# A perspective on the restructuring of the Finnish electricity market

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**Although 1995 was an important year in the deregulation of the Finnish electricity industry, with the enactment of the Electricity Market Act (EMA), the market in Finland has always been very liberal. This is probably one of the most distinct features of the Finnish situation. This paper introduces a four-dimensional restructuring framework to put the Finnish reform process into perspective. The dimensions are market type, ownership and horizontal and vertical integration. Some important aspects of reforms in other countries are also presented, showing the originality of the Finnish case. We describe the market before and after 1995 and highlight the changes. This is the first such analysis of the Finnish electricity reform in energy literature.**
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## Introduction

Many countries are making a *paradigmatic* change to their electricity markets. From reliance on central coordination, they are moving toward faith in free competition. Previous deregulation experiences of smaller nations, such as Chile, New Zealand and Finland, tend however to remain in the background or are very poorly documented. These experiences nevertheless contain relevant information that could benefit other energy market redesigns. Moreover, the Finnish case is unique in the sense that, even before the official reform, the market was already very open. All changes were made progressively, with no radical transformations such as, for example, the breakdown and privatization of the main utility in the U.K. The goal of this paper is to give an account of the original development and interesting features of the Finnish electricity market reform. More precisely, the Finnish experience is of interest for at least two reasons. First, the structure of the Finnish electricity industry has been unique and, on some occasions, at odds with that of other countries. Its portray is in itself clearly appealing when considering industry structure possibilities. Second, electricity reforms in Nordic countries, England and New Zealand are often referred to as classical examples. Yet, though Finland is a Nordic country, greater attention has been given to the Norwegian and Swedish cases (e.g. Hjalmarsson, 1996, Amundsen and Bergman, 1998, and Midttun and Summerton, 1998). Since some significant features distinguish the Finnish market, a thorough presentation of it could help to understand the unifying movement observed in Nordic electricity markets.

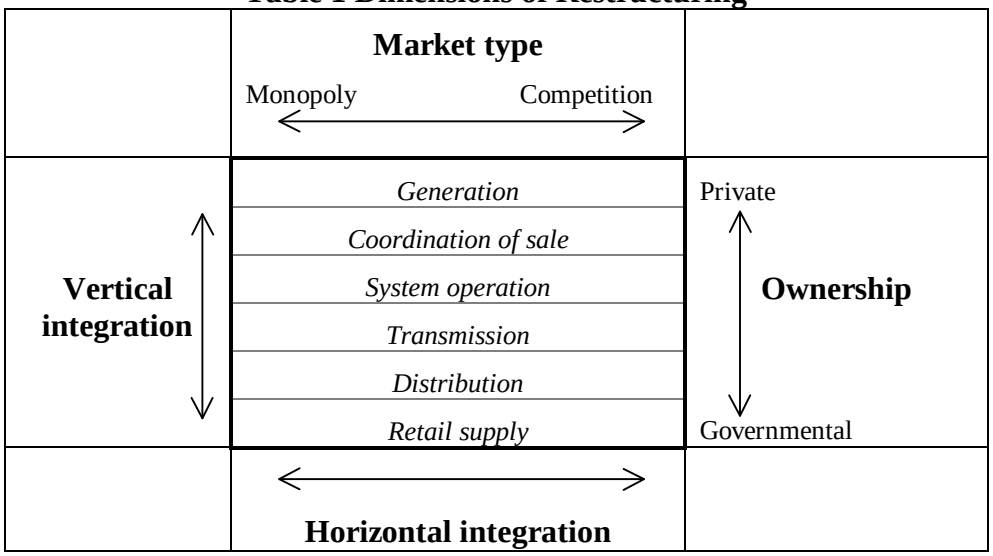
First we introduce a framework that sheds light on the different dimensions of electricity reforms. We quickly review how some pioneering countries have moved along these lines. Then, we describe the Finnish restructuring process in two steps. We start with a portrait of the pre-reform situation and continue with the reform itself and its outcome. A third section provides a brief analysis stressing some possible shortcomings of the resulting structure.

## Market restructuring and international overview of electricity reforms

### *A restructuring framework*

Many *restructuring* moves can be accomplished in what is rather simplistically labeled "liberalization" or "deregulation" of the electricity market. A mixture of these moves is usually involved in this restructuring process, aiming in all cases at a more competitive electricity market. The electricity market can be broken down into six levels, as presented in the center of Table 1. Each of these levels represents a specific subgroup of the industry that can be structured in its own way. The four dimensions that define a structure are the *market type*, *ownership* and *horizontal* and *vertical* integration of firms.

**Table 1 Dimensions of Restructuring**




The *market type* dimension goes from a purely competitive industry to a monopolistic one, with different degrees of oligopoly in between. The *ownership* dimension shows how involved the government is in the utilities. This involvement can range from complete control to total absence. Intermediate levels include mixed ownership, partial control and various social/political objectives. The *horizontal* and *vertical* integration dimensions indicate the two types of concentration that can occur in an industry. Firms can be highly specialized in their activities or in specific markets (being respectively vertically and horizontally *dis*integrated), or, on the contrary, they can cover many businesses and different markets (greater integration). The horizontal integration dimension differs from that of the market type mainly, but not only because of some spatial issues. For example, there could be different small, regulated monopolies in

different areas. However, from a more global point of view, these monopolies are distinct from each other and the level of horizontal integration could be very low[1].

