

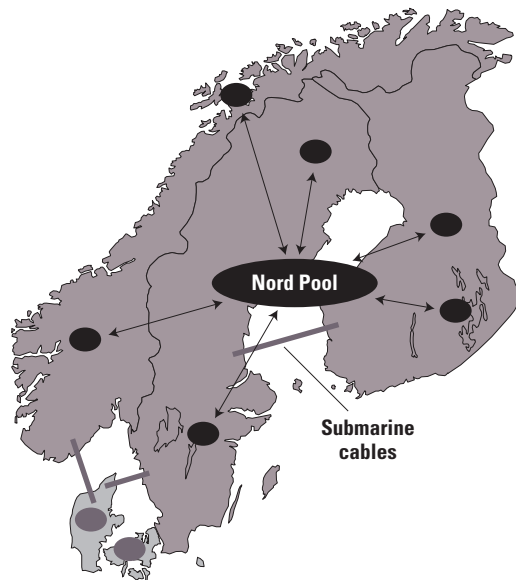
International Power Trade— The Nordic Power Pool

Lennart Carlsson

Scandinavia, where countries have traded power for decades, has the world's most developed international market for electric power. Recently the trading system has changed dramatically, moving from the old model of cooperation among the leading vertically integrated utilities in each country, under the Nordel agreement, to competitive market rules. A common power market for Norway and Sweden, Nord Pool, was established in 1996, and Finland joined in June 1998 (figure 1). This Note examines why Nord Pool came into being, what conditions facilitated its development, and what lessons it provides for World Bank client countries.

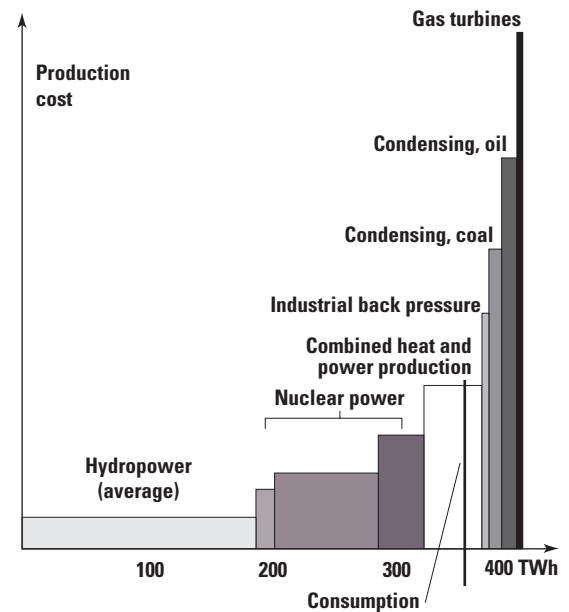
Differences in generation mix largely explain the establishment of interconnections in Scandinavia. Norway relies entirely on hydro, while Denmark generates all power in thermal plants, mainly from imported coal. Sweden has a mix of about half hydro and half nuclear generation, and Finland a mix of hydro (25 percent), conventional thermal (45 percent), and nuclear (30 percent) plants. The power market is fairly large: together, the four countries consume about 360 terawatt-hours (TWh) a year, surpassing the U.K. market. The differences in generation structure have made it economically attractive to trade power, allowing the countries to optimize production (figure 2).

FIGURE 1 THE NORD POOL POWER MARKET



- Finnish, Norwegian, and Swedish players trade on equal terms.
- From outside the free trade area Danish participants trade on special terms.

FIGURE 2 POWER GENERATION STRUCTURE IN THE NORDIC COUNTRIES



Note: The figure reflects three different cost structures for nuclear power generation.
Source: Nord Pool.





The old structure

Before the move to the international pool the power sectors of Norway, Sweden, and Finland all had an oligopoly structure, with dominant state-owned enterprises that also controlled the national grids, though there were differences in structure, ownership, and regulation.

Norway's power sector was dominated by the government-owned integrated utility Statkraft, which also operated the national grid. There were also many small local and regional utilities. Between fifty and sixty companies, many owned by local or regional authorities, were involved in the transmission of electricity at the regional level. The local and regional utilities had gained access to the national grid in 1969 and could buy and sell power through a spot market. Electricity was distributed locally by about 200 companies, many of which were owned by municipalities.

