Flexible operation of large scale battery systems

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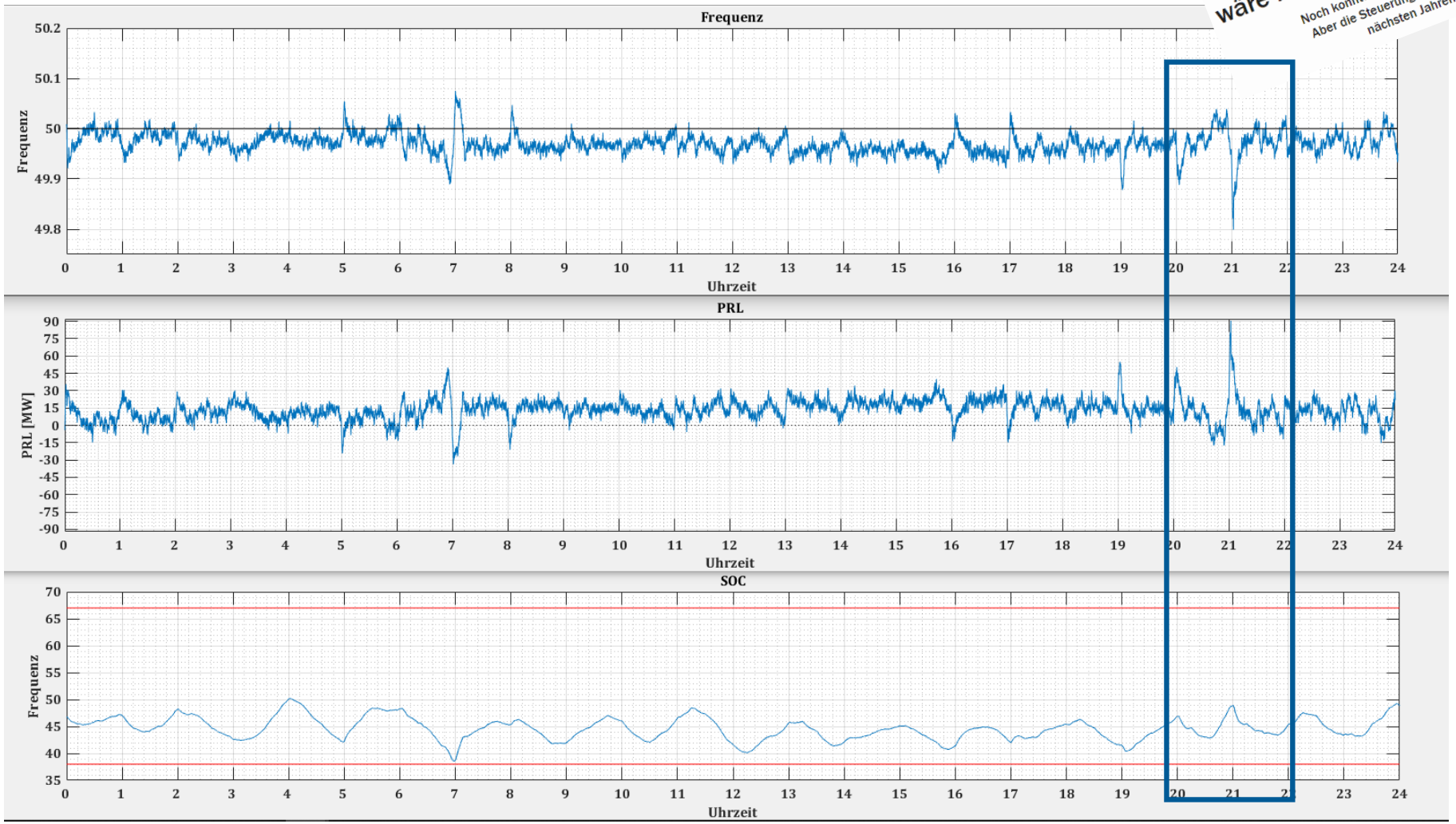
10.01.2019 - Close to Blackout in Europe

Frequency

Primary Control Power

SoC



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