



Appendix I: National Report for Finland

Seppo Kärkkäinen, July 1999

International Energy Agency Demand-Side
Management Programme
**Task VIII: Demand-Side Bidding in a Competitive
Electricity Market**

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1 Summary

The electricity markets in Finland are free to competition in generation and customer side, and all customers can freely select their suppliers. Transmission and distribution networks are lightly regulated monopolies offering market places to all suppliers and customers with similar conditions.

In Finland there are three basic groups of DSB-products on the market:

- Ancillary services including automatic frequency control services (DSB as momentary disturbance reserve) and system security services (DSB as fast disturbance reserve)
- DSB in regulating power market (balancing market) and
- supply contracts where supplier can directly switch off electric heat loads of customers or start reserve diesel plants of customers

The first two groups of DSB-products are bid by the system operator (Fingrid) and the last one by local utilities (supplier or network operator). Basically DSB can be used also for handling of transmission constraints inside Finland, but until now it has not been used for that.

General opinion on DSB is positive. Main reasons seem to be possible economic benefits and/or new business possibilities. Environmental reasons are not the most important, and environmental effects can be positive or negative. Opinions can be summarised as follows:

- System operator/transmission network operator has positive experiences from products related to ancillary services. Also new product related to slow reserve is under consideration. DSB can also be one way to handle transmission constraints if it can be seen economical compared to the increase of capacity
- Market operator is interested in DSB if it gives possibilities for new products to be offered to market
- Regulator sees DSB as an alternative to network capacity enforcement and possibly also for reserve capacity. Also environmental benefits can be obtained due to reduced peak load
- Suppliers are thinking new DSB-products from the economical point of view, but also environmental reasons are important (green image also important)
- Distribution network owners try to get new use for the existing load control systems which may be used for peak load reductions in networks, for services to suppliers and for improving energy efficiency at customers

During the discussions with different actors on the market several barriers were identified. Summary is given in the following:

- **Technical barriers.** In DSB-products related to ancillary services and balancing market all the loads contracted are not yet under direct control or real-time measurements. This barrier will be removed in the case of large customers, but exist also in the future for small customers. The use of load profiles instead of hourly metering is the barrier in developing new products for that group.
- **Structural barriers.** The main barrier is the separation of supply business from the monopoly network business. Cost and benefits from demand reductions are divided into different organisations/business units. The utilisation of the existing load control systems is more difficult than before.

- **Information.** The potential users and developers of DSB products are not aware on the possibilities of DSB. On the other hand, some suppliers are hesitating to offer products, which decrease the power quality due to image reasons.
- **Financial.** This is one of the main barriers at the moment due to low market prices. For example, the DSB products in balancing market are not used for this reason.

2 Structure of the Electricity Market

The legal basis for electricity market in Finland is defined in the Electricity Market Act (effective June 1, 1995) including the following features:

- Third party access (TPA) for customers above 500 kW started in November 1995. In January 1, 1997, TPA was extended to all customers although small individual customers were in practice excluded from competition due to the expensive hourly metering requirements making the transaction cost too high. In September 1998 small customers were allowed to change suppliers without new meters.
- Generation and electricity trade is subject to competition, while transmission and distribution remain natural regulated monopolies.
- Transport charge is based upon a “point tariff” (e.g., vary only by time and voltage level and is not dependent on transportation distance)
- Utilities are divided into business areas on an accounting basis (sales and distribution activities). The companies lose their franchise right in sales and have to compete on equal terms with other suppliers
- The government authority (the Electricity Market Authority) supervises transport tariffs (i.e., fees for transmission and distribution) under the conditions of reliability and economic efficiency.

According to the Electricity Market Act, the electricity transmission and distribution networks are neutral marketplaces that are to serve both buyers and sellers with fairness and equality. Each end user can buy electricity from any supplier in the market. For this to be possible, distribution is to be transparent and regulated, while selling, importing, or exporting electricity no longer require a special permit. Energy production as such is also no more subject to a permit, although permits are still required by environmental laws and nuclear energy legislation for nuclear power plants.

The network business is seen as a natural monopoly. It is regulated, but the regulation is light-handed, based on publicity and transparency of the network business instead of heavy-handed, strict rules. Network companies are required to maintain separate accounting for network business, selling of electricity, generation of electricity from each other, and other business.

