Disruptive Storage Options

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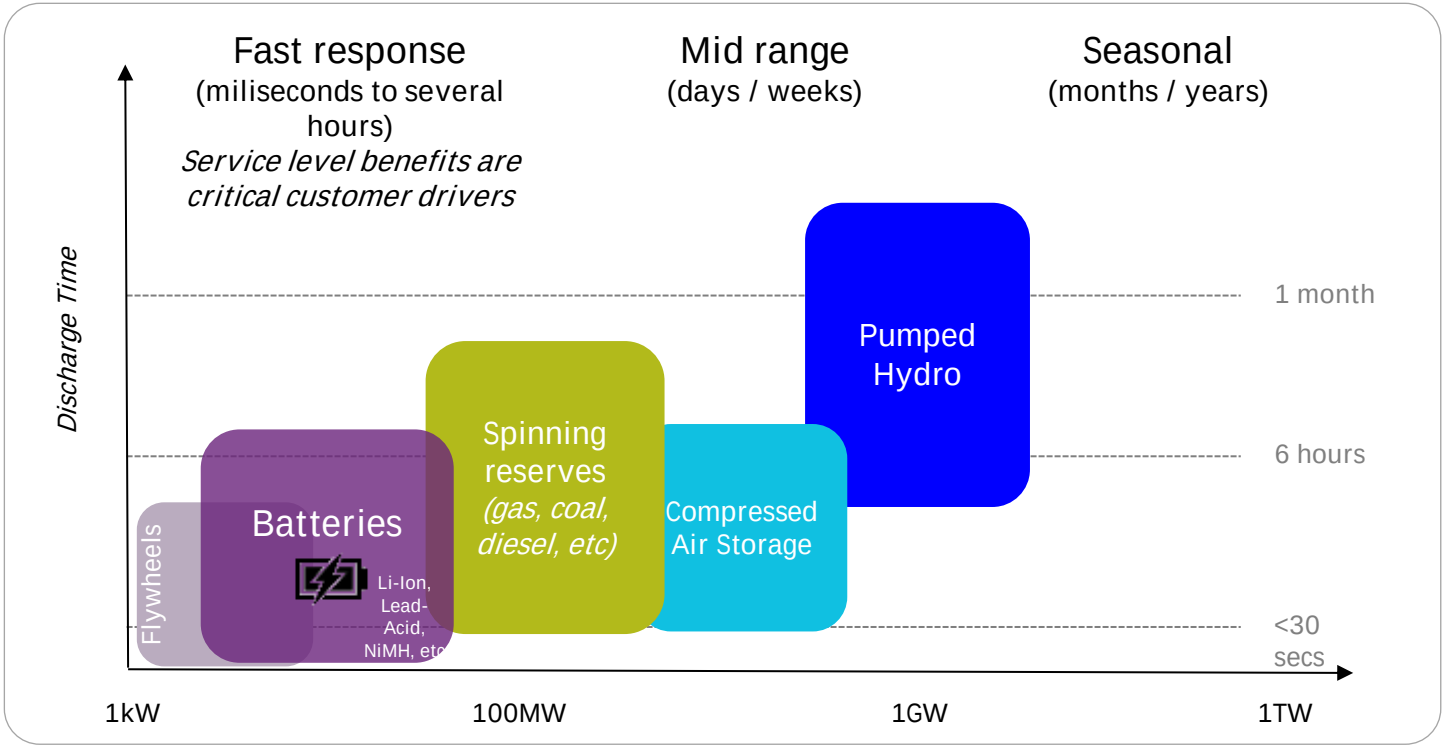
Discussion

