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How can battery storage contribute to system stability in Europe?

Lars Stephan - Senior Manager for Regulatory and Government Affairs, Younicos AG

May 27th, 2015

Younicos at a Glance

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Founding of the Company
2005

Younicos AG
Berlin, Germany

Younicos Inc.
Kyle and Austin,
Texas, USA

>60 gigawatt-hours charged and discharged

Experience from battery storage **97** Megawatt installed

Total number of employees: 130

23 Storage projects worldwide

99 31

More than 2 terabytes of field performance data collected

850,000 hours of operating run time on integrated power control & battery systems

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Who we are –
We tailor battery solutions according to your needs

Battery Parks

- Increase grid stability
- Avoid grid expansion costs
- Increase renewable share
- Optimize portfolios
- Reduce carbon footprint

Island Systems

- Reduce energy cost
- Reduce dependency on diesel
- Reduce energy price volatility
- Increase renewable share
- Improve power quality

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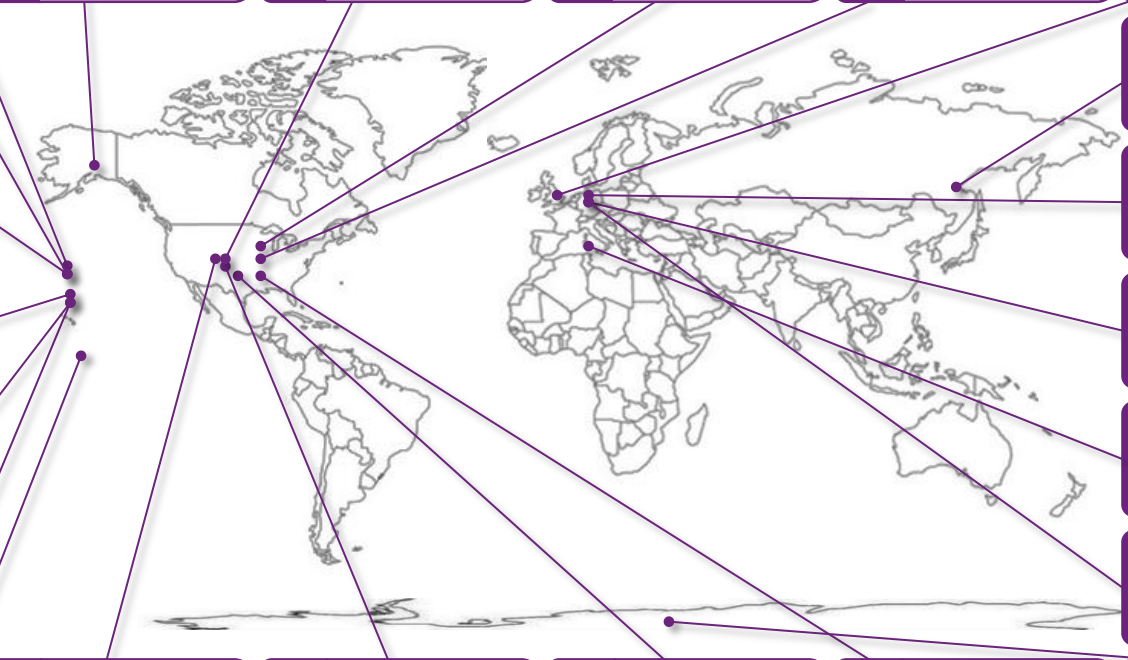
From south pole to Alaska: Experience from over 97 MW in the field



1.5 MW	**KIUC III** Kauai, HI Lead Acid Grid Stability	3 MW	**KEA** Kodiak Island, AK Lead Acid Wind Integration
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Battery storage – safeguard to grid stability

Storage is the key to higher efficiency and grid stability today

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Services provided by Younicos storage solutions

System services

- Frequency containment reserve
- Frequency restoration reserve
- Voltage support
- Islanding capability
- Black start capability
- Short-circuit power
- Oscillation damping

Other services

- Grid investment deferral
- Ramp rate control
- Renewables integration
- Gen-Set optimization
- Fuel reduction
- Peak load management
- Self consumption optimization

