

Is the energy crisis a thing of the past?

The Danish majority government tried to create an atmosphere of crisis, for instance by abolishing a public holiday. However, a recent cash check by the minister of finance has shown a much larger surplus of money than expected a few months ago. The sigh of relief in the public debate was attended by some irony over the government's gloomy forecasts.

Energy prices are moving back towards normal levels. Everything will soon be back to normal.

The public debate in Denmark does not discuss how to prevent or relieve similar crises in the future. The public attention has already been taken over by other issues.

Anger over windfall profits

One of these issues concern the profits gained during the energy crisis by energy trading companies and particularly by some of their employees.

Danish distribution companies used to be cooperatives. Cooperatives were supposed to be self-contained and operate in the interest of their owners and customers. The rules of the electricity market forced the distribution companies to split up into technical and commercial branches and a complex pattern of organizations was developed.

Financial products are important parts of the electricity markets. Distribution companies have created subsidiaries for financial trade. This trade has in 2022 caused very high profits in some cases and losses in other cases (fig. 2).

However, the 10 billion DKK profit did not cause as much debate as individual bonuses exceeding 100 million DKK. The media prefer individual stories over a broader approach.

The accumulation of extreme profits for Danish energy traders indicates inefficiencies in the electricity market. One reason is a weak coupling between wholesale and retail markets. The profits have been paid by consumers on the top of high wholesale prices. A more basic reason is the high volatility of European spot prices. These price variations could be reduced by maintaining larger fuel storages and sufficient backup capacity for drought, calm periods and international crises, but initiatives of that kind are not known.

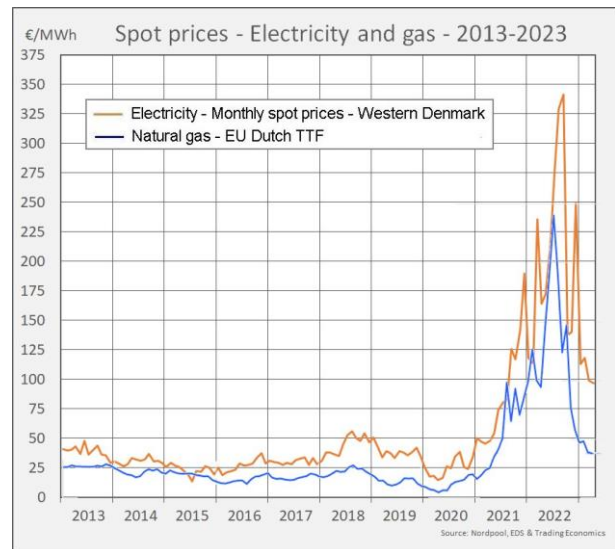


Fig. 1 - Towards normal energy price levels

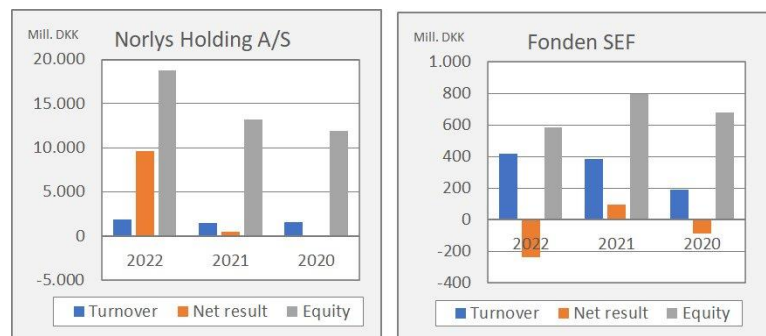


Fig. 2 - Danish distribution companies with profit and loss in 2022

Europe's big power exporting nations in decline

Some European nations depend on electricity import for maintaining a high security of supply. A few countries have been the main suppliers, above all France, Germany and Sweden. However, some trends in these countries indicate declining export capabilities in the years to come.

For reasons, which I have explained in a previous article, the French power balance got displaced by about 60 TWh from 2021 to 2022, and Sweden replaced France as the largest European exporter of electricity.

