Summer Snapshot of the Nordic Power System

On 24 June, the Swedish Radio discussed consequences of the current power shortage in the southern part of Sweden[1]. The Swedish TSO, Svenska Kraftnät, has made agreements about prolonged operation of the nuclear unit, Ringhals 1, and extraordinary operation of an oil-fired unit in Karlshamn. Generally, I do not consider snapshots as valid arguments in a debate, but sometimes a snapshot can be informative.

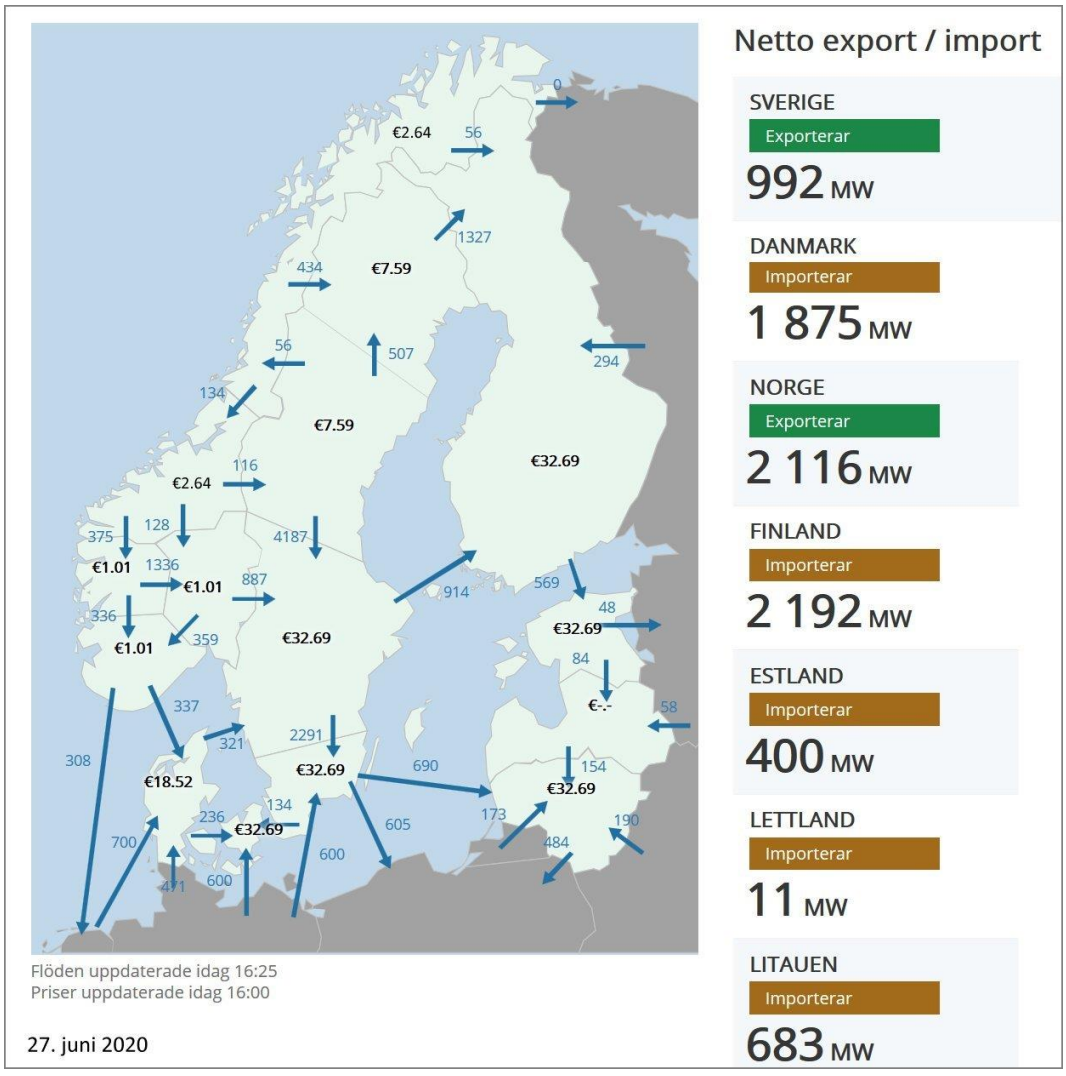

Fig. 1 - Spot prices and flows in the Nordic power system 27 June 2020 16:25. Source: www.svk.se

First, look at the spot prices:

- Norway south: €1.01
- Sweden north: €7.59
- Denmark west: €18.52
- Denmark east, Sweden south, Finland, Estonia, Lithuania: €32.69

[1] https://sverigesradio.se/sida/artikel.aspx?programid=83&artikel=7502375&fbclid=IwAR0sYbQvJhQf3hZjySEcCIrd7yEmzVO29Q79VDaP3L72tfKL79nXbAG5ifc

The spot prices for the same hour were €18.52 in Germany and €18.50 in the Netherlands (source: www.nordpoolgroup.com).

Trade in the spot market is supposed to move electricity from the low-price area (Norway south) to high-price areas, i.e. Denmark east, Sweden south, Finland, Estonia and Lithuania.

