

energyPRO

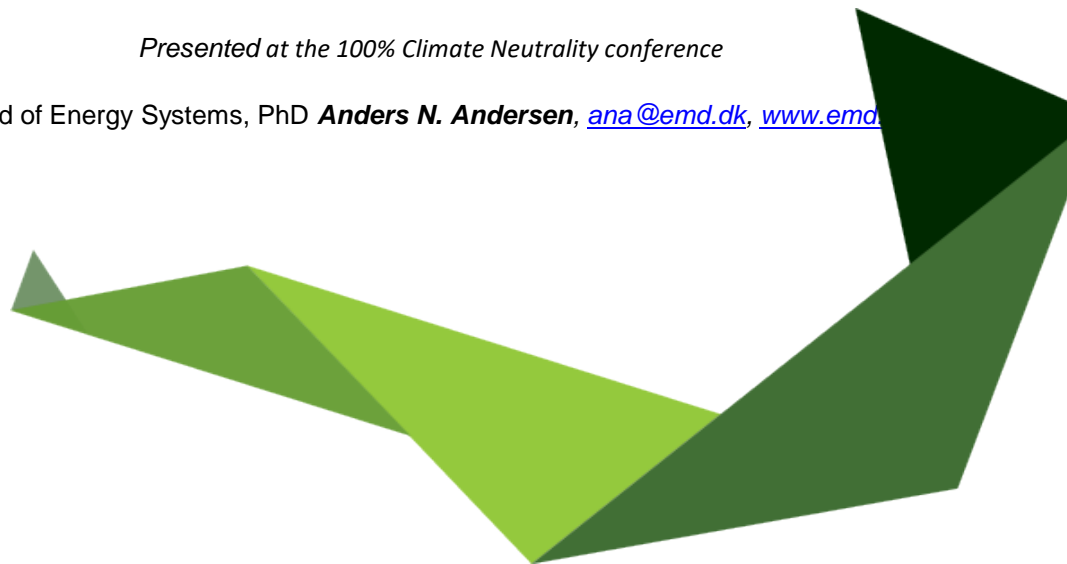


energyTRADE

## Optimization of private wire operation of wind production and district energy in Hvide Sande

*Presented at the 100% Climate Neutrality conference*

Head of Energy Systems, PhD **Anders N. Andersen**, [ana@emd.dk](mailto:ana@emd.dk), [www.emd.dk](http://www.emd.dk)



100%  CLIMATE NEUTRALITY  
Pathways towards a smart society

100%  
CLIMATE NEUTRALITY

30 September - 2 October 2019  
Sonderborg, Denmark



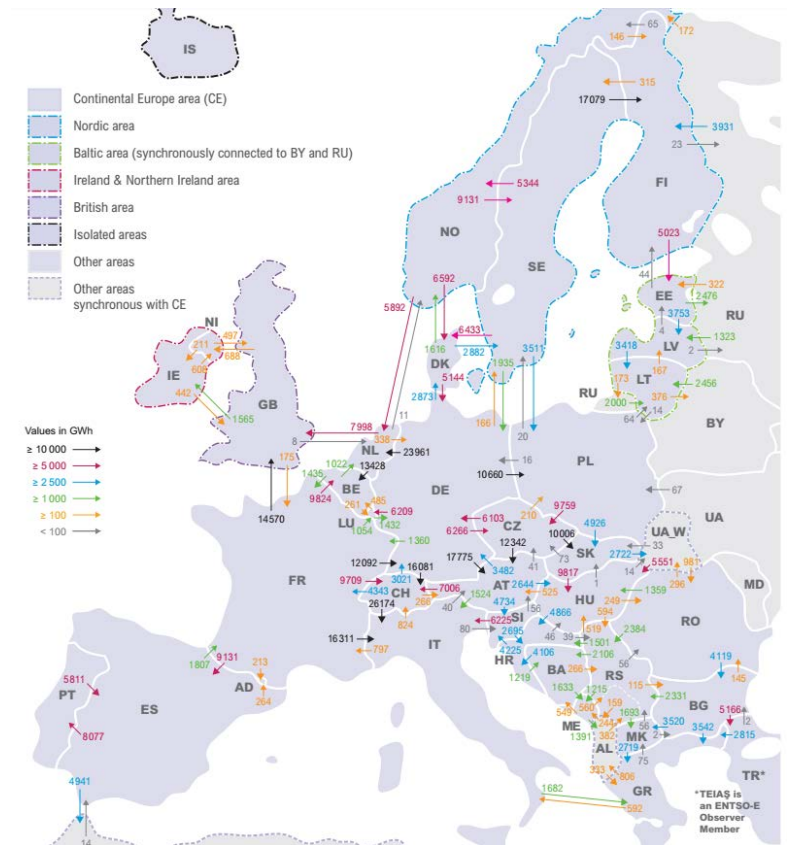
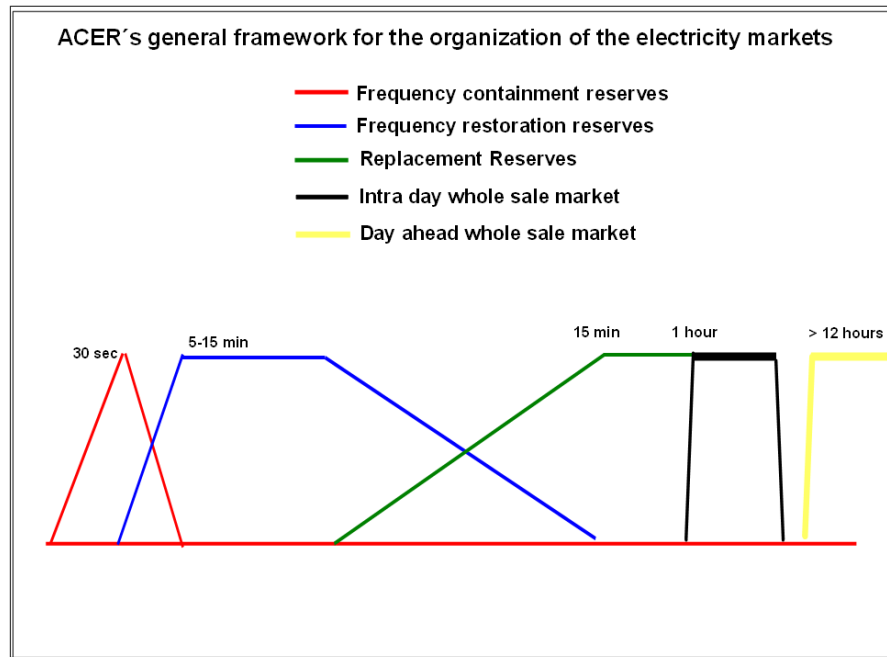
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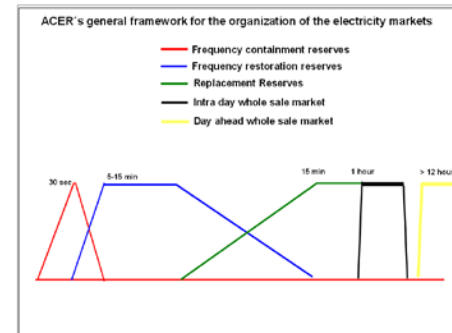
# My presentation

