

2012

# OIL & GAS SECURITY

Emergency Response of IEA Countries

## FINLAND

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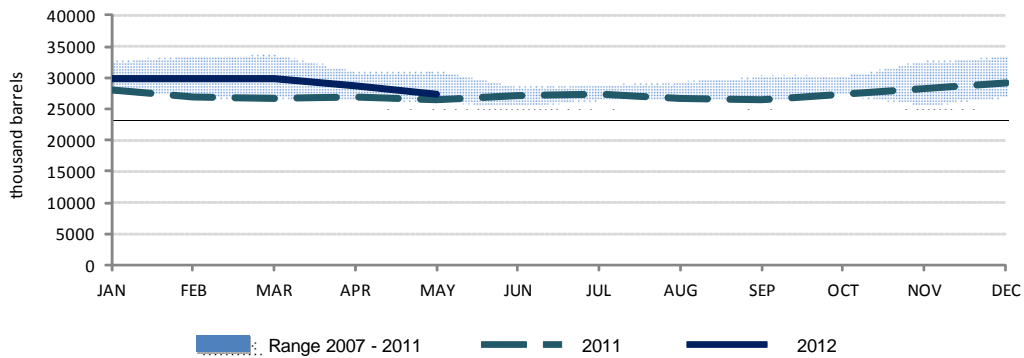


International  
Energy Agency

## Finland

## Key Oil Data

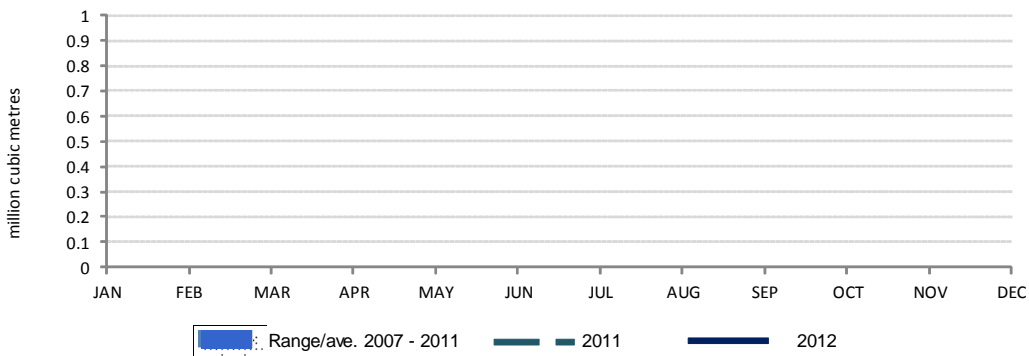
|                                 | 1985   | 1990   | 1995   | 2000   | 2005   | 2009   | 2010   | 2011   |
|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>Production (kb/d)</b>        | -      | -      | -      | -      | -      | -      | -      | -      |
| <b>Demand (kb/d)</b>            | 205.3  | 225.5  | 203.1  | 212.8  | 218.4  | 206.6  | 214.2  | 204.8  |
| <i>Motor gasoline</i>           | 35.2   | 46.0   | 43.9   | 41.2   | 43.4   | 39.8   | 38.9   | 37.5   |
| <i>Gas/diesel oil</i>           | 79.9   | 85.8   | 80.7   | 87.2   | 86.4   | 82.5   | 87.9   | 81.6   |
| <i>Residual fuel oil</i>        | 49.1   | 41.9   | 33.8   | 35.7   | 34.8   | 24.0   | 25.3   | 20.8   |
| <i>Others</i>                   | 41.1   | 51.9   | 44.7   | 48.8   | 53.8   | 60.3   | 61.9   | 64.9   |
| <b>Net imports (kb/d)</b>       | 205.3  | 225.5  | 203.1  | 212.8  | 218.4  | 206.6  | 214.2  | 204.8  |
| <b>Import dependency</b>        | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| <b>Refining capacity (kb/d)</b> | 299    | 241    | 265    | 265    | 265    | 265    | 265    | 265    |
| <b>Oil in TPES</b>              | 38.9%  | 34.4%  | 29.0%  | 28.6%  | 30.3%  | 28.4%  | 26.5%  | -      |

End-Month Total Oil Stock Levels<sup>1</sup> - Five Year Range

## Key Natural Gas Data

|                            | 1985   | 1990   | 1995   | 2000   | 2005   | 2009   | 2010   | 2011 * |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>Production (mcm/y)</b>  | -      | -      | -      | -      | -      | -      | -      | -      |
| <b>Demand (mcm/y)</b>      | 996    | 2 681  | 3 486  | 4 199  | 4 435  | 4 269  | 4 700  | 4 101  |
| <i>Transformation</i>      | 390    | 1 199  | 1 956  | 2 759  | 3 078  | 2 694  | 3 047  | -      |
| <i>Industry</i>            | 553    | 1 156  | 1 187  | 1 060  | 952    | 1 086  | 1 171  | -      |
| <i>Residential</i>         | 31     | 34     | 21     | 28     | 37     | 53     | 59     | -      |
| <i>Others</i>              | 22     | 292    | 322    | 352    | 368    | 436    | 423    | -      |
| <b>Net imports (mcm/y)</b> | 996    | 2 681  | 3 486  | 4 199  | 4 435  | 4 269  | 4 700  | 4 101  |
| <b>Import dependency</b>   | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| <b>Natural Gas in TPES</b> | 3.2%   | 7.9%   | 10.1%  | 11.0%  | 11.0%  | 10.8%  | 10.8%  | -      |

\* based on monthly data submissions to the IEA.

End-Month Natural Gas Stock Levels<sup>2</sup> - Five Year Range

1 -Primary oil stocks on national territory; these exclude utility stocks and including pipeline and entrepot stocks where known.  
2 -Stocks held on national territory as reported to the IEA in monthly data submissions

## OVERVIEW

Oil has been a main energy source in Finland, accounting for some 26% of the country's total primary energy supply (TPES) in 2010. Finland's oil demand slightly increased from 202 thousand barrels per day (kb/d) in 2000 to 223 kb/d in 2007, and then decreased to 209 kb/d in 2011. The transport sector accounted for about 47% of the total oil consumption in 2010.

As Finland has no domestic oil production, it is entirely dependent upon crude oil imports. In 2011, its oil imports were around 343 kb/d, consisting of 217 kb/d of crude oil, 16 kb/d of NGLs and feedstock, and 110 kb/d of refined products. Around 89% of the total crude oil imports came from Russia. In the country, there are two refineries with a total crude distillation capacity of around 261 kb/d. Finland was a net exporter of refined product, exporting around 154 kb/d of refined products in 2011.