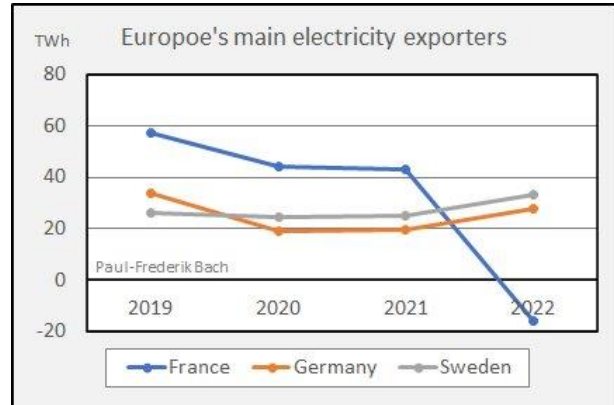


Fig. 3 - France became a net importing country in 2022

The Swedish transmission system operator, Svenska Kraftnät, recently published a new power balance forecast.

Svenska Kraftnät expects increased demand of electricity for industrial purposes. The net result will be a deteriorated total capacity balance (fig. 4).

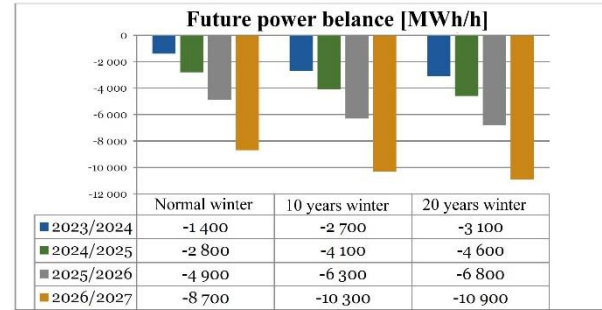


Fig. 4 - Sweden: Power balance forecast during winter peak load

The message is that Sweden will occasionally need import of electricity.

The future German power balance is uncertain, but the operational conditions will change after the complete decommission of German nuclear power.

The variations from month to month of onshore wind output in fig. 5 is striking, but a combination of wind and solar power looks like a reasonable replacement of dispatchable power.

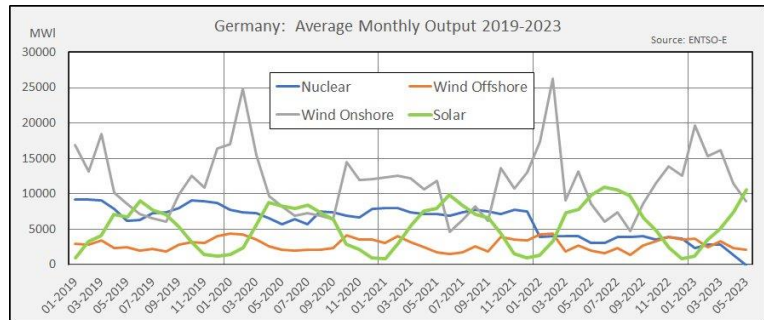


Fig. 5 - The last five years with nuclear power in Germany.

However, the combination of wind and solar output still has dramatic hourly variations (fig. 6).

The load factor of the combined wind and solar power in Germany was only 0.39 for the first four months of 2023. The load factor of the nuclear generation in 2023 until decommission was 0.87.

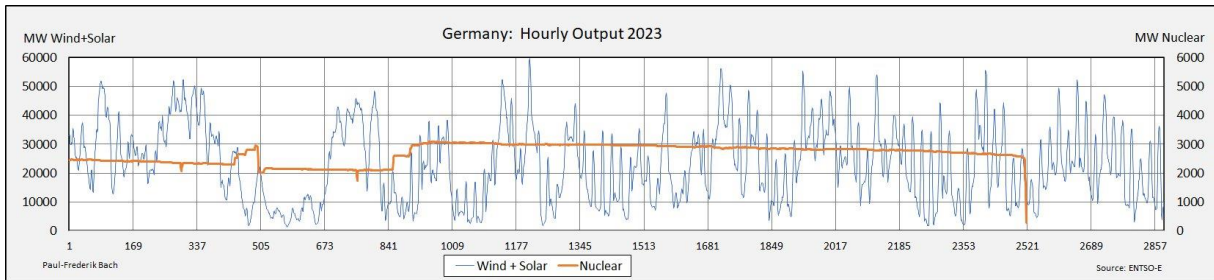


Fig. 6 - The combined German wind and solar output has large fluctuations in 2023 (Please note the two scales)

Fluctuating generation requires more transport of electricity

It is obvious that it takes increasing balancing resources when dispatchable generation is replaced by fluctuating energy sources. It is less understood that much more electricity must be moved around when dispatchable generation with a high load factor is replaced by generation with a low load factor.