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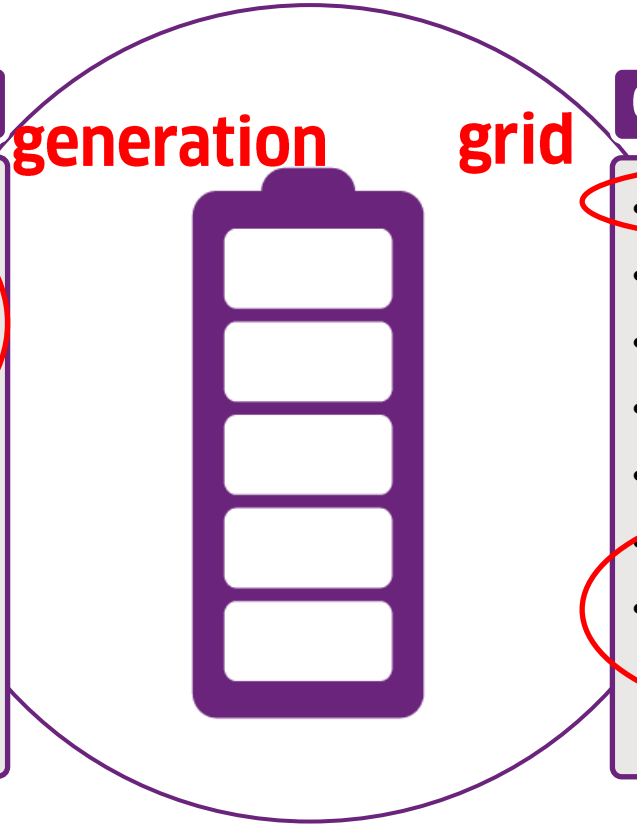

Other services

- Grid investment deferral
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load

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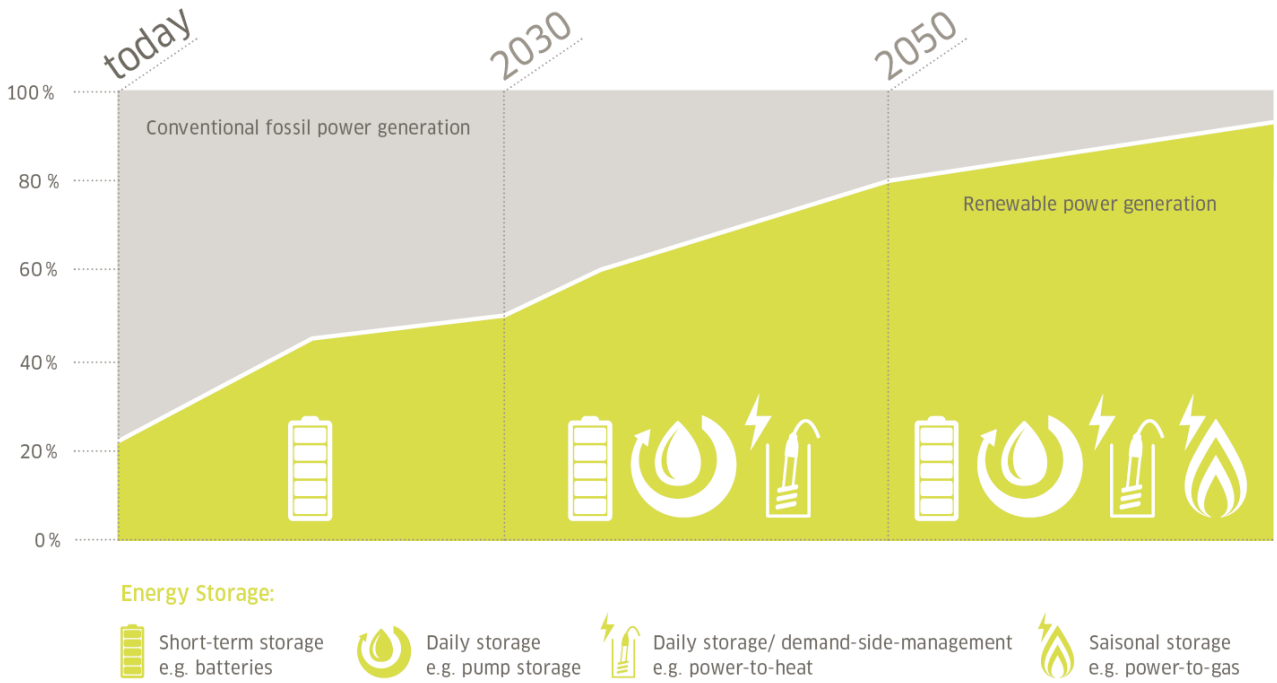
Storage roadmap for the Energiewende