Along these four dimensions, many possible types of reforms are feasible at each level of the industry. If all the theoretically possible combinations of each of the six levels were computed, the result would be a very large number of cases, only a few of which would be really interesting. It is not our purpose to go through all these possibilities. First, because an exhaustive survey would not be appropriate, and, second, because the most relevant cases have already been presented in numerous places (e.g. Yajima, 1997, OECD, 1997b, see also Hämäläinen and Pineau 1999 for an overview of new models).

The six levels of the electricity sector presented in the center of Table 1 can be further classified into two groups, according to the *physical* and *informational* natures of the activities performed. In the next section, we summarize the usual actions that are taken at each of these levels.

### *International experiences*

For the physical activities occurring at the *generation*, *transmission* and *distribution* levels, competition is usually discussed only for the generation level, as natural monopoly features still characterize transmission and distribution. To introduce competition, horizontal disintegration of large generation utilities is carried out or entry is made legal by changes in the law (see Table 2).

At the other three levels, *coordination of sales*, *system operation* and *supply*, where informational activities are carried out, competition usually occurs only in (retail) supply, and has been introduced in several countries (see Table 2 below). It is on this level that the energy part of the electricity service (distinct from the transmission and distribution parts) is managed. Sales are coordinated in two ways: using over-the-counter bilateral contracts or spot markets. Spot markets pool production to sell it to buyers. Such pooling can be mandatory (as in the British system) or parallel to direct bilateral contracts between sellers and buyers. At that level, competition could occur only if different spot markets are active in the same region, which is usually not the case since an official spot market is designated. Within the pool, many mechanisms can be used to fix prices. Different bidding and auctioning systems can be developed, but we again refer to other works for detailed description of these procedures because this kind of review is outside the scope of this work (see Hunt and Shuttleworth, 1996, Yajima, 1997). Finally, system operation is responsible for the physical dispatch of electricity from power plants to distribution systems, through transmission lines and transformers. System operation is mainly an informational business because it has to gather information about inflows and demand, respecting the constraints of physical systems. No responsibility is assumed for generating electricity, and the physical transmission and distribution assets do not have to be under its ownership. Indeed, in the United States, the FERC is promoting a system with an Independent System Operator (ISO) only managing the system and not owning any physical assets (transmission and distribution wires). They would remain under the ownership of utilities. This level of the business still has to be kept centralized and thus regulated.

Table 2 presents a synthesis of the main features of some of the most relevant international examples of electricity market reforms[2].

**Table 2 Highlights of Electricity Market Structures for Some Pioneering Countries**

| Major features | | Countries | | | | | |
|---|---|---|---|---|---|---|---|
| | | **California** | **Great Britain** | **Chile** | **New Zealand** | **Norway** | **Finland** |
| Vertical disintegration<br>*p* = with privatization | | | • *p* | • *p* | • | • | • |
| Horizontal disintegration<br>*p* = with privatization | | | • *p* | • *p* | • | | |
| Competition in generation | | • | • | • | • | • | • |
| Spot market<br>*m* = mandatory pool | | • | • *m* | *m* | • *m* | • | • |
| Transmission assets | System operation | Independent | NGC | ELDC | Transpower | Statnett | Fingrid |
| | Owner | Utilities | | Transelec | | | |
| Type of organization | System operation | Nonprofit organization | Privately owned by distributors | Gvt. Agency | State firm | State firm | Utilities, state, investors |
| | Owner | Private | | Private | | | |
| Competition in transmission | | | | • | | | • (withdraw) |
| Competition in distribution | | | | | | | |
| Competition in retail supply | | • | | | • | • | • |
| Main references | | Bushnell & Oren (1997) | Newbery & Green (1996) | Rudnick & Raineri (1997), Spiller & Martorell (1996), Yajima (1997) | Read (1997) | Bråten (1997) | Ministry of Tade and Industry (1997a) |

NGC: National Grid Company
ELDCs: Economic Load Dispatch Centers (Centro de Despacho Económico de Carga)

In almost all cases, the reform contained some vertical disintegration to separate generation from transmission. Indeed, in all countries except California and Chile, where an Independent System Operator (ISO) was created, transmission assets and system operation have been separated from generation to avoid any transmission privileges. In California, system operation is carried out by the ISO even though transmission lines remain the property of the previous owners (utilities). It is also worth mentioning that in Chile investment in transmission is open to anyone and some competition does take place in that sector between the major transmission company, Transelec, and other smaller ones (Rudnick and Raineri, 1997). System operation in Chile is planned by the Economic Load Dispatch Center (ELDC), which is an body governed by the National Energy Commission (CNE). In Finland, as seen below, competition in transmission has been discontinued. Spot markets were also created with all reforms, except in Chili where competition occurs through contracts only (Yajima, 1997). However, as in England and Wales, a mandatory pool enables the ELDC to calculate a system marginal cost, which serves as a basis for the market price. When a spot market is active, the spot price directly generates a public reference price.