- The 5 European electricity markets that integrates intermittent production
- Hvide Sande District Energy plant participating in three of these electricity markets in two days
- Private wire operation of Hvide Sande District Energy plant
- The 6th “at the moment significant” electricity market - Special regulation

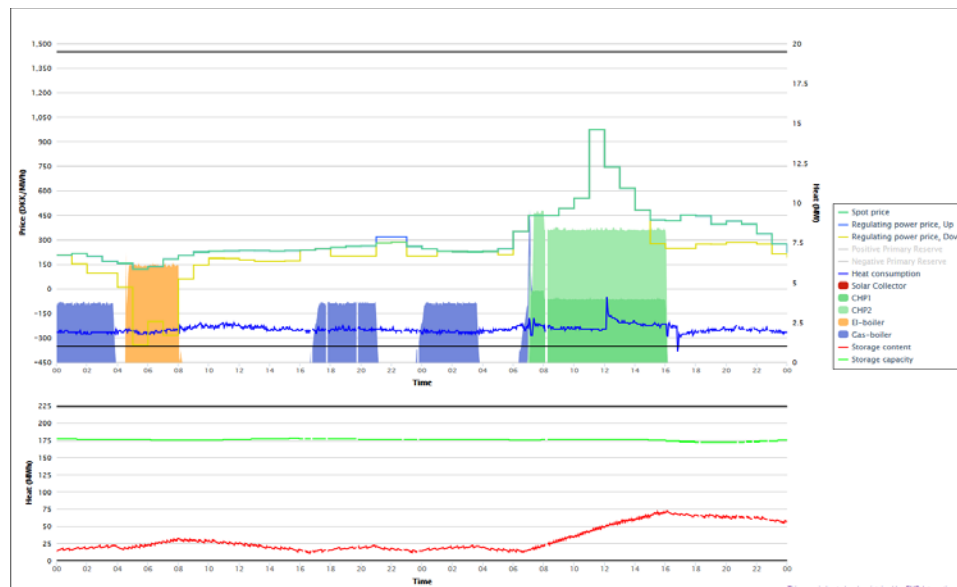




## Hvide Sande District Energy plant participating in three different electricity markets in two days



- Electrical boiler being activated in Regulating power market from 5-8 in Day 1.
- CHP being full loaded in Day-ahead market from 7-8 in Day 2
- CHP being 80% loaded in Day-ahead market from 8-16 in Day 2, allowing for offering 20% in two 4-hour periods in Primary reserves.

