Useless messages

Summary
I have been posting news, analyses and opinions about Danish and European energy policy since 2009. In this note, I try to show with selected examples what has occupied me over the years.

- The use of natural gas has brought Europe into the same vulnerable situation as before the oil crises in the 1970s, both in terms of supply and economy.
- Insufficient internal transmission networks in Germany, Sweden and Norway create large geographical price differences in the spot markets for electricity.
- The expansion of fluctuating electricity production from wind and solar power has led to volatile prices in electricity markets in most of Europe. Flexible demand was supposed to smooth out variations in weather-dependent production, but the development of this type of demand was neglected.
- Due to the risk of international unrest, Denmark, should be able to cover an appropriate minimum of its electricity needs from its own land-based controllable production plants.
- In the event of a total blackout, Denmark should be able to restart electricity production with its own resources.
- Denmark has high ambitions for a rapid green transition. Now the work has run into significant delays and increased costs. Broad cooperation should be established to update the plans with more realistic solutions and timetables.

4 December 2009:
Challenges of Climate Change
Natural gas has excellent properties, but is not carbon free either. Furthermore, the amount of natural gas in the North Sea is shrinking and cannot last for the life time of a new power station.

It is an irony that the energy political development, which was started by a price increase of Arab oil in October 1973, seems to end with all of Western Europe being dependent on import of gas from states or via states, which could be as unstable as the countries supplying oil before 1973.

20 August 2011:
Are we paving the way for another energy crisis?
From a Danish point of view the issue of this report should be seen in a longer perspective. The report has demonstrated an increased vulnerability of security of supply in the UK, but the problems will be similar in several other countries. Gas is gaining an increasing importance in Europe during these years. Gas is an attractive fuel which can be utilized in plants without expensive facilities for pollution control. However, gradually more and more gas must be imported from potentially unstable regions.

Prior to the crisis in 1973 oil had the same role in Europe as predicted in this report for gas in the future.

Based on the experience from 1973 Denmark has developed a more robust infrastructure including combined heat and power (CHP), multi-fuel plants and large fuel storage facilities.

The discovery of oil and gas in the Danish sector of the North Sea gave the Danes a feeling of security, so the experience from 1973 is fading away.

9 January 2013:
A Game on Security of Supply
The "Strategy Plan 2012" from Energinet.dk discusses the European capacity arrangements. It states that Denmark maintains a high security of supply due to the strong interconnections and the integration with the European electricity markets.

This strategy creates uncertainty on the development of electricity production in Denmark and on the future security of supply. It may also cause a reduced combined production of heat and power which was so far an essential part of Danish energy policy.

The implementation of a capacity market requires several years. The British capacity market was introduced in a white paper [4] in 2011. It is expected to be effective from 2019 but could be brought forward, if required.

After 2020 the capacity balance is expected to be negative in both Denmark and Germany. A continuation of the present policy will create an international competition on buying both capacity and balancing services. This situation could be very expensive to Danish electricity consumers.

Denmark has a fleet of very efficient power plants. The heat supply for the district heating systems depends on this fleet. From the 2020s a new generation of flexible, clean and efficient power plants will be needed for the future production of electricity and heat.

It is time for preparing the generational change. A first step could be an open strategy for the development of the supply structure and for encouraging the necessary investments.

8 May 2013:
50 Years' Blackout Lessons
In 1965 President Johnson would prevent a recurrence of the Great Northeast Blackout. He did not succeed.

The large AC power systems are vulnerable. A delicate balance between demand and supply must be maintained every second. The rare occurrence of blackouts demonstrates that the first lines of defence (spinning reserves and N-1 grid redundancy) are efficient in most power systems.

However, black start capabilities and procedures (the last line of defence) have often proved to be inefficient. It was for instance the case in East Denmark and in Italy in 2003.

Officially all power systems maintain a high security standard, but a NERCC audit on the European power systems could be an interesting experiment.