The physical structure of the Finnish electricity system is presented in the figure 1 and trading arrangements in the figure 2

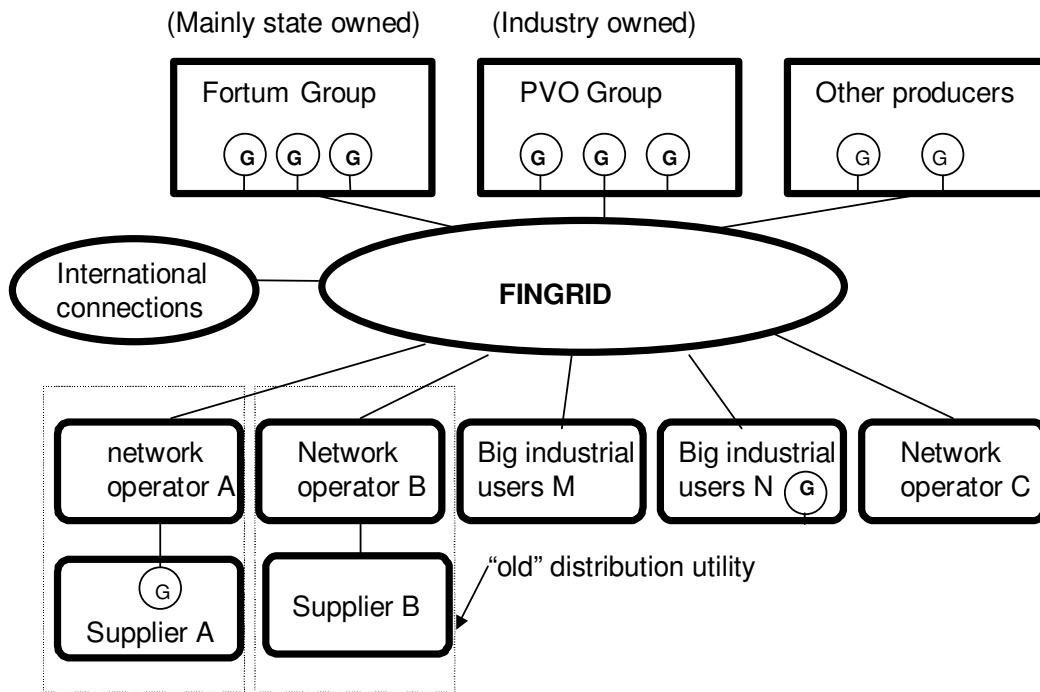


Figure 1. Electricity system of Finland

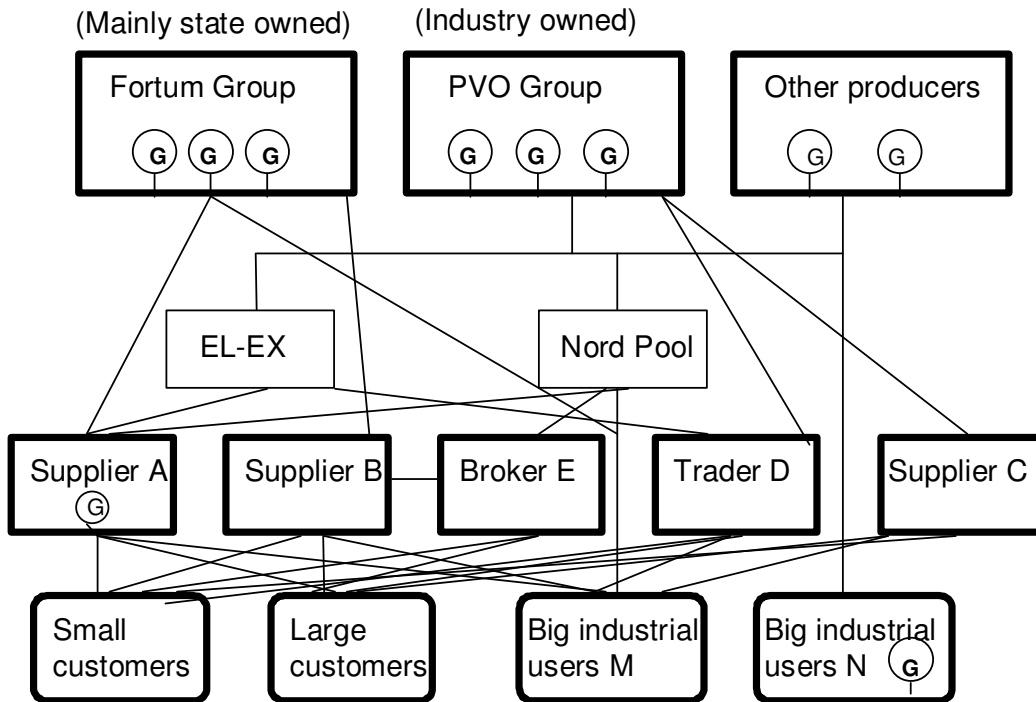


Figure 2. Trading arrangements in the Finnish electricity system

According to the above figures the main players in Finnish electricity market are:

- **Fingrid Oyj** acts as both *System Operator* and *Transmission Network Operator*. Its responsibilities are defined in the Electricity Market Act including also the upkeeping of the national balance, which is partly based on the trade of balance differences, and the centralised balance clearing (settlement) system. The special company owned by Fingrid called Fingrid Systems takes in practice the system responsibility. Fingrid is a share-holding company owned by Fortum (1/3 from the shares), PVO (1/3), the Finnish government (1/6) and institutional investors (1/6). All the costs related to the mandatory responsibilities of Fingrid are covered through network tariffs (point tariffs).
- There are two *Market Operators* in Finland: **Nord Pool** and **EL-EX**. They operate in close co-operation having a little bit different products. Nord Pool is the Nordic Power Exchange owned by the Norwegian and Swedish grid companies, and EL-EX is the originally Finnish power exchange owned at the moment by Fingrid and the Swedish grid company Svenska Kraftnet. EL-EX also represents Nord Pool in Finland. Only part of electricity is traded through market operators: most of the electricity is traded on the basis of bilateral contracts between wholesalers (generators) and large industrial companies or retailers (selling parts of distribution companies).
- **The Electricity Market Authority** started its operation as *Regulator* in 1995, at the same time the Electricity Market Act took effect. It works in co-operation with the Office of Free Competition, and finances its operation primarily with supervision and permit charges collected from network operators.
- *In generation side* there are more than 300 generating units, which can be grouped into 3 main groups: Fortum (40 %), PVO group (40 %) and others (20 %). Fortum is a result of the merge of the national oil company Neste and the largest power company IVO, and it is share-holding company where the majority of shares is owned by the Finnish government. PVO group is industry owned power company, and the large part of its generation is in process industry (industrial CHP). Rest of the generation is mainly owned by local utilities having usually CHP generation plants producing both electricity and district heat for the local heat distribution networks.