System requirements define application, time and usage of storage technologies in the energy sector

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Problem: Must-run limitation restrict the integration of Renewables

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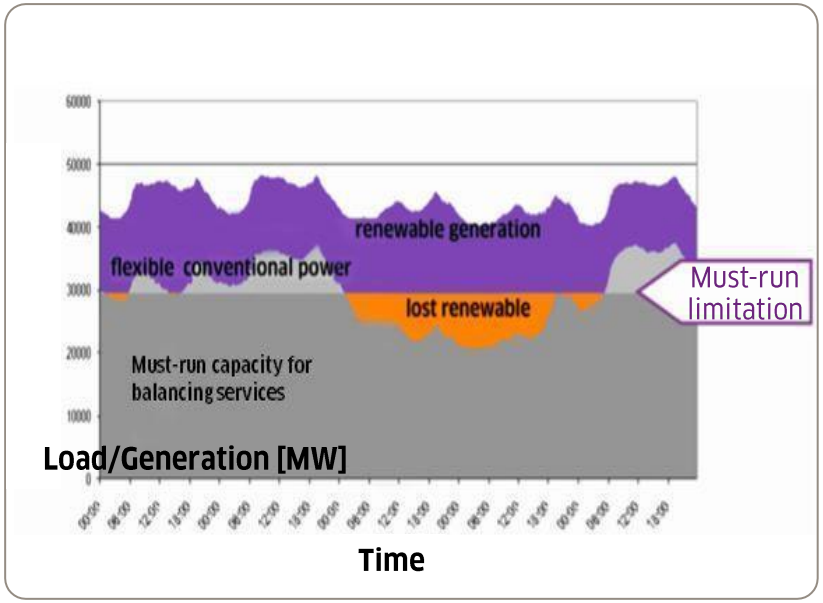
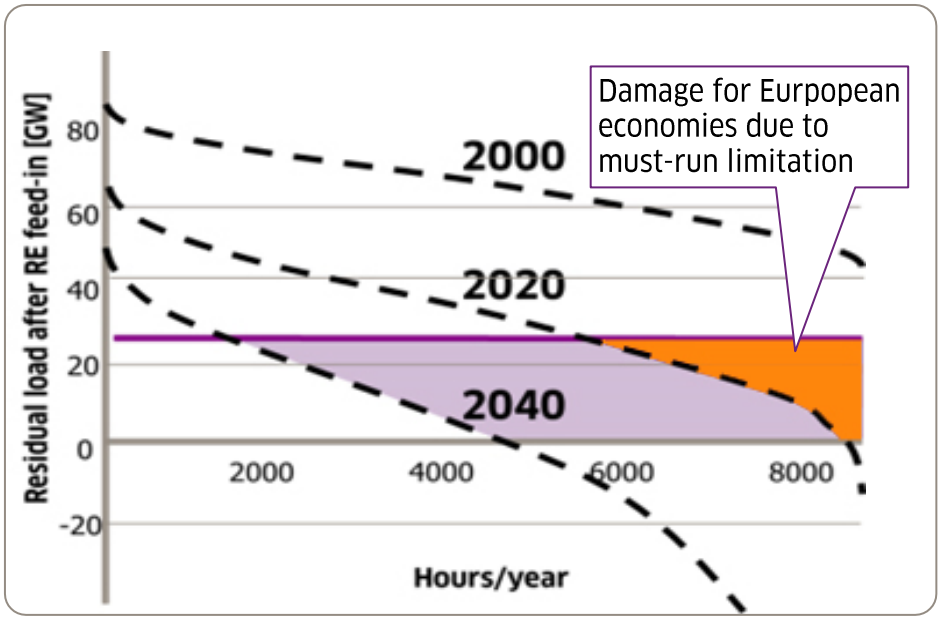
Must-run losses over a 24 h-period