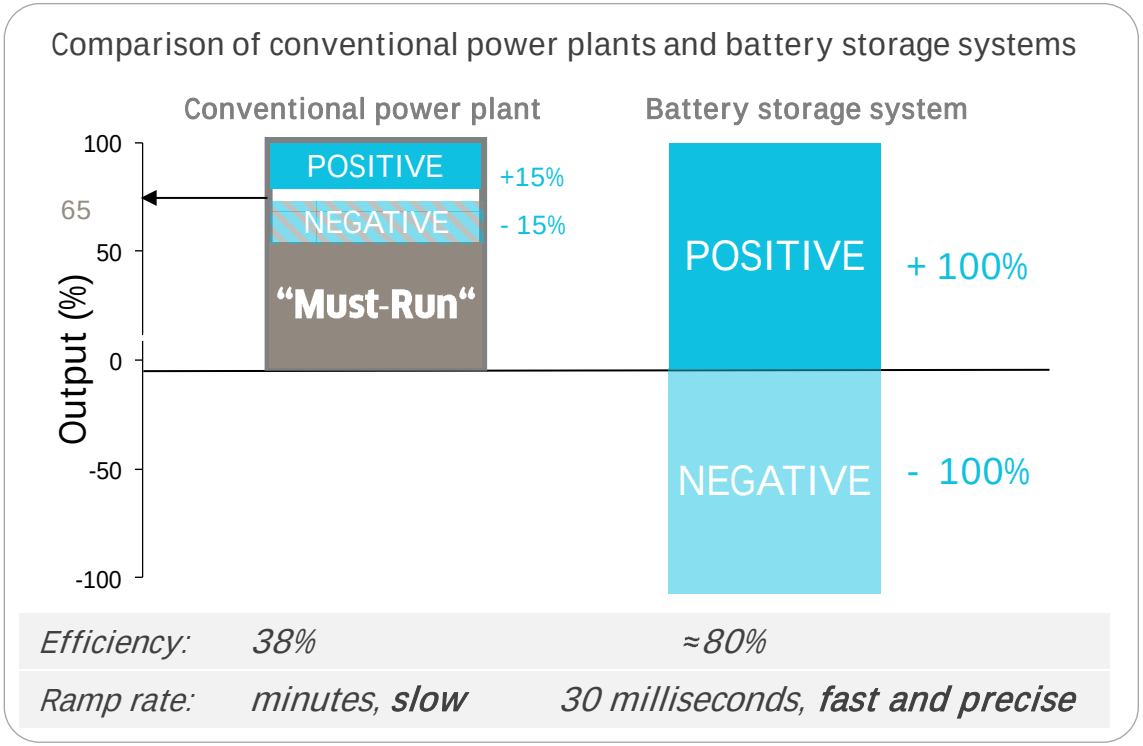
- What type of energy storage technology is relevant in today's grid operations?
- How does energy storage equip our energy system for the transition to a renewable future?
- What role does energy storage play in our grid today?
- How can Europe profit from a cogent energy storage strategy?

Europe's fast response energy storage market needs innovative technologies



Renewables and the fundamental efficiencies of energy storage batteries are driving requirements for more immediate reaction times in the fast response segment

Fast response storage delivers flexibility relative to conventional power, facilitating integration of renewables



Batteries provide services more efficiently and cost effectively than conventional power plants

Loss prevention: The must-run capacity prohibits efficient use of Grid Capacities

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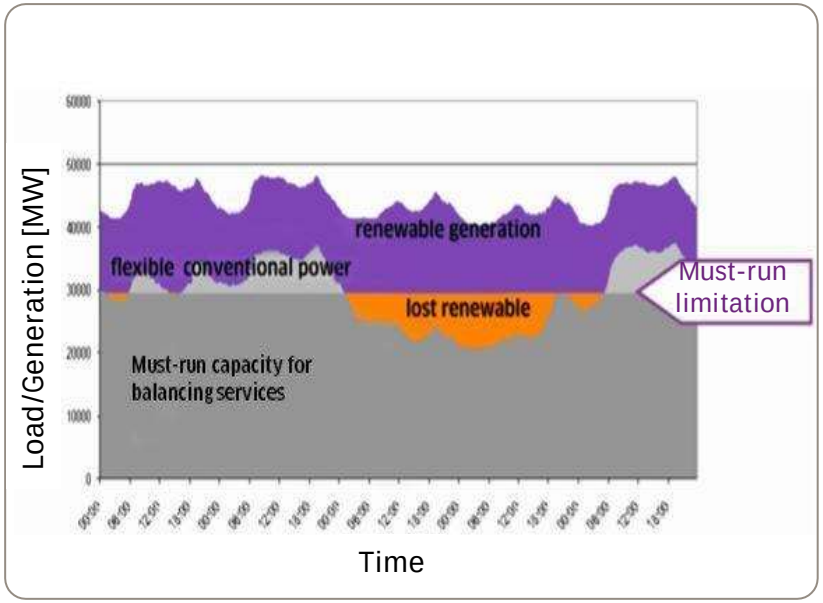
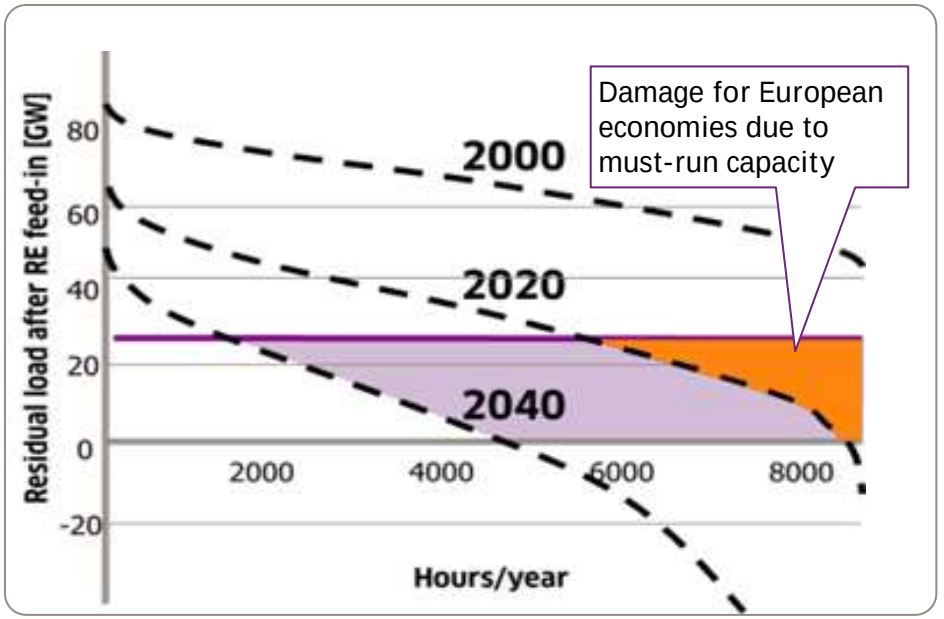
Must-run losses over a 24 h-period