It is hard to justify the cost of facilities and staff for observing all rules and for the ability to conduct a black start when an average power system experiences less that one blackout per decade. Therefore, the current security levels could be considered as reasonable from a socio-economic point of view.

The system operators will face new challenges from the massive introduction of un-dispatchable power plants (wind turbines) in several countries. We have not yet seen the last black-out.

23 July 2013:
100% RE is a Misleading Target
The Danish government has made 100% RE a target in itself. This target seems to inspire creative bookkeeping and to move the following classical virtues into the background:

- Clean, reliable and competitive energy services for the consumers
- Sustainable energy supply with minimum dependence on foreign fuel supply and energy services and maximum robustness to unexpected international developments
- Minimum environmental impact in the widest sense from energy services

The two questions from Dansk Energi deserve clear answers:

- Not-dispatchable electricity production should be balanced by efficient and useful utilizations instead of relying on electricity export
- The share of renewable energy is not a target in itself. Therefore, Danish RE targets should be in balance with the targets in the neighbouring countries

Only in this way the classical virtues can be given a fair consideration.

29 January 2014:
Why is it so important to DONG Energy to expand abroad?
The fact that DONG Energy is owned and controlled by the Danish state suggests that DONG Energy as an element of a green Danish policy has received a political instruction to invest in offshore wind parks. If this is the case it is natural that it is the finance minister who must find the necessary venture capital.

This is aparently a risky business area. The price of reducing that risk will be the loss of influence which is reflected in the agreement with Goldman Sachs. The green policy is simply expensive.

Several politicians in the parties which are supposed to support the agreement have raised the issue of postponing the final decision in order to consider possible alternatives.

The most obvious alternative would be to limit the ambitions of DONG Energy to a level which DONG Energy can afford and to business areas serving Danish consumers.

9 July 2014:
Do we have Sufficient Black Start Capabilities?
In 2003 the Southern Sweden and East Denmark suffered a total blackout. The Danish black start facilities failed and the capital area in Denmark had to wait several hours for support from Sweden. Since then, very little has been published about Danish black start capabilities and there is no evidence of significant improvements.

There could be two reasons for the silence about this matter:

- It is unpleasant to imagine and describe the worst case scenario when so much is done to prevent it from ever happening.
- New black start facilities would require large investments. It can be hard to justify investments in facilities which may never be utilised for their purpose.

During these years many power systems are in a fundamental transition with an increasing share of fluctuating and non-dispatchable generation. This will change the risk of disturbances and the system properties during a restoration process will be different. Hopefully, the restoration procedures and the black start procedures are being regularly reconsidered and tested. Public information on the results would be welcome.

26 July 2014:
Misleading Report from Danish Energy Agency (DEA) on Cost of New Wind Power
It has become an unreflective political target to remove the use of coal from the Danish energy systems as soon as possible. The carbon emission and the global climate is the main argument. There is no doubt that this view is predominant regardless of the result of any calculation. This must lead to the conclusion that the CO_2-costs used in the calculations are too low. The real CO_2-cost is higher. The cost of the Danish Energiewende is higher than realized so far.

The future market response to more wind and PV will depend on the development in other European countries. Therefore, the development of the loss of market value for non-dispatchable power is very uncertain. It would be a wise Danish strategy to be more reluctant with the installation of new offshore wind parks in the next few years and to make careful market observations for supporting the necessary decisions on future new Danish power plants.

7 August 2014:
Denmark Needs a Capacity Market
After the recent closures of thermal power plants Denmark must rely on foreign dispatchable capacity. Energinet.dk expects an additional closure of more than 1000 MW traditional power plants until 20207. The cost of this increasing dependency on foreign dispatchable capacity is unknown.

A well-designed Danish capacity arrangement in due time might prevent an unnecessary closure of Danish power plants and improve the security of supply in Denmark during a period with an increasing uncertainty about the capacity conditions in Europe.

It could serve Danish interests if Danish authorities would go forward with the development of an efficient capacity arrangement and work actively for a future joint European capacity market instead of just observing what is going on elsewhere.

