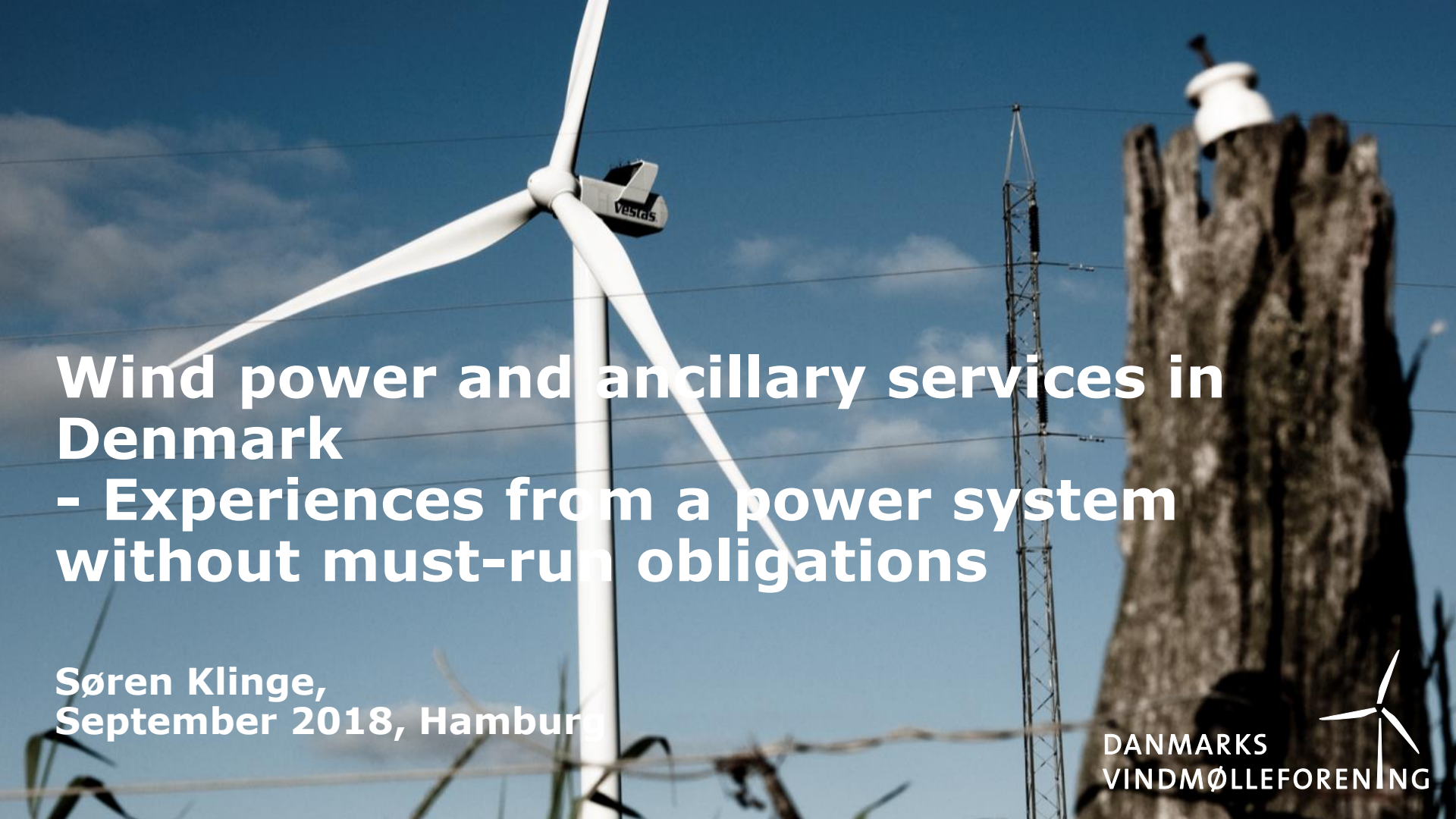




Wind power and ancillary services in Denmark

- Experiences from a power system without must-run obligations

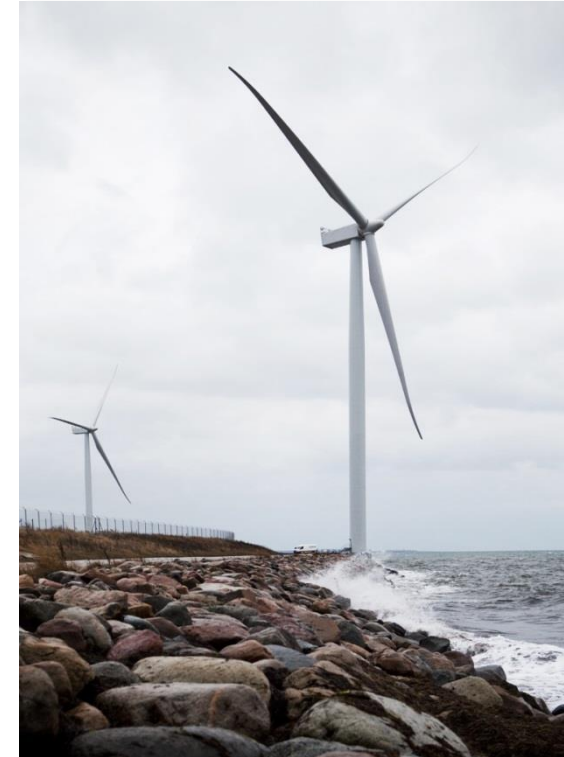
Søren Klinge,
September 2018, Hamburg

DANMARKS
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Wind turbines and ancillary services in Denmark

- Wind turbines in Denmark supply large volumes of ancillary services to the Danish TSO Energinet
- This is especially FRRm, which is used for counter trade on the interconnector between Western Denmark and Germany. The market design is based on voluntary bids (energy)
- Wind turbines in Denmark are a significant contribution in maintaining system stability during faults in the grid, due to “fault-ride-through” capability
- The Danish power system had a “must-run” requirement for 6 conventional power stations in operation at all times until 2016/2017
- The TSO paid operators to keep power plants in operation and this had a significant impact on spot prices, especially during the summer months



Courtesy: Siemens Gamesa