The transmission grids have not been designed for this increased transport. It is very difficult to get permission to build new large transmission lines, particularly in densely populated areas and in protected natural areas. For such projects it may take 10 or 20 years to obtain all necessary permissions. It is much faster to build new wind farms and new solar parks.

The green transition will fail without new infrastructure

The May/June 2023 issue of the IEEE power & energy magazine is focused on blackouts and blackout prevention. A comment states that "Electrification and decarbonization are two seismic shifts that pose significant reliability challenges to power grid planning and operation."

The reliability criteria, developed through several decades, may need a fundamental update. This is illustrated with NERC's¹ four pillars of the clean energy transition (fig. 7).

Denmark frequently emphasizes its ambitious wind power program, but without mentioning its dependence on foreign balancing services and energy reserves. Denmark does not contribute sufficiently to the last two pillars.

Denmark will be in a vulnerable position during international crises.

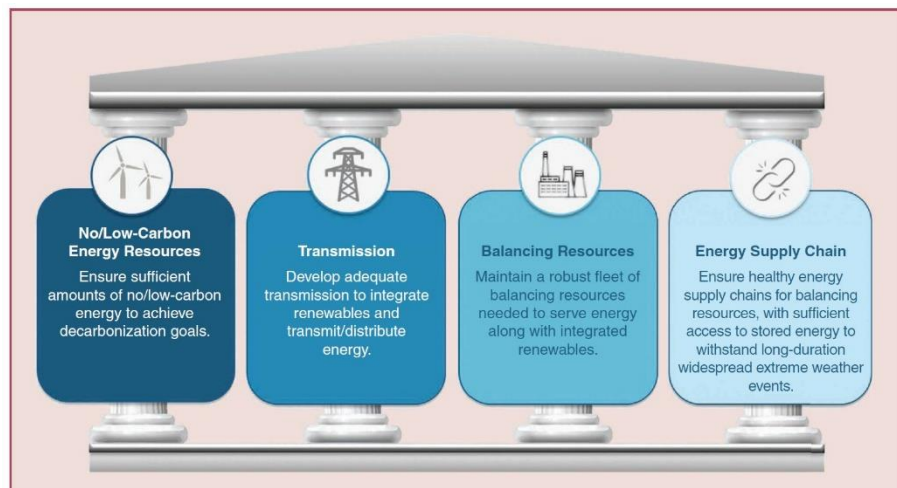


figure 1. Four pillars of the clean energy transition—NERC.

IEEE power & energy magazine

may/june 2023

Fig. 7 – 2023: Denmark fails in supporting balancing and energy supply chain

¹ NERC: The North American Electric Reliability Corporation

The political process is heavily focused on clean electricity production. This policy implies a major change from dispatchable sources into fluctuating and non-dispatchable sources, such as wind and solar power.

The green transition requires a different infrastructure and a new security strategy.

New balancing capacities such as Power2X and flexible consumption have been discussed for decades. Some minor Danish projects are being commissioned. The technologies are not yet mature for large scale implementation.

Large transmission projects are planned in several European countries, but they will probably stay well behind the need due to difficulties in carrying out such projects.

Current trends in European energy policy may increase vulnerability

Flexible demand was supposed to be a main balancing resource since the first wind farms, but the fluctuating production ran far ahead of the flexible demand. The alternative solution is long-distance exchange of power, but the transmission grids have not been reinforced correspondingly. The grid operators must set tight exchange limits in order to keep transfers within safe limits.

The result is less efficient utilization of available energy sources, occasionally curtailment of wind and solar power and increasing price volatility in the electricity markets.

The long-term solution must be a better match between fluctuating production and infrastructure. The efforts should be moved from new wind and solar power to improved infrastructure such as stronger transmission grids, new conversion technologies (Power2X) and energy storages.

The typical trend seems to be opposite. This must lead to less robust electricity supply systems. Europe's defence against new energy crises will be weakened. The consumers will primarily meet more volatile energy prices, but in worst case also power outages.

The European energy crisis is not yet over.