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
Deutrsch Übertragungsnetzbetreiber, Aauswirkungen reduzierter Schwungmasse auf einen stabilen Netzbetrieb, 2014

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Batteries offer higher efficiency in the provision of frequency containment

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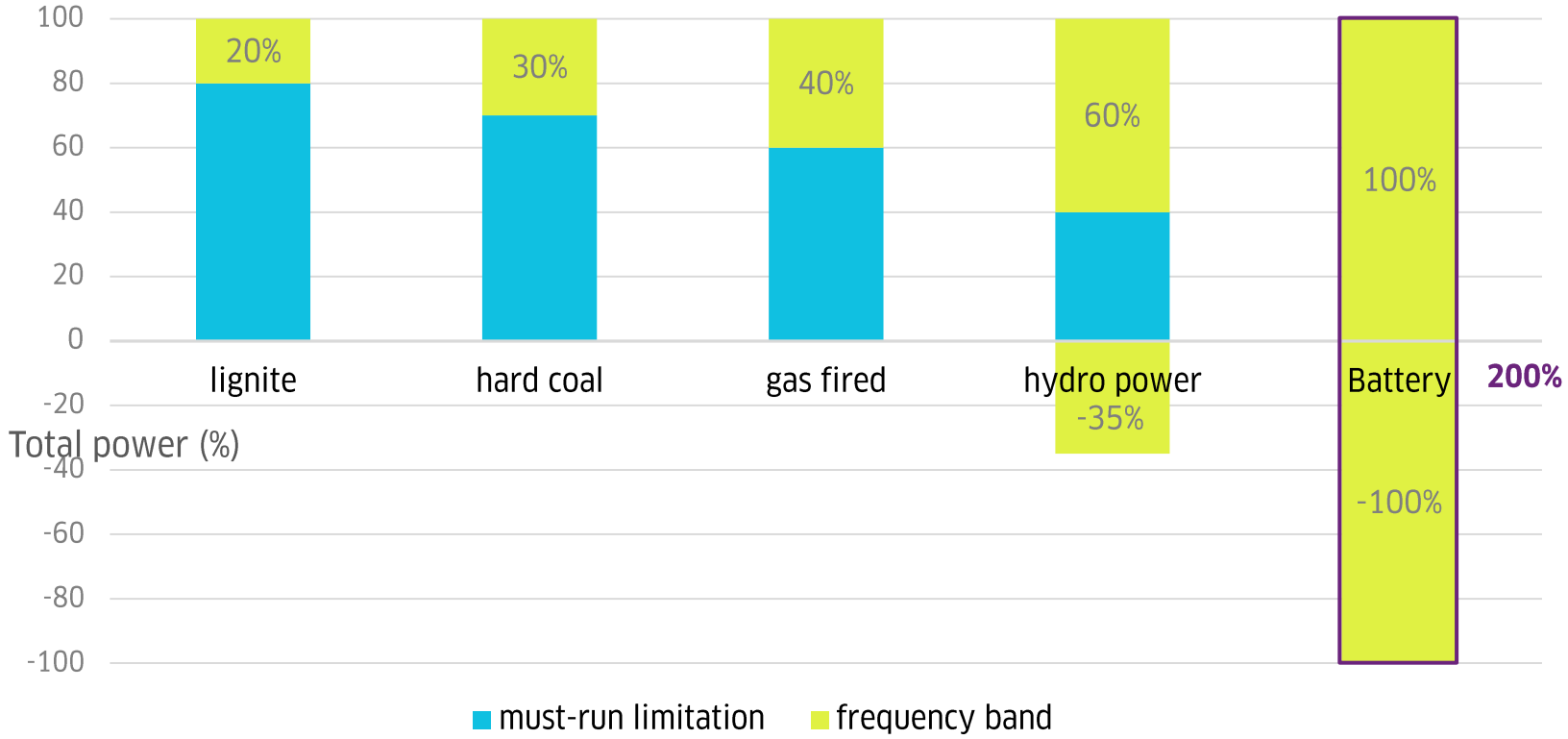
Control bands of different power plants in % of overall power (Frequency Containment Reserve and Frequency Restoration Reserve)



