

Small stocks of gas made Europe vulnerable

Danish power producers used large stocks of fuel for stabilizing electricity prices after the oil crises in the 1970s. Besides, due to the risk of freezing waters it was required to keep fuel for a complete winter season.

Several power plants with large fuel storages have since then been decommissioned. A new international energy crisis is the logical consequence. Nevertheless, it has taken us by surprise.

The year 2020 was rich on hydro and wind energy and the year 2021 was poor. A comparison between the two years offers an opportunity to examine the importance of long-term energy storages.

Spot prices for electricity and gas are related

The spot prices for electricity and gas have since 2016 been closely related (fig. 1). It is particularly interesting that a surplus of electricity in 2020 seems to have pressed the price of gas down to a historically low level, while scarcity of electricity in 2021 elevated both prices in 2021.

Gas fired power plants gain increasing importance as nuclear and coal fired power plants are decommissioned. Usually, gas fired power plants do not have their own gas storage. This lack of flexibility has given international suppliers of natural gas new opportunities. Russia has taken advantage of the situation by limiting their supplies to Europe.

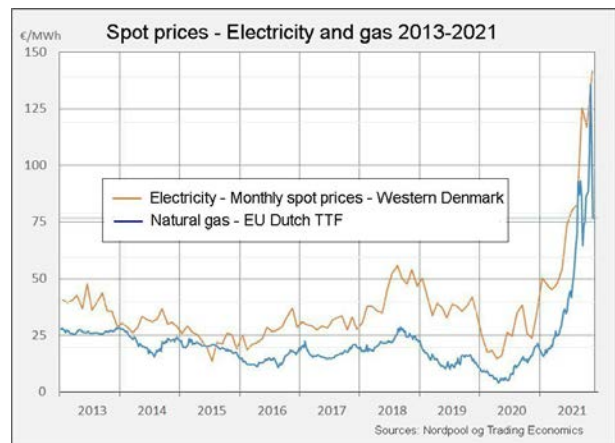


Fig. 1 – Did the electricity spot market press the gas price to the bottom in 2020?

The Russians are not to blame for this policy. Any monopolist would have done the same.

Europe's stocks of gas reduced by 20 % from 2020 to 2021

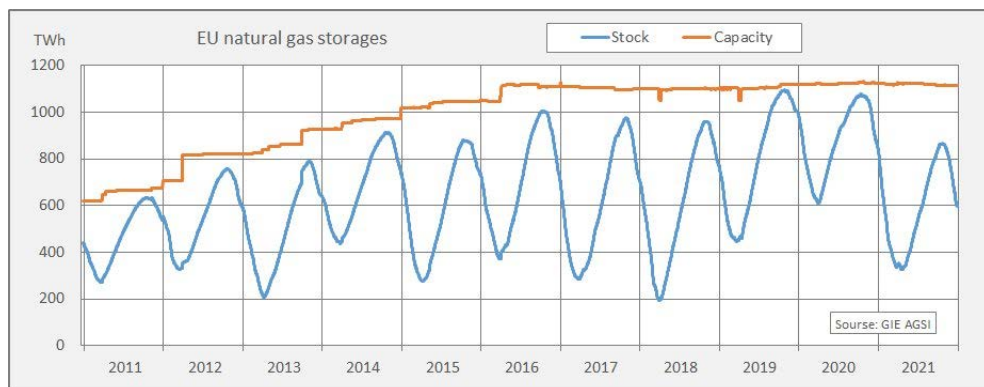


Fig. 2 – EU's stocks of natural gas are 230 TWh lower in 2021 than in 2020

The total capacity of the European gas storages is a bit over 1100 TWh or 24% of the annual consumption (fig. 2). The 230 TWh decrease in stocks from 2020 to 2021 is about 5% of EU's annual consumption of natural gas.

The stocks of natural gas at the beginning of a winter season is probably decisive for the balance of power between suppliers and buyers of gas. Is there a tipping point somewhere between 19% and 24% of the annual consumption?

The storage capacity for natural gas is very unevenly distributed in Europe. The natural conditions for the establishment of a storage facility are different, but the will to cover the cost of such preparedness is probably decisive (fig. 3).

EU imports more than 80% of the consumption of natural gas. There are limited opportunities for additional import. Therefore, stocks of gas about 20% of the annual consumption at the beginning of a winter season do not go far. The price formation depends on unpredictable psychological factors, but the traders' economical and physical endurance must have some influence. Therefore, it must also be of some importance if the buyer has large or small storages and stocks of gas.

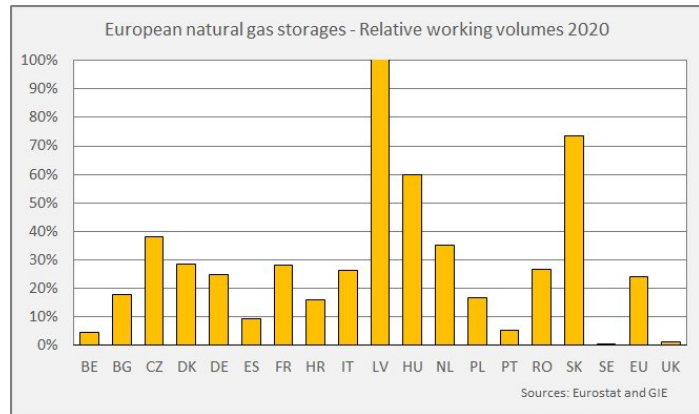


Fig. 3 – Latvia's storage capacity is 185% of the country's annual gas consumption. The corresponding UK figure is 1.1%.

