

Denmark Needs a Capacity Market

A European shortage of dispatchable power may be developing

Spot prices under pressure from subsidized energy

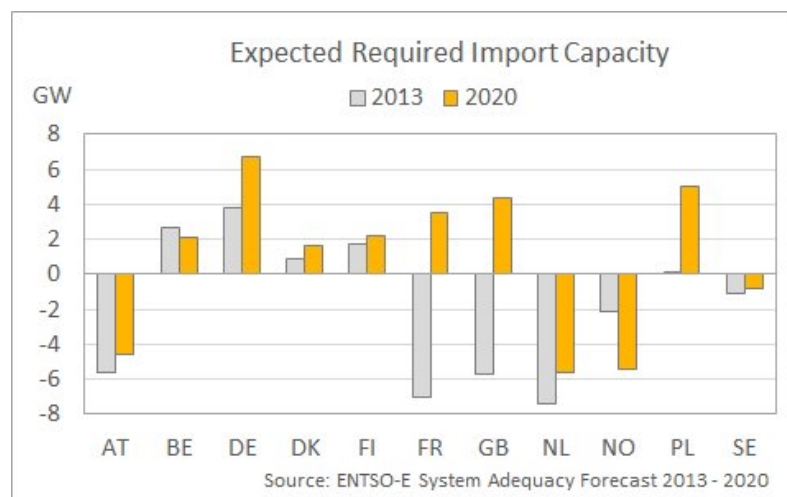
When the spot market was designed the price levels were expected to include both the cost of energy and incentives for the replacement of obsolete capacity by new power plants. However, as a result of the injection of renewable energy, financed by subsidies, the spot market prices reflect only variable costs.

The European consumers should be happy about the low market prices. Unfortunately there will be an additional bill to pay.

In 2013 the total generation capacity in Denmark (dispatchable and non-dispatchable) was more than three times the maximum load. This capacity composition is economically unsustainable. Several European thermal power plants are being mothballed or closed down as a result of the new conditions.

Wind power and photovoltaics (PV) are non-dispatchable electricity sources. Therefore the total amount of dispatchable power is decreasing, while the amount of non-dispatchable power sources is increasing.

ENTSO-E¹ has analysed the European capacity balances for the years until 2020². Each country needs a certain import capacity in order to keep the lights on in every imaginable situation. It is defined as "Remaining Capacity" minus "Adequacy Reference Margin".



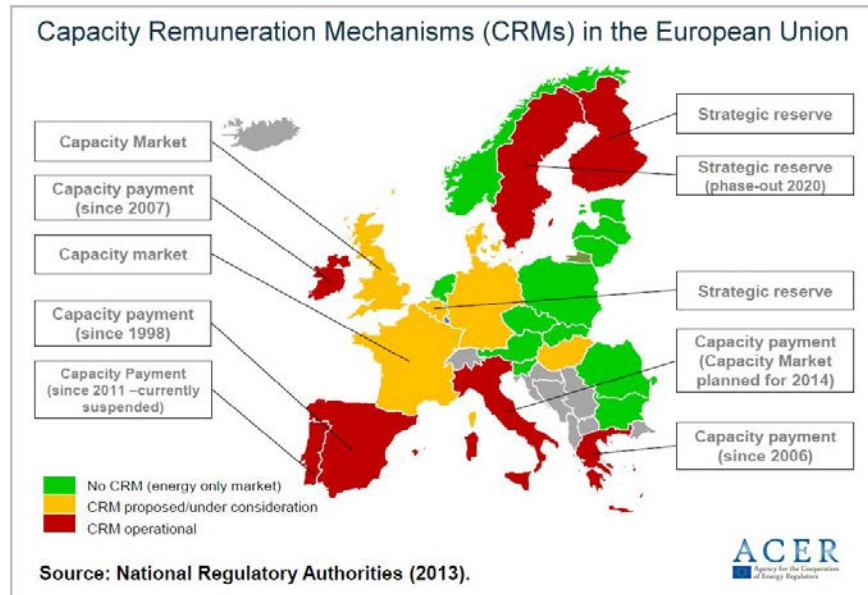
For Denmark the expected necessary import capacity has increased from 850 MW in 2013 to 1660 MW in 2020. This is far below the capacity of the Danish interconnections. The problem is something else. For the countries in the chart the total net balance is expected to change by 29,000 MW from 2013 to 2020. The question is if the corresponding export capacity will be available in Europe.

¹ The European Network of Transmission System Operators for Electricity

² Scenario Outlook & Adequacy Forecast 2013-2030

Different capacity arrangements in different countries

The capacity problems have been anticipated for some time and several countries have prepared or implemented different measures.



There are different capacity arrangements and there are even different models for capacity markets. This may cause coordination problems in the future.

It is a common feature of all capacity arrangements that the producers must be paid for providing additional dispatchable power and that the consumers must carry the additional cost.

