Market Efficiency Depends on Proper Bidding Zones

Electricity markets have replaced traditional load dispatch.

Electricity companies always tried to minimize production costs by distributing production between available power stations in an optimal way. *Load dispatch* centres were established for the purpose. However, an increasing number of producers and the need for exchanging electricity across Europe has made the traditional load dispatch less efficient.

Electricity markets are alternative ways of achieving the optimal dispatch. A market can serve several countries and a very large number of market participants. The spot price is an important indicator in the market at a given time of day. A perfect market without physical limitations will have a common spot price for the same price interval.

However, markets are never perfect. Bottlenecks in power grids are the most common market imperfections. Interventions are necessary in order to prevent grid overloads. There are two main types of interventions.

For some nations (e.g. Germany), it is important to have only one spot price per time unit for the entire national territory. In such cases, *counter trading*, can be used for preventing overloads. Grid owners, who are unable to provide the demanded grid capacity, must pay market participants for deviating from the optimal dispatch.

Other nations create a number of *price zones* or *bidding zones*. Bottlenecks should as far as possible be at borders between price zones. When a bottleneck is fully loaded, the two adjacent price zones will have different prices. Electricity will flow from the cheap zone into the expensive zone and from cheap countries into expensive countries. The available transfer capability will be fully utilized. Market participants must accept the risk of different prices.

Wrong price zone borders disturb markets

Unfortunately, bottlenecks move around in the grid depending on the distribution of electricity demand, wind power and solar power. Price zones cannot be moved around correspondingly. Therefore, the definition of a price zone border is often a compromise.

Nordpool was the first international electricity market. The grid structure in Norway made the use of price zones necessary. Norwegian producers and consumers have accepted the risk of geographic price differences.

It is a condition for the appropriate market function that the market operator has all available transfer capability between bidding zones is at his disposal.

Sweden introduced price zones in 2010 because the result of local counter trading was non-optimal international exchanges.

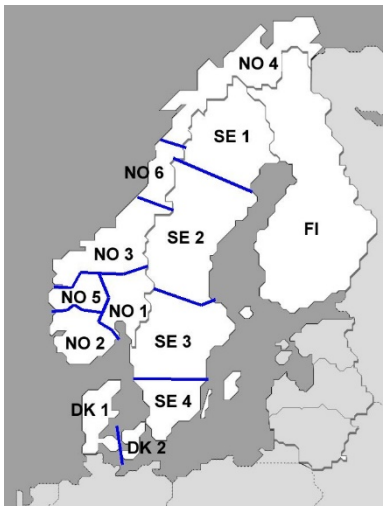

Fig. 1 - Current Nordic price zones

Congested grids and spot price variations in Europe

It has been important to EU to establish an internal European market for electricity. Different market designs are now in use in the EU countries. The markets are linked together by *market coupling*.

Average Wholesale Baseload Electricity Prices, first quarter of 2019					
	€/MWh		€/MWh		€/MWh
FI	47,5	IE	61,1	EE	47,7
SE	46,4	UK	59,2	LV	48,0
DK	42,9	NL	48,6	LT	47,8
DE	40,9	BE	48,7	PL	50,7
CZ	44,5	FR	47,3	SK	45,8
AT	45,0	ES	55,5	HU	54,2
IT	59,4	PT	55,5	RO	54,0
NO	47,4	SI	52,7	GR	68,0
CH	49			BG	47,4

Source: https://ec.europa.eu/energy/en/statistics/market-analysis

Table 1 - Average spot prices from 40.9 €/MWh in Germany to 68.0 €/MWh in Greece in first quarter 2019

It is not realistic to eliminate all bottlenecks in Europe. Therefore, the spot prices in table 1 are different.

Germany has a special position in Europe with a large electricity export and correspondingly low spot prices. A few years ago, Norway had the lowest prices, but new large interconnections between Norway and the continent have raised the price level in Norway. Denmark is closely linked with Germany and had the second lowest price in the first quarter of 2019.

Nordpool 2018	Average €/MWh	St.dev. €/MWh
SYS	43,99	9,94
SE1	44,23	11,56
SE2	44,23	11,56
SE3	44,54	12,06
SE4	46,36	14,23
FI	46,80	15,12
DK1	44,05	15,06
DK2	46,20	16,72
NO1	43,65	10,47
NO2	43,25	9,38
NO5	43,05	9,48
NO3	44,08	10,41
NO6	44,08	10,41
NO4	43,71	9,53

Table 2 - Nordpool spot prices 2018

The average spot prices for the 14 Nordic price zones were not very different in 2018. They were between 43.05 €/MWh (NO5) and 46.36 €/MWh (SE4). The differences in price volatilities are more significant. See standard deviations in table 2. Denmark and South Sweden have more volatile spot prices than Norway. Wind power contributes to price variations.