Detailed description of all reforms can be found in many references (some are given in Table 2), except for the Finnish case, which has been covered in relatively few papers that are not widely available. The only ones of which the authors are aware are Rännäri (1995), Ministry of Trade and Industry (1997a) and OECD (1997a and b).

## The Finnish reform process

### *Pre-reform Finnish electricity industry*

The Finnish electricity industry is unique due to its historical development and this has led to unusual reforms. Indeed, at the beginning of the century, Finland was far from being an industrialized country and the GNP per capita was clearly below that of any other Nordic or western European countrys[3]. All electricity technology had to be imported and wood was still the major energy source. From that original state, a modern, diversified electricity industry arose. This industry is as efficient as that of countries initially much more developed. For a complete account of the historical development of the Finnish electricity industry until the 90's, see Myllyntaus (1991). Here we review the more recent regulatory changes that took place in 1995 with the Electricity Market Act (EMA).

#### Generation and coordination of sales levels

In Finland, generation has always been a multi-player business. Even with a state-owned company (*Imatran Voima Oy*, or IVO, now called Fortum[4]) that dominates generation with more than 30% of the total production capacity (it has approximately 5 000 MW[5]), other smaller utilities were already important before deregulation and had a capacity of nearly 4 000 MW. Distribution companies (2 000 MW), and industries (2 400 MW) were also producing.

The wholesale market was in theory open, but in practice dominated by IVO and limited by long-term contracts and difficult access to the grid. Nevertheless, industries and distributors were allowed to produce and sell, thus limiting the monopoly power of IVO. Small private pools operated to dispatch in an efficient merit order, under the leadership of IVO and other producers. To ensure high level reliability of the system, a regime of cooperation and self-regulation was maintained between the different parties. This means that no regulatory board with duties similar to those of the *North American Electricity Reliability Council* (NERC) ever existed.

Another distinctive feature of the Finnish electricity industry is the diversity of the production technologies in use. Nuclear (27%), hydro (17%) and all types of thermal units are utilized, with as much as 32% of electricity coming from Combined Heat and Power production (CHP)[6], making Finland a leader in this technology. Remaining electricity comes from other thermal units and imports. After 1989, no construction permit was needed for power stations with capacities lower than 250 MW. Nuclear power and hydropower production nevertheless remained controlled by specific environmental regulations. A license was also still needed for foreign trades of electricity.

## Transmission and operation control levels

At the time, a very unusual feature of the Finnish electricity industry, compared with the worldwide situation, was the presence of competition in the transmission network. Indeed, two companies, IVO and *Pohjolan Voima* (PVO), owned and operated most of the transmission lines, with some parallel links in certain locations. From 1992 to 1997, subsidiaries of IVO and PVO, respectively IVS and *Teollisuuden Voimansiirto* (TVS), were required to manage their transmission activities.

The purpose of TVS was to minimize the costs of a consortium of generators who wanted to avoid using IVO's network. Hence, no real open access to third party was available in this network, which was also limited in length. The IVS network was open to third parties and the transmission pricing system used is described in Table 3[7].

**Table 3 Transmission Pricing Structure of IVS**

| | Duration | Component | Variables |
|---|---|---|---|
| Long-term contracts (S-2000 pricing) | 5-10 years | • Fixed fees (FIM / input-output points / month).<br>• Power fees (FIM / MW / month).<br>• Distance-relative fees (FIM / MWkm / month). | • Density of population in area of transmission.<br>• Length of contract. |
| Spot transactions | temporary | • Fixed and variable components. | |

All spot transactions were subordinate to long-term contracts, so they took place only if there was no conflict with them. The level of fees was fixed to cover the forecast average cost plus an adequate profit for IVS. Some restrictions on these fees were, however, introduced owing to the fear of others entering into transmission. Indeed, construction of new lines was open to anyone, and IVS had the obligation to link such lines with the existing network.

This pricing practice limited spot transactions and was not providing an efficient signal to the producer of electricity because there was no short-term indication regarding the losses and constraints of specific transmissions.

At the operating level, the following should be noted regarding IVS's behavior:

- Losses of transmission were compensated by IVS's electricity purchases according to anticipated use of the network. This was at IVS's own risk.
- IVS cooperated with other networks whenever it could avoid losses.
- When lines were congested, or near full capacity, no long-term contracts were made. Only spot agreement were possible.
- In peak periods, if a congested line was blocking a transmission, out-of-merit power was bought (by IVS) at the destination node.

This transmission pricing practice precludes full efficiency for the following reasons. First, IVO was the main user of its own grid but was not applying its transmission pricing scheme for its own production. The global efficiency efforts in transmission pricing were consequently smoothed out. Indeed, the economic signals contained in the

transmission price were not apparent in the price of energy sold. Furthermore, these signals could be of only really limited scope because they did not reflect the continual (or at least hourly) changes in the network. Marginal losses and constraints caused by a particularspecific transactions could not be taken into account.