Finland meets its stockholding obligation to the IEA by holding government stocks and by placing a minimum stockholding obligation on industry. Under the relevant acts, the National Emergency Supply Agency (NESAs) manages the public oil emergency reserves. Oil importers are obliged to hold at least two months of stocks based on an average of their imports from the previous year.

Finland held 29 million barrels (mb) of oil stocks for oil emergencies at the end of April 2012, equating to 148 days of 2011 net-imports. Some 40% of the total stocks were held in the form of middle distillates, while the share of crude oil was around 23% of the total. Finland's oil stocks in terms of days of net imports have consistently been well above 120 days since July 2008, and government stock levels have been above 50 days of net imports since September 2006.

The use of emergency oil stocks is central to Finland's emergency response policy, which can be complemented by demand restraint measures. In an IEA coordinated action, Finland would likely respond by releasing government stocks.

The share of natural gas in the country's TPES stood at 11% in 2010. Finland's gas demand increased from 0.5 billion cubic meters (1.3 mcm/d) in 1974 to 5 bcm (13.7 mcm/d) in 2005, and then has slightly decreased to 4.7 bcm (12.8 mcm/d) in 2010. Without domestic natural gas production, Finnish gas demand is entirely met by imports from Russia supplied via a twin-pipeline connection.

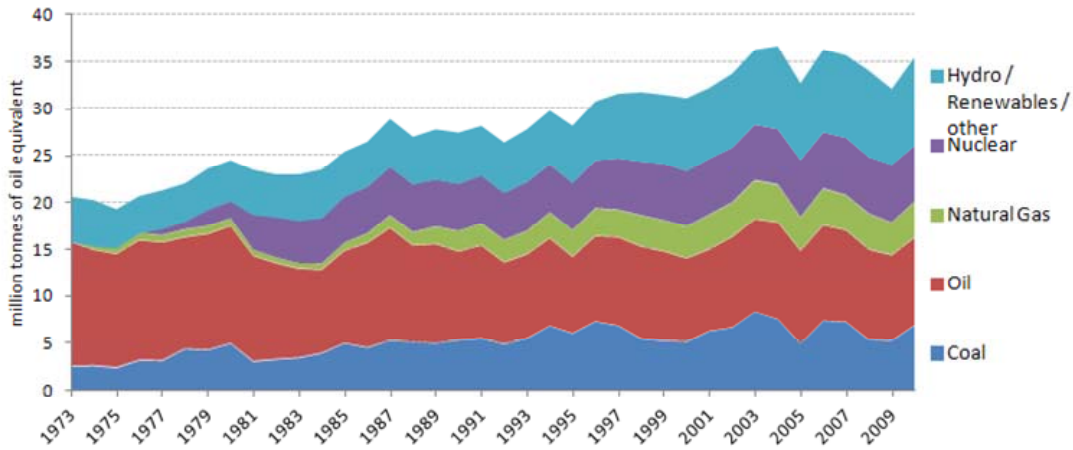
Key elements for Finland's overall gas security policy are compulsory stocks in the form of oil products for fuel switching, control of excess supply and cut back of contractual supplies. The gas importer, gas plants and municipal users consuming above a certain amount of gas are each obliged to hold alternative fuel stocks corresponding to 3 month's natural gas import/consumption. NESAs also holds alternative fuel stocks for gas disruptions, and it decides the amount of its stocks with consideration for the Government's objective to have stocks of imported fuels corresponding to five months' consumption of all imported fuels. It covers stocks for industrial use on which there is no stockholding obligation. Substitute fuels for gas are light fuel oil, heavy fuel oil and propane gas.

The transmission system operator, Gasum Oy, is responsible for assuring gas supplies to protected customers which can only use gas, by providing air-mixed propane gas. In case of a natural gas disruption, LPG stocks are also planned to be used in the Porvoo refinery which is one of the largest consumers of natural gas in the country. Small amount of domestically liquefied LNG stocks can also be made available during gas disruptions.

# 1. Energy Outlook

Oil has been a main energy source in Finland, accounting for some 26% of the country's total primary energy supply (TPES) in 2010. Renewable energy sources is also a large energy source in Finland, whose share in the country's TPES increased to 26% in the same year. The share of natural gas in the country's TPES steadily increased from 3% in 1977 to 11% in 2010. Nuclear energy provided 17% of TPES, while coal represented 19% of the country's energy supply.

**Total Primary Energy Supply**

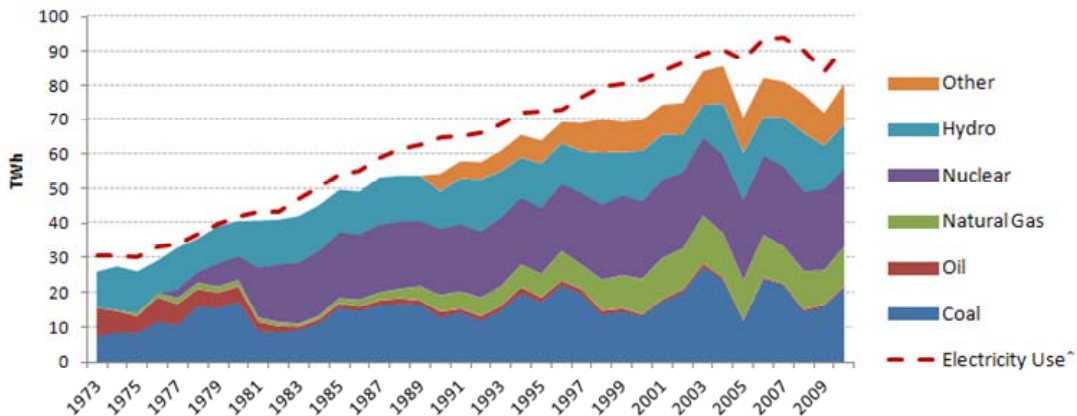


Source: Energy Balances of OECD Countries, IEA

Finland's TPES has risen steadily to 36.6 million tonnes of oil equivalent (Mtoe) in 2004, and marginally decreased to 35.4 Mtoe in 2010. However, the Administration's available projections for energy use in Finland imply that TPES will grow at a compound annual growth rate of less than 1% from 2010 to 2025, rising to over 38.7 Mtoe in 2025.

The Administration aims to increase the share of renewables to 38% of its TPES to meet its EU target. In addition to the existing four nuclear power plants in operation in the country, a fifth nuclear plant is under construction as of 2012. As Finland has a plan to construct two further plants, the share of fossil fuels in the TPES is expected to fall below the current level.

