion in primary energy production, sights are set on the municipalities and industry.

With the falloff in coal use for power generation, from 3.6mt in 1980 to 0.48mt in 1981, combined heat and power is now the largest coal consumer at around 1.2mt, followed by industry at around 0.9-1mt.

To increase consumption significantly beyond these levels will require an improved distribution system to move coal beyond the coal-burning municipalities and industries of the southern industrial belt, to the central and northern parts of the country. But that process has been complicated by Finland's successful efforts to diversify its coal supply sources.

Reducing dependence on traditional suppliers like the USSR and Poland was already an aim before the collapse of the Polish coal industry in 1981 accelerated the process. Prior to 1980, Finland imported about two-thirds of its coal (some 4mt a year) from Poland and nearly all the rest (0.7mt/year) from the USSR. In 1981, however, imports from Poland fell to 1.4mt. To compensate, imports from the UK were doubled to 1.1mt and imports from the US quadrupled from 0.5mt to 2.3mt. Imports from the USSR remained steady at 0.7mt.

Despite the recovery of the Polish coal industry in 1982 and strenuous marketing, Finland increased its purchases only slightly to 2mt. Imports from the UK rose slightly to 1.2mt but imports from the US were slashed to 0.9mt. Imports from the USSR remained at 0.7mt.

But Finland's decision to procure nearly half of its coal from non-Baltic Sea suppliers has demanded major investment in port facilities. It does not have ports suitable for the large coal carriers used in ocean trade.

To cope, the Finns have expanded the southern port of Inkoo to take full Panamax size vessels (60-80,000dwt, 13-metre draft).

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But increasing coal use in north western Finland will require further port expansion at Tahkolouto near Pori. At the moment, Tahkolouto is a 10-metre draft port without cranes. By 1985-86, it is to be expanded to cope with 15.3-metre draft, 100-160,000dwt carriers, the size most economically operated from the US.

But that is not the end of the problem. On the southern coast, some 10 ports will have to be able to take feeder coal; on the western coast about nine. Many of these ports are without cranes. But the decision on the size and type of carrier fleet needed, particularly for serving the West Coast port, has not yet been taken.

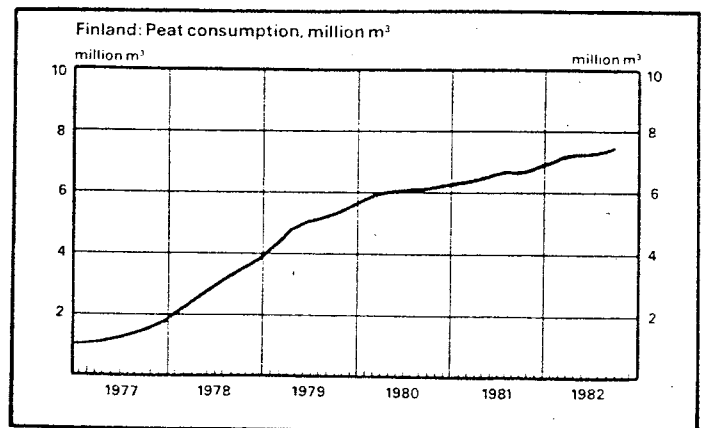
Canal
transport

Another proposal for internal distribution northwards is to transport coal via the canal in Soviet Karelia through to the big lakes where it can be carried in the same barges up to Kopiu and Varkaus.

Peat

Last year, Finland overtook Ireland as the world's second largest peat producer after the USSR. Production jumped by over 300% from 3.9m m³ in 1981 to 16m m³. The share in total consumption also rose from 1.9% (25% of domestic fuels) to 24% (32% of domestic fuels). Peat use rose to 0.6mtoe (7m m³) last year from 0.5mtoe (9m m³ in 1981).

The government aim is to increase peat's share of energy to 6-8% of total consumption by the end of this decade. Eventually a share of 10% is anticipated. Increased use is being helped by moderate increases in the market price of milled peat. This rose to FM48 per MWh last year against FM42 per MWh in 1981.



Electricity

Already
harnessed

With virtually all potential hydropower capacity already harnessed, significant changes in hydro output are determined by water availability. In 1981, for example, unusually heavy rainfalls pushed hydro consumption up by 32% to 3.4mtoe. More normal conditions in 1982 pulled the figure back to 3.2mtoe. Average consumption is around 2.6mtoe.

But while hydro's share of domestic fuels use has remained fairly stable, its share of electricity generation has fallen markedly with the commissioning of the nuclear power plants. In 1976, the

year before the first nuclear station came on stream, hydro power comprised 12,000 Gwh or 37% of total electricity supply. Last year, hydropower was 12,983 Gwh but only 31.1% of the total.