Must-run losses over a year



In Germany, ~ 600 MW primary frequency control, equivalent to ~ 20 GW must run, creating damage of ~€5.25 bn. in 2017* Europe requires 3,000 MW of primary frequency control

SRU, Systemkonflikt in der Transformation der Stromerzeugung, 2010
Deutsche Übertragungsnetzbetreiber, Endbericht zur notwendigen Mindestleistung, 2012
Deutrsch Übertragungsnetzbetreiber, Aauswirkungen reduzierter Schwungmasse auf einen stabilen Netzbetrieb, 2014

Battery plants are the cheapest option to provide frequency control

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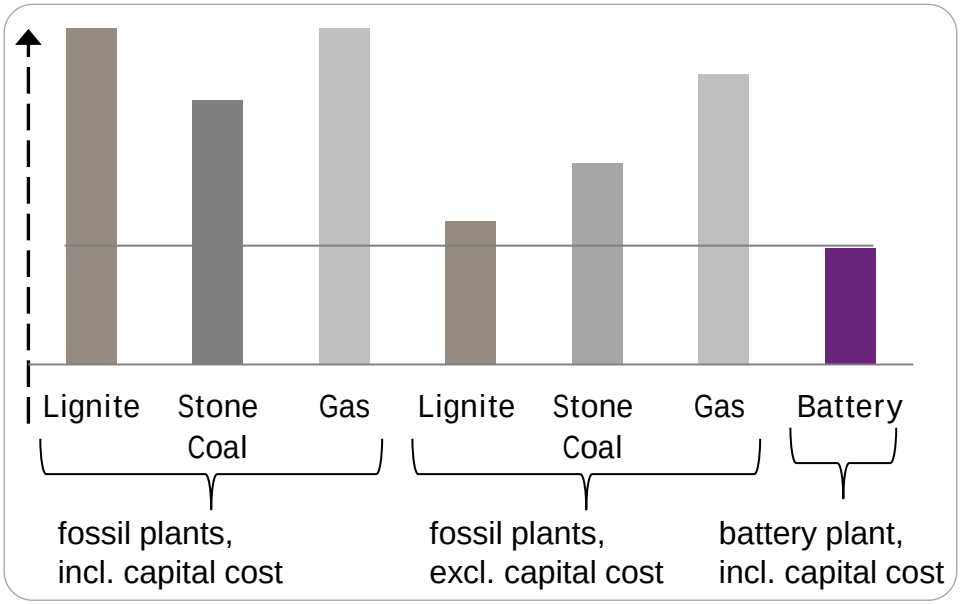
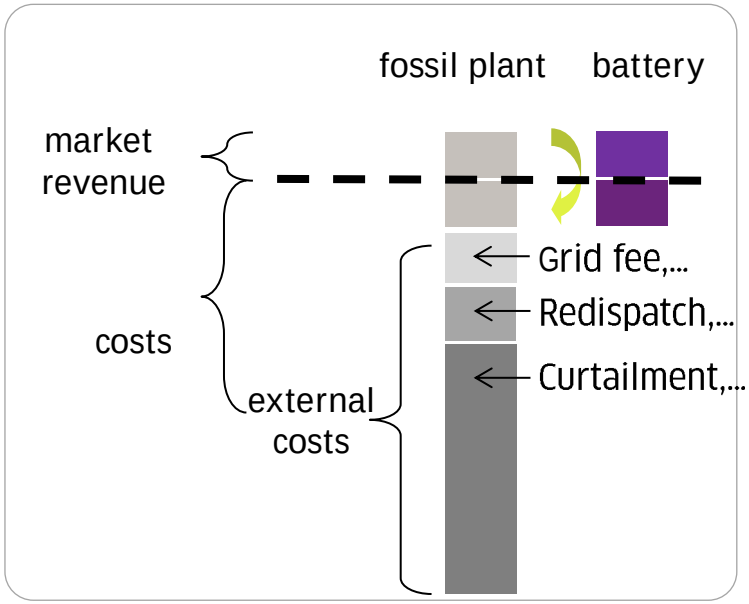
Comparing costs for 2MW control band