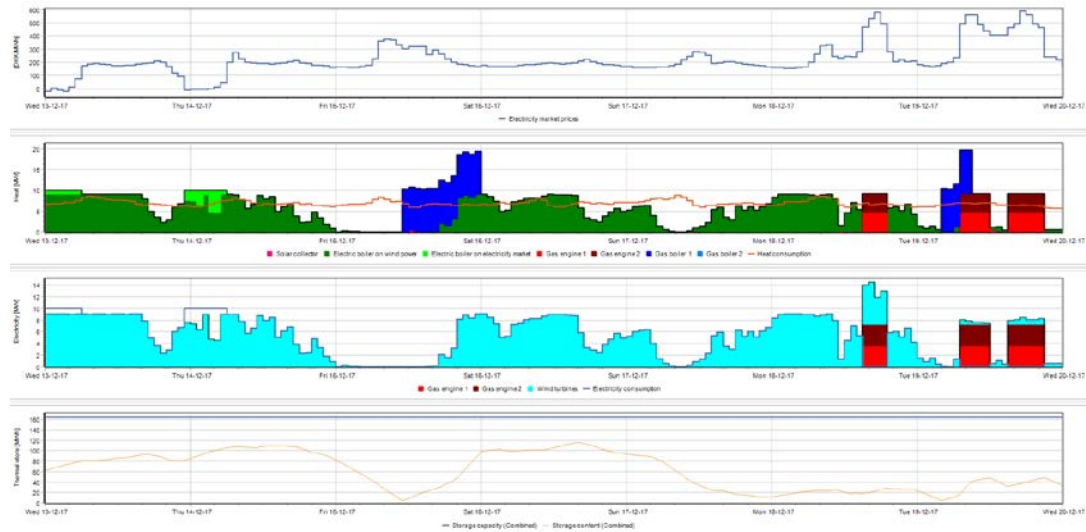


## Private wire operation of Hvide Sande District Energy plant



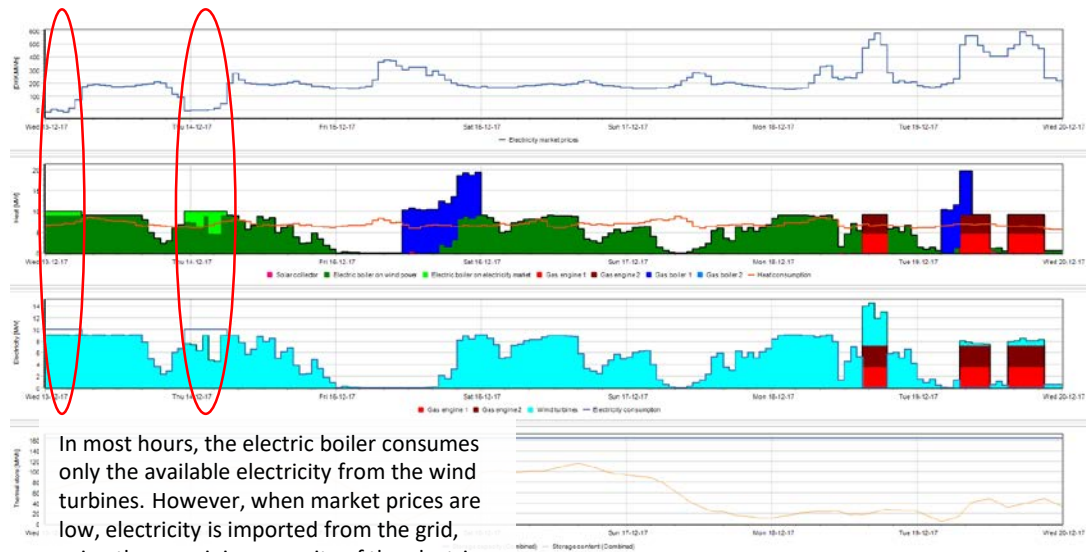
# Hvide Sande District Heating

## energyPRO simulation



# Hvide Sande District Heating

## energyPRO simulation

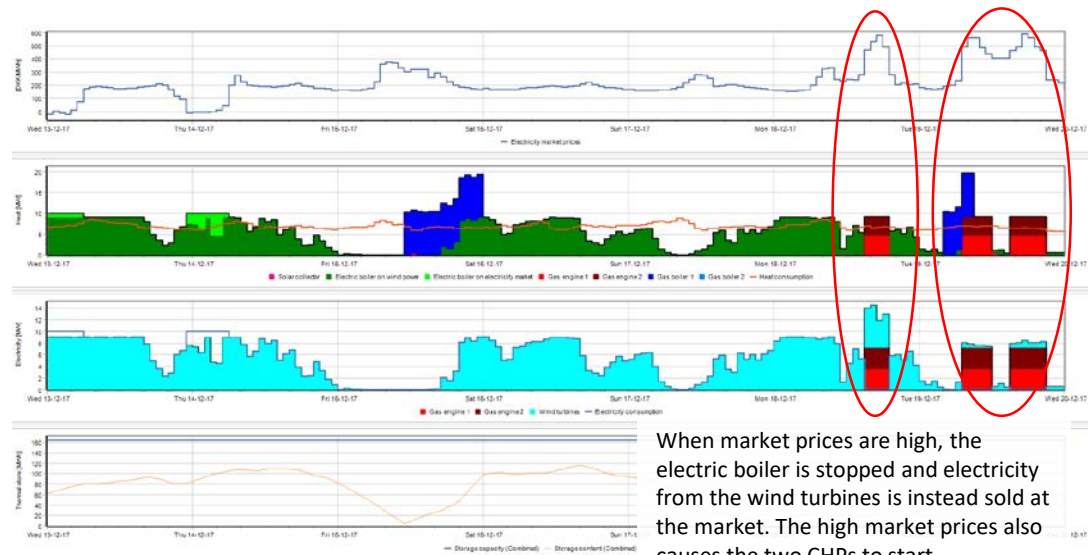


In most hours, the electric boiler consumes only the available electricity from the wind turbines. However, when market prices are low, electricity is imported from the grid, using the remaining capacity of the electric boiler.