Entso-e opens debate on European price zones

Large price zones with internal bottlenecks (e.g. Germany) can cause barriers to the international trade with electricity. ENTSO-E, the European Network of Transmission System Operators for Electricity, has begun investigations on alternative price zones in Europe.

In 2018, Entso-e published two reports[1][2] about the price zone structures in central European countries.

Fig. 2 - Germany and Austria are now separate price zones

The definition of price zones can be a sensitive political matter, because they may create different spot prices within a national territory.

The Entso-e reports present alternative price zone structures. The reports do not recommend any solution, only “continued evaluations”.

Aug-Oct 2019	AT	BE	DE-LU	FR	NL
€/MWh	39,09	35,92	37,63	36,64	38,16

Table 3 - Selected central EU average spot prices

Fig. 2 shows the configuration at the beginning of the study. The split-up of the Ger-

[1] ENTSO-E: First Edition of The Bidding Zone Review, 2018
[2] ENTSO-E: Bidding Zone Configuration Technical Report, 2018

man-Austrian price zone was already pending at that time. The price differences between selected central European countries are not alarming (table 3). Austria had slightly higher prices in August to October 2019 than Germany/Luxembourg. Belgium had the lowest spot price.

Fig. 3 shows the four investigated alternatives. No. 2 has already been realized.

In no. 4, two mergers of small countries have been outlined, but the difference in spot prices (table 3) suggest maintenance of two separate price zones for the Netherlands and Belgium.

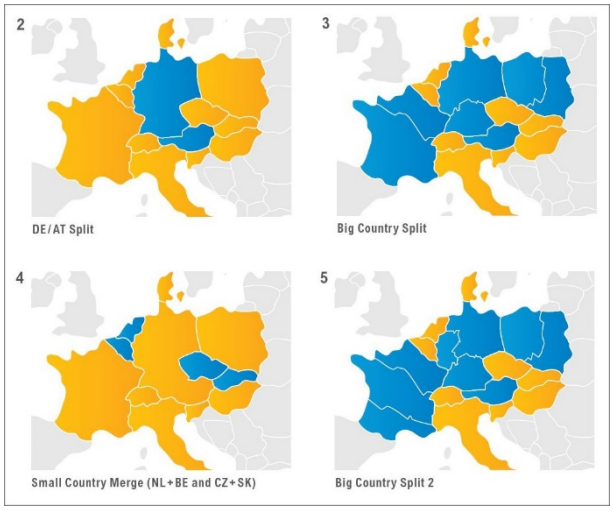

Fig. 3 - Four investigated alternatives

In no. 3 and 5, Germany and France have been divided into two and three zones. Recent operational observations support the idea of dividing Germany into at least two zones.

The two reports have 238 pages and 158 pages. A large amount of data has been collected and many charts show the analysed situations. Nevertheless, the conclusions are rather vague. Therefore, due to political implications, it may last long until essential changes of the price zone structures in Europe can be realized.

In 2019, Entso-e needed only eight pages for the presentation of an alternative Nordic price zone structure[3] (fig. 4).

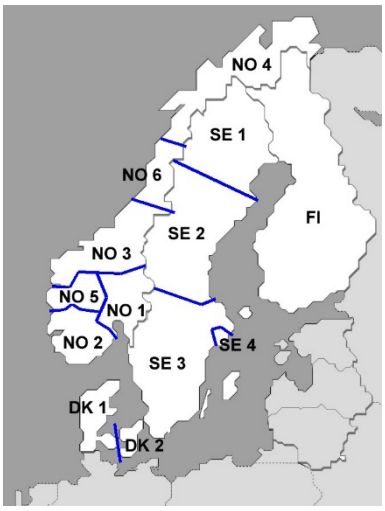

Fig. 4 - Alternative Nordic price zone structure, Entso-e draft

The additional price zone in Norway (NO 6) has already been realized.

The idea of combining SE 3 and SE 4 to a larger SE 3, but with the city of Stockholm as a separate SE 4 (fig. 4) has caused some concern in Sweden. Firstly, because there are real bottlenecks in the border area between SE 3 and SE 4, and secondly, because it might cause higher spot prices in the capital area than elsewhere in Sweden.

There is reason to worry about the electricity supply to Stockholm. There are CHP stations with a considerable electricity production in the city, but the middle-term preservation of these stations is uncertain. Svenska Kraftnät (SKN) is therefore about to drill a tunnel below Stockholm from north to south in order to reinforce electricity supply to the city area.

Fig. 5 - SKN drill for tunnel

[3] ENTSO-E: Bidding Zone Review Region Nordic Region, 26 August 2019