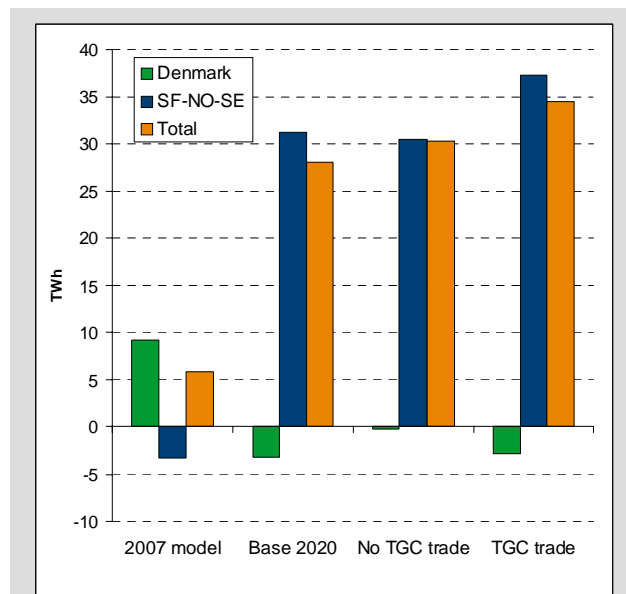


RES deployment profoundly changes the market balance of the Nordics

Implementation of the RES directive shifts power market balances and trade patterns in Europe significantly. The Nordic area has large and relatively cheap RES potentials, combined with (probably) lenient targets because of a high initial share of RES-E generation. The proposed burden sharing does not take current or future supply/demand balances into account, and the Nordics may become large exporters of both electricity and green certificates if trade in certificates (TGC) develop. The effect is reduced Nordic power prices and reduced thermal generation. The huge expansion of RES-E generation may be accompanied by higher grid costs.

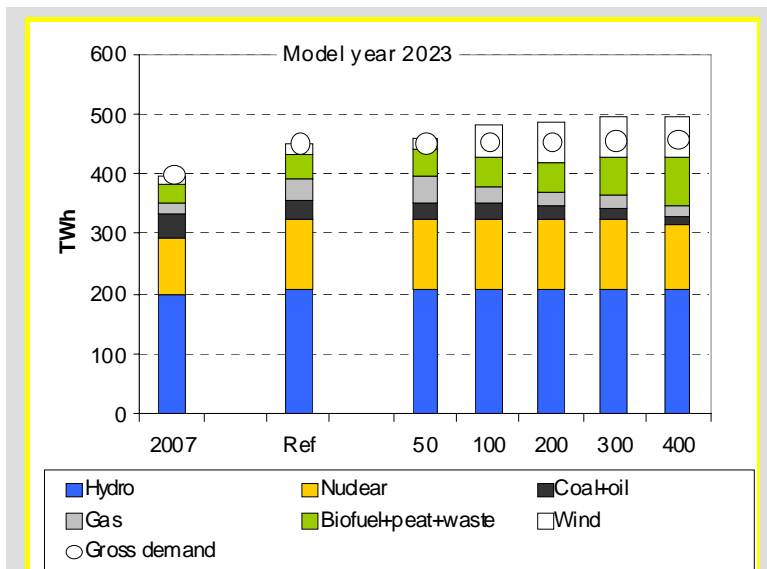
Results from the NEP models clearly demonstrate that ambitious renewables targets profoundly affect market balances in the Nordics. As can be seen in the figure on the right, the market balances in the Nordics are almost reversed compared to 2007 (modelled). Denmark becomes a net electricity importer, while Norway and Sweden become large exporters in 2020. Finland is also a net exporter to the Nordics (imports from Russia and Estonia are not included in the figure).

The pattern is similar in all three RES 2020 scenarios:
Base: RES generation is developed according to national policies and there is no certificate trade
No TGC Trade: The EU RES target is fulfilled without certificate trade
TGC Trade: The EU RES target is fulfilled with certificate trade



Net electricity exports from the Nordic countries. Total Nordic exports to Germany, Netherlands and Poland is 34 TWh in the scenario with an EU-wide market for green certificates (TGC).

Finland, Norway and Sweden exporters of Green Certificates



Total power and RES-E generation in the Nordics increase when the TGC price (here 50-400 SEK/MWh) level increases.

Finland, Norway and Sweden are exporters of certificates in the TGC trade scenario, and TGC trade increases the RES-E generation and the electricity exports from Norway and Sweden. Increased electricity supply also reduces prices, and hence demand increases in the Nordics. This implies that net electricity exports do not increase by the same volume as the certificate export.