**Electricity Generation, by Fuel Source**

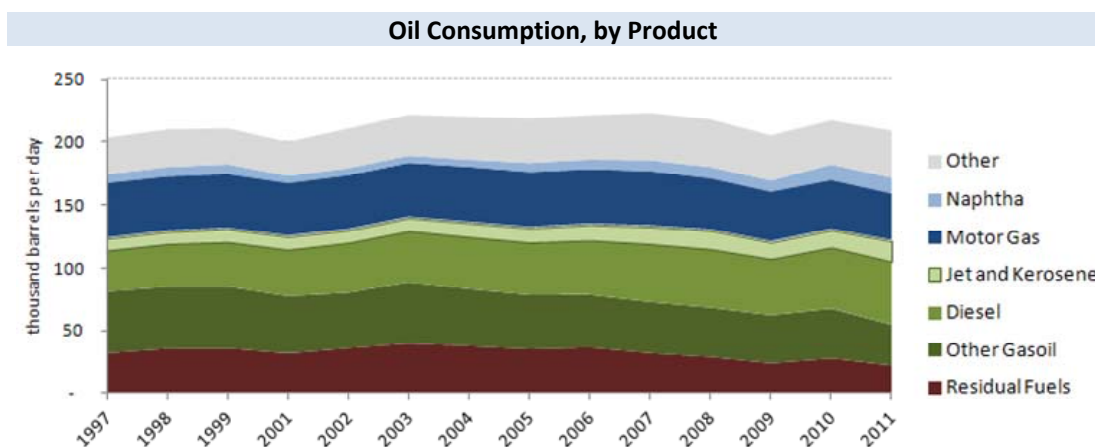


Source: Energy Balances of OECD Countries, IEA

## 2. Oil

### 2.1 Market Features and Key Issues

Finland does not have domestic production of crude oil, so Finnish oil demand is fully covered by imports. Its oil demand slightly increased from 202 kb/d in 2000 to 223 kb/d in 2007, and then decreased to 209 kb/d in 2011 with a compound annual decrease rate of some 1.5%.



In 2010, 47% of Finnish total oil demand was consumed in the transport sector, while the industry sector and the transformation/energy sector accounted for 23% and 14% respectively. In terms of oil demand by product, demand for diesel has increased by 23% between 2002 and 2011, whereas demand for gasoline has decreased by 12% over the same period. Demand for heating oil/other gasoil and residential fuels dropped by 32% and 46% respectively. Demand for naphtha, kerosene, as well as for LPG and ethane increased by more than around 35% during the same period.

| Oil Demand (kb/d)     |            |            |              |               |
|-----------------------|------------|------------|--------------|---------------|
| kb/d                  | 2002       | 2011       | % change     | % change p.a. |
| LPG and Ethane        | 9          | 13         | 34.9%        | 3.4%          |
| Naphtha               | 6          | 10         | 75.8%        | 6.5%          |
| Gasoline              | 43         | 37         | -12.0%       | -1.4%         |
| Kerosene              | 10         | 17         | 59.8%        | 5.3%          |
| Diesel                | 40         | 49         | 23.1%        | 2.3%          |
| Heating/other Gasoil  | 47         | 32         | -31.7%       | -4.1%         |
| Residual Fuels        | 39         | 21         | -46.2%       | -6.7%         |
| Other Products        | 23         | 26         | 11.7%        | 1.2%          |
| <b>Total Products</b> | <b>217</b> | <b>205</b> | <b>-5.6%</b> | <b>-0.6%</b>  |

*Source: IEA Monthly Oil Statistics*

According to a forecast by the Administration, total oil demand is expected to decrease to 7.7 Mtoe (some 157 kb/d) in 2020 and to 6.9 Mtoe (some 140 kb/d) in 2035.

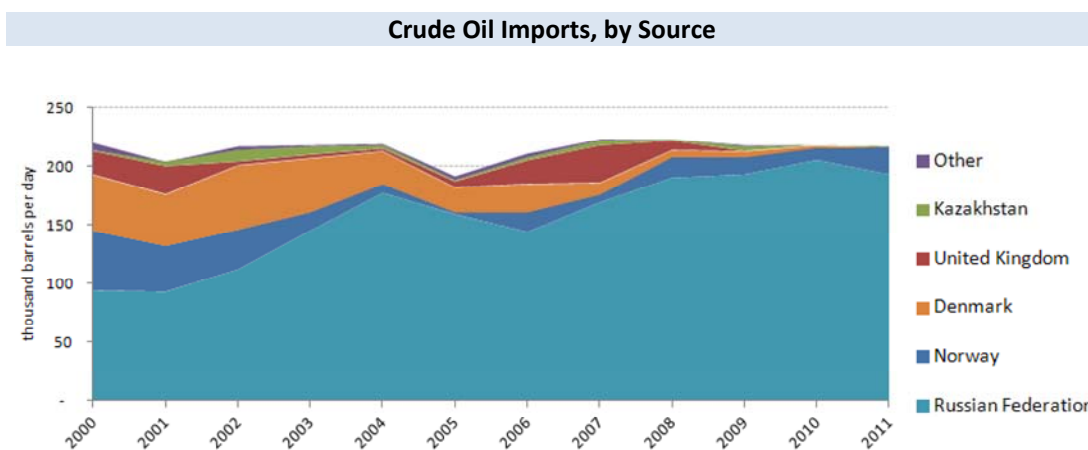
In Finland 6% of transport fuels should be bio components (in terms of energy content) whose raw materials are mostly imported.



## Imports/exports and import dependency

Finland's oil imports in 2011 were some 343 kb/d, consisting of about 217 kb/d of crude oil, 16 kb/d NGLs and feedstock, and some 110 kb/d refined products. Finland is highly dependent on Russia as a source for its crude oil imports, which accounted for 89% of the total crude oil imports in 2011 with the rest imported from Norway. The import dependency on Russian crude oil significantly increased from 43% of total crude oil imports in 2000 to 89% in 2011, with a compound growth rate of around 7%.

In 2011, refined product imports came from Russia (53%), India (8%), Kazakhstan (8%) and Sweden (8%). However, Finland was a net exporting country of refined product in the same year, exporting around 154 kb/d of refined products, 30% of which was shipped to Sweden.



Source: Monthly Oil Statistics, IEA

## Oil Company Operations

Neste Oil Oy, a majority state-owned company, is a key player in the domestic market and the single crude importer owning both refineries in Finland. In the Finnish retail market, the share of Neste Oil Oy was around 33%, followed by Teboil (25%), ST1 (12%) and ABC (11%). In addition, NEOT, a joint venture between retailers, acts as a wholesale company which deals with procurement and logistics of oil products for some retail companies including ST1 and SOK (which owns ABC).