# Hvide Sande District Heating

## energyPRO simulation



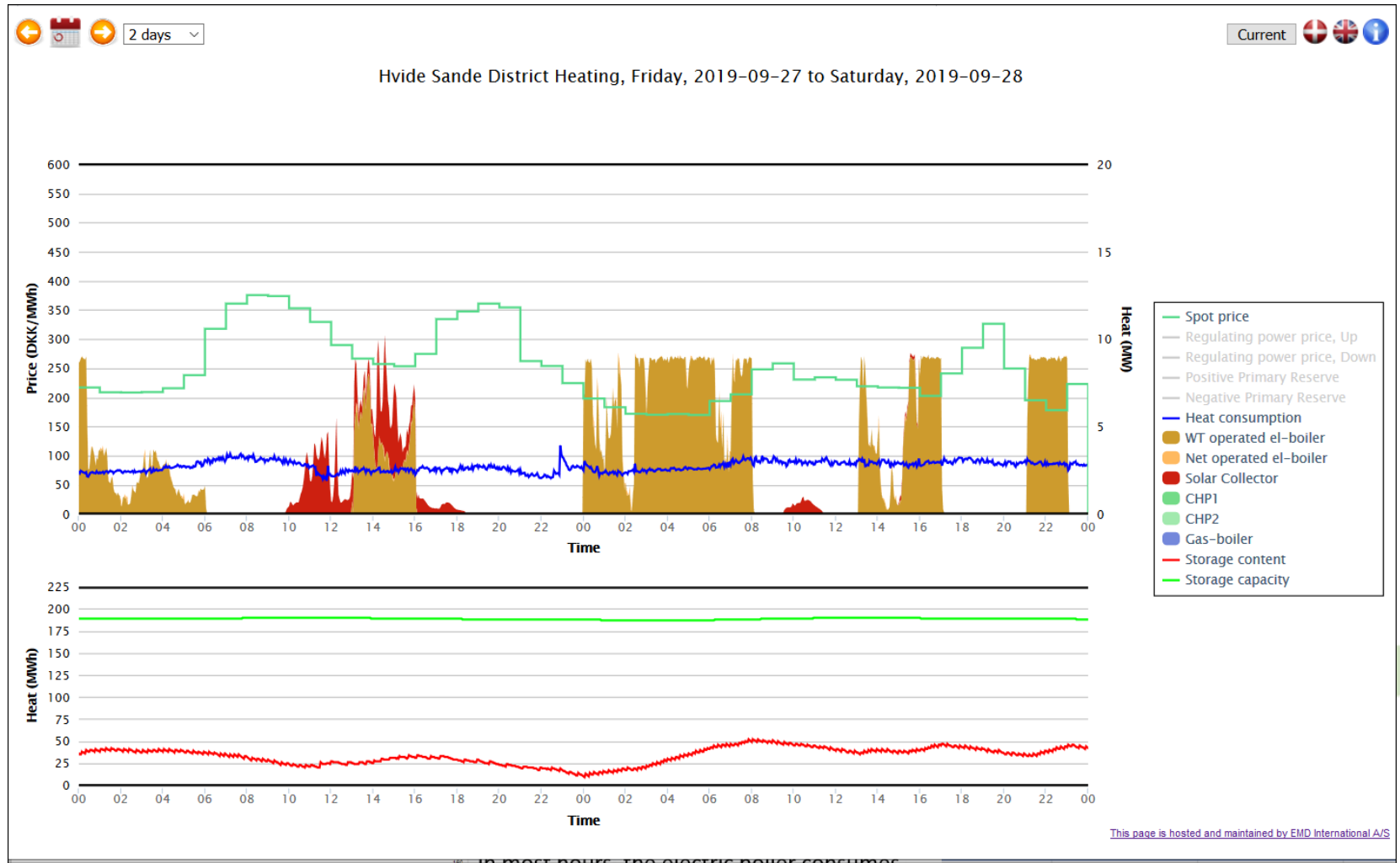


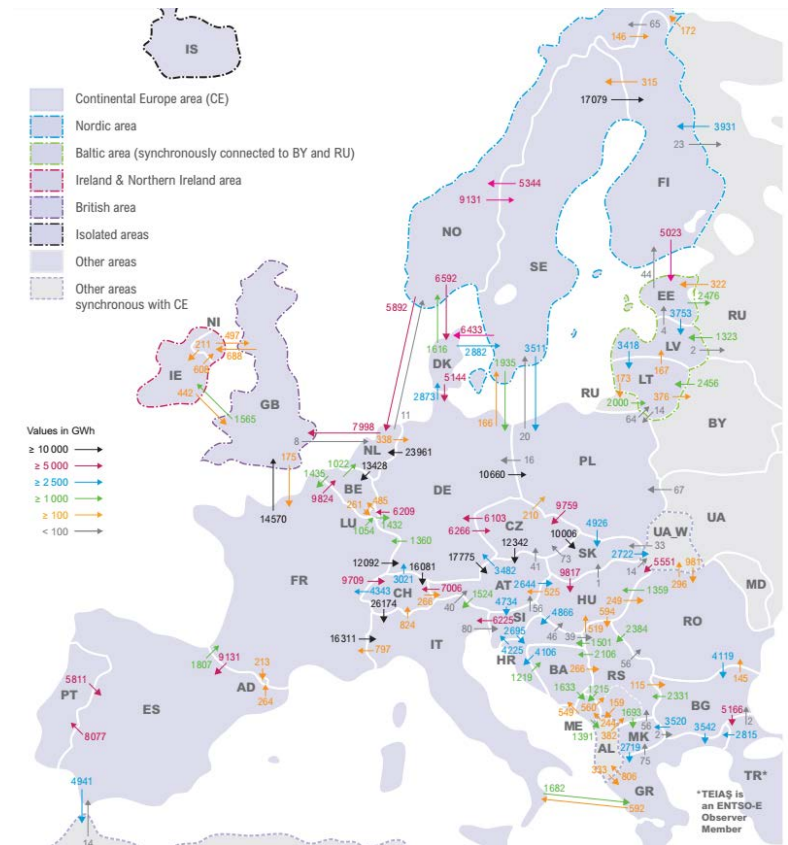
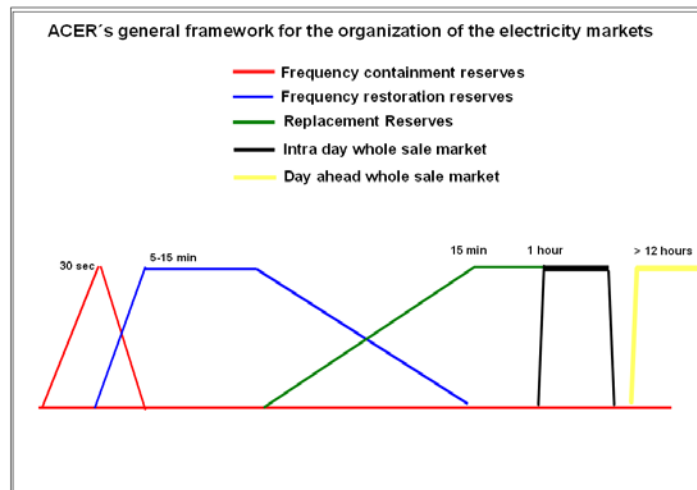
In a situation where the wind turbines and the electrical boiler in the Day-ahead market both is operated at 5 MW, three bidding prices to be used in the next hour in the