### Distribution and retail supply levels

About 100 distribution companies[8], owned mainly by municipalities, were operating in their local (and exclusive) territories. Between their networks and the high-voltage transmission network, some regional networks were in operation, linking the national grid to the distribution networks. Table 4 shows the number of different owners and the voltage of the three types of networks before 1997[9].

**Table 4 Number of Owners and Voltage Level of the Different Networks**

| Level | Number of owners | Voltage |
|---|---|---|
| Distribution network | 113 | 0.4-20 kV |
| Regional network | 10 | 30-110 kV |
| Transmission lines | 2 | 110 kV and over |

Construction of lines was already open to anyone, but approval from the Ministry of Trade and Industry (Electricity Market Authority after 1995) was required for lines exceeding 110 kV. Distribution companies could build lines without special permission in their territories, but authorization was required for projects on other territories. Pricing principles of the distribution and regional networks did not change after 1995. They will be discussed later.

Distribution companies had a monopoly over their territory, so retail customers were captive. From 1988 to 1995, the Office of Free Competition (OFC) monitored their pricing, on a "reasonable profitability" basis.

### Regulator role

Under the system we described in the previous sections, only one organization acted as a regulator: the Ministry of Trade and Industry. Generally, the OFC's role was only to react to complaints and monitor "free competition". The following points can summarize the Ministry's main duties in the electricity sector:

- Delivering licenses for nuclear production;
- Delivering licenses for transmission lines of 110 kV or more;
- Adjudicating complaints about transmission prices in the three networks and abuse of monopoly power in distribution;
- Monitoring imports.

These are limited fields of action, compared with the traditional role of regulatory agencies. In most countries, regulators usually have some control over new production capacities, prices and levels of profits for companies involved in generation, transmission and distribution. The Ministry’s monitoring was mainly reactionary and relied on the owners’ cooperation. Indeed, there were no explicit, detailed written rules.

### *Opening of the Finnish electricity market*

Efficiency and competitiveness were the main drivers of the Finnish reforms (OECD, 1997a). However, the desire to fully participate in the Norwegian/Swedish electricity market and therefore to create a Nordic electricity market also played an important role in the process.

The common public marketplace for Sweden and Norway, and its major coordinating tool, is the Nord Pool, which dates from January 1996[10]. This market is composed of a spot market, a future market and a regulation (balance) market. Since October 1996, Finnish companies have been active in this pool, but not as full participants because of the domestic market differences with Sweden and Norway. Denmark was initially in the same situation as Finland and some border fees were imposed on inter-country transmissions. However, after the reforms in the Finnish market, the situation changed in 1998 for Finland with the removal of the border fee between Finland and Sweden, and its complete integration in Nord Pool. Finland is now a distinct Nordic price-zone. We now retrace the moves made by Finland to join this ground-breaking international electricity marketplace.

#### The Electricity Market Act

The objective of the 1995 Electricity Market Act (EMA) was to increase efficiency and competition in generation and transmission in order to be ready for an opening of the Finnish electricity market to international competition (mainly from other Nordic countries). Compliance with the EU policy energy directives was also a factor[11].

The EMA led to the following results:

- **Creation of the Electricity Market Authority - 1995**. It is "an independent expert body subordinate to the Ministry of Trade and Industry"[12] supervising transmission pricing and delivering licenses for transmission operations.
- **Gradual opening of network**. In 1995 open access was given to lines over 500 kW, and to all lines at the beginning of 1997 (see Creation of Fingrid below).
- **Creation of EL-EX - 1995**. This formal, independent power exchange organization was created to ease trade of electricity by offering standard spot contracts. Basic contracts were of one hour, and could be grouped to form blocks of various lengths.
- **Unbundling of tariffs - 1996**. Tariffs shown to customers must provide as complete an itemization as possible of the various components of electricity delivery, namely energy, transmission and measurement.
- **Unbundling of book keeping - 1996**. Companies involved in both generation and distribution have to keep separate accounts for each activity.
- **Tax reform - 1997**. The new tax focuses on consumption instead of production, in harmony with the situation in other Nordic countries.
- **Creation of Fingrid - 1997**. This independent company was then created to operate the transmission network in a neutral manner. More details are given below.

- **Complete opening of the market - 1997**. From the beginning of 1997, all customers were able to choose their suppliers. However, in practice, a costly metering system (5 000 to 10 000 FIM[13]) was needed, and only large consumers could really select this option. Since the fall 1998, such meters are no longer necessary because a "load profile" system is used (see below for more on this topic).

The EMA improved the market structure to bring it closer to free market principles and practices in other Nordic countries. Before describing in more detail changes and actual practices in different levels of the industry, we present two sectors where the EMA had remarkably low impact. The first one is the nuclear sector and the second, trade.

