One single price zone in German and Austrian power grids

German Market Policy Limits Electricity Exchange

Recently the Danish TSO, Energinet.dk, announced an agreement with TenneT (one of four German TSOs) on upgrading an old 220 kV interconnection between West Denmark and Germany to 380/400 kV. On 8th April 2015, the Danish Energy Association (DE) said that there is plentiful capacity across the border, but that the utilisation is constrained by bottlenecks in the internal German grids. Bloomberg has passed on the story[1].

This note is an attempt to put these details into a greater whole.

The projects

The parties have known for more than ten years that the inflow of German wind power from the North Sea would reduce the transfer capability from Denmark to Germany correspondingly. Therefore, plans for reinforcements have been on the way all that time.

One result is the agreement on a link between Denmark and the Netherlands, the COBRAcable[2]. This link can bypass the German bottleneck at the river Elbe from 2018.

Since the DENA report in 2005[3], several German studies have analysed the grid problems. After the decision on the energy transition in 2011 ("Die Energiewende"), the federal government gave the responsibility of preparing grid development plans to the Federal Grid Agency (Bundesnetzagentur). The most recent plan is the second draft of Grid Development Plan 2014 (NEP 2014)[4].

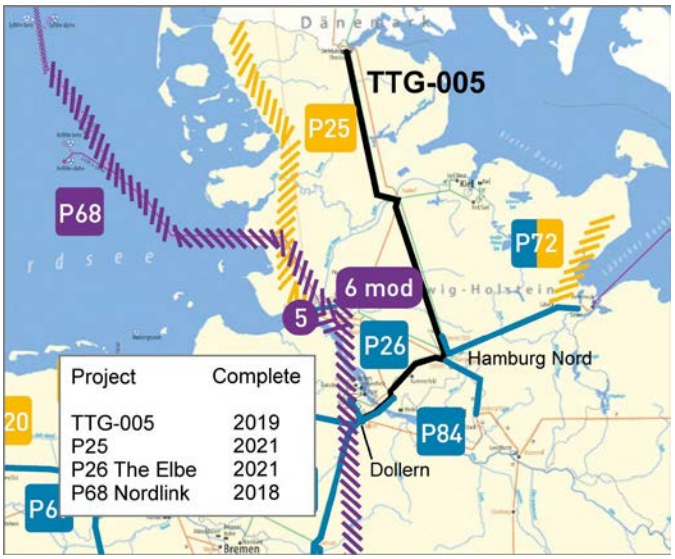
The interesting projects from a Danish point of view are:

TTG-005:
: Conversion of 220 kV lines to 380 kV. Already approved.

P25:
: New 380 kV lines from Brunsbüttel to the Danish border, the West coast line.

P26:
: New 380 kV line crossing the river Elbe.

P68:
: 1,400 MW HVDC link to Norway.



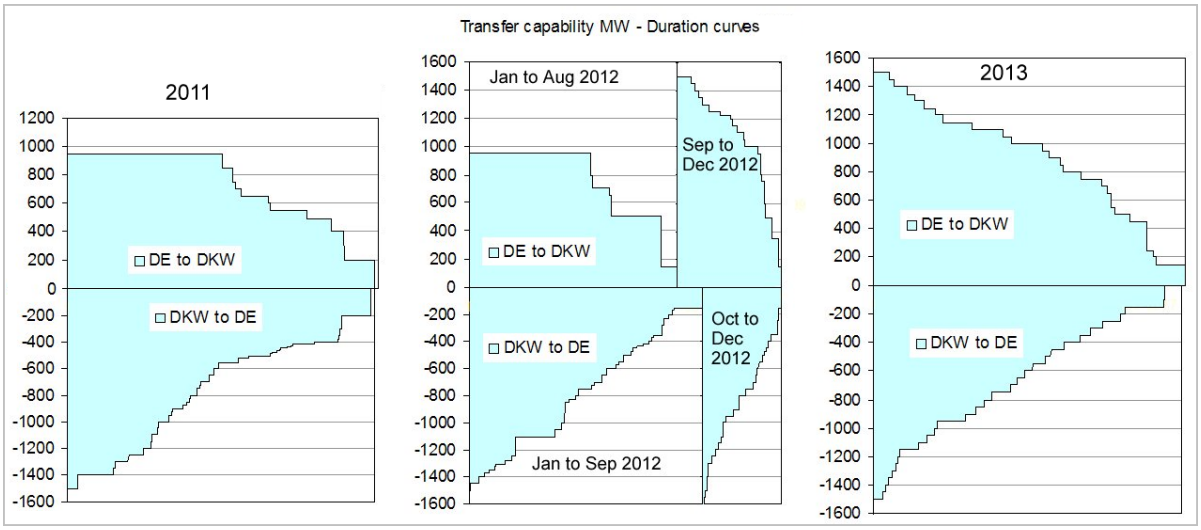
TTG-005 includes the section Hamburg Nord to Dollern, which will be complete in 2015.