The situation in Germany is not yet clarified. There is currently a discussion if the future security of supply should be based on strategic reserves or on a capacity market. At the same time German politicians are arguing for a joint European capacity solution.

Reluctance in Denmark

Due to Denmark's location with strong interconnections it has for several years been a firm policy that special capacity arrangements would be unnecessary in Denmark.

Energinet.dk's System Plan 2012³ was confident: *"Due to the planned infrastructure development Denmark will not depend on supplies from a single country. It will be possible to cover the maximum demand even in case of capacity shortage in a neighbouring country. Due to this risk diversification Denmark will still have a high security of supply and a low cost of electricity."*

In System Plan 2013 Energinet.dk must relate to a new reality: *"In 2013, Denmark passed a symbolic boundary in relation to output sufficiency when Ensted Power Station and the Stignæs stations were mothballed. As such, domestic Danish power station capacity is no longer sufficient to cover every imaginable peak load situation when the wind is not blowing."*

³ Not available in English, my translation.

With capacity shortage in several countries and capacity arrangements in the neighbouring countries Denmark will face an increasing uncertainty by relying on foreign dispatchable capacity.

System Plan 2013, chapter 7: *“As described in Section 5.1, there is a risk that in the long term the current market model will be unable to assure sufficient financial incentives for maintaining the desired production capacity/flexibility that is necessary to ensure efficient transition to renewable energy. Energinet.dk will therefore examine the opportunity of introducing new market elements with the capacity to generate more long-term incentives to ensure sufficient output – in the form of either production capacity or flexible, interruptible consumption.”*

Whether the necessary capacity is Danish or imported there will be an additional cost of maintaining a safe level of dispatchable capacity.

The time has come to discuss future capacity arrangements, even in Denmark.

Closure of Danish power plants can be expensive

Denmark still has a fleet of modern dispatchable thermal power plants. The current market prices and sale of heat for the district heating systems will probably not be sufficient to maintain their continued operation.

Postponing a Danish capacity arrangement might lead to the situation that efficient power plants are decommissioned before the end of their technical lifetime. After a few years the Danish consumers must pay for new dispatchable Danish or foreign capacity which may be rather expensive and perhaps without being natural elements of the CHP⁴ systems.

There has been a lot of public focus in Denmark on advancing the wind and solar power and practically no interest for the need for something to fill the gaps created by the natural variations of wind and sun. Very little has been done to develop new dispatchable plants for a green and lasting replacement of the present workhorses in the power stations. A systematic transition plan might save a lot of money to the consumers of electricity and heat.

A Danish capacity arrangement might be able to keep a crucial power plant capacity operating with balancing services for the renewable energy and heat supply for the district heating systems until new concepts are ready.

Cheaper energy from existing power plants than from new wind power

The Danish Energy Agency (DEA) recently presented the message: “Wind is cheapest”. The statement was based on a cost calculation for ten technologies. The conclusion is that on-shore wind energy is far cheaper than any of the alternatives and that the current replacement of thermal power plants by wind power makes sense, even economically.

The comparison does not acknowledge the difference in market values between dispatchable and non-dispatchable power in the present spot markets. It does not anticipate a future separate cost of dispatchable capacity either.

⁴ CHP: Combined Heat and Power

The cost of continued operation of three Danish coal fired power plants commissioned in 1991, 1992 and 1998 has been drawn up. Their data are similar to the data for a new coal fired unit in the comparison. Their total lifetime is assumed to be 40 years. The cost elements are identical to the cost elements in the EA report⁵ except that there is no capital cost and the CO₂-cost is based on CO₂-prices⁶ for the remaining life time for each of the three units.

DKK/MWh	New wind		New coal	Existing coal fired units		
	Onshore	Offshore		Unit 1	Unit 2	Unit 3
Capital cost	230	423	198	0	0	0
Balancing cost	15	15	0	0	0	0
O&M	76	144	118	118	118	118
Fuel cost			216	216	216	216
CO2 quotas			163	122	125	142
Other emissions			25	25	25	25
Heat revenue			-185	-185	-185	-185
Total	321	582	535	296	299	316

The balancing cost covers only forecast errors. In order to eliminate the difference in market value in 2013 about 40 DKK/MWh should be added to the offshore cost and about 50 DKK/MWh to the onshore cost. The future correction will depend on capacity market conditions.

The calculation above is not meaningful in itself, but by using the same data as the EA report it challenges the statement that wind is cheapest. There are cheaper options for the transition.

A Danish capacity market can pave the way for a cheaper transition

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.

⁵ EA Energianalyse: Elproduktionsomkostninger, Samfundsøkonomiske langsigtede marginalomkostninger for udvalgte teknologier, 08-04-2014

⁶ Energinet.dk's analyseforudsætninger 2014-2035, table 5

⁷ Energinet.dk's analyseforudsætninger 2014-2035, fig. 1