Contrary to other deregulation cases, significant, non-decreasing use of nuclear power remained after the EMA. Nuclear power is indeed fading in many countries (United States, Canada and United Kingdom) because of difficulties in integrating such production units into the free market[14]. It is noteworthy that in Finland nuclear power remained sustainable. This situation can be explained by a successful choice of reactor technology, efficient management and adequate regulation on safety and licensing (Hjalmarsson, 1996). We should also mention that, in Finland, nuclear power was developed in a context of low regulation, so that the financial plans for investment in this technology were not deeply affected by market restructuring. However, as reported in Hämäläinen (1991), the policy debate on nuclear power is strong in Finland. The construction of a fifth nuclear power plant is still an open issue.

The EMA also had a limited influence on trade. All previous type of trade remained in use. These types are:

- **Bilateral contracts**. A seller and a buyer make a private agreement for the supply of electricity. This mainly covers base load needs, and is generally done on a mid- or long-term basis. Most trades are still made under this kind of contract.
- **Official spot markets**. The Finnish spot market EL-EX created at the time of the EMA and now part of the Nord Pool, covers only approximately 10 to 15% of traded electricity[15].
- **Private pools**. For immediate and small supply adjustment, private pools made up of various competitors are used. They cooperate in the continuous exchange pool to minimize their own dispatch cost. In March 1998, three private pools were operating in Finland.

As it can be seen, we presented trading places in relation to types of contracts ordered according to length, from longest to shortest. In the first case, agreements could last years, whereas in the last one, minutes. Final balance settlements are made within the grid.

Since bilateral contracts still cover the majority of power exchanges, less intense competition is taking place in the spot market. This situation will change as contracts progressively end. At that time (1999-2000), buying in the spot market could be more desirable for bulk customers than having a fixed contract with one producer. Also, all new contracts will probably be linked to the spot price.

## Change in the transmission level

It is the transmission sector that was most affected by the EMA. This is because transmission has to be impartial and fully open to give all those involved the same opportunities to transmit outputs of trading. Independence was achieved by merging the two existing grids in one national network, and changing the ownership structure. The result was the creation of Fingrid, a private company operating, maintaining and developing the high-voltage transmission lines.

We describe the main characteristics of Fingrid and its central role first, then we give an overview of the transmission pricing used and, finally, we discuss the investment issue in the grid.

### Fingrid

Fingrid operates the national transmission network of Finland, which "carries" all electricity at a voltage equal to or higher than 110 kV. The company owns 13 600 km of lines, representing almost all the transmission lines of Finland and all the cross-border lines. Starting its operations in September 1997 after the merger of the transmission assets of IVO and PVO, Fingrid is now owned at an equal level of 25% by IVO and PVO, the state (12%) and by institutional investors (38%), which have no other interests in the electricity business. This type of ownership is different from that in other countries[16].

Fingrid plays a central role in the free operation of the market for two reasons. The first is that open access to transmission lines is crucial for competition to take place. Indeed, if only one player controls the network, he has the power to limit electricity transactions and can then prevent competition from taking place, if to do so is to his advantage. The second reason is more closely related to the development of the market in Nordic countries. The official electricity trading place for Norway and Sweden, Nord Pool, is equally owned by Statnett and Svenska Kraftnat, the national grid companies of these countries. In order to integrate Finland into this common free market, Fingrid must also participate as an equal in Nord Pool. The goal is to integrate transactions taking place EL-EX to those of Nord Pool. A first move in this direction was when Fingrid bought EL-EX in February 1998, preparing the combination of the two pools. Now Finland constitutes a distinct price-zone for the Nordic spot price of electricity set in the Nord Pool, and EL-EX no longer exists as a separate body.

Co-ownership of the pool and grid can provide efficient coordination of electricity transactions and transmissions. Neutrality in the network is possible if no player has a dominant participation and if transmission prices are non-discriminatory. We investigate this point in the next section.

### The transmission pricing system

In November 1998,Fingrid introduced a new, simpler, transmission tariff. It replaced the previous "point-tariff" principle used only since 1997 (see the appendice). This tariff gives the right to use the whole transmission network, without spatial restrictions. The four components of the fee, all in FIM/kWh, are (Fingrid, 1998):

- **Marketplace charge**. (Fixed charge) All users connected to the grid pay this charge, independent of their use of the grid. The charge is based on their

consumption "behind" the connection point. The rational for this charge is to pay for the possibility of using the grid for trade.

- **Use of grid charge**. (Variable charge) Two time periods are defined for this variable charge: winter weekdays and other days.
- **Loss charge**. (Variable charge) To compensate for transmission losses, all grid input and output is subject to a fee for losses. On winter weekdays, this charge is higher for output from the grid, but otherwise it is similar for all users.
- **System service charge**. (Fixed charge) In order to cover operations costs and system balance, this charge applies to all consumption behind the connection point.

Each owner of a connection point pays this fee to Fingrid. Transmission cost, profits and future investment needs are included in the fee. Some other fees are paid for regional and distribution network services. The Electricity Market Authority, mandated to react when there is excessive pricing from the network operator, monitors the pricing level and discriminating effects. He applies rules of "reasonable" pricing for "reasonable" profit to the owners.