The retail market is fully open to competition, and 5 oil retail companies operate 1,947 filling stations in Finland as of December 2011. The largest are ST1 (531 stations including those of Shell which was incorporated with ST1 in 2010), Neste Oil (481), ABC (423), Teboil (337) and SEO (186).

The Finnish Petroleum Federation (FPF) acts as an umbrella organisation for the oil industry operating in Finland, representing around 95% of oil products sold on the Finnish market.

## Taxes and maximum price mechanism

The oil product market is fully liberalized. Wholesale and retail prices are mainly influenced by the relevant quotation prices and exchange rates, which are driven by the global market

fundamentals and expectations. Government interference is limited to determining the level of the excise tax and VAT. In addition, a stock fee is levied on consumption of oil products, natural gas, coal and electricity in order to finance the public stockpiling system. As of 3Q2011, while the share of all tax components in the retail price is some 58% for unleaded gasoline, the share of all tax components is some 45% for automotive diesel (for non-commercial purposes), and about 33% for light fuel oil.

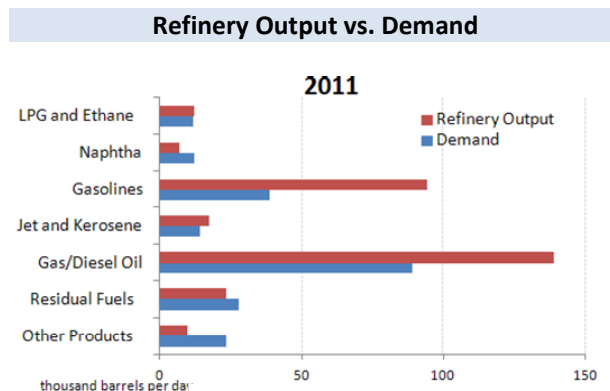
## 2.2 Oil Supply Infrastructure

### Refining

There are two refineries in Finland, with a total crude distillation capacity of around 265 kb/d: 206 kb/d for the Porvoo refinery and 58.5 kb/d for the Naantali refinery. The refineries can also process feedstocks directly in secondary units, with a total vacuum distillation capacity of around 100 kb/d.

Although the refineries started operation in the mid-1960s (for Porvoo) and in the late 1950s (for Naantali), they are equipped with complex units as a result of investments made in 1990s and 2000s.

In 2011, total crude throughputs averaged 231 kb/d, which indicates that the overall capacity utilisation rate was over 85%. In the same year, the refined product output from the two domestic refineries totalled 302.5 kb/d. The composition of production from these refineries was gas/diesel oil (46%), gasoline (31%), residual fuel oil (8%) and LPG (4%).



With the exception of naphtha, residual fuels and other products, domestic refinery production is sufficient for meeting demand in the country. In 2011, domestic production of naphtha was able to meet 55% of domestic demand, while residual fuels amounted to some 84%, requiring imports to meet the remaining share. However, nearly half of the refined oil products outputs (44%), including gasoline and diesel oil, were exported in 2011. Domestic refinery gross output has slightly increased from 301 kb/d in 2009 to 302.5 kb/d in 2011.

### Ports and Pipelines

Finland does not have either cross border oil pipelines or domestic oil pipelines. The imports of crude oil and petroleum products are mainly undertaken by tanker fleets, rail tanks and trucks. Of these transport routes, over 91% of the feedstock used at Neste Oil's refineries were supplied by sea, 7% by rail, and the rest mainly by road in 2011, and 70% of products to Neste oil's domestic customers were shipped by sea, 19% by road, and the rest by rail.

Crude oils and refined products are imported through six main oil import terminals. Of these, only Porvoo and Naantali terminals, owned by Neste Oil, can import crude oils with a total crude

oil import capacity of 19 Mt per year (some 385 kb/d): 304 kb/d in Porvoo and 81 kb/d in Naantali. Russian crude oil is imported from the nearby Russian oil port Primorsk, which is located at 147 nautical miles from the Porvoo terminal.

Importing and exporting capacity for products in the Porvoo and Naantali terminals sums up to 18 Mt per year (some 300 kb/d based on the share of product imports): 15 Mt (250 kb/d) in Porvoo and 3 Mt (50 kb/d) per year in Naantali.

### Oil Infrastructure Map



This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

### Storage Capacity

Finland has a total storage capacity of over 63 million barrels (10 million cubic metres) mainly in 25 coastal and inland major storage facilities. Major coastal terminals are located at the refineries in Porvoo (44 mb or 7 mcm) and Naantali (6 mb or 1 mcm), and at Inkoop (3.1 mb or 0.5 mcm), Kokkola (2.5 mb or 0.4 mcm), Kemi (1.6 mb or 0.2 mcm) and Hamina (0.6 mb or 0.1mcm). Around two thirds of the all storage facilities are in forms of underground rock cavern storage.

While the major storage facilities are owned mostly by the industry, the public stockholding agency NESAs owns more than half of the storage capacity necessary for storing public stocks.



## 2.3 Decision-making Structure for Oil Emergencies

The Department of Energy in the Ministry of Employment and the Economy is responsible for general energy issues related to the security of supply in normal times as well as during supply disruptions. The Department forms the core of the Finnish National Emergency Strategic Organisation (NESO).

The NESO also includes personnel from the National Emergency Supply Agency (NESA), the Ministry of Transport and Communication, and industry. The Security of Supply Act (1992) provides the legal basis for cooperation between NESA and the industry, which is made through a pooling system such as the Oil Pool and Power and District Heat Pool. The Oil Pool updates contingency plans as well as general guidelines for a disruption, and conducts trainings and seminars.

During an emergency, the Council of State will make a decision to release public stocks, based on a proposal by the Ministry of Employment and the Economy. Obligated industry oil stocks may be released by NESA's approval in case a shortage of oil could endanger the operations of the holder of the compulsory stocks.

Finland has participated in IEA's Emergency Response Exercises in Paris. In addition, the Oil Pool and its gas section conduct domestic emergency response exercises with industry from time to time.

## 2.4 Stocks

### Stockholding Structure

Finland meets its stockholding obligation to the IEA by holding government stocks and by placing a minimum stockholding obligation on industry. Under The Act N° 1390/1992 on the Security of Supply (1992), NESA manages public oil emergency reserves.

According to the emergency reserve target set by the Government Decision on the Objectives of Security of Supply issued on 21 August 2008, the country should hold a total of five months' stocks of imported fuel consumption of oil, natural gas and coal. Even though there is no official objective for individual fuels, the Administration makes efforts to maintain stocks for each fuel at close to five months of consumption.