- Traditional utilities operating in local distribution areas are at the moment divided into separate unit at least on bookkeeping base: *network operator, generation part, selling part and other businesses*. Network business is regulated having a monopoly over an area according to the licence given by the Electricity Market Authority. Inside its distribution area the network operator must have public network tariffs (point tariffs) which are same to all suppliers. At the moment there are more than 100 network operators although the number is decreasing. Local utility must also have public energy tariffs for those customers who are not willing to change their suppliers. The supply business (generation, trading and selling of electricity) is highly competitive business where small utilities may have high risks. Therefore that part of utilities is often separated into new larger companies owned by several small traditional utilities. Therefore the number of suppliers is decreasing more rapidly than that of network operators. On the other hand, also new national traders are coming into market (Vattenfall, oil companies etc.).

- All customers are free to select their suppliers. Since September/November 1998 small customers (< 45 kW) don't have needed hourly meters, but larger customers (> 45 kW) still must have hourly meters if they change their supplier from the local one. As a result of competition most of the larger customers have changed their suppliers or negotiated new contracts with their existing supplier. From the 2.2 million small customers about 1 % has changed its supplier. Also some new small customer organisations are buying electricity as groups: farmers, small-house owners etc. As a result of the competition suppliers have decreased also their public tariffs by 5...15 %, and thus also those customers who are not willing to change their supplier have received benefits from the competition.

The rest of this report is mainly based on the answers to the questionnaire prepared by the Operating Agent and experts of the IEA DSM Task VIII. The following organisations in Finland were interviewed in the connection of the questionnaire: **Fingrid Oyj** (system operator and transmission network operator), **EL-EX** (market operator), **the Electricity Market Authority** (regulator) and **Espoon Sähkö Oyj** (supplier).

