New Market Rules will not Solve the Energy Crisis

Fundamental changes of electricity markets should be carefully considered

The Belgian Energy Minister Tinne Van der Straeten has warned that the next five to 10 winters in Europe will be "terrible" unless the EU swiftly moves to impose a price cap on runaway gas prices. Other prominent persons have also called for immediate action.

The fragile European energy systems

The causes of the energy crises are shortage of energy combined with abuse of market power. New market arrangements will not provide additional energy. The shortage of energy must be handled by physical means on both supply and demand side.

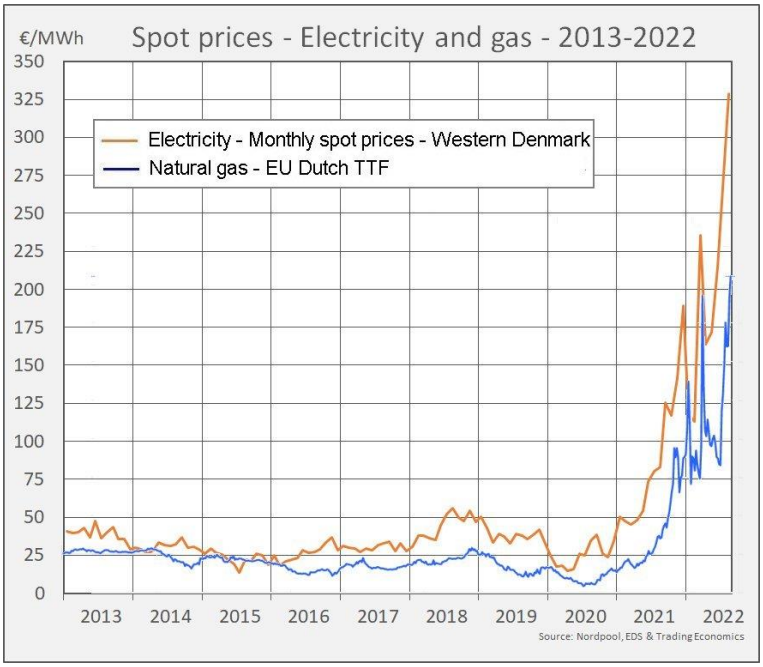

Fig. 1 - Low electricity prices controlled the gas market during first half of 2020.

There is a coupling between the European markets for electricity and gas. In 2020 there was a surplus of electricity in Europe. Norway could not export its surplus of electricity due to bottlenecks on the export links. The spot price market collapsed in Norway with average spot prices at €/MWh 1.46 in June 2020[1].

The pan-EU spot price for electricity was the lowest ever recorded at €/MWh 24.20 for second quarter of 2020.

The spot price for natural gas reached a historic low in 2020 (fig. 1). The reason was probably the cheap electricity prices in Europe. The electricity spot prices were robust against reduced gas supplies.

The situation changed completely in 2021. An electricity deficit was caused by low inflow of water to the Nordic hydro systems, low production of wind energy and power station outages. The Danish offshore wind index changed from 103.1 in 2020 to 90.2 in 2021.

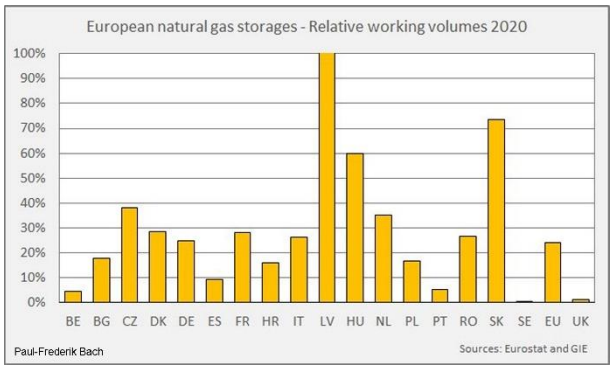

Fig. 2 - Insufficient European gas storage capacities

[1] http://pfbach.dk/firma_pfb/references/pfb_loss_on_cable_faults_2020_07_01.pdf

The increasing international tensions made Russia exercise its power in the gas market, and the race towards record high energy prices began.