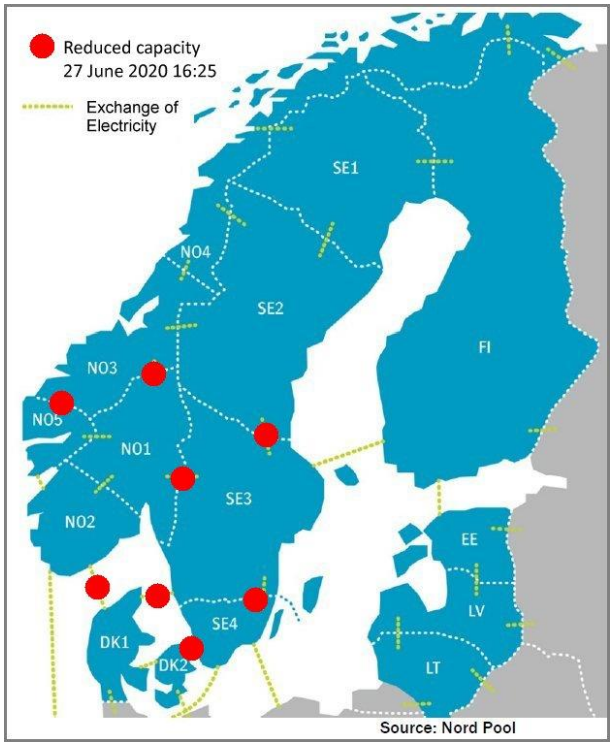

Fig. 2 - Congested borders

The large price differences reflect lack of transfer capabilities in the Nordic grids.

Nordpool has reported capacity reductions for the borders marked on fig. 2 for the hour 16-17 on 27 June. Planned outages are the reasons for most reductions in Norway and Sweden. Exchange between Norway and Denmark is limited by cable faults on three of the four cables between Norway and Denmark. About 1350 MW are missing for this important link.

Low prices indicate a surplus of power in Norway south (NO1 + NO2 + NO5), but insufficient export capacity.

The Danish TSO, Energinet, assures that the loss of import from Norway will not reduce security of supply in Denmark, but fig, 1 shows that it creates a peculiar flow pattern. Denmark imports 700 MW from the Netherlands and 1071 MW from Germany. Sweden imports 600 MW from Germany, but exports 605 MW to Poland and 690 MW to Lithuania.

Main reasons for the stressed situation in east Denmark and south Sweden are prolonged planned outages during the summer season and temporary lack of wind. The Swedish measures indicate that there are only limited available reserves left in the Nordic power systems.

Frank Swedish debate about power shortage

There is practically no debate on the risk of shortage of power in Denmark, but several Swedish media have discussed the matter.

Recent headlines from Swedish media:
Kvällsposten 17 June: Electricity shortage can paralyze Sweden this summer
Aftonbladet 17 June: Responsible authority covers risk of serious power fault
Dagens Nyheter 24 June: Power shortage causes increased electricity prices in southern Sweden

The Swedish TSO, Svenska Kraftnät, says in an announcement 18 June 2020 (my translation):

The operational condition is particularly stressed this summer because more nuclear producers have prolonged the maintenance time, while low electricity prices have made electricity production unprofitable during certain periods. Nuclear power, which is synchronously connected to the grid, contributes to the system with both active power and important properties, such as voltage stability and short circuit capacity.

Over the years, the power system planners and operators have developed routines for planning maintenance activities and for handling stochastic events such as forced outage for power stations and transmission facilities. The fluctuating production of wind and solar power has added new stochastic elements to the power system planning.

It should not take anybody by surprise that phasing out of dispatchable production units together with typical outage patterns and calm weather will cause power shortages and volatile spot prices.

Entsoe's Midterm Adequacy Forecast 2019 (MAF 2019) did not predict supply problems in south Sweden and east Denmark in 2020, but they are expected to exceed the 0.5 hour LOLE limit in 2025 (fig. 3).

The current problems call for specific plans for the future security of supply.

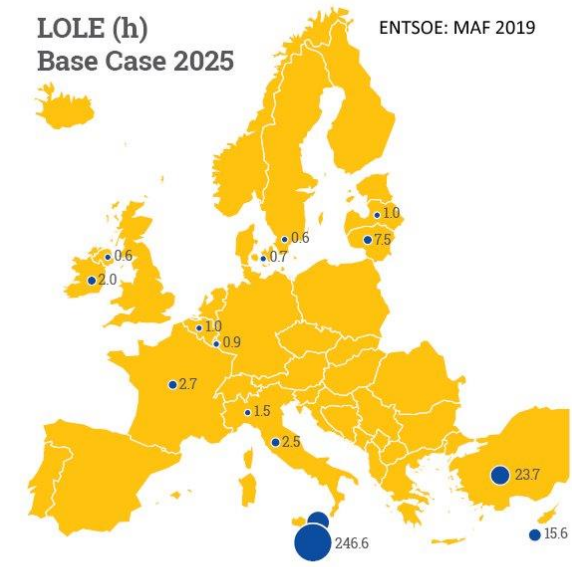

Figure 4: Loss of load expectation (LOLE) values for the 2025 Base-Case scenario.

Fig. 3 – The LOLE level in south Sweden and east Denmark is not expected to be alarming in 2025