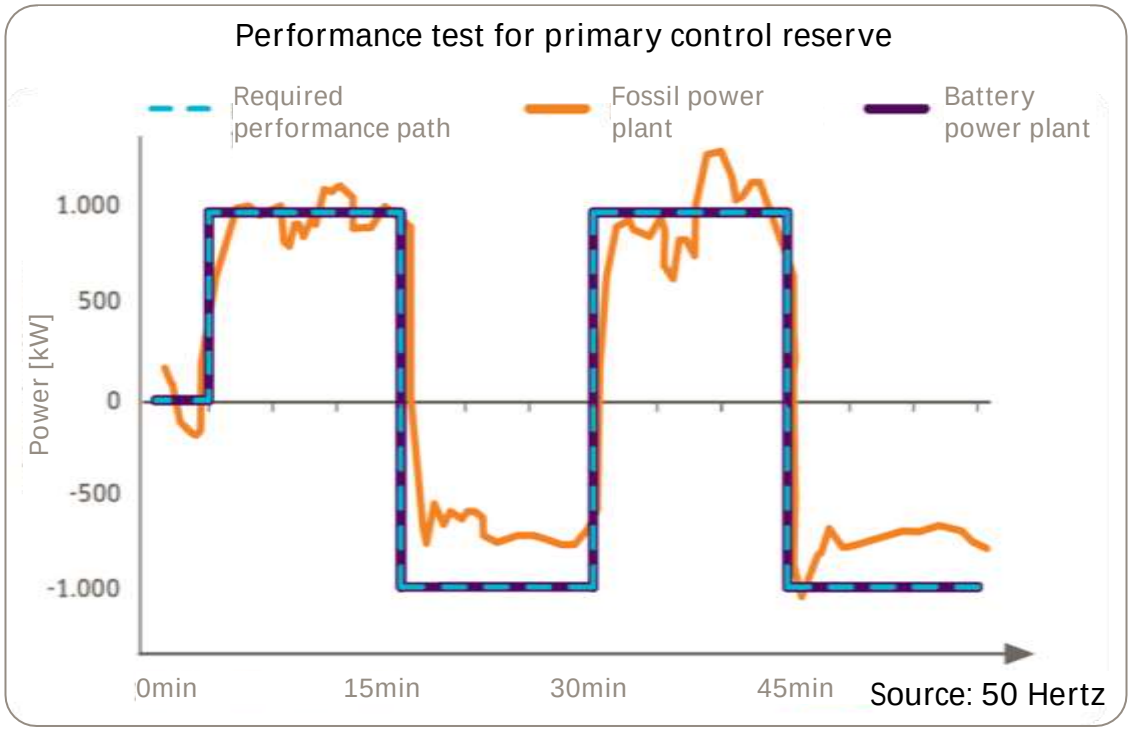
External costs outside the regulated framework*



Batteries are cheaper, because they operates without external costs

*(dena, Systemdienstleistungen 2030, 2014)

Digitalization of the grid in Europe



Batteries can replace conventional plants in the provision of grid stability and benefit European consumers

*Battery power plant's response time< 5 ms

The Battery Energy Storage opportunity: Can we afford not to take it?