As can be seen, this pricing structure is very similar to the previous one (see Table 3), except that it is no longer distance dependent. The main criticism that can be done is then the same: tariffs are fixed. No indication of the current effect on the network (and thus the actual marginal cost) is assigned to the transmissions, thereby preventing full efficiency in the network. But it can also be said that customers appreciate the simplicity of the tariff structure and that, so far as no capacity limits are present, all economic trades are feasible. So the possible gains in efficiency from a better tariff structure may not outweigh the efficiency of simplicity.

**Long term network developments**

Fingrid has the duty to maintain and develop the network. Investment has therefore to be directed for that purpose. The situation in Finland is one of excess transmission capacity, and a yearly investment of 250 millions FIM (42 millions Euro) is made to maintain this situation. Free access to cross-border transmission lines is also one of Fingrid’s goals, to enable international transactions and competition.

Reliability criteria and the aim of developing the market place are the main objectives of investment decisions. Developing the market place is understood by Fingrid as a requirement to always offer capacity for trade. If no capacity is available in the short run (bottleneck), then Fingrid will buy electricity at a point in the network to allow the initial trade to take place, as agreed by the two parties. If such a situation remains over the long term, Fingrid adds some capacity.

### The regional and local distribution levels

The lower voltage networks operate in exclusive territories, and apply a pricing principle similar to Fingrid’s. They are also subject to the conclusions of the Electricity Market Authority, concerned by fair and reasonable prices and profits.

The distribution segment is now just a wire business, because retail supply is completely open to any seller. There have been takeovers of distribution companies by

generation enterprises, because until the fall of 1998, distributors were the exclusive sellers of electricity. The retail market knowledge and information on customers they possess, such as local load patterns, is indeed the key to success and profitability for sellers. That explains the appetite of generators for these businesses. The acquisition of distributors by generators was not, in 1998, subject to any law or to the approval of the Electricity Market Authority. However, such vertical integration could moderate competition or even to some extend annihilate it because of possible collusion. This is of course against the spirit of deregulation. This issue is presently under discussion in the parliament of Finland and some new legislation could limit the ownership of distributors by electricity sellers.

### The supply level

No real change occurred in retail business before small consumers[17] could easily switch from one electricity supplier to another. In theory, consumers of any size had been able to contract their energy from any supplier since 1997 but, as mentioned earlier, the required meter was too expensive to make any change economically sound for small consumers. Only after the introduction of the load profile procedure (in September 1998) did changing electricity suppliers became a real possibility. We now describe this process.

Local distributors classify all small customers into four pre-defined groups, according to the characteristics given in Table 5.

**Table 5 Characteristics of Small Consumer Groups**

| Group | Consumption | Fuses | Category | Proportion of small consumers in groups |
|---|---|---|---|---|
| 1 | ≤ 10 000 kWh/a | ≤ 3×63 A | Household, no space heating | 70% |
| 2 | > 10 000 kWh/a | ≤ 3×63 A | Household, with electric heating | 20% |
| 3 | - | ≤ 3×35 A | Commercial users | 5% |
| 4 | - | > 3×35 A | Commercial users | 5% |

For each group, a predefined *load profile* is available, based on statistical information collected for these types of consumers for each month of the year, weekdays, and other days. The usual periodic metering is made for each consumer, and the cost of that customer's consumption is then calculated according to his load profile. In the case of group 2 consumers, who use electrical space heating, the daily temperature is recorded and the bill is adjusted to reflect the average impact of temperature on consumption.

Distributors directly charge small customers for their use of the local network and they send the total consumption and the customer group information to the suppliers. In turn, they send their bill to the consumers for the energy used. It is this portion of the market that is competitive, while the distribution remains regulated.

### The role of the regulatory agency in the energy market

The only "regulator" in Finland is the Electricity Market Authority, but its role is closer to the one of an arbitrator. This agency is subordinate to the Ministry of Trade and Industry, but acts independently. The Ministry names the director of this agency.

Mandatory tasks consist in delivering transmission licenses to network operators (national, regional and local) and monitoring transmission pricing practices of the 120 firms involved in network operation. A staff of less than 10 persons does this work. The agency gets its financing from the government, licensing fees and annual fee paid by each network operator, linked to its volume of activity.

As we already mentioned, no explicit pricing rules are used to assess the adequacy a transmission price proposed by a firm. The price should simply be at a "reasonable" level.

No other area of the electricity market is regulated except investments in nuclear energy, an energy source which is still controlled and controversial, as mentioned above. New generation projects require only an environmental authorization. Trading is free, and the only restricted components of the price paid by customers are transmission and distribution components, which have to be "reasonable" and respect the general lines of the OFC and the Electricity Market Authority.