Scandinavian Regulating power market (gate closure 45 minutes before the operating hour).

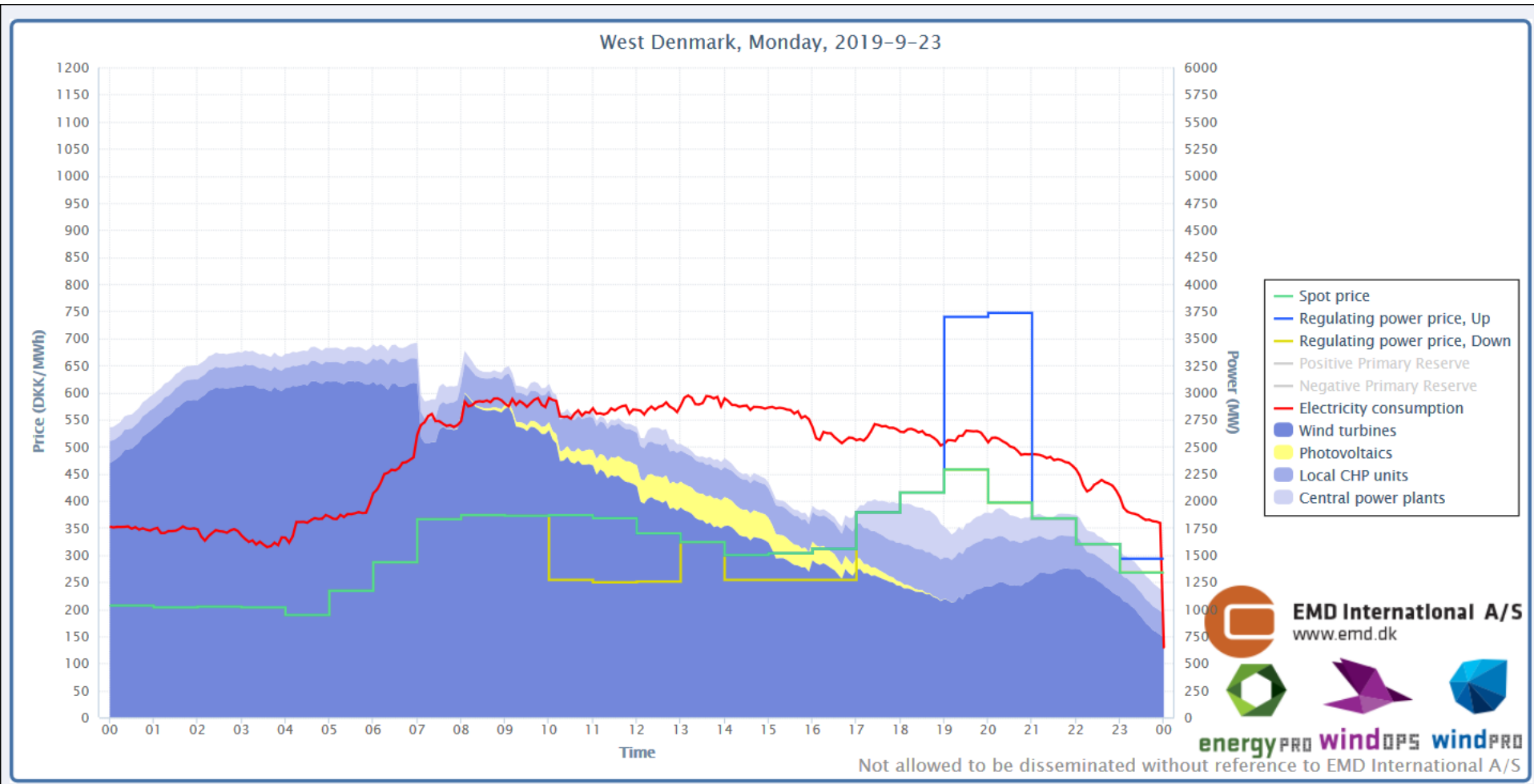
- One upward regulation bid of 5 MW by closing the electrical boiler.
- One 4 MW downward regulation bid by raising the power of the electrical boiler from 5 MW to 9 MW.
- One 4 MW downward regulation bid by closing the wind turbines.

