European backup capacities for wind power

In November 2025, there were a few days with very low production of both wind and solar energy in Northern Europe.

For 7 countries, the total decline in wind power from Tuesday to Friday is estimated to be around 75 GW. The 7 countries are Denmark, Germany, the Netherlands, Norway, Sweden, Great Britain and France. See fig. 1 to 7.

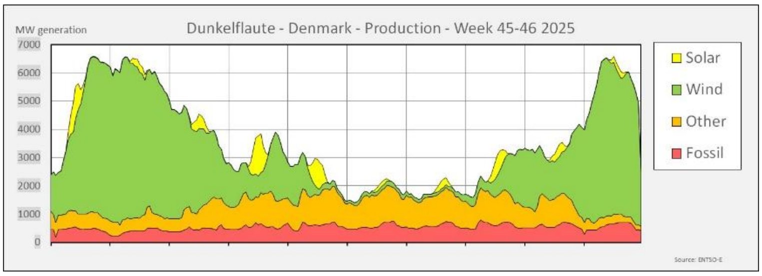

Fig. 1 - Denmark - Total generation 3rd to 12th November 2025

I would like to know what replaced the 75 GW. See fig. 8 to 14.

Some of the countries compensated for the decline in wind power with their own dispatchable power plants. This applies to Norway, Sweden, Great Britain and France. Norway also increased exports by up to 7 GW. Germany covered about half of the decline with domestic resources. Denmark and the Netherlands used only imported electricity.

Most of the imports to Denmark, Germany and the Netherlands had to come from countries other than those mentioned. The survey was expanded to include the Czech Republic and Poland (Fig. 15 and 16). It turns out that the Czech Republic delivered up to 4 GW over several days, while Poland only exported for shorter periods.

Of the 25-30 GW that Denmark, Germany and the Netherlands imported, I found 7 in Norway and 4 in the Czech Republic.

The results point to two conclusions so far:

- The European electricity market is proving effective in absorbing significant fluctuations in the production of wind and solar power. The fluctuations in market prices reflect bottlenecks in production and transmission systems.
- Some countries choose to maintain production capacities through capacity mechanisms to fully or partially compensate for the variations in fluctuating production. With growing international unrest, it is a question to what extent all EU countries should secure themselves through similar arrangements.

High ambitions for much more wind and solar power in Europe will make it necessary to continuously map and plan the total balancing capacity, both in the form of flexible production and flexible demand. See https://energy.ec.europa.eu/topics/markets-and-consumers/capacity-mechanisms_en.

75 GW drop in wind power for seven European countries

ENTSO-E provides production of electricity per hour for approximately 20 different types of production. Here they are summarized as follows:
- Solar energy
- Wind energy
- Hydropower
- Other renewable energy
- Production with fossil fuels
- Nuclear power

Fig. 1 shows that electricity production from wind and solar in **Denmark** was completely gone during the weekend in week 45. The total production fell from over 6 GW to between 1 and 2 GW. This does not necessarily mean that more could not have been produced, but that there were no competitive alternatives ready for operation.

Thermal production is mainly determined by the need for energy for district heating. The fossil is equally divided between coal and gas. It has been possible to increase thermal production by up to 1 GW at the weekend, mainly based on biomass.

Germany also had very little wind power at the weekend, but unlike Denmark some solar power (Fig. 2). The highest daily production fell from 60-70 GW at the beginning of the week to 40-50 GW at the weekend. Fossil production increased from around 15 GW to over 30 GW, distributed as 35% lignite, 44% gas, 20% coal and 1% oil.

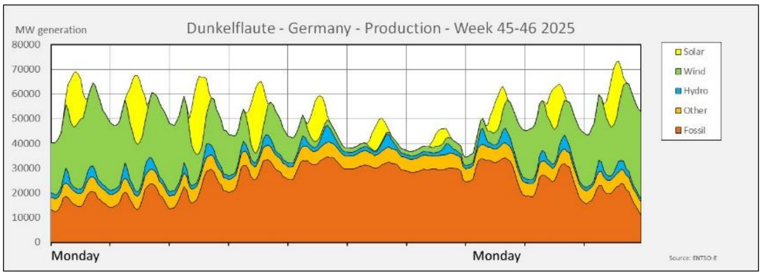

Fig. 2 – Germany – Total generation 3rd to 12th December 2025

With the Cobra cable, the **Netherlands** has also become one of Denmark's electrical neighbours. Fig. 3 shows that wind power in the Netherlands has roughly the same weight as in Denmark. ENTSO-E's data does not provide any information on what "Other" includes, but it is probably gas-fired production and in that case a fossil production. This production has a significant regulation within the day, but does not compensate for the fluctuations of wind power.