In Sweden about half the generation was government-owned through Vattenfall, which also operated the national grid and provided distribution services in parts of the country. About ten other integrated utilities of various sizes also used the national grid, but a relatively high network fee made it uneconomical for smaller utilities to use it. Like Norway, Sweden had a large number of distribution companies (presently about 250), many owned by municipalities.

In Finland the state-owned Imatran Voima Oy (IVO) was the largest utility. IVO also operated the national grid. Much of the power generation was owned by Finnish industries, however, which formed a transmission company, TVS, to interconnect their generation and supply areas.

In Denmark, for geographical reasons, the grid is divided into two main parts: one on the Jutland peninsula and the other on the island of Sjælland. In each of these two areas the generation and distribution utilities, mostly owned by municipalities, formed special-purpose organizations to manage the extra-high-voltage grids and the coordinated operation.

Trading of electricity between the countries was enabled through Nordel, an organization set up in the 1960s to promote cooperation among the largest electricity producers in each country. Nordel was based on the principle that each country would build enough generating capacity to be self-sufficient. Trading was meant to achieve optimal dispatch of a larger system—and investment in interconnection was generally based not on net exports but on expected savings from pooling available generating capacity. The countries exchanged information about their marginal cost of production. When there was a difference, trading took place, at a price that was the average of the two marginal costs.

The cost-plus structure in the Nordic power sector led to overinvestment in the power sector and poor return on equity. But because the system retained a degree of competition, there were no significant operating efficiency problems in the utilities.

The shift to a market-based structure

The shift to an international pool was triggered by power sector reforms in Norway starting in the early 1990s. Norway introduced competition in electricity supply in 1991 through reforms aimed at reducing regional differences in the cost of power, promoting operational efficiency in generation and distribution, and achieving more efficient development of the power sector. Statkraft's transmission activities were spun off to a new national grid company, Statnett SF. In addition, all transmission networks were opened to third-party access, and vertically integrated companies had to adopt separate accounting for generation, distribution, and supply activities.

In Sweden reform was fueled by discontent among the private power companies stemming from Vattenfall's control of the national grid, and dissatisfaction among the smaller power companies and among customers over their lack of access to the market for occasional power. The first major step, taken in 1991, was to corporatize Vattenfall's generation and distribution activities. Vattenfall remains government-owned, however. The national grid was retained as a government-owned institution, Svenska Kraftnät, which also

serves as the system operator. The networks were gradually opened to new players, and a new electricity act allowing a competitive market finally took effect in January 1996.

Finland introduced new energy legislation in 1995. IVO had already separated its grid activity into a separate company, IVS. But with the privately owned grid company TVS, Finland had two overlapping grid companies for several years. Since September 1997 Finland has had a single, merged grid company, Fingrid, which also acts as the system operator.

In Denmark reform moved more slowly because of the power sector's different structure, with two nonconnected groups owned by municipalities or cooperatives, each with a monopoly in its area. New legislation opening the grids to negotiated third-party access and allowing competition for large consumers, distributors, and generators was introduced in 1996.

The creation of a pool

Norway led the way in reform, opening up a spot market in 1992. A similar power market in Sweden would have been difficult to manage, as Vattenfall and Sydkraft, the two largest generating companies, together control about 75 percent of generating capacity. But the Norwegian market also experienced problems. Because all the power in Norway is produced by hydroelectric plants, the spot market price was very volatile. A combined Norwegian-Swedish market would address the problems of both countries. A decision was therefore made to establish a joint electricity trading exchange in January 1996, with a design based on the Norwegian experience. The grid operators own the company, Nord Pool, that organizes the market. Finland joined the power exchange in June 1998.