The chosen bidding prices will be highly dependent on the expected production at the solar collector and wind turbines in the next days and the content in the thermal storages.

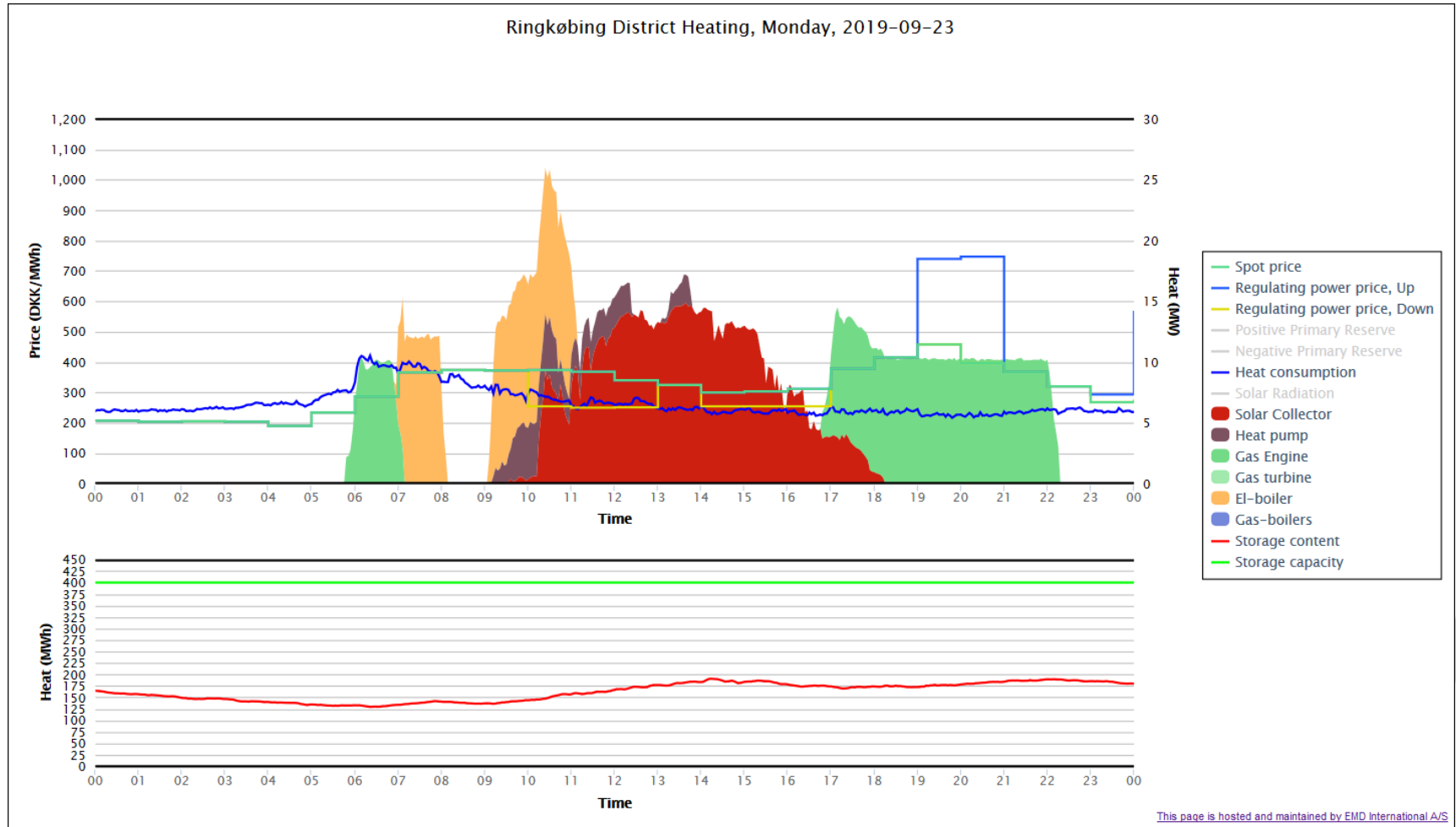
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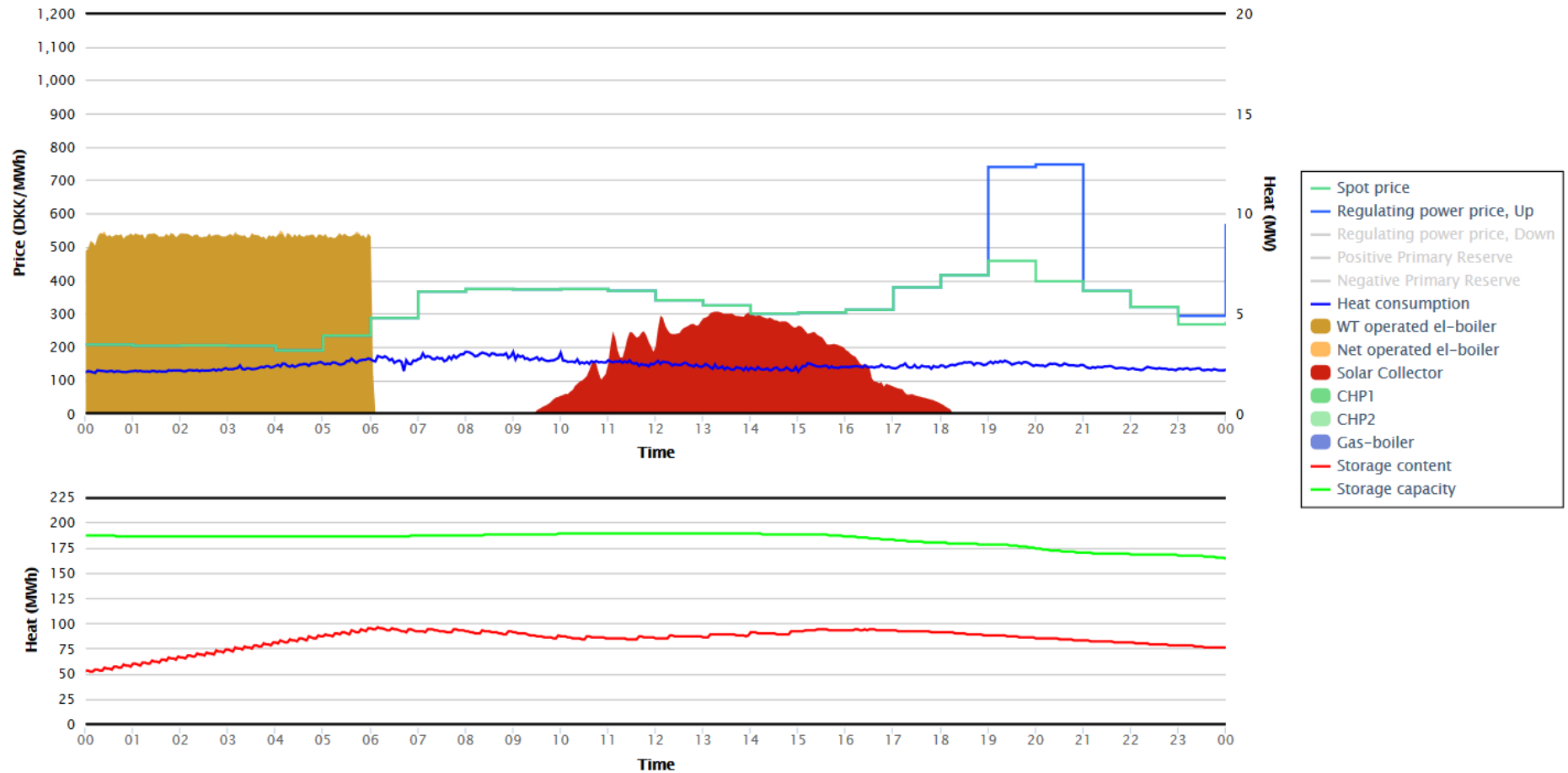




