

# Systemic view to the energy transition – Value of flexibility



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Solution Architect for Global  
Bioeconomy & Cleantech Opportunities

# We are in an energy transition

Changes pushed by climate change mitigation and cost reductions of variable generation (wind, solar)

- Demand side, prosumers, increasing role

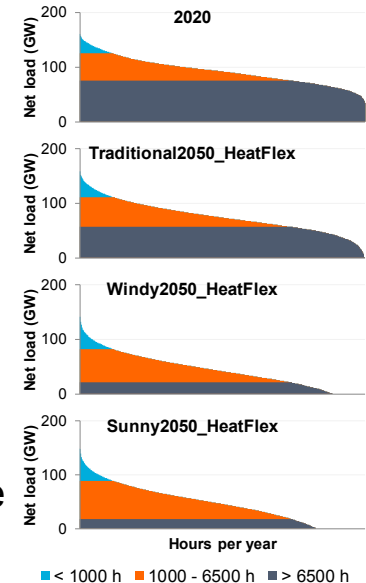
Changing business models for energy utilities

- Competition from renewables and demand response

There will be high shares of wind and solar meaning sometimes generating a small part of load and sometimes as much as load

- Power plants that are flexible and prepared to generate at part loads and only part of the week will be needed in future markets

Energy sector integration – power, heat, gas, transport



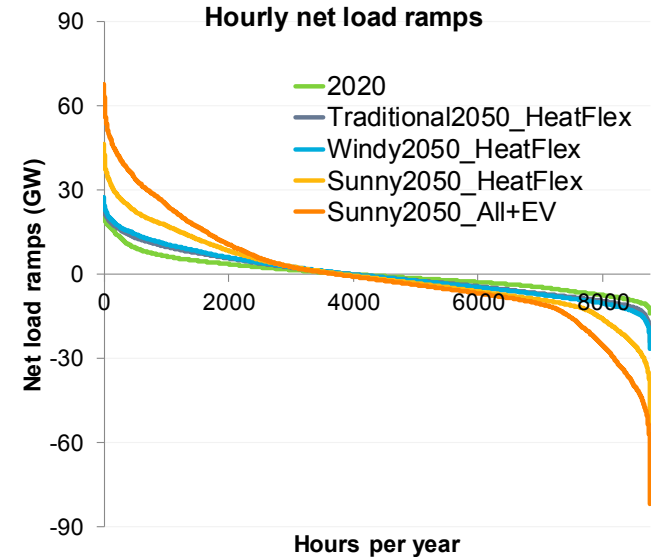
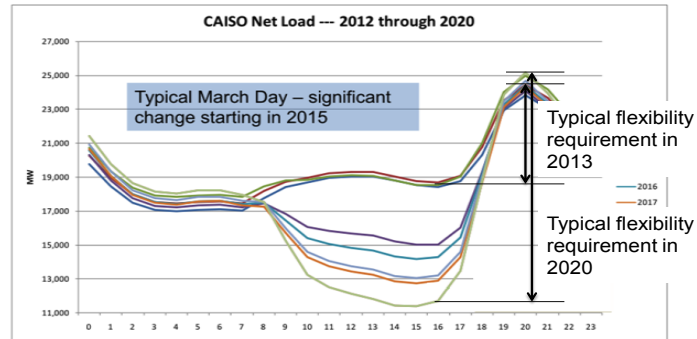
# Flexibility needs

Weather dependence will be more prominent

## Need for flexibility – California in 2020

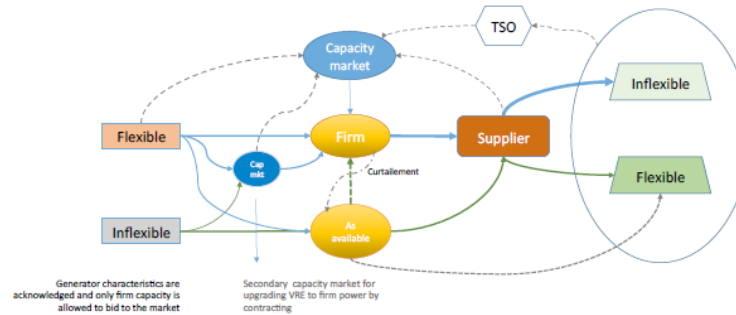
Flexibility is needed sooner rather than later

Net load patterns are forecast to change significantly starting in 2015



# Market design to enable flexibility

Market models where flexibility is traded separately have been investigated



Future market designs a topic for future research

TODAY

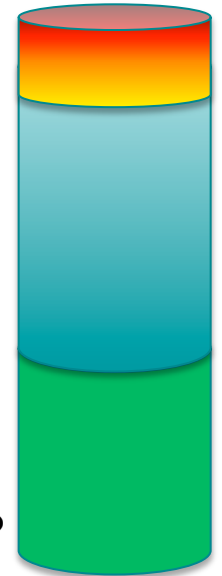


System  
services

Energy

Capacity/  
Flexibility?