After the oil crises in the 1970s most countries spread their fuel purchase and avoided dependence of a single fuel supplier. This policy seems to be completely forgotten. Unfortunately, it will take a decade or two to restore the independence.

Small fuel storages, weak transmission systems and increasing amounts of fluctuating production have left Europe with a power system, which is vulnerable to small variations in energy supplies, for instance from wind and rainfall.

The electricity crisis in California in 2001

A comparison with the electricity crisis in California in 2001 might be useful.

An electricity market opened in 1998 in California. The market was operated by California Power Exchange (CPX). The power system was monitored and operated by California Independent System Operator (CAISO).

The new market performed quite well in 1999, but it became increasingly difficult to mobilize sufficient capacity for daily operations during the year 2000. Market manipulations and capped retail electricity prices were among the causes for shortage of electricity supply.

CAISO's open information policy made it easy to follow the increasing operating problems. CAISO reported stressed operational condition on their web site, using a six step scale from "Alert" to "Stage 3 Emergency" (fig. 3). Emergencies might imply the use of "brownouts", which means interruption of supply for selected geographical areas for e.g. two hours. Consumers in affected areas can be informed in advance.

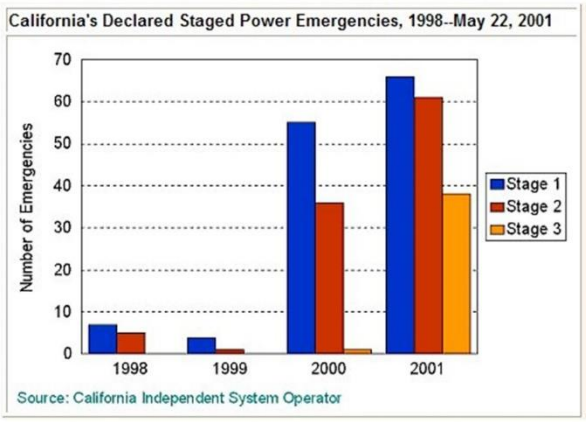

Fig. 3 - Power emergencies in California 1998-2001

A disturbing number of emergencies occurred during the summer of the year 2000. Interruptible loads were mobilized in order to stretch out the reserves.

On June 14th, the voltage at Silicon Valley was between 226 and 228 kV and approached the critical value, 225 kV. CAISO requested Pacific Gas & Electric (PG&E) to interrupt supply for 100,000 customers (households and small enterprises around San Francisco). The disruptions included a demand at 421 MW. The duration was between 65 and 82 minutes. It was done exactly by the book.

The next day, governor Gray Davis wrote a letter for the president and the chairman of California Public Utilities Commission (CPUC). The letter assumes that poor maintenance of power stations and power lines are main reasons for the problems and requests CPUC to investigate the circumstances. CPUC, who felt their role weakened after the deregulation, took the opportunity to write a very critical answer, particularly concerning CAISO.

In January 2001, power cuts affected several hundred thousand customers and governor Davis declared a state of emergency. In March, power cuts affected 1.5 million customers

The CPX, through which most power had been traded in California, filed for Chapter 11 in March 2001, roughly one month prior to PG&E's Chapter 11 filing.

The crisis had no single primary cause, but a complicated pattern of causes. The common denominator was lack of resources for covering an increasing demand for electricity. A political decision to cap retail prices was a contributing element. Execution of market power and delays in approval of new power plants were other elements. Besides, California depends on external supplies of natural gas, of which the price increased considerably during the crisis.

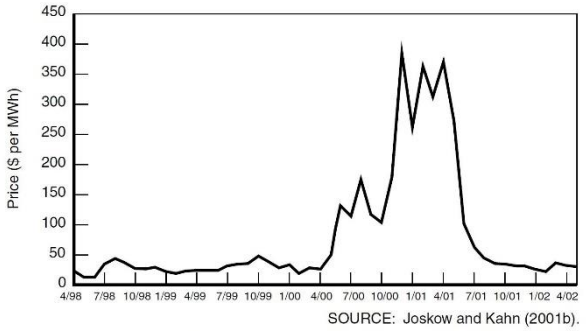

Fig. 4 - The state of California used $ 12 mill. in an attempt to save the market

A gradual improvement during the summer of 2001 had several reasons. Permissions to increase retail prices were given. New power stations were commissioned. Electricity consumption decreased after campaigns for saving electricity. Besides, the price of natural gas was moving back towards a more normal level.