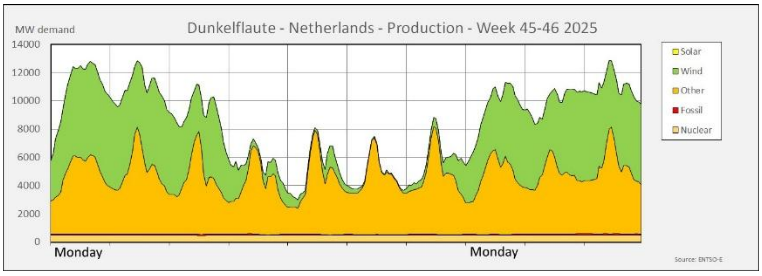

Fig. 3 - The Netherlands Total generation 3rd to 12th November 2025

For Denmark, Germany and the Netherlands, the decline in wind power is estimated to be up to 40 GW. Of this, Germany itself covered approx. 15 GW with increased fossil production, while the rest was imported.

In **Norway**, the production of hydropower varied in the range between 13 and 25 GW (Fig. 4).

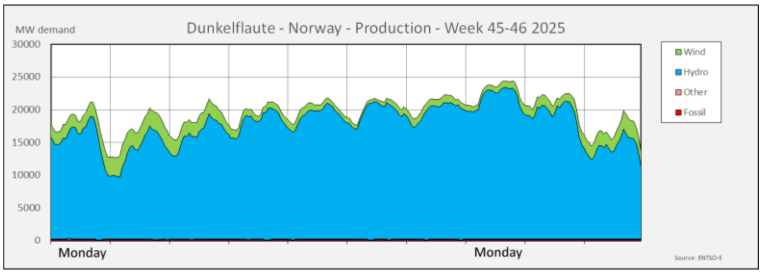

Fig. 4 - Norway Total generation 3rd to 12th November 2025

In **Sweden**, the period of weaker wind is also evident in electricity production (fig. 5). However, Sweden has sufficient capacity of hydropower and water reservoirs to compensate for the decline in wind power.

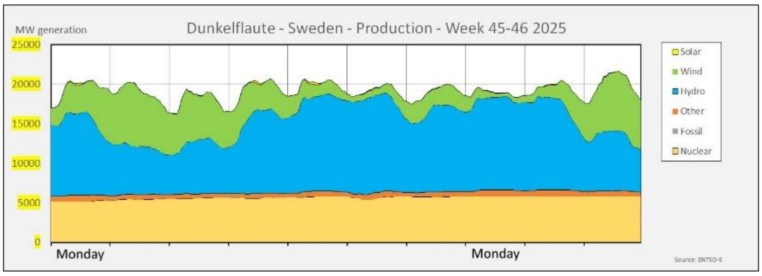

Fig. 5 - Sweden Total generation 3rd to 12th November 2025

After Brexit, it requires special procedures to obtain comparable data from **Great Britain**, but as Great Britain has established more interconnections to the continent, the country has become an important piece in the overall picture.

The decline in wind power in Great Britain was most pronounced from Thursday to Saturday, i.e. slightly earlier than on the continent (fig. 6). Electricity production from wind power fell from around 15 to around 5 GW. The decline was fully offset by fossil production.

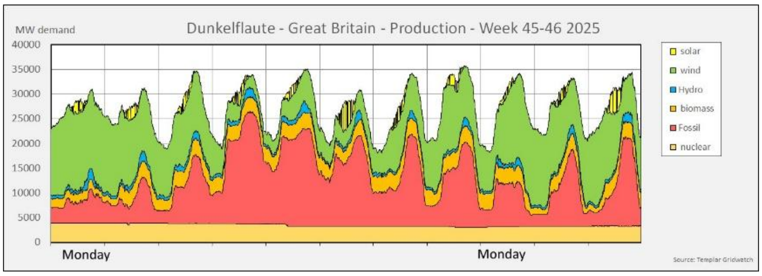

Fig. 6 - Great Britain Total generation 3rd to 12th November 2025

In **France**, wind power production fell by about 10 GW on Friday, Saturday and Sunday. While nuclear power in Sweden, the Netherlands and the UK ran constant production throughout the period, French nuclear power has to actively participate in balancing (fig. 7).

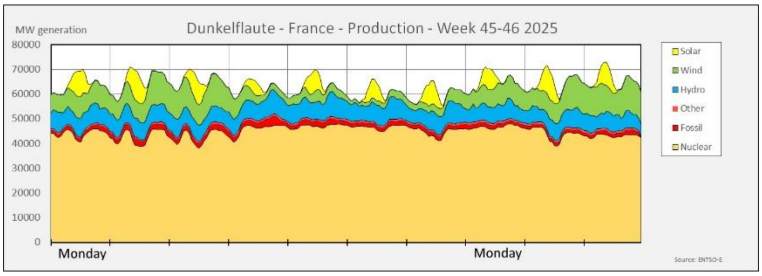

Fig. 7 - France Total generation 3rd to 12th November 2025

For the 7 countries mentioned, the total decline in wind power from Tuesday to Friday is estimated to be around 75 GW.