Primary position

Nuclear power confirmed its primary position in Finnish electricity production last year with a 15.1% jump in output against a rise in gross electricity consumption of 1.1%. All other forms of electricity generation fell: hydropower by 4% from 13,518 Gwh to 12,983 Gwh, back pressure power by 5.7% from 9,463 Gwh to 8,923 Gwh, and conventional condensation power by 25.8% from 2,299 Gwh to 1,705 Gwh.

Nuclear electricity generation rose from 13,825 Gwh in 1981 to 15,922 Gwh last year.

Electricity imports also rose in 1982 to 2,266 Gwh from 2,244 Gwh. Electricity is imported and exported through the Nordic system and imported from the USSR.

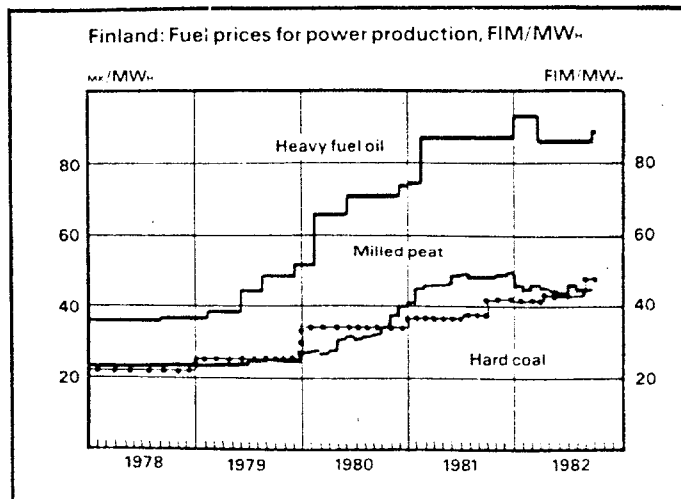
Gross consumption

Gross electricity consumption last year totalled 41,799 Gwh, a 1.1% increase on the 1981 figure of 41,359. Of this, nuclear power provided 38.1% (33.5% in 1981), hydropower 31.1% (32.6%), back pressure power 21.3% (22.9%) conventional condensation power 4.1% (5.6%), and net imports 5.4% (5.4%).

Nuclear

Nuclear power has become a major success story for Finland, with load factors far outstripping original projections.

Finland now has four nuclear power stations in operation - two privately operated and two in the state sector. The state sector reactors, Loviisa I and II, on the island of Hastolmen about 100kms from Helsinki, are operated by the State power company Imatran Voima. Both are Soviet-designed VVER 440MW pressurised water reactors (pwr).



Source Finnish Energy Department

FINLAND: ELECTRICITY CONSUMPTION BY SECTOR (Kwh)

	1981	1982
Industry	23.8	22.9
Public and private	12.1	12.8
Space heating	3.4	3.6
Losses	2.3	2.5
TOTAL	41.6	41.8

Source: Finnish Energy Department

Prices of electricity fell for all categories of user in 1982. Large industries, which were paying 19.6p/unit at the beginning of the year were paying 17p at the start of 1983. Price fall for other sectors were - small private consumers from 26.1p to 24.9p, large private consumers from 39.5p to 38.8p.

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Although planned to produce 440MW overall, they are actually producing about 465MW, enabling a full 440MW to be delivered to the national grid.

The private sector nuclear plants are operated by Teollisuuden Voima Oy. Owned approximately 50:50 by the state and Finland's industrial giants, Teollisuuden Voima was set up to provide power at cost through two Swedish-designed 660MW boiling water reactors located on the island of Olkiluoto in the Gulf of Bothnia.

*Load
factors*

In 1981, the Loviisa I reactor had a load factor of 80.6% and Loviisa II, in its first full year of operation, 70.5%. Last year, Loviisa I had a load factor of 84.2% and Loviisa II of 77.7%. The lower figure for Loviisa II reflects a recent large-scale survey, done every two years; because of this, the reactor was not operating for two months.

These results, plus a similarly good performance from the Olkituoto reactors, have pushed nuclear's share in Finland's primary energy consumption up from 1.7mtoe or 7.9% of the total in 1980 to 3.5mtoe or 13.9% in 1981 and to 4mtoe or 16% in 1982.

The major question hanging over the nuclear power industry now is whether or not the government elected in March this year will plump for coal or uranium for Finland's next power station.