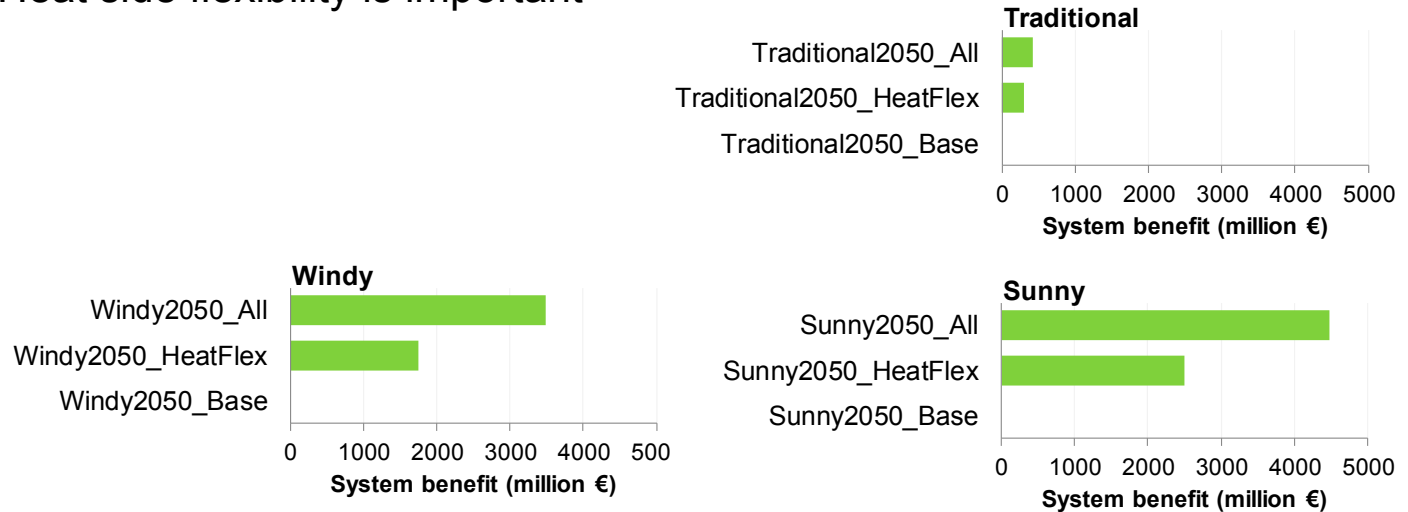
FUTURE?



# Results: system value of flexibility

From power system point of view, there is increasing value of flexibility when more wind/PV added to the system

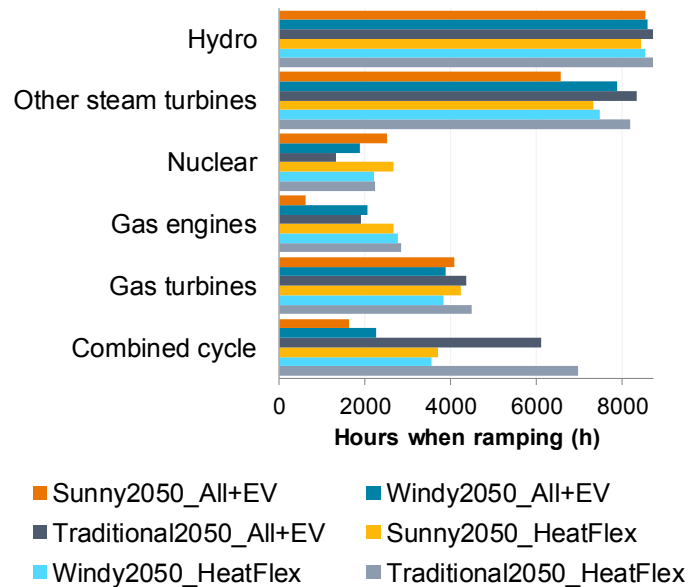
Heat side flexibility is important



# Capturing flexibility needs and value

Large market areas – how are the different flexibility options used?

What is the value for each technology, from providing the flexibility?



# Tools are evolving

Capturing the flexibility needs and constraints in model simulations

Which time scales of flexibility are relevant?

Importance of more detail in simulations

- Time resolution: hourly simulations not enough to capture all flexibility needs, and value
- How much flexibility is available from thermal and hydro generation?  
Ramp rate constraints, minimum operation level restrictions

# Linking models to capture local responses