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Security of supply in Denmark

New analysis of challenges for security of supply in Denmark from Energinet

["Security of electricity supply report 2018"](#) (page 5):

"Energinet's most recent and most comprehensive analyses of the need for properties required to maintain power system stability show that the electricity system is more robust than previously assumed."

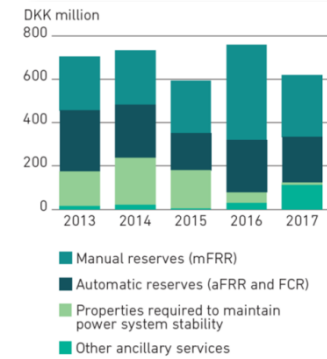
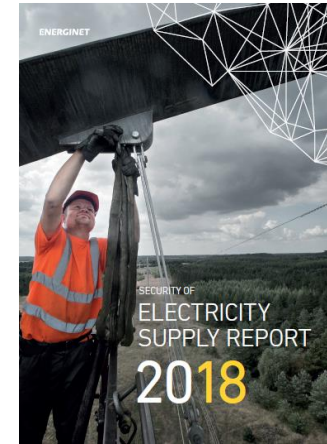
This is due to, for example, the fact that today's modern wind turbines help to stabilise the system, and that Energinet can use automation to operate the grid closer to the limit.

Thus, Energinet can operate the electricity grid more stably, even without power stations running."

Grid code requirements in Denmark:

In a normal operation of the grid are wind turbines in Denmark not required to exchange reactive power with the grid.

(Grid code requirement: $\cos\varphi = 1$)



Summer in the Danish power system



Source: Energinet's webpage – Real time status of the Danish power system