While oil importers are required to maintain compulsory oil stocks corresponding to two months' imports based on the average of the previous year, NESA holds the public stocks corresponding to the remaining balance of the stockholding target. The stockpiling obligation applies to the imports of crude oil, other condensates for refineries, diesel oil, light fuel oil, gasoline (motor and aviation) and jet fuel. Based on the Act N° 1070/1994 on the Compulsory Stockholding of Imported Fuels (1994), oil importers that annually import less than 39.5 kb (5,000 tons) of kerosene/jet fuels, less than 84.5 kb (10,000 tons) of motor gasoline and less than 147.5 kb (20,000 tons) of crude oil or other products are exempted from the obligation to hold compulsory stocks. As a result, four or five oil importers are obliged to hold compulsory stocks.

NESA is responsible for ensuring the implementation of the oil stockpiling obligations. It is empowered to determine the quantities of oil to be stockpiled on an annual basis and to supervise the compulsory stocks and their use.

The Security of Supply Act forms the basis for Finland's emergency response policy. It provides the Administration with the statutory power in case of emergency to release public stocks. Under this Act, NESA manages public oil emergency reserves.

### **Crude or Products**

Finland held some 29 mb of oil stocks (10 mb of government stocks and 19 mb of industry stocks) at the end of April 2012, equating to 148 days of 2011 net-imports (61 days of government stocks and 87 days of industry stocks), to meet the IEA obligations. Middle distillates accounted for 65% of the total public stocks, followed by crude oil (29%) and motor gasoline (6%). In terms of industry stocks, middle distillates was also the main product held (26%), followed by crude oil (20%), NGL & feedstocks (20%), residual fuel oil (12%), and motor gasoline (9%). Compulsory stocks are comingled with commercial and operational stocks.

A crude oil importer has an obligation to hold stocks in the form of crude. However, it can apply for a permission from NESA to substitute up to 50% of this crude oil stock obligation with oil products. Likewise, importers of oil products have an obligation to hold stocks of the same products, but can apply for a permission to substitute their obligation for a particular product by other finished products. Substitution of oil products by crude oil is not allowed.

### **Location and Availability**

Finland has bilateral agreements with Sweden, Denmark, Estonia and Latvia. At the end of April 2012, Finland held some emergency oil stocks for Sweden (456 kb), Denmark (118 kb) and non-member countries such as Estonia (556 kb).

Although Finnish oil importers may hold up to 20% of stocks in the countries which have concluded bilateral agreement with Finland, no compulsory stocks are held abroad as of March 2012. Public stocks maintained by NESA are not allowed to be held outside the country.

Public stocks of crude oil are located in both refineries, although most are stored at the Porvoo refinery.

For the minimum operating requirements, Finnish oil refineries hold 2 weeks of feedstocks and other oil importers hold 10-14 days of product stocks on top of the compulsory stocks. As for public stocks held by NESA, the tank bottom calculation rule (10%) is applied.

### **Monitoring and Non-compliance**

Finland has consistently met its minimum IEA stockholding obligation, with total stock coverage ranging between 110 and 168 days. It has been well above 120 days since July 2008, and public stock levels have been above 50 days of net imports since September 2006. Minimum stock levels necessary to cover the 90 days of net imports required by the I.E.P. Agreement range between 14 mb to 18 mb, depending on the mix of crude and product stocks held.

NESA conducts regular on-site audits to monitor physical availability and quality of compulsory stocks. Companies can be fined if they fail to comply with their stock obligations in terms of quality, quantity and location of oil products. There has been no serious non-compliance of domestic stock obligations over the past years.

### **Stock Drawdown and Timeframe**

The Act on the Supply Security requires a decision by the government (which is to say the Council of State) to draw down public stocks during an oil supply disruption. The Council of State will make a decision based on a proposal made by the Energy Department of the Ministry of Employment and the Economy in close coordination with the Oil Pool of the Finnish NESO. The amount of drawdown is to be determined based upon estimates of imports, exports and estimated consumption. The Government's decision could be made in two to four days.

Upon receiving the stock release order from the government, NESA would release public stocks to oil refineries, oil companies and major consumers through public tenders. Foreign companies are also allowed to participate in the tendering.

For the industry obligation, NESA may, upon request, authorize industry holders of compulsory stocks to use their obligated stocks if the holder's production or business would be at risk. It is estimated that such a decision could be made in two days. Decisions on how the compulsory stocks should practically be released are made by the stockholder. In June 2012, the Government submitted a proposal to the Finnish parliament for an amendment of the Act on the Compulsory Stockholding of Imported Fuels to allow the Ministry of Employment and the Economy to temporarily release compulsory industry stocks to meet international commitments such as IEA and EU obligations.

During a crisis, Finland would be able to drawdown public stocks at the following rates. For the second week following the government decision to release stocks, the drawdown would be at a maximum rate of 50 kb/d, which is a quarter of the domestic oil demand in 2011. The maximum drawdown rate would increase to 70 kb/d during the fifth week with crude oil released and would be raised to 100 kb/d by the ninth week.

### **Financing and Stockholding Costs**

Public stockpiling costs, including operation and management fees, are financed by a levy called Precautionary stock fee. It is charged on end-user prices of gasoline, diesel, fuel oils, coal, natural gas and electricity. The level of the stock fee is 2.86 Euros per tonne for low sulphur fuel oil, 6.73 Euros per kilolitre for motor gasoline, 3.53 Euros per kilolitre for light fuel oil and diesel oil, 2.86 Euros per kilolitre for heavy fuel oil.

The Precautionary stock fee is collected by the Finnish Customs and passed on to NESA directly. The total annual budget of NESA amounts to around 50 million Euros, around 20% of which (10 million Euros per year) are used for stockholding of energy resources, as NESA is also responsible for other supply security issue including food security, transportation logistics and healthcare.

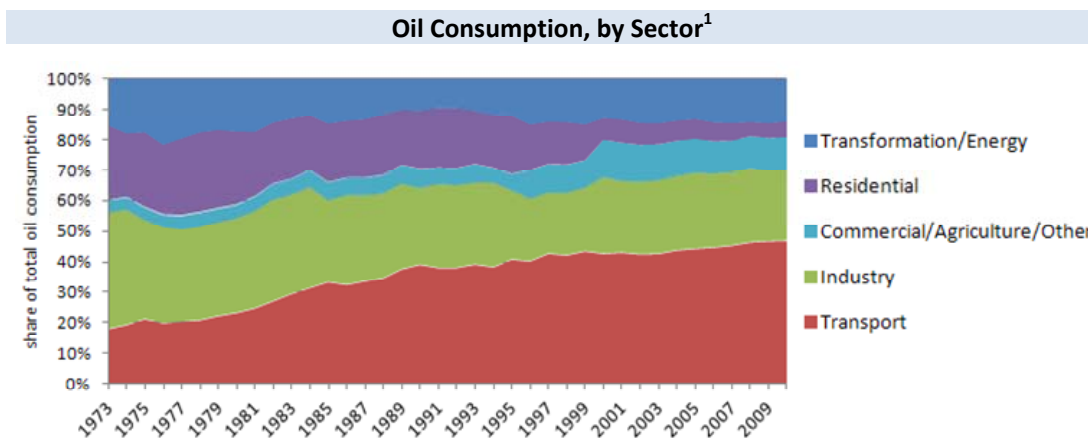
Annual storage costs vary from below 10 Euros per tonne (or 1.36 Euros per barrel in case of crude) in caverns to above 25 Euros per tonne (3.4 Euros per barrel) in tank farms. As two thirds of the storage facilities owned by NESA are in the form of underground cavern, most of storage cost is limited to below 10 Euros per tonne.