### *Future moves*

The next steps in the Finnish deregulation process are the following:

- **A unified transmission pricing system**. Different transmission pricing systems still prevail between Norway, Sweden and Finland. Transmission lines *between* countries are also priced in different ways, a fact that could be improved to more accurately reflect the economic value of each transmission.
- **Integration with the European electricity market**. Developments in Denmark, Germany and also Baltic countries (especially Estonia) will surely have an influence on the Finnish market. Local competitiveness and know-how could give a significant advantage to Finnish power producers and marketers.

## Analysis of the Finnish case

Putting the Finnish electricity structure before and after restructuring in the framework developed in the first section, we obtain Tables 6 and 7.

**Table 6 Electricity Sector in Finland before Restructuring - 1995**

| LEVEL | VERTI. INTEG. | HORIZONTAL INTEGRATION | MARKET TYPE | OWNERSHIP |
|---|---|---|---|---|
| | | HIGH ----------LOW | MONOP. ------- COMP. | GVT.--------- PRIVATE |
| **Generation** | \| | _____*_____ | _____*_____ | _____*_____ |
| **Coor. of sales** | \| | _____*_____ | _____*_____ | _____*_____ |
| **Sys. Oper.** | \| | _____*_____ | _____*_____ | _____*_____ |
| **Transmission** | \| | _____*_____ | _____*_____ | _____*_____ |
| **Distribution** | | _____*_____ | *_____ | _____*_____ |
| **Supply** | \| | _____*_____ | *_____ | _____*_____ |

**Table 7 Electricity sector in Finland after restructuring - 1998**

| LEVEL | VERTI. INTEG. | HORIZONTAL INTEGRATION | MARKET TYPE | OWNERSHIP |
|---|---|---|---|---|
| | | HIGH ----------LOW | MONOP. ------- COMP. | GVT.--------- PRIVATE |
| **Generation** | \| | ____*____ | ____*____ | ____*____ |
| **Coor. of sales** | | ____*____ | ____*____ | ____*____ |
| **Sys. Oper.** | | *____ | *____ | ____*____ |
| **Transmission** | | *____ | *____ | ____*____ |
| **Distribution** | | ____*____ | *____ | ____*____ |
| **Supply** | | ____*____ | ____*____ | ____*____ |

As the comparison between Tables 6 and 7 shows, some vertical break down took place (creation of Fingrid). At the generation level, it could be said that horizontal integration stayed the same, but that competition increased by small amount, with the easier access to transmission. Ownership stayed the same. Coordination of sales became more integrated with the opening of the unique spot market (Nord Pool), but as bilateral contracts are still possible, coordination of sales is not ruled by a single entity. Such is not the case for the system operations and transmission, under the sole control of Fingrid. At the distribution level, mergers increased horizontal integration, but nothing changed in other dimensions. For supply, the market type switched from monopoly to a more competitive setting.

From the depiction of the Finnish "regulated" electricity industry, summarized in Table 6, three features appear unusual compared to other countries:

- the high diversity in the generation, in terms of technologies and number of producers led to early and significant competition;
- the transmission field was not a monopoly;
- no regulatory agency was active, because reasonable and cooperative behavior could be widely expected.

Note that the usual arguments for deregulation do not apply perfectly to the Finnish case. Indeed, there was already no monopoly preventing competition and no dedicated bureau was regulating the market. However, the EMA allowed some significant improvement in the level of competition in the industry, mainly through the changes made regarding transmission. Unifying the network cut the inefficiencies of the two previous ones, and introducing open access eliminated the strategic positions some players had due to their ownership of transmission assets. More competition resulted from the reform, which was the goal.

However, even though the level of competition in the Finnish market has improved, we can formulate some limits to the reforms. We develop in the following three points that mitigate the positive impact of restructuring in Finland.

### *Transmission pricing practice*

While the actual transmission pricing is neutral, in the sense that it is the same for all users, it is nevertheless not always a perfect promoter of competition because the transmission price does not reflect the real economic value of each transmission. For

example, all users pay the same loss charge for their transactions even though each of them has a different impact on real losses (and could even avoid losses). Thus, some inefficiency is introduced in the market.

A scientific literature is considering the subject of an efficient transmission pricing system (see Chao and Peck, 1996 and 1997, Hogan, 1992, and Hogan et al. 1996). The main idea of these works is to sell transmission rights at the economic value of the marginal transmission. In these frameworks, these rights are the income of the grid. But such a system implies that non-congested lines are not creating any revenue because the marginal cost of transmission is then zero (if we neglect losses). In order to have revenue and make profit, the grid owner would then have an interest in having congested lines. Few incentives for capacity expansion would result from such a system, and even if there were motivation for it, revenue resulting from transmission rights would probably not cover the investment costs. A parallel system of charge would be necessary for network maintenance and development.

These last important problems and the complexities involved in other types of pricing offer some grounds for Fingrid's practices. However, when the marginal cost of transmission is ignored, the actual pricing can not achieve complete economic efficiency.

### *Market power*

In order to be competitive, the market should be free of large, dominant players. When too few are present, the market may be described as an oligopoly. In Finland, as we have seen above, a small number of important players can rule the market to a certain extent. The implicit goal of marginal cost prices is thus hardly achieved. This is probably by far the biggest concern one can have about electricity market reforms and it calls for careful attention from market authorities.