16 February 2015:
The Market Value of Wind Energy
The next few years until 2020 will be an interesting observation period.
If the development of fluctuating power in Germany and Denmark is faster than the integration measures, we will see decreasing market values of wind energy and electricity export together with increasing market values of electricity import. If the integration measures prevail, we will see stable or increasing market values of wind energy and electricity export.

The total investment in renewable energy is considerable. The total cost of the transition programme depends on the market value of the renewable energy. Therefore, it will take a suitable amount of new balancing resources to prevent increasing spot price volatility and decreasing market value of the wind energy.

5 January 2016:
Denmark more and more Dependent on Foreign Resources for Balancing the Power System
The real problem is to maximize the market value of the energy from fluctuating power sources such as wind power and photovoltaics. It is widely accepted that new flexible utilizations of the unstable power must be developed. Besides, also a suitable amount of dispatchable capacity for balancing services based on non-fossil fuels must be available.

So far, the construction of wind power turbines has been much faster than the implementation of a flexible response. Very little has happened on the demand side so far. The market values of the Danish power exchanges for the next few years will indicate if the balance is improving.

The cost of foreign balancing services will probably increase in a future with an increasing share of wind power and photovoltaics in all neighbouring countries. The development and implementation of domestic flexible resources in time could be decisive to both economy and security of energy supply in Denmark.

23 April 2017:
The Electricity Markets Will Set the Cost of Wind Power Integration
The non-dispatchable generation creates hours with surplus of power and low spot prices and other hours with deficit of power and high prices. The price volatility has increased.

The implementation of smart grids with flexible electricity demands has been discussed for at least 20 years, but very little has happened so far.

The value of wind energy in Denmark seems to have stabilized at about 80% of the value of energy from dispatchable sources. The difference can be seen as a cost of integrating wind power and must be considered in comparisons with alternative production methods.

It is difficult to predict if the wind power value in Denmark will remain stable at the present level. The future spot price volatility in Germany will be decisive. Therefore, there is good reason for a close observation of the German Energiewende during the next few years.

13 May 2019:
Congested Grids Curtail Wind Power
A green transition requires European countries to boost the infrastructure development and moderate wind and solar power development in order to avoid unacceptable curtailment of wind energy.

2 September 2019:
Forecasts are always wrong
The crude oil prices will probably fluctuate in the range between 20 and 100 US $ per barrel depending on the international trading conditions. Consequently, the best possible smooth forecast may have errors up to 40 $ up or down. Unbalanced forecast would give even larger errors.

Without a well-founded estimate of the time for the next recession and for the peak oil, any guess is as good as the official forecasts.

Private investors in energy project should make sure that their projects are sufficiently robust against large forecast errors.

Public investments are often required to have positive business cases. A biased fuel price forecast can support decisions on projects, which are not profitable in a narrow sense, but which have wider purposes. The bias is normally unintended, but it is hard to believe that the planners of the Danish train fund were in good faith.

24 September 2019:
Lessons Learned after British Power Failure
The result of increasing shares of wind and solar power will be decreasing short circuit cpacities and rotating inertia. This will in turn lead to more rapid frequency changes and less stable voltage vectors and it can be necessary to install stabilizing units, such as synchro-nous compensators.

The conclusion is that improbable events do happen. Such events offer useful opportunities to improve system stability and robustness.

31 January 2020:
Denmark is a Roundabout in the European Grid
When the high Danish share of wind power is mentioned as a model for other countries, it should also be explained that it is a crucial condition that other countries are ready to cover the gaps and to purchase the overflow. Danish grids and interconnections serve the Danish need for exchange of electricity plus a similar amount of other countries' need for electricity transit. The international electricity markets have made the Danish strategy possible.

Imaginative domestic solutions have been proposed, but realistic concepts are still missing. The Danish tradition for strong interconnections is the most efficient measure until now, but the market for balancing services may be more strained when the wind power penetration in the neighbouring countries reach the present Danish level.