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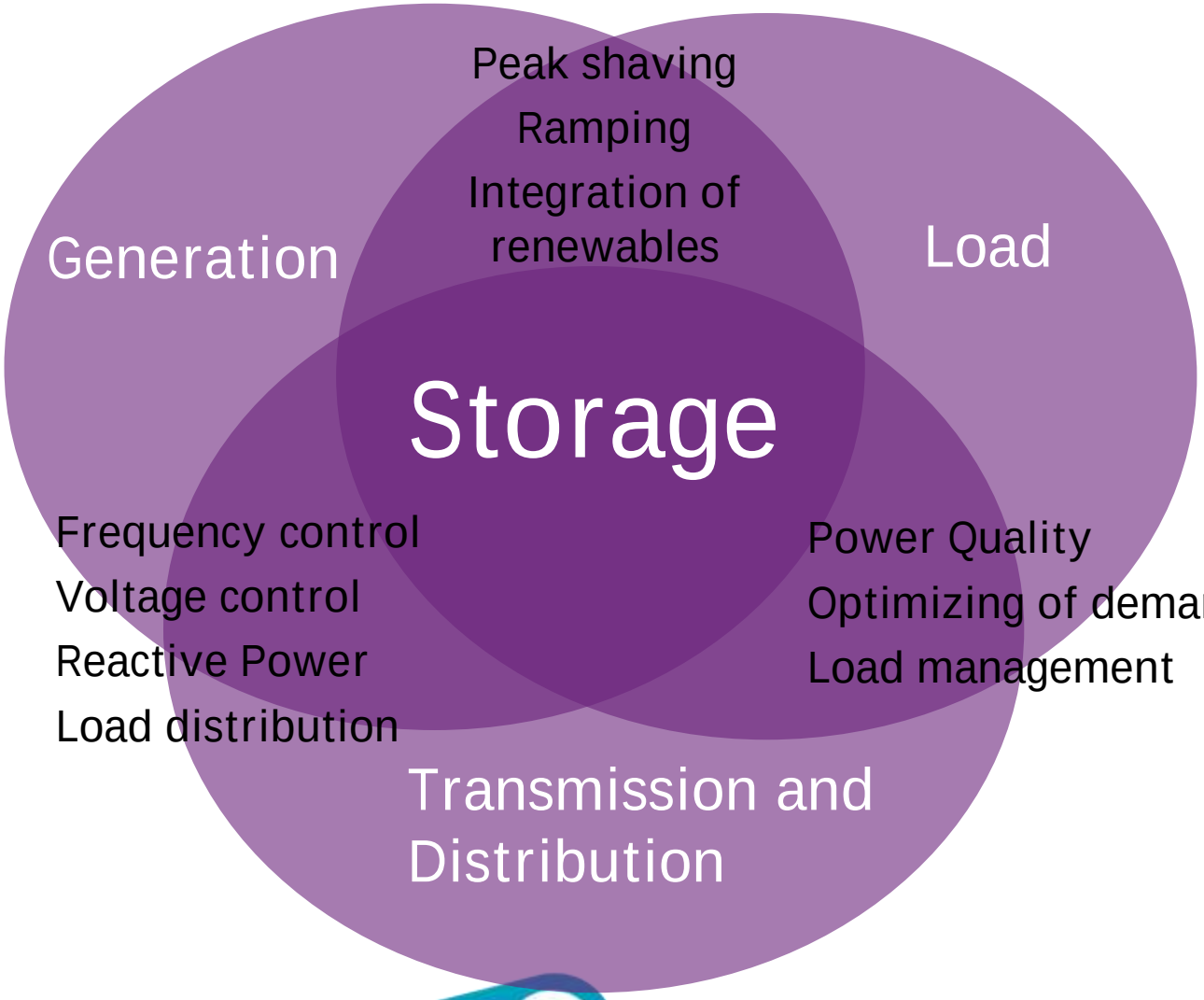
Benefits of installing 3,000 MW of battery plants throughout Europe to provide frequency control and additional grid services

- Eliminating must-run costs in Europe
  - Germany saves €5.2 bn. For ~600MW of primary frequency control*
  - Europe requires ~3,000 MW of primary frequency control
- Equipping the grid to safely integrate up to 60-80 % of renewable energy
- Reducing costs and dependency from fuel imports
  - In 2012, Europe imported fuel worth €545 trillion
- Reducing CO_2 emissions from electricity production
- Saving capital expenditure for grid stabilization throughout Europe
- Increasing grid stability throughout Europe

*(BMWi/efzn Speicherstudie 2013)

Battery Energy Storage – to define a new enabler in the regulatory framework



Thank you for your attention!

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