If a new reactor is chosen it will most likely be in the 1,000MW range; both Soviet and French designs are under consideration. But a major factor will be the question of fuel supply and waste disposal.

Under the agreement with the USSR, the Loviisa reactors receive their fuel in ready-to-use form with supplies guaranteed for the life of the reactors. Even more importantly, the nuclear waste has to be stored for just five years - after which it is returned to the USSR for reprocessing or long-term storage.

But the Swedish-built reactors do not have this advantage. The long-term storage of spent nuclear fuel they imply has been a matter of controversy. TVO has now put forward a scheme to bury high-level waste in Finland at a cost of some FM3.2bn. Sending this waste abroad for reprocessing could cost an estimated FM6bn.

*High-level
waste*

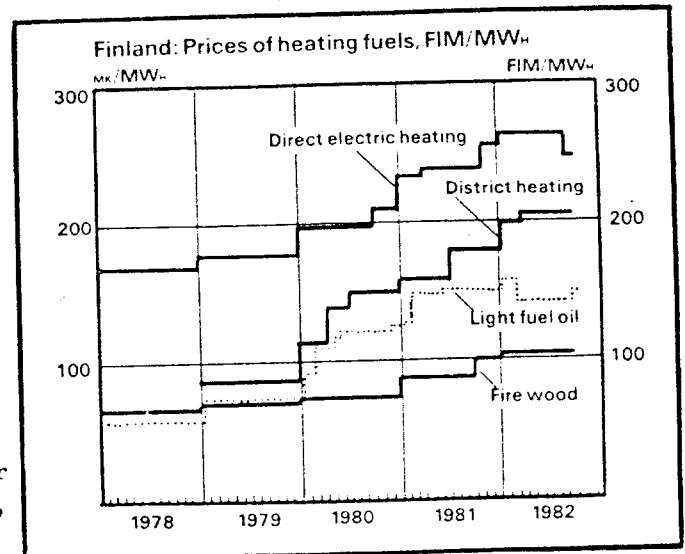
Under the proposed scheme, high-level waste will be sealed in copper drums and placed in temporary storage on the surface until an underground depository is built. This will be a man-made cavern with capacity of 90,000m³, capable of housing an estimated 1,200 tonnes of high-level waste. Final disposal would begin in the year 2020 and the cave would be sealed once and for all.

To carry out the scheme TVO will have to find reserves covering future costs from this year on. The plan has yet to be approved by the Ministry of Trade and Industry, but most observers believe it will go ahead because of the lack of any real alternative. All the same, many Finns, perhaps even a majority, clearly do not want any further spent nuclear fuel depots. That must make the USSR the strongest contender for the country's next nuclear power station.

District Heating

Finland is one of the world leaders in the use of district heating (DH). About 80% of Helsinki's homes and a third of all Finnish homes are DH-linked. Electricity utility sources see the national figure rising to 50% by the end of the century. Production of district heat more than doubled between 1973 and 1981 (the latest year for which data is available), from 7,355GWh to 15,740 GWh. About 55% of output

in 1981 came from combined heat and power plants, the rest directly from heat-only boilers. Consumption of district heating increased again last year from 14,252CWh in 1981 to 14,500GWh. Coal replaced heavy oil as the major fuel with a consumption share of 40% against 37% in 1981. Heavy oil consumption comprised 38% (44% in 1981) and peat 14% (13%). Other fuels, about half natural gas, provided 8% (6% in 1981).



Source: Finland Energy Department

FINLAND: TARGETED POWER STATION COMPLETIONS

Location	Power (MW) electricity/ district heat	Commissioning	Remarks
Vanaja (Haemeenlinna)	20/80	Jan 1983	coal-fired.
Kristiinän Kaupunki	222/-	1983	oil-burning boiler replaced by coal boiler. Electricity production only.
Salmisaari II (Helsinki)	30/62	1983	new coal-burning station to replace existing Salmisaari I.
Jyvasyla	75/180	Spring 1986	peat-fired. 120W of heat for district heating, remaining 40MW as process steam for paper mill.
Joensu	60/120	June 1986	peat-fired.
Kouvola	2 x 15/30	1987	peat-fired

Source: Imatran Voima

Conservation

Cutting specific consumption and diversifying the fuel base is now well-established Finnish policy, prosecuted with the aid of tax incentives or disincentives and subsidies. It is also backed up by an intensive R&D programme and general information service designed to make Finns "energy conscious". Total expenditure in this area last year was budgeted at FM900m, including the research programme. Of this, some FM17m was spent on the information programme and FM145m on energy saving in households.

FINLAND