3 Experiences with Demand Side Bidding

In Finland there are three basic groups of DSB-products on the market:

- Ancillary services including automatic frequency control services (DSB as momentary disturbance reserve) and system security services (DSB as fast disturbance reserve)
- DSB in regulating power market (balancing market) and
- supply contracts where supplier can directly switch off electric heat loads of customers or start reserve diesel plants of customers

The first two groups of DSB-products are bid by the system operator (Fingrid) and the last one by local utilities (supplier or network operator). Basically DSB can be used also for handling of transmission constraints inside Finland, but until now it has not been used for that.

In the following a short description of the existing products is given.

A. DSB as momentan (momentary) disturbance reserve

Fingrid is responsible to have enough momentary disturbance reserve capacity in Finland as a part of Nordic system. At the moment, the requirement is about 240 MW. Fingrid has arranged that on commercial basis setting up a so-called reserve bank having contracts with generators and owners of controllable loads. At the moment the reserve bank has about 700 MW momentary disturbance reserve capacity. From that about 330 MW is in interruptible loads of 5 industrial companies. They are used usually only once per 3 year. The system has been in operation since 1998 and seems to be working well.

DSB-product is thus used for automatic frequency control during disturbances in Nordic generation system when the frequency is below 49.5 Hz. Fingrid offers the product and large industrial customers are buying it.

The contract period is one year. The contractor has no responsibility to keep the load continuously connected to the grid, but the fees paid to the contractor are dependent on how long time per year the load is connected to the grid. The fees are following:

- Fixed contract charge (1 Euro = 5.95 FIM)
 - 30000 FIM/MW, if the availability of the load is > 2000 h/a
 - 15000 FIM/MW, if the availability is < 2000 h/a but > 500 h/a
 - non, if availability is < 500 h/a
- Hourly fee 2 FIM per MW per h
- Energy fee if the load is disconnected by Fingrid

Most of the loads are under direct control of Fingrid and are measured and monitored in real time, and the aim is to have all loads under real-time control. Fingrid provides the communication system.

B. DSB as fast disturbance reserve

Fast disturbance reserve is needed after larger disturbances to maintain the system security and to release the momentary disturbance reserve for its original purpose. Fingrid has some own capacity for this purpose, and it has agreed similar contracts with generators and owners of interruptible loads as in the case of momentary disturbance reserve. Loads are for this purpose with similar conditions as explained earlier in the case of momentary disturbance reserve. Actually the same loads are usually used for both purposes. Loads are used for fast disturbance reserve usually about once a year.

The main idea is that the fast disturbance reserve is used primarily in disturbance situations but Fingrid can offer it also to balancing market (see product C) pricing it with running costs + 5 % margin.

C. DSB in regulating power (balancing) market

Fingrid is responsible for upkeeping the national balance of electricity system in Finland. For that purpose it has organised the regulating power market, which are used for balancing purposes during the operation hour. In these market Fingrid System is asking upward or downward regulation on the basis of offers given by the owners of regulating power (this can be either generation capacity or interruptible load). The price defined in these regulating power market is also used as reference price between Fingrid System and so-called balance responsible suppliers when balance differences are cleared day after the operation day.

Each balance responsible supplier has the responsibility to try upkeep its own balance, and the pricing of balance differences has also incentives to suppliers to do that. In the balancing market the supplier can buy a balance window with a price of 5000 FIM/MW per month and if its balance difference is inside this window then the price is the normal price of balancing electricity, but if the window is exceeded then the price is higher. For the suppliers there are two physical markets by which they can try to upkeep their own balance: Elspot-product offered by Nord Pool for each hour of the next operation day (market closed 12 hour before the operating day) and Elbas-product offered by EL-EX for each operation hour (continuous trading closed 2 hour before operation hour).

The regulating power market organised by the Fingrid System is a complementary market for the above ones and also interruptible loads can be offered to the market. The product has the following characteristics:

- The offer is given for the next operation hour and the market is closed 10 minutes before the operation hour
- The offer includes the power (+/- MW), price (FIM/MWh) and the transmission area inside Finland
- Minimum power offered is 10 MW and the power must be available at least within 10 minutes from the activation
- Fingrid System can activate the offer starting from the beginning of the operation hour or later during the operation hour

- The price of regulating power is the marginal price of the last activated offer during the operation hour.
- The regulation must be registrable. In the future real-time measurements are required

As mentioned above DSB is possible in the regulating market. In practice it is not yet realised mainly due to low price level of regulating power market.