The Finnish government does not provide financial support for building compulsory industry stocks. All refiners and importers must self-fund the operational costs of meeting emergency requirements. These costs are implicitly passed on to final consumers in market prices.

## 3. Other Measures

### 3.1 Demand Restraint

As in other IEA countries, the transport sector makes up the single largest share of oil consumption in Finland. In 2010, the transport sector represented 47% of total oil use in the country. However, this is lower than in most IEA countries (the IEA average is around 60% for the transport sector). Following the transport sector, the industry sector represented 23% of total oil demand. The remainder of oil consumed in Finland in 2010 was in the transformation sector (14%) and the commercial/agriculture sector (11%).



Source: Oil Information, IEA

Demand restraint is considered as a secondary emergency response measure that could complement an oil stock release in Finland. As Finland has abundant amounts of emergency oil stocks, demand restraint measures would only be deployed in case of a long lasting severe supply disruption.

Finland's demand restraint measures would range from light-handed measures (e.g. lowering of room temperature in space heating and limitations in ventilation and warm water) on a recommendation basis, to heavy-handed measures (e.g. lowering of speed limit, lowering of room temperature, limitations in use of cars and rationing of traffic fuels/ light and heavy fuel oils in space heating, industrial use and agricultural use) made by compulsory orders.

Measures based on recommendation can be implemented immediately by responsible authorities, while full operations of compulsory measures require one to three months of preparation.

Plans for fuel rationing have been regularly updated to take account of changes in the Finnish oil market, according to the Act of Supply Security.

<sup>1</sup> Total Consumption (including refinery consumption), does not include international marine bunkers.



## 3.2 Fuel Switching

Short-term fuel switching from oil to other fuels is not regarded as an emergency response measure in Finland, as the ratio of oil used for power generation to Finland's total oil consumption was only 0.6% in 2010, amounting to 484 GWh. There is little potential to switch away from oil to other energy sources. According to the Administration, Finland's fuel-switching capacity from oil to other fuels is estimated to be some 3% of the total oil consumption at a maximum in the industry and transformation sector.

## 3.3 Others

As there is no oil production in Finland, surge production of oil is not considered as an emergency response measure in the country.

## 4. Natural Gas

### 4.1 Market Features and Key Issues

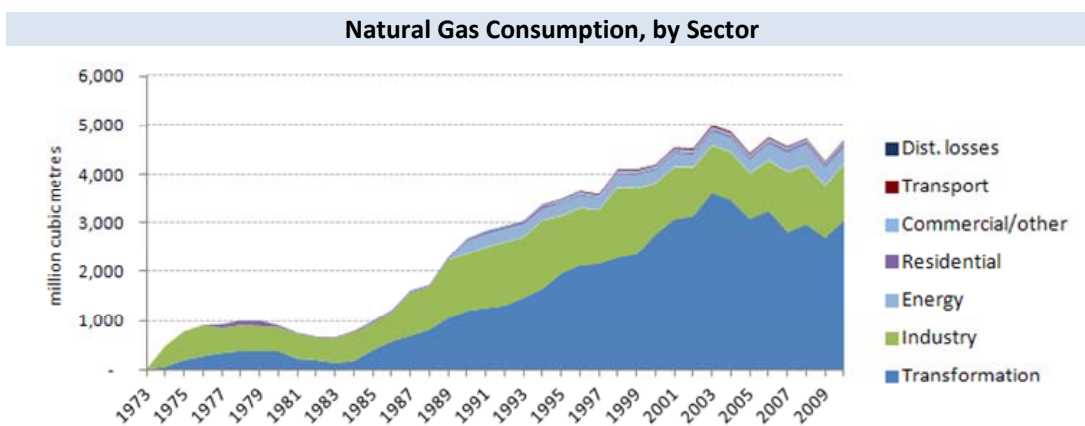
#### Gas production and reserves

Apart from a small amount of biogas production, Finland has no domestic production of natural gas. With a single gas import link, Finland has been importing all of its natural gas from a single source, Russia, since 1974. Finland has no natural gas reserves / stocks.

Biogas production was 144 mcm in 2009. Around 67% of production was consumed in the country, while the other 33% was flared. Although there are 65 biogas plants (35 landfill plants and 30 reactor plants including wastewater and farms), more than 75% of the biogas was produced in landfill gas recovery plants. In addition, several projects to establish biogas production plants, with total annual production capacity of 185 GWh (or around 17 mcm), are expected to be completed by 2014.

#### Gas demand

Finland's demand for natural gas increased from 0.5 billion cubic meters (1.3 mcm/d) in 1974 to 5 bcm (13.7 mcm/d) in 2005, and then has been slightly decreased to 4.7 bcm (12.8 mcm/d) in 2010.



*Source: Natural Gas Information, IEA*

In 2010, the transformation sector was the largest consumer of natural gas in Finland, representing about 65% of the country's total gas consumption, while the industry and the energy sector represented 25% and 8%, respectively. Gas demand in Finland peaks in winter when gas consumption significantly increases for electricity, combined heat and power (CHP) and heat plants. The Finnish daily peak gas demand stood at some 22.1 mcm/d on 18 February 2011 (when temperatures averaged about  $-25^{\circ}\text{C}$ ), and the hourly peak consumption was 0.96 mcm/h on 8 January 2010.

The Administration estimates that gas demand will remain at the current level or decline during the next decade because of relatively high gas prices reflecting oil and other energy prices, which can lower its competitiveness against other energy sources such as nuclear energy and renewables.

## Gas import dependency

Due to the absence of natural gas production, Finnish gas demand is entirely supplied by imports, all of which have come through a twin-pipeline connecting with Russia since 1974. The amount of natural gas imports from Russia equals the domestic consumption.