25 July 2021:
Weak Transmission Grids Disturb the Electricity Market - A political responsibility
Critics claim that security of supply has deteriorated and that carbon emissions will increase. Svenska Kraftnät answers that they are operating the system in the best possible way within the frameworks given by the Swedish government.

This statement transfers the responsibility to the political level.

Power system operators know that a power system needs reserves for unplanned events. It is important that the decision makers understand this basic condition. The current untenable situation for the Swedish power system could be a result of insufficient communication between the technical and the political level.

The market collapse in 2020 was not just an unfortunate coincidence. In 2021, other unplanned events are disturbing the market functions. Sweden had in the past one of the best planned power systems in the world. Now the grid reserves are insufficient. The problems will continue until a reasonable balance between production and transmission has been planned and implemented.

12 October 2021:
The Vulnerable Energy Market
The explanations in previous sections are focused on variations in wind conditions and inflow of water to the hydro systems. The supplies of gas has also been a limitation in 2021. IEA says in its Gas Market Report, Q4 2021, that "the combination of recovering economic activity, lower liquefied natural gas (LNG) availability and a succession of severe weather events has put the global gas system under strong pressure and sent market prices to new highs." The lesson of the energy crises in 1973 and 1979 was that dependence on imported energy could be a threat to normal life in Europe. In the following years, the aim of energy policy was to develop more robust energy systems. The present instability of the European energy markets suggests that this experience has been forgotten or ignored. The instability will be characteristic for European energy markets for many years to come.

18 January 2022:
Europe Revives the Energy Crises of the 1970s
A couple of essential conditions have changed and may help explaining, why the fuel storages are disappearing.

- In the past, Danish electricity companies were required to have fuel for a certain time at the beginning of the winter season due to the risk of freezing waters, but freezing waters have not been a problem since the 1990s, and the rules have been lifted.
- The introduction of competition and the development of electricity markets did not give power producers incentives to maintain stocks of fuel.

Eventually, there will be only minor fuel reserves left at the power stations.
However, fuel storages and long-term stocks of fuel are still important measures if a certain stability of energy prices is desirable.

The point is that all types of electricity production have advantages and disadvantages. The disadvantages of dominant use of wind and solar power have been ignored. Targets were set in a green competition between political parties. The result is an ambitious transition, which has not been properly planned.

24 June 2022:
Norway at the Capacity Limits of its Power System
The Norwegian water storages have been utilized close to both maximum and minimum limits. Lack of export capacity contributed to full storages in 2020, and doubled export capacity reduced the Norwegian energy reserves in 2022 and divided Norway into high price and low price electricity markets.

It must be a Norwegian consideration, if this is a problem, but it is unlikely that Norway will be able to increase the sale of balancing services significantly.

Norwegian authorities have probably assessed each new link to be profitable, but putting the planned link to Scotland on hold indicates that the impact of new interconnectors on the Norwegian electricity markets has taken them by surprise.

Most countries have ambitious plans for new wind and solar plants. Additional transmission and balancing capacities must be established simultaneously with the commission of new generation. In some countries, large transmission projects are already several years delayed.

This situation seems not to be fully recognized in Denmark and some other countries.

29 June 2022:
Have technical experts lost influence on the Swedish power system?
We do not know the planning procedures. Our Swedish colleagues are no doubt as brilliant as they always were, but they may be less influential. There may be good reasons for the development. Answers to the following questions might help us to understand:

- What was the purpose of installing 12 GW wind power? The wind energy production in 2021 had the same magnitude as the Swedish electricity export. Was wind power built for electricity export?
- Was the installation of wind power coordinated with the planning of the transmission system and why not?

7 June 2023:
The energy crisis is not yet over
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.

31 August 2023:
Germany after nuclear shutdown
The increasing cost of balancing services indicates that a stronger price response is desirable. A price response from retail customers will not be sufficient. It must be followed by a large-scale response at wholesale level, for instance from P2X plants.

The capacity of price responsive demand must be increased substantially in order to pave the way for additional wind and solar power in Germany and in its neighbouring countries.