The MARKAL Nordic model show similar results. The panel to the left shows that total generation and RES-E generation in the Nordics increase when the TGC price level increases. For certificate prices above 300 SEK, most of the cheap potential for RES-E generation in the Nordics is exploited. Model results from the European model (above) yield a European TGC price well above the 300 SEK level.

Increased investments in RES-E generation crowd out thermal generation

As the share of RES-E generation increases, the generation levels in conventional thermal power plants are reduced. First the generation in existing coal and gas plants is affected, and subsequently, investments in new conventional capacity are postponed. The model results indicate that no new investments in conventional capacity are profitable before 2020 in the TGC trade scenario.

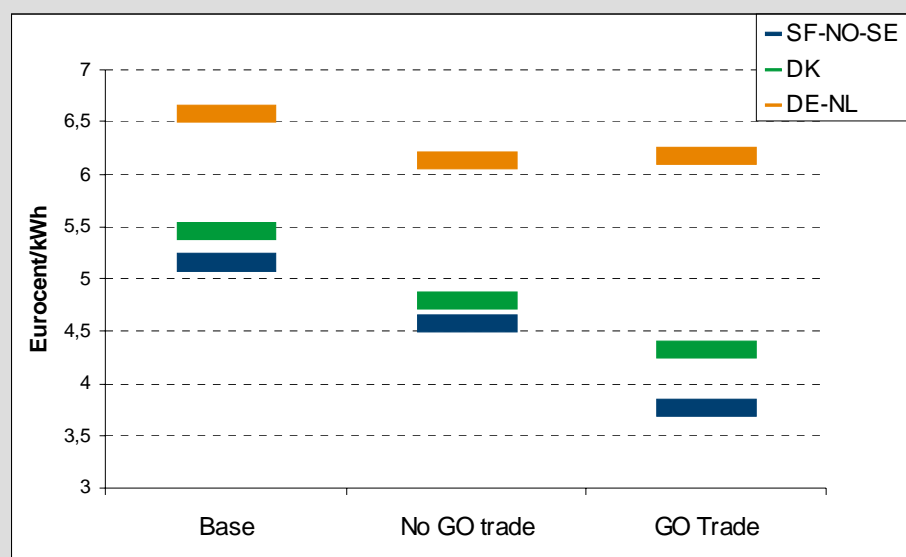
Electricity prices in the Nordics stay below Continental prices

There is a clear division in average price levels in the relevant market areas. The Danish prices lie between the prices in Norway, Sweden and Finland and the prices on the continent, i.e. Germany and the Netherlands. Allowing trade in RES-E certificates amplify the differences. It should be noted that the reason why price levels are generally lower in the full RES-E scenarios is that EUA prices are lower: 30 €/ton compared to 21.5 €/ton.

New interconnectors more profitable with RES-E certificate trade?

As the price differences and traded volumes increase, so does the income from trade. In the Trade scenario the NorNed cable is fully utilized for exports from Norway to the Netherlands, i.e., prices are higher in NL than in NO in all load blocks, and the price differences indicate that an expansion of the capacity may be profitable.

The results are however very sensitive to changes in the RES-E level, and to the way trade is modelled (price structures). It should also be noted that results for 2020 are not representative for the full lifetime of an interconnector. In addition, the utilization of cables vary significantly between seasons and years, and these



Clear three-way division of price levels with the hydro-area, SF-NO-SE at the lower end. RES-E expansion and European trade in certificates reduce Nordic price levels, and increases price differences and congestion rents.

aspects are not captured by the long-term scenario models used here.

The RES directive

Targets: In order to reach the 20% RES target, the electricity sector is set to increase RES-E generation to an estimated 30-35% from today's level of around 8,5%.

Burden sharing: Remaining potentials for RES-E generation and the ability to lift such massive investments vary across EU member states. The Commission has proposed a burden sharing which takes these factors into account. The result is that RES-E investments will be unevenly distributed among member states.

Measures: An EU wide market in Guarantees of Origins have been rejected by major member states. Certificate trade in the form of joint target compliance, joint projects of transfer certificates will be permitted.

Huge challenges for national grids

The reversal of trade patterns and the dramatic increase in net exports from the Nordics indicate that the RES-E expansion poses a huge challenge for TSOs. The description of the system in 2020 shows increased transit, particularly through Sweden and Denmark, increased intermittency as the share of wind power increases, and reduced flexibility as the share of conventional power generation is reduced.