[1] http://www.bloomberg.com/news/articles/2015-04-09/as-germans-block-danish-wind-a-new-feud-tests-crisis-weary-eu
[2] http://energinet.dk/EN/ANLAEG-OG-PROJEKTER/Anlaegsprojekter-el/Kabel-til-Holland-COBRA/Sider/Kabel-til-Holland-COBRA.aspx
[3] http://www.ewi.uni-koeln.de/fileadmin/user_upload/Publikationen/Studien/Politik_und_Gesellschaft/2005/EWI_2005-02-24_Netzintegration-von-Windenergie.pdf
[4] http://www.netzentwicklungsplan.de/en/grid-development-plan-2014-second-draft

Based on this information a certain improvement is probable when the reinforced Hamburg Nord-Dollern is available later this year. The COBRAcable will give further relief from 2018. Some sources expect Nordlink to be delayed until 2019. Between the start of Nordlink and the completion of P26 increasing congestion problems must be anticipated.

Indications of congestion

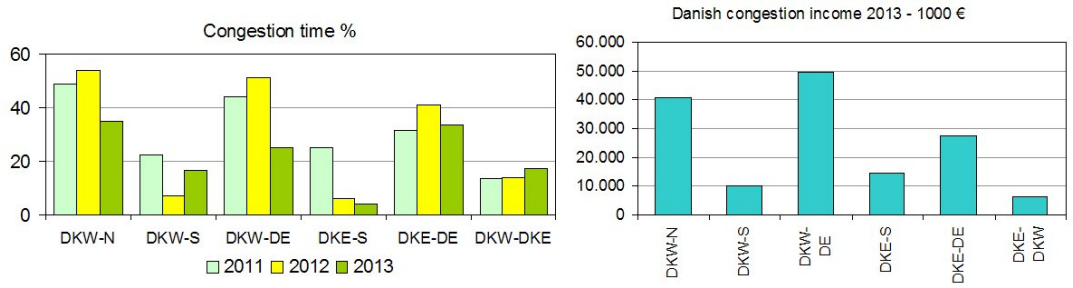
In September 2012, the interconnection between Germany and West Denmark was up-graded. Annual duration curves can illustrate the available transfer capability:



Available capacity between Germany and West Denmark 2011, 2012 and 2013. Source: Energinet.dk

The available capacity is constrained by bottlenecks in the adjoining grids, presumably mainly in Germany. Until the upgrade, the nominal capacity from Germany to Denmark was available about half the time. For transfer from Denmark to Germany the capacity is rather evenly distributed between 1500 and 200 MW. The upgrade had a limited effect. Now the capacity distribution is even in both directions.

The duration curves confirm that the effects of internal bottlenecks have been moved to the national border. However, they do not show if the market needs more capacity. Congestion time and congestion income[5] are helpful indicators for that purpose.



Source: Energinet.dk

[5] Different spot prices in two price areas occur when the link between them runs at its full capacity. The selling area has the low price. This means that the exporters receive less money for the transferred energy than the importers pay. The difference is the congestion charge or bottleneck fee, which the owners of the link usually share. Congestion charges are the main sources of income for financing new links.

Denmark is still an important link between Germany and Norway. The links from West Denmark to Norway and Germany had high congestion charges in 2013 and seem therefore to be the most important Danish links. The congestion seems to have been well balanced between the two links, but the expansion of the Skagerrak link to Norway in 2015 from 940 MW to 1640 MW may have left the border between West Denmark and Germany as the essential bottleneck of the power route Norway-Denmark-Germany.

For both links, the congestion time decreased from 2012 to 2013.

The reinforcement of the Skagerrak link in 2015 will probably increase the pressure on the border between Denmark and Germany in the years to come.

The dilemma: more redispatch or reduced interconnection capacity?

Neither DE nor Bloomberg have mentioned the German electricity market as a potential barrier for efficient utilization of the interconnections.

It is German market policy to have one common spot price for all parts of Germany (and Austria)[6]. This model assumes a grid without congestion. However, congestion is an increasing problem in Germany. The measure for solving the problem is called **redispatch**[7]. The market participants receive compensation for the cost of redispatch.

This system is also known as **counter trade**. It could be a fair solution, but the duration curves seem to indicate that the cross-border capacity has been adjusted more than justified by technical limits at the borders in order to reduce the cost of redispatch. In that case, the solution will be wrong.

The Nordpool spot market uses **price areas** (or price zones or bidding areas). Until 2010, Sweden was one price area using a combination of counter trading and reduced exchanges with neighbours. However, Sweden had to split the country up into four price areas in order to contribute to optimal operation of the spot market area. This model is the automatic alternative to the manual redispatch procedure, but it cannot guarantee an equal geographic distribution of congestion cost.

There is evidence that Germany did not find the optimal balance between redispatch and capacity adjustment of the interconnections. The congestion problems in Germany will probably last for years. Therefore, Germany should reconsider its choices and the neighbouring countries should watch the German power market critically.

[6] "An Electricity Market for Germany's Energy Transition", a Green Paper from the Federal Ministry for Economic Affairs and Energy, October 2014

[7] The Green Paper, p. 32: *Grid operators advise electricity producers on one side of the anticipated bottleneck to reduce production in their plants. On the other side of the grid bottleneck, power stations are ramped up to replace the curtailed electricity production to the same extent. This process currently guarantees secure system operation but will reach its limits if grid congestion is aggravated.*