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Microeconomic balance: Batteries are the cheapest option to provide grid stability

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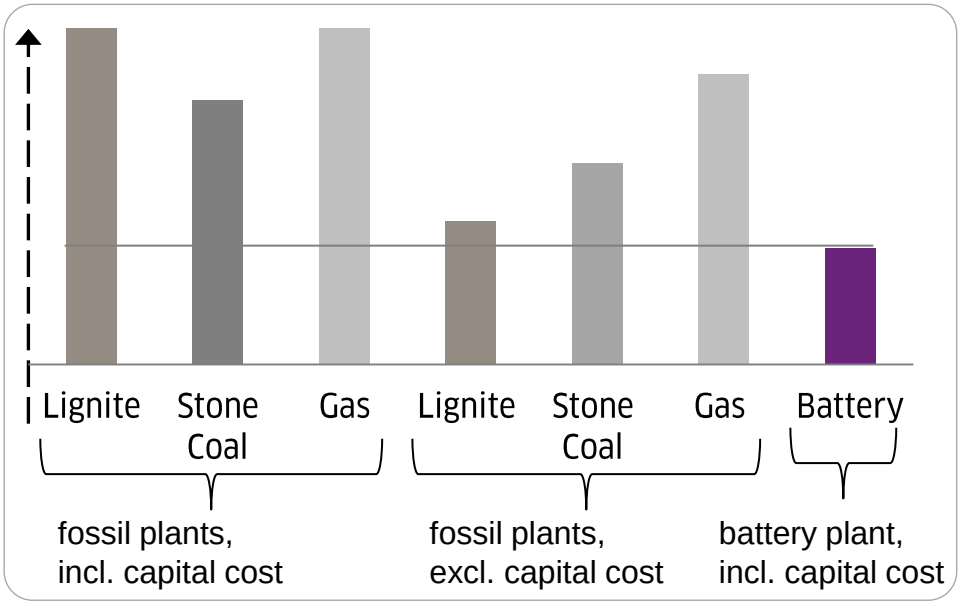
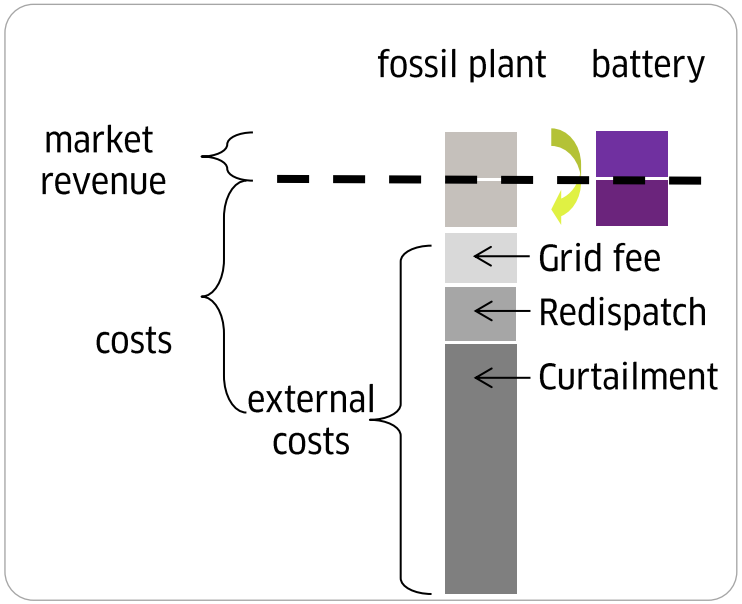
Comparing costs for 2MW control band of frequency regulation