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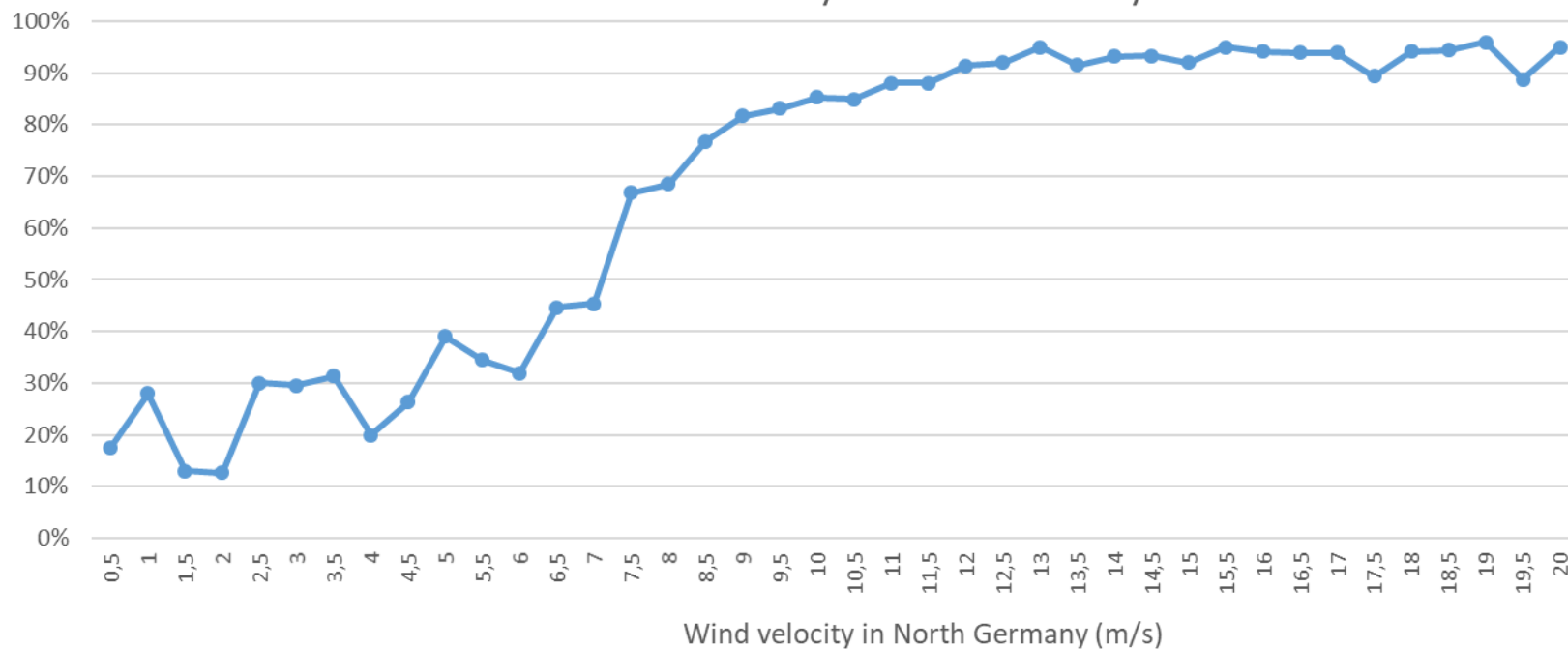
# Hvide Sande District Heating, Monday, 2019-09-23