Energy content in hydro reservoirs reduced from 2020 to 2021

The capacity of the hydro reservoirs in Norway, Sweden and Finland is about 120 TWh. This figure cannot be compared with the stocks of gas, because gas cannot be converted to electricity without a loss of energy. Less wind, less rainfall and increased consumption of electricity made it necessary to take 24 TWh from the hydro storages (fig. 4).

The hydro storages seem to be operated differently in the southern part of Europe. The variation over a year is 5 or 10 TWh against 60 TWh in the Nordic countries.

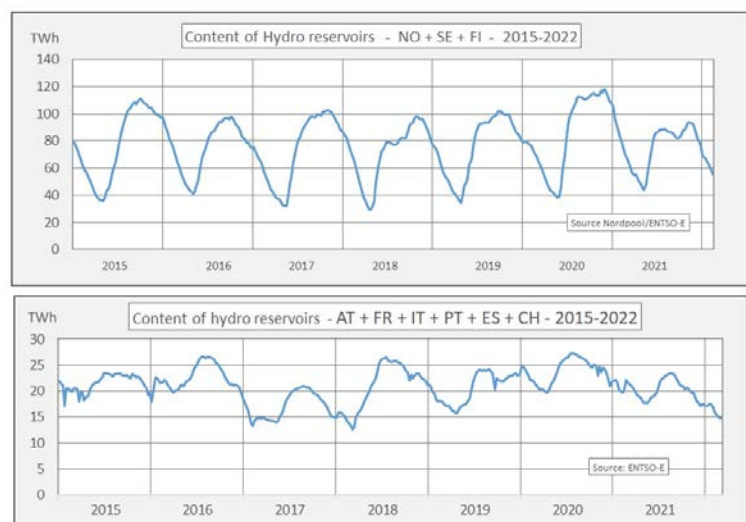


Fig. 4 – Clearly reduced energy contents from 2020 to 2021

The distribution of the energy content between the six countries was (week 26, 2021): Austria 5%, France 10%, Italy 10%, Portugal 10%, Spain 47% and Switzerland 13%.

Dependence on natural gas made Europe vulnerable

After decommissioning of dispatchable power plants with fuel storages, natural gas has become the main long-term fuel reserve. This is a main reason for the fragile situation in energy supply at the beginning of 2022.

Any deficit in the energy account, as described above, must be outbalanced by increased import of natural gas.

It was always good practice for fuel buyers to have a choice between suppliers, and to negotiate from a position of strength, i.e. with fair fuel reserves. The green transition is planned without such commercial considerations. Our present weak position could have been avoided with reasonable care.

The location of heavy load centres was taken into account in the planning of traditional power plants. The best possible harmony between production, transmission and consumption was aimed at. Only few wind turbines can be installed close to the load centres. This is one of the reasons, why wind and solar power cause large energy transports over longer distances.

The transmission grids have not been planned for the new conditions. This is well known to the planners, but a political pressure requires a fast transition. Unfortunately, large new transmission facilities cannot be installed rapidly. It takes 10, 20 years or more to get all necessary permissions for a new power line. Therefore, the necessary grid extension has become strongly delayed, especially in Sweden and Germany. The development of a new structure with wind and solar power should proceed in harmony with the necessary infrastructure. A faster transition towards climate neutrality has its price.

Did the Danish Energy Agency forget energy?

The Danish Energy Agency has published the result of a comprehensive analysis of security of supply for electricity in January 2022¹. A worse security of supply is expected after 2030, particularly in Eastern Denmark. Three elements of security of supply have been examined:

- Adequacy of production capacity
- System security
- Adequacy of transmission

However, a fourth element, **adequacy of energy**, seems to be ignored. A stable energy supply is decisive for price stability. It was a natural criterion in Danish power system planning before 2005.

Similarly, the scarcity of wind and rainfall in 2021 seems to have taken everybody by surprise. The previous Nordel cooperation was based on utilizing the synergy between thermal and hydropower systems, because a hydropower system must be planned for both dry and wet years. Even wind energy has variations from year to year. Providing energy reserves for years with a combination of low wind energy and low hydro energy as in 2021 should be part of normal planning procedures.

¹ Report in Danish: Klimaafteleanalyse 1 – Hovedrapport: Elforsyningsikkerhed frem mod og efter 2030, Energi styrelsen, januar 2022

Renewable energy (wind and solar) may have been considered so stable that designated long-term energy reserves would be superfluous.

Security of supply for energy in Danish electricity industry deserves a thorough and open debate. It is not a simple matter. Denmark cannot avoid influence from the problems in Sweden and Germany. Denmark is only a small piece in the European electricity market.

Denmark should have its own emergency preparedness for international crises. A committee for emergency preparedness for the Danish electricity industry has been established, but it has not been possible to find any current activity of the committee. New targets have replaced previous energy criteria.

A relevant question is: How long time could an interconnected or divided Danish electricity supply be maintained without foreign support?