External costs outside the regulated framework*



Batteries are cheaper for the system, because they operate without external costs

*(dena, Systemdienstleistungen 2030, 2014)

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Batteries are more flexible and accurate than conventional power plants

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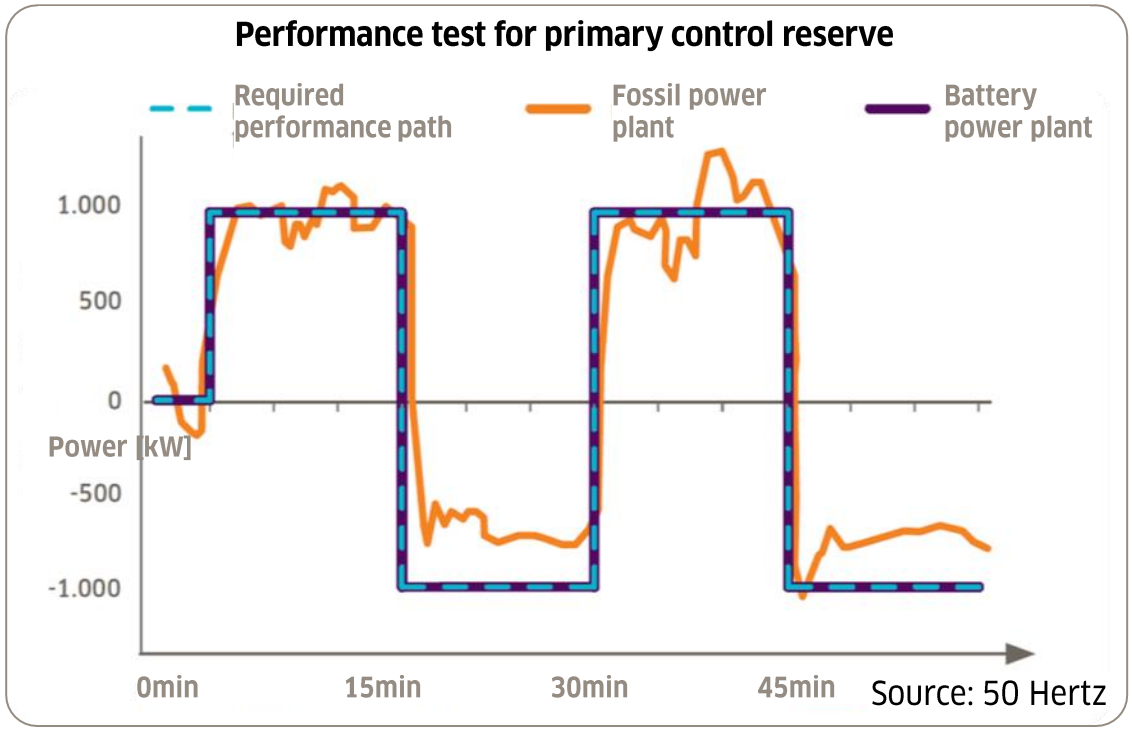

Faster and more accurate response of batteries make balancing more efficient and lowers the need for frequency regulation

*Battery power plant's response time< 5 ms

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Ecological balance of battery storage: Battery vs. coal plant

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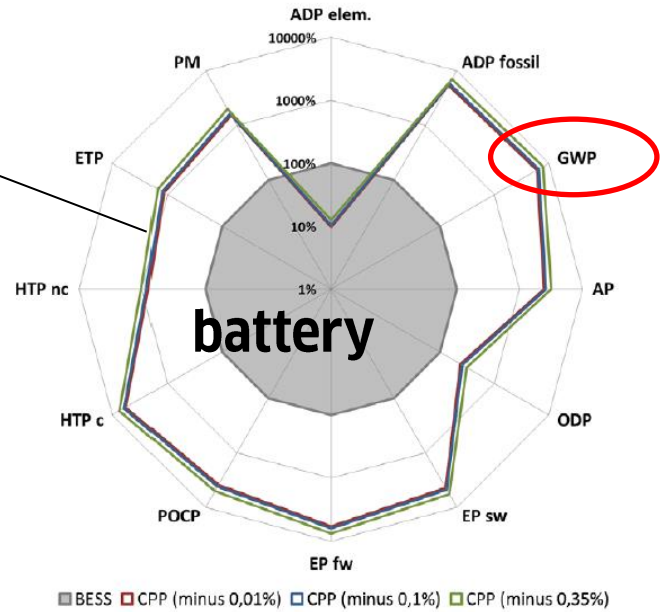
Comparison for the provision of frequency containment reserve