It might be useful to analyze the similarities between the present energy crisis in Europe and the events in California back in 2001.

Large scale flexible demand could be a short-term solution

It is a widespread view that the retail energy prices can be normalized by minor revisions of the rules in the electricity markets. This view ignores the energy shortage and the vulnerability of the energy systems. It is urgently necessary to increase and spread energy supplies and to increase the capacity of transmission and storage systems. Unfortunately, the necessary infrastructure reinforcements will take a decade or more.

The electricity markets have served their users well for a couple of decades. Hasty changes might get unpredictable bad consequences.

Fig. 5 – Case Sept. 1st 2022 hour 8: export from the Nordpool area adds more than 100 € to the spot price

The marginal price principle works perfectly in a normal market. The opportunity to execute market power is a high risk in any market system. A price cap would do nothing but reducing supplies.

The demand side also has a responsibility for the spot price runaway. In the example (fig. 5) the quantity at market equilibrium (without export) is 31,865 MW, of which 30,537 MW were

bids at Nordpool's maximum price. These bids represented traders, who wanted to buy, regardless of price. Only 4% of the accepted demand had some flexibility. The demand side price flexibility is very low, though this issue has been investigated for more than 20 years.

The development of more large scale price flexible demand is probably the fastest way to give the demand side the influence to force down the spot prices.

This is not a matter of moving demand a few hours, but of refraining from use of electricity for days. Periods with low wind can last one week or more.

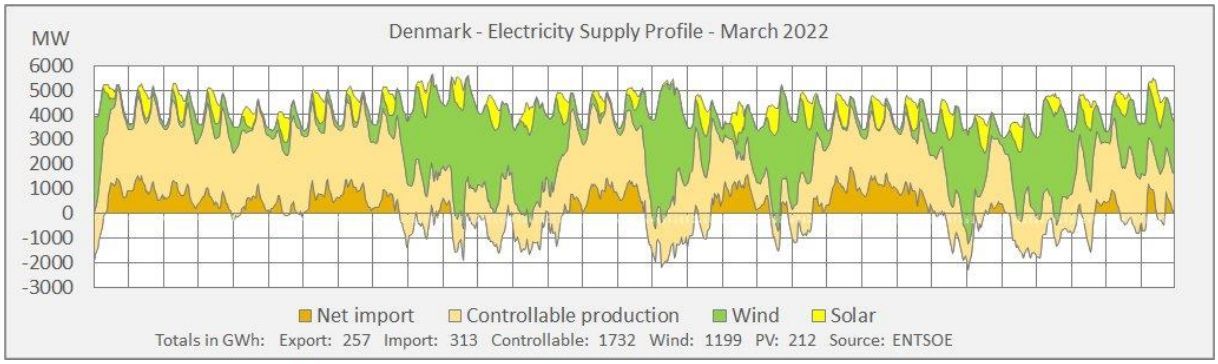

Fig. 6 – Most Danish controllable production is CHP. The beginning of March was cold and calm.

Fig. 7 - The spot prices (DK1) reflect the variations of wind power

The price variations (fig. 7) suggest some simultaneity of European wind power because Danish and German spot prices are closely connected. The average price level may change, but the volatility will probably remain. Batteries and PTX facilities will need price variations for their profitability. The question is, if additional demand during windy periods will affect the price differences.

Conclusion

There is an energy shortage in Europe due to reduced supplies in 2021 and 2022. Lack of demand flexibility and insufficient infrastructure has given the supply side the opportunity to press electricity spot prices upwards.

Price caps or new market rules will not improve the energy balance. Reinforcing infrastructure (energy storages and transmission systems) will take a decade or more. The effect of additional wind turbines will depend on stronger infrastructure.

The best and fastest option seems to be improved price sensitivity on the demand side.