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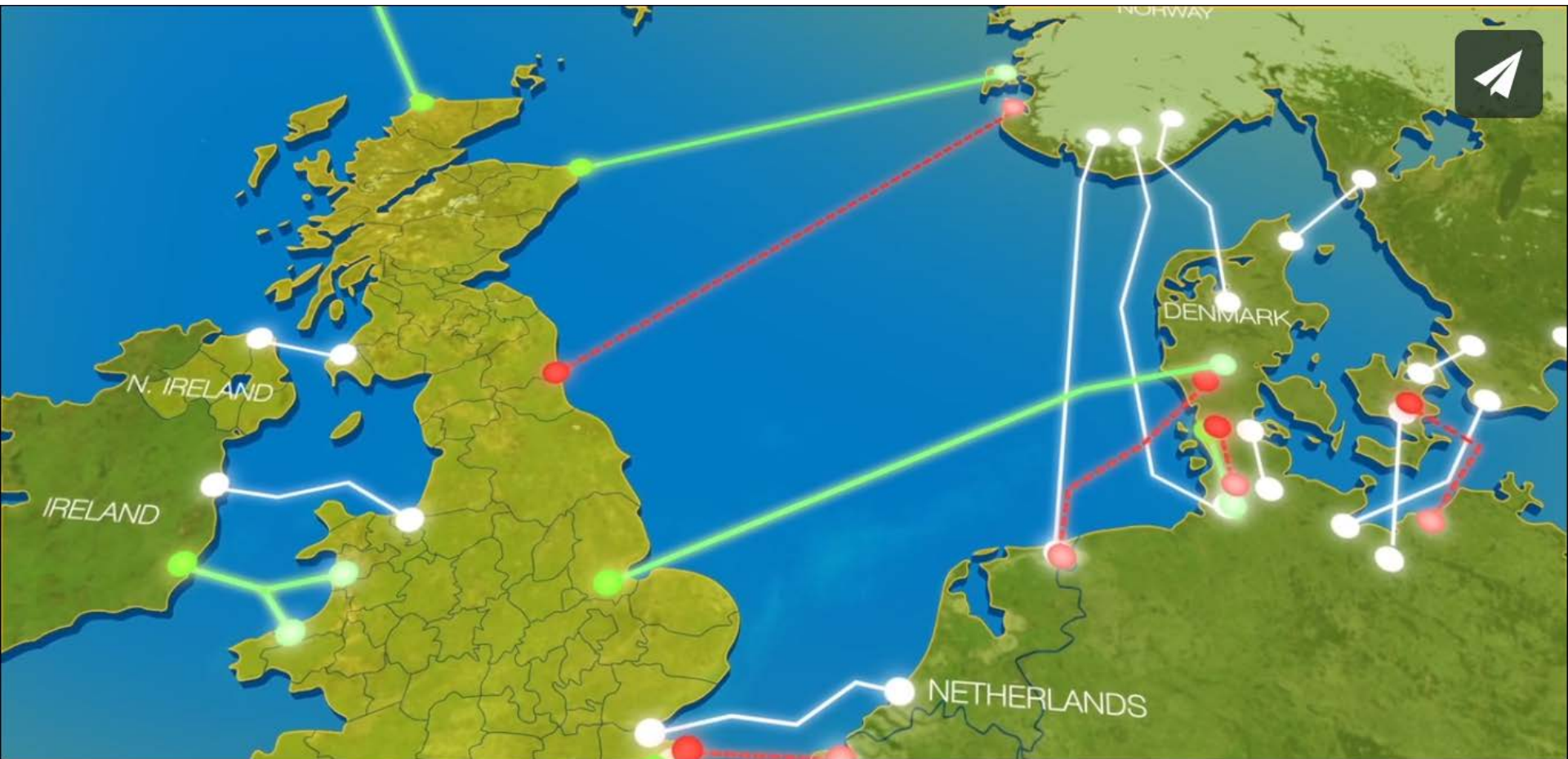


**Special regulation** in % of all downward regulation in West Denmark as  
function of wind velocity in North Germany





What is the future of Special regulation – when Viking Link is established?





Thank you for your attention!