coal plant

$ADP_{elem.}$	Abiotic Resource Depletion Potential (mineral)
ADP_{fossil}	Abiotic Resource Depletion Potential (fossil)
GWP	Global Warming Potential
AP	Acidification Potential
ODP	Ozone Depletion Potential
EP sw	Eutrophication Potential (saltwater)
EP fw	Eutrophication Potential (fresh water)
POCP	Photochemical Ozone Creation Potential
HTP c	Human Toxicity Potential (carcinogen)
HTP nc	Human Toxicity Potential (non carcinogen)
ETP	Ecotoxity Potential
PM	Particulate Matter



global warming potential of coal plants exceeds that of battery plants by a factor of up to 90

Batteries help to reduce emissions and pollution from the energy sector

*FZ Jülich (2015): Life Cycle assessment of primary control provision by battery storage systems and fossil power plants

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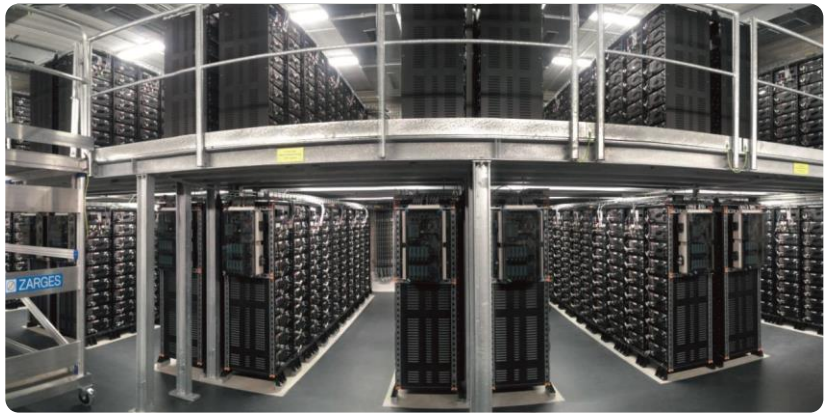
From R&D to innovation to market design: Battery storage is a proven technology today

Battery Storage is ready to penetrate the market

Schwerin, Germany

Schwerin Battery Park

- 5 MW/5 MWh
- Lithium-Ion
- Primary frequency response
- Younicos delivered turnkey battery power plant
- Option to extend to 10 MW/10 MWh
- Commissioned: 06/2014
- Client: WEMAG