Another topic of concern is the vertical integration of distributors with producers. Since distributors still control a large share of the retail market, such mergers could reduce competition.

### *New regulatory office*

Paradoxically, even if deregulation is meant to remove regulation and unnecessary bureaucracy, the creation of a new regulatory office is usually unavoidable. Indeed, in Finland where no special bureau ever exited to monitor the electricity industry, one was created in 1995 with the EMA. It is there to insure that there is no abuse and that the companies involved maintain a "reasonable" level of pricing, a behavior that was mostly natural in Finland’s former regulated market.

In his attempt to illustrate the positive aspects of the UK electricity reform, Newbery (1998) concludes by saying "that the price of an efficient and competitive electricity industry is eternal vigilance by the competitive authorities". The goal of having naturally low electricity prices through competitive pressure alone seems then to be difficult to reach. The cost of such eternal vigilance should not be neglected, even though a reliable estimate would surely be difficult to obtain. However, it should also be kept in mind that this regulatory cost will always be marginal compared with the overall turnover of the industry.

The Finnish example showed how a reform improved the level of competition, though it maintained some features that prevent complete efficiency. A legitimate question would then be the following: which kind of possible reforms illustrated in Table 1 could bring the market closest to maximal efficiency? An answer to this question is far beyond the goal of this paper but would call for further research.

## Conclusion

Here, we have presented a general framework under which electricity market restructuring attempts can be classified, and we reviewed the main features of some early reformed markets, in different countries. We then examined the Finnish case to illustrate and document its original market development. Constant progress in the market makes it impossible to offer a completely up-to-date account of the reform, but the central elements are presented and discussed here. The conclusion we can draw from this case illustration is that electricity reforms can start from very different initial market structures, and are not motivated by market failures alone. In Finland, there were initially no complaints in the industry and the level of efficiency at that time could have been the objective of many reforms planned in other countries.

The main contribution of this paper lies, however, in the presentation of the Finnish electricity market reform. Hopefully, this work will help to increase understanding of the many aspects needed to coordinate a successful electricity market reform, and offer a satisfactory account of one of the most competitive electricity markets in the world.

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[1] Competitive behavior is also possible in a very integrated market. Such a situation would arise if a unique franchise is granted to a single firm through an auction. The chosen firm could be highly horizontally integrated but still act in a competitive way because of the constraints resulting from the auction (see Demsetz, 1968, for more on that).
[2] This table reflects the history of reforms until 1998, further modifications could have change the situation now.
[3] With 100 being the GNP per capita level of Finland in 1910, U.K. was above 200, Belgium and Germany around 170 and Sweden and Norway at 130 (Myllyntaus, 1991, page 10).
[4] The new name was introduced after the merger, in 1998, of IVO with Neste. Neste was the Finnish state-owned oil and gas company.
[5] All capacity shares are taken from Ministry of Trade and Industry (1997b).
[6] These percentages come from FINERGY (1997).
[7] Source: Ministry of Trade and Industry (1997a).
[8] Between 1987 and 1997, this number was reduced by more than one third, from 157 to about 100 (Ministry of Trade and Industry, 1997b).
[9] Source: Electricity Market Authority (1997).
[10] See www.nordpool.no.
[11] See Ministry of Trade and Industry (1997b) and Fingrid (1997).
[12] Electricity Market Authority (1997)
[13] One Finnish Mark (FIM) corresponds to 5.94 Euros.
[14] An explanation of this could be linked to the special cost structure of nuclear power and the investment risk involved. See Kidd (1998) for more on this topic.
[15] See Nordel (1998) for information on the volume traded in the Finnish spot market in 1997.
[16] See Table 2.
[17] A "small customer" is defined by main fuses of at most 3×63 A and a maximum load of 45 kW.

## Appendice: The transmission pricing system (1997 - November 1998)

The transmission pricing system used by Fingrid from 1997 to November 1998 followed a "point-tariff" principle. A fixed fee per MW/h was calculated for each access point of the network and had to be paid for any load put on the network, irrespective of the destination. (Thus the cost was no longer related to the distance, contrary to the previous IVS tariff, see Table 3). This fixed fee was public and was changed yearly. The fee at each access point was calculated according to the following components:

- **Loss charge**. This volume-dependent fee reflected an estimate of the cost of the loss caused by an injection of power at one point. It had a positive or negative impact on the total fee, going from -3% to 3% of the amount of electricity going through the point. It was estimated once a year through forecasts and had a different value in winter.
- **Maketplace charge**. This charge can be thought as a variable connection fee, because it was volume dependent. The word "marketplace" is justified by the fact that the grid offers the possibility to trade without any distance constraints. Even if no trade is made, i.e. no electricity goes through a point, this charge had to be paid because of the potential to use the network.
- **Use of grid charge**. This component reflected, through a two-level price (one for winter weekdays and one for the remaining periods), a "congestion cost" of the line from the point considered.