Balancing reserves are unevenly distributed in Europe

When the production of wind and solar power falls away, available and competitive alternatives are activated. Some countries have capacity arrangements that are intended to ensure the availability of sufficient local backup capacity, both in the form of flexible production and flexible demand.

By adding exchange at the bottom of the charts, we can see the country's overall balance and electricity consumption (fig. 8).

In **Denmark**, it has so far been the practice to compensate for the variations in the fluctuating production by exchange with neighbouring countries, as it is too expensive to keep Danish plants operational and staffed for this purpose. The range of variation for the exchange with neighbouring countries within the same week is often of the same order of magnitude as the country's electricity consumption. This is a policy that requires a strong transmission network and sufficiently strong interconnections.

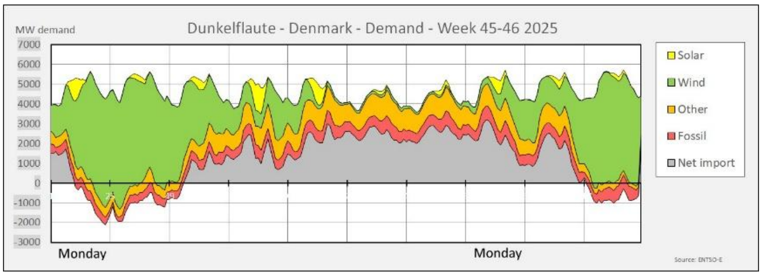

Fig. 9 - Denmark Total demand 3rd to 12th November 2025

Germany also has a significant electricity import due to low wind power production.

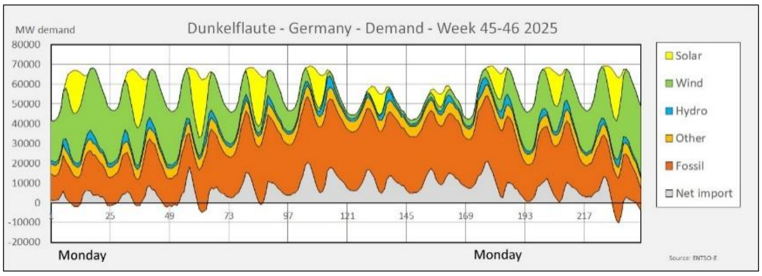

Fig. 8 - Germany Total demand 3rd to 12th November 2025

The **Netherlands** seems to be using the same practice as Denmark. Here, imports are growing to around 10 GW (fig. 10).

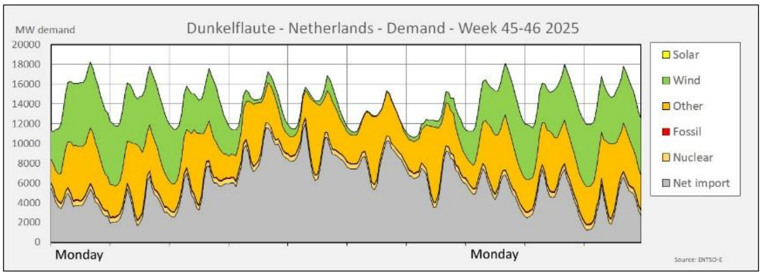

Fig. 10 - The Netherlands Total demand 3rd to 12th November 2025

On Friday, Saturday and Sunday, Denmark, Germany and the Netherlands imported a total of between 13 and 27 GW.

In most years, **Norway** is an important exporter of electricity. However, precipitation and thus hydropower vary significantly from year to year. In the period studied, Norwegian exports grow from Tuesday to Monday from 0 to about 7 GW (fig. 11).

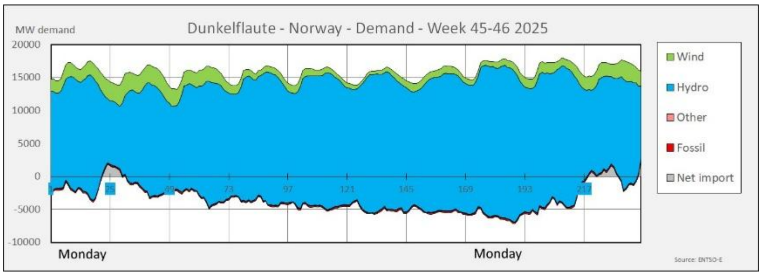

Fig. 11 - Norway Total demand 3rd to 12th November 2025

Sweden is another significant exporter. Sweden was able to fully replace its loss of wind power by regulating its hydro-power (fig. 12).

Sweden's electricity exports were kept fairly constant at around 5 GW.