A single importer in the country, Gasum Oy, has agreed a contract to import Russian gas to Finland until the end of 2026. Maximum annual importing volume of the contract is 5.5 bcm or 51 TWh. Gasum Oy is currently negotiating with Gazprom to make the annual contract more flexible to take into account the downward trend of domestic gas consumption and higher peak demand. It also aims to diversify natural gas sources with a plan of constructing an LNG terminal and increasing biogas production even on a small scale.

## Gas Companies

Gasum Oy is responsible for imports, transmission and wholesale trading of natural gas in Finland. It is the sole importer and wholesale supplier. The company is owned by a consortium of Fortum (major electricity company: 31%), OAO Gazprom (25%), Government of Finland (24%) and E.ON Ruhrgas International GmbH (20%).

A subsidiary of Gasum Oy runs a secondary market called Gas Exchange, where customers can make direct transaction with each other. This market is open to gas users procuring over 5 mcm per year and certain retail sellers. Around 5-10% of total gas consumption is traded on the Gas Exchange. Although there are no interruptible contract in the country, Gasum Oy has a product "Gasum Miinus" to buy back fixed deliveries through the Gas Exchange to reduce load. The Transmission System Operator, Gasum Oy, acts as a clearing house to monitor the market.

There are over 30 regional distribution companies for regional consumers and other small scale users in the retail market for gas in Finland. Some distributors are partly owned by Gasum Oy. In 2010, there were around 37,000 customers of natural gas, around 92% of which are households for cooking. However, the share of those consumers in total consumption is below 1%, while 25 power plants accounted for around 45% of the total consumption, followed by heavy industry (42%) and district heating plants (9%). The Porvoo refinery, owned by Neste Oil Oy, is one of the largest consumers of natural gas.

The Finnish gas association has 63 actual members including the gas importer (Gasum Oy), gas distribution companies and big gas consumers.

In addition, Gasum Oy opened an LNG production plant in Porvoo in 2010. Annual LNG production capacity is about 20,000 tons (or 27 mcm of natural gas). As it is quite small, the produced LNG is used for peak-shaving, fuel of cruise ferries and industry. As this plant is not equipped with any sending capacity to the gas network, the produced LNG would be delivered by trucks or fed into the network through mobile LNG vaporisers with a capacity of 75MW (or 0.18 mcm/d).

## 4.2 Natural gas supply infrastructure

### Ports, LNG Terminals and Pipelines

All natural gas is imported from Russia through a twin pipeline system that can be operated separately. The maximum annual import capacity of the pipeline of 82.1 GW (around 8.2 bcm/y, 22.5 mcm/d or 0.95 mcm/h at net calorific value) in the domestic network is determined by a domestic compression centre.<sup>2</sup> However, the hourly peak utilisation reached around 0.96 mcm/h in January 2010, thereby exceeding the maximum technical capacity. The normal utilisation rate of the Finnish gas pipeline network is about 85%. Finland has experienced a gas supply disruption only once during the past 20 years – this lasted one day and resulted from a pipeline accident near St Petersburg in the summer of 2007. At the time Gasum Oy used linepack gas to maintain gas supplies to consumers.

The transmission system operated by Gasum Oy has approximately 1,314 km of pipeline within Finland. With the distribution grid included, the total length of the gas pipeline grid is around 3,100 km. The system has three gas compressor stations with a compressor capacity of 64 MW. In Imatra there is a natural gas receiving station, where the amount of natural gas brought into the country is measured. The other two compressor stations are located in Kouvola and Mäntsälä with the central control centre located in Kouvola. Gas pressure of the existing pipelines is 30-54 bar pressure. There are around 200 interfaces which connect with transmission pipelines, 131 of which are pressure reduction stations in the network.

The gas grid is currently confined to the southern region of Finland, but Gasum Oy is planning to expand its natural gas transmission network to the western part of Finland, mainly to the cities of Turku and Naantali. The length of the pipeline extension would be about 200 km. In 2011, a new gas transmission pipeline was completed between Lempäälä and Kangasala (34 km). Gasum Oy has also completed constructing a new pipeline from Mäntsälä to Siuntio (89 km) last year. New pipelines are constructed for 80 bar pressure of gas.

In addition, a biogas production plant in Kouvola was connected to the natural gas transmission network in October 2011. The plant's biogas production capacity is about 7 GWh (or 0.6 mcm) per year.

There is no third party access to the gas pipelines. It will be applied if the gas network is connected to Baltic countries and other European countries, or if more than 25% of gas is supplied by another importer.

The Balticconnector project to connect Inkoo in Finland with Paldiski in Estonia, with a total capacity of 2 bcm per year, is under discussion in the context of Baltic Energy Market Interconnection Plan (BEMIP) which was initiated by the European Commission in 2008. It would allow Finland to access gas markets and storage facilities in the Baltic countries. The primary capital expenditure of the pipeline construction is estimated to be around 95-100 million Euros.

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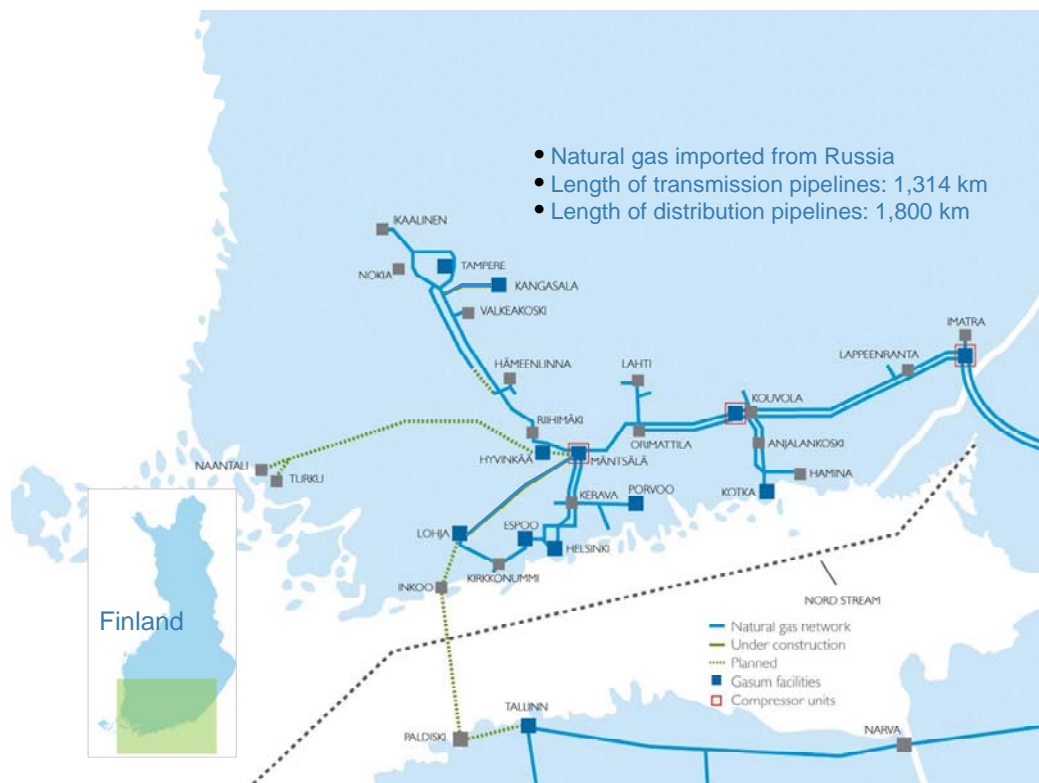
<sup>2</sup> The technical capacity of the pipeline at the border amounts to about 32 mcm/day.