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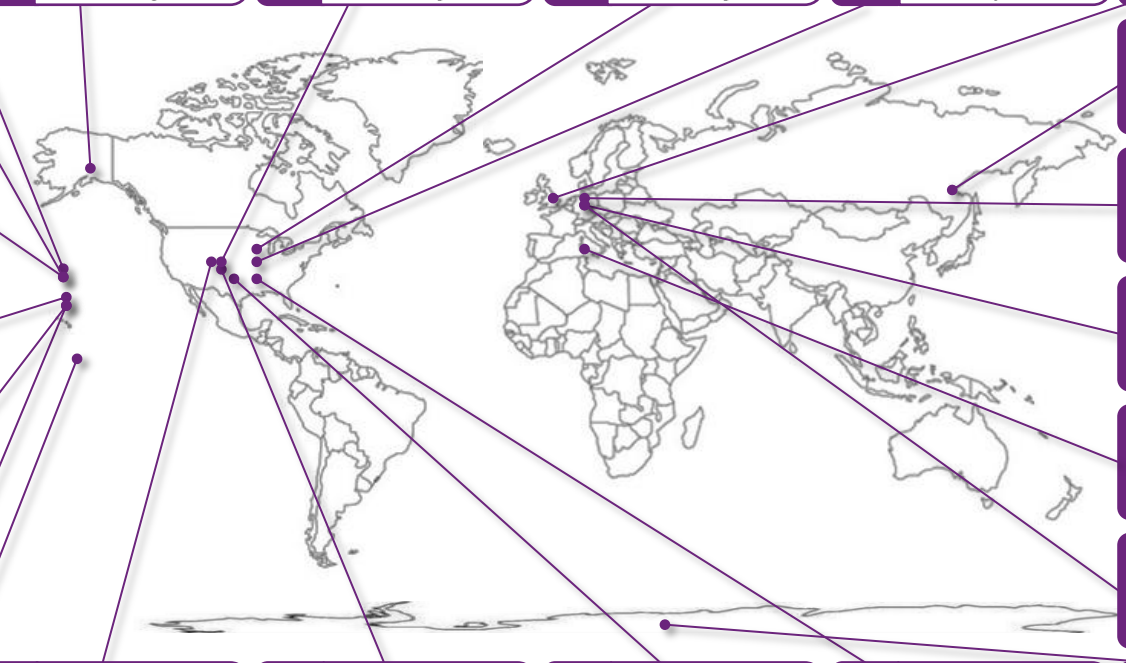

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Battery Energy Storage – a new enabler in the old regulatory framework

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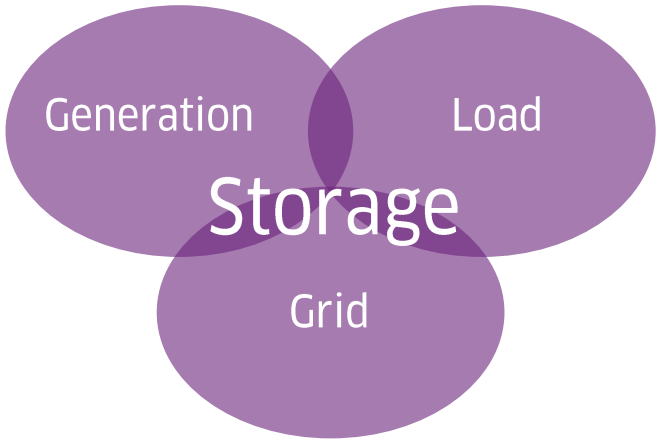
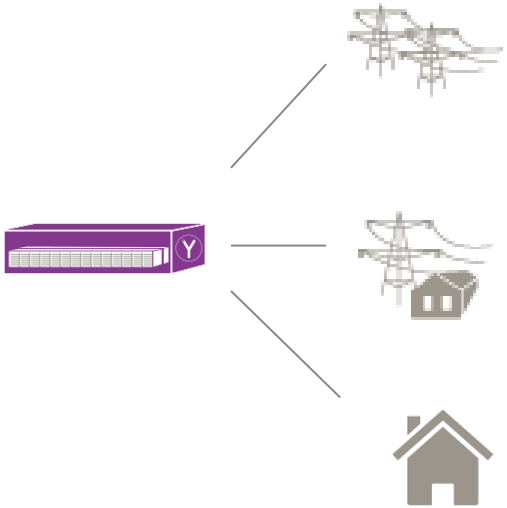
Across the unbundled energy sector



Across different grid-levels



Storage technology can be employed in different applications and on different grid levels, which constitutes a challenge in today's regulatory framework

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Regulatory Challenges: Is the market ready for battery storage?

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No definition for storage in unbundled markets, whereas storage can provide services as production, load and grid source

→ **Need to definition storage during legislative process to redesign electricity market**

Technology specific barriers for storage prevent market penetration
NC LFCR Art. 45(6) – 30 min capacity requirement for storage

→ **Markets have to be designed non-discriminatory towards different technologies**

Value of storage to the grid is not yet reflected by market design, e.g. speed and precision of service delivery; most ancillary services not traded on markets

→ **Adaptation of technology-friendly regulation and unfreezing of restricted markets to competition** (see regulation in the US)

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Thank you for your attention!

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