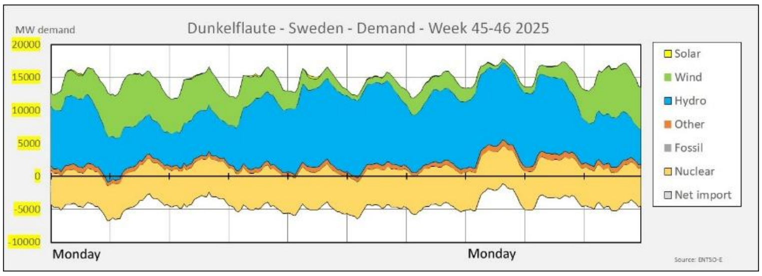

Fig. 12 – Sweden Total demand 3rd to 12th November 2025

Great Britain imported around 5 GW throughout the period. Fig. 13 shows the weaker wind fully compensated by local production, which mainly consists of CCGT units (Combined-Cycle Gas Turbine), which are gas-fired. It may be a security issue that gas reserves in the UK are small, so production depends on ongoing imports of gas.

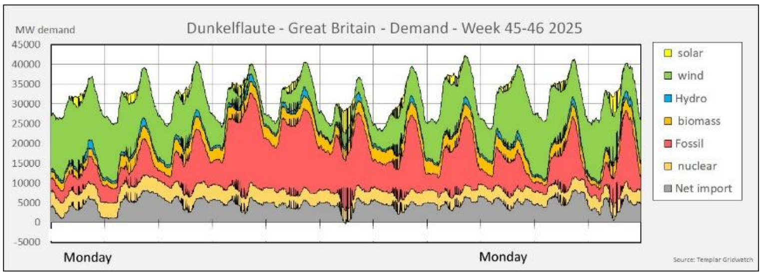

Fig. 13 - Great Britain Total demand 3rd to 12th November 2025

Compared to the UK and Germany, **France** has a remarkably even electricity demand throughout the day.

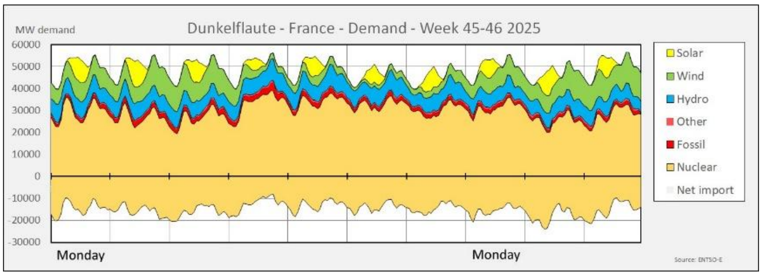

Fig. 14 – France Total demand 3rd to 12th November 2025

Imports to Denmark, Germany and the Netherlands reached over 20 GW, but apart from Norway, none of the countries shown seem to have increased exports accordingly.

On the other hand, the **Czech Republic** has. On the other hand, the Czech Republic has.

Exports are mainly due to increased production based on fossil fuels, the vast majority of which is fired with lignite.

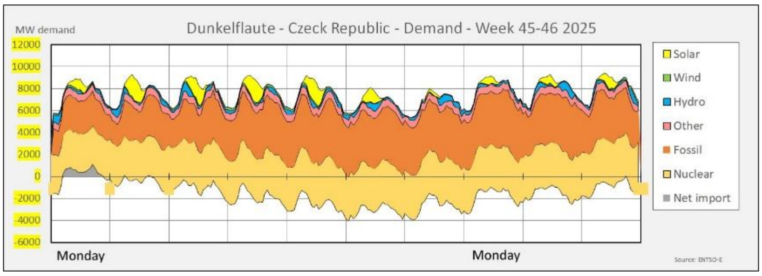

Fig. 15 - The Czech Republic Total demand 3rd to 12th November 2025

Wind power production also fell in **Poland**, but this was offset by lower load at the weekend.

The fossil fuel is roughly composed of 30% lignite, 20% gas and 50% coal.

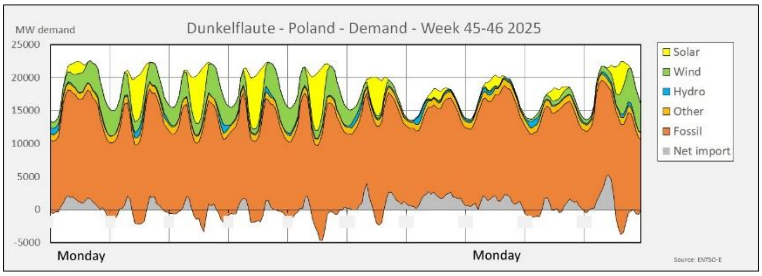

Fig. 16 – Poland Total demand 3rd to 12th November 2025