D. Supply contracts (mainly with customers having direct resistance heating)

Small houses in Finland are often heated by electricity, and direct resistance heating is quite common. About 600000 small houses have electric heating. They usually have time-of-use tariffs with lower electricity prices during night and/or summer times. Therefore domestic hot water is usually produced during night-time and stored in the hot water tank. Space of the house is often heated through direct resistance heating. This heating load or part of it can be interrupted for short periods without harm to customers. This kind of direct load control contract has traditionally been offered by several utilities to their customers. The number of that kind of contracts in Finland has been 30000...50000 and they have been offered by tens of utilities.

The main characteristics of the product are:

- The main reason for the product has been the structure of whole-sale tariffs with very high penalties if the pre-ordered demand is exceeded
- The product is offered by local suppliers to reduce their own peak loads
- Long-term contract time (usually continuous)
- Supplier can interrupt the load directly without any notice
- Interruption can last usually 0.5...2 hours depending on the type of the house
- The number of interruptions is usually limited to 1 to 2 per day and certain time between successive interruptions is required. In some contracts also the maximum number of interruptions per year is defined
- The availability fee is usually 50 % reduction from the fixed charge corresponding usually 300...500 FIM/a. No extra trigger fees are paid
- Supplier has usually one-way communication system to customer (ripple control or distribution-line carrier system)

The direct load control has been used during cold winters in Finland especially in 1985 and 1987, and also sometimes later. However, the use of the system is decreasing due to several reasons:

- Whole-sale tariff system is no more defining marginal price of electricity, and marginal price defined by spot market has been quite low and don't give incentives to offer product
- Customers did not usually remember or understand this kind of contract and complained from interruptions
- Separation of supply business from network business has caused organisational problems because the technical system is usually owned by the monopoly part but also suppliers may need the system

Also some other type of supply contracts have been available from some utilities: for example the use of reserve diesel plants owned by the customer either directly or indirectly by supplier during peak load periods. These kinds of contracts are usually bilateral contracts and their forms have been different at different utilities. One special type has been the heating contract with large buildings where the utility has bought the existing oil boilers and assembled an electric boiler parallel to that and used electricity and oil for heat production depending on price level.

4 Views towards Demand Side Bidding

General opinion on DSB is positive. Main reasons seem to be possible economic benefits and/or new business possibilities. Environmental reasons are not the most important, and environmental effects can be positive or negative.

Comments can be summarised as follows:

- System operator/transmission network operator has positive experiences from products related to ancillary services. Also new product related to slow reserve is under consideration. DSB can also be one way to handle transmission constraints if it can be seen as economical compared to the increase of capacity
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5 Barriers to Demand Side Bidding

During the discussions with different actors on the market several barriers were identified. Summary is given in the following:

- **Technical barriers.** In DSB products related to ancillary services and balancing market all the loads contracted are not yet under direct control or real-time measurements. This barrier will be removed in the case of large customers, but will exist also in the future for small customers. The use of load profiles instead of hourly metering is the barrier in developing new products for that group.
- **Structural barriers.** The main barrier is the separation of supply business from the monopoly network business. Cost and benefits from demand reductions are divided into different organisations/business units. The utilisation of the existing load control systems is more difficult than before.
- **Information.** The potential users and developers of DSB products are not aware on the possibilities of DSB. On the other hand, some suppliers are hesitating to offer products, which decrease the power quality due to image reasons.
- **Financial.** This is one of the main barriers at the moment due to low market prices. For example the DSB products in the balancing market are not used for this reason.

6 Discussion and Conclusions

In Finland DSB is utilised successfully in ancillary services of system operator and also new products are under consideration. In balancing market DSB products are also available but they are not used due to low price level.

The market operator is interested in possible new products based on DSB. New innovations are expected also from this project: products should be beneficial to both market operator and sellers of demand side bids.

Local utilities have traditionally offered products based on direct load control of electrical heating to their customers. New barriers related to low market prices, structural changes in utilities and price based competition are decreasing the interest to that kind of product. On the other hand, the technical system is still available and new innovative products can be developed. Environmental image in the products can be important factor.

General opinion to DSB is positive mainly on the economical reasons, and new business possibilities are searched. New developments in IT technology and building automation give new possibilities in developing DSB products.