## Storage

Finland has no large scale gas storage capacity in the country. All natural gas storage facilities in Finland are in the form of pipelines and spherical storages for daily balancing and peak shaving, which amounts to around 10-14 million cubic meters.<sup>3</sup> In addition, Gasum Oy operates an LNG storage facility with a capacity of 2,000 cubic meters for produced LNG in Porvoo.

A potential future connection to the Baltic countries via the Balticconnector project might create possibilities to use gas storage facilities in Latvia, as Finland's geological structure makes domestic storage very expensive to build.

### Natural Gas Infrastructure Map



<sup>3</sup> Around 4 mcm swings due to seasonal demand changes.



## 4.3 Emergency Policy for Natural Gas

Key elements for Finland's overall gas security policy are compulsory stocks in the form of alternative fuels for fuel switching, control of excess supply and cut back of contractual supplies, as stated in the Gas Emergency Response Plan, updated by the Oil Pool (natural gas section) of the NESO in 2011.

The Act on Compulsory Stockholding of Imported Fuels (1994) sets the standard of gas supply security for suppliers. The gas importer (Gasum Oy) and gas plants are required to hold alternative fuel stocks corresponding to three month's natural gas import. Municipal users consuming over 15 mcm of natural gas per year are also obliged to hold alternative stocks corresponding to three months of consumption. Substitute fuels are light or heavy fuel oil and/or propane gas. Industry users consuming gas as raw material have no obligation. The release of compulsory alternative fuel stocks would be decided by NESO in the event of a gas supply disruption.

According to the Act on Security of Supply (1992), NESO holds alternative fuels for gas disruption, and it decides the amount of its stocks with consideration for the Government's objective to have stocks of imported fuels corresponding to five months' consumption of all imported fuels. It covers stocks for industrial use on which there is no stockholding obligation. An emergency supply fee of 0.084 Euros per MWh is levied on natural gas users in order to maintain the public stocks of alternative fuels.

The Oil Pool of the Finnish NESO has a permanent natural gas section composed of members representing Gasum Oy (TSO), natural gas users in the communities and industrial users of natural gas, the Finnish Gas Association and NESO. As Neste Oil Oy is one of the largest users of natural gas, its representative participates in the natural gas section as well. The natural gas section led by the industry plays an active role by implementing emergency exercises and updating its operational handbook in 2011.

### Emergency response measures

Finnish TSO (Gasum Oy) has an early warning system deployed with a Russian control centre which is located 150 km from Finland. Due to another data connection system with Russia, Gasum Oy is able to monitor pipeline flow to 500 km within Russia. This system allows Gasum Oy to monitor real time gas flows in Russia and get early warning of potential disruptions in order to implement contingency plans switching to the parallel gas pipeline or deploy emergency response measures.

In the initial stage of a gas emergency, when a shortage of gas supply is anticipated, the TSO will first endeavour to curb consumption by increasing the price for excess gas and implementing a buy back system through the Gas Exchange. Price increases to balance gas supply and demand were used for peak shaving of natural gas in 2010.

If these measures are not sufficient to mitigate the impact of a gas disruption, the TSO will reduce the contractual capacities of all its customers on a pro-rata basis, except for protected customers (detached houses and other residential properties that directly use natural gas), as most residential buildings cannot use substitute fuels. Consumers can also reduce their own

consumption more than required by the TSO, and they can sell their quota to other customers through secondary market trade.

In the event that the natural gas supply is totally interrupted, NESAs can give permission to release compulsory stocks of alternative fuels, according to the Act on Compulsory Stockholding of Imported Fuels. Public stocks of alternative fuels for natural gas held by NESAs would be released by a decision of the Government according to the Security Supply Act.

#### Fuel switching possibilities from gas to alternative fuels

| Hours | Natural Gas / % | HFO / % | LFO / % | LPG / % | Others / % |
|-------|-----------------|---------|---------|---------|------------|
| 0     | 100             | 0       | 0       | 0       | 0          |
| 8     | 50              | 6       | 41      | 2       | 1          |
| 24    | 30              | 15      | 50      | 2       | 3          |
| 120   | 11              | 22      | 54      | 6       | 7          |

*Source: Administration*

Over 40% of natural gas consumption can be switched by light fuel oil within 8 hours after fuel switching starts (see table above).

An air-propane mixing plant has been built in Porvoo to provide protected customers with air-mixed propane gas. The air-propane plant can only be activated when the pressure in the transfer pipelines has fallen below 7 bars. The gas mixture capacity of the plant is equivalent to 350 MW (or some 0.84 mcm/d at net caloric value), by which gas demand of protected customers (200 MW or 0.48 mcm/d) can be covered.

The total emergency stock of LPG is 36,500 tons, corresponding to around 46.7 mcm of natural gas, around 70% of which is owned by NESAs (25,500 tons corresponding to 32,6 mcm of natural gas). In addition to protected customers, LPG stocks are planned to be used in the Porvoo refinery of Neste Oil Oy in case of a natural gas disruption. The Porvoo refinery is one of the largest consumers of natural gas, using 1.85 mcm/d of natural gas, which accounts for around 60% of its total fuel use for energy and hydrogen.

Domestically liquefied LNG in Porvoo can also be available during a gas disruption. However, as the LNG production plant is not connected to the gas network, the LNG should be delivered by trucks and fed into the network through mobile LNG vaporisers with a capacity of 75MW (or 0.18 mcm/d) from the LNG storage facility, which has a capacity of 2,000 cubic meters (or around 1.23 mcm).

Transportation of alternative fuels would be a challenge for the Administration and the industry during a gas disruption. Finnish private companies own 406 trucks for light fuel, 52 for heavy fuel and 2 for LNG in total, and only a small number of them stand idle. The Oil Pool has studied a transportation plan for a gas emergency.