The spot market organized by Nord Pool trades in hourly contracts for the following day. It is open to all companies that have signed the necessary agreements with Nord Pool, and presently about 200 trade on the exchange. Bids are submitted each morning, and supply and demand curves are then constructed to provide the system price and the traded quantity for each

hour during the next day. About 44 TWh were traded on the spot market in 1997. The price of the power to balance the system is also determined through bidding. Statnett, Svenska Kraftnät, and Fingrid are each responsible for balancing the system in their country. Although they follow the same principles, the rules differ and work is under way to harmonize them.

In addition to the spot market, Nord Pool offers futures contracts, which are traded as weekly contracts four to seven weeks ahead, as blocks of four weeks up to fifty-two weeks ahead, or as seasons up to three years ahead. The futures are purely financial contracts used for price hedging. About fifteen brokering companies offer services to the electricity market. The bulk of the volume traded is in standardized financial contracts, often referred to as over-the-counter (OTC) contracts. The liquidity of the OTC market is quite high, particularly for the nearest season. Contracts can be resold, or a position netted out by making an opposite contract. In 1997 the contracted volume in Nord Pool futures and the OTC market was estimated at more than 310 TWh.

In addition to the spot and futures markets there is direct trading between parties in bilateral forwards. These bilateral contracts are normally for physical deliveries and are often tailor-made to particular requirements. Despite the diversity in trading instruments, most of the trading between players still takes place under bilateral contracts for physical delivery that were signed before the reform.

Impact and lessons

The smooth transition to the world's first international power market has been thanks in large part to the long tradition of cross-border bilateral energy trade and cooperation and the existence of cross-border transmission structures.

Ownership and structure

Setting up the pool did not require privatizing government-owned companies. A mix of companies continues to operate in the Nordic power sectors—from large government-owned utilities to privately and municipally owned



companies of varying size—running generation, regional networks, and distribution systems and supplying power to consumers. But ownership of the international interconnections that existed in the Nordel area when the sectors were restructured in Finland, Norway, and Sweden has been transferred to the grid company in each country. That has opened trading to all the players in the wholesale markets—generators, distributors, and large consumers.

Competitive pressures in the electricity market have resulted in several ownership and structural changes in the sector, including some cross-ownership between countries and the entry of some foreign power companies. In addition to the traditional power companies, other players can trade on the market, including brokers, oil companies, foreign power companies, and power trading companies representing consumer groups.

The Nordic market has demonstrated that it is unnecessary to have a single system operator. Statnett, Svenska Kraftnät, and Fingrid each have the responsibility for managing and balancing the national system in their country. National tax, environmental, and other laws still need to be harmonized, but the system has nevertheless functioned quite well.

Competition and regulation

Strict regulation of the network service ensures that third-party access works. But the market is largely assumed to be able to take care of itself under the supervision of national competition authorities. This approach differs from that adopted in England and Wales, where the pool is heavily regulated. Because the Nordic countries already had a large number of players, reform was easier to implement.

The spot market operated by Nord Pool is working well so far. In contrast to the English and Welsh pool, where only the producers can participate in the bidding, the Nordic pool is a market for both sellers and buyers. Another difference is that the generators in the Nordic system are not obligated to offer their power to the pool. So

to keep business from going elsewhere, the pool must ensure that it is an attractive marketplace.

The main initial problem for competition has been that the cost of installing hourly metering has prevented small consumers from changing suppliers. Norway has solved this problem by adopting a system of predefined customer consumption profiles. Sweden will probably also adopt the consumption profile solution.

Expansion of the pool may lead to a need to increase transmission capacity between the countries. When a free market opens up, the cross-border power flow tends to increase if the international power exchange had previously been limited to optimizing marginal production. The capacity between Norway and Sweden has already fallen short at times, resulting in a difference in system price between the two countries. A shortcoming in the Nordic market (as in most other power markets) is that there are no clearly defined rules prescribing when network expansions have to be built by the grid companies and how they should be financed. Such matters probably will have to be resolved case by case in the Nordic market, possibly with some political involvement.

Conclusion

An advanced system requiring sophisticated players, the Nordic power market probably is not a suitable model for developing countries just beginning to move from a traditional government-owned monopoly utility to a more market-oriented structure. But Nord Pool demonstrates the possibilities of an international power market, an attractive option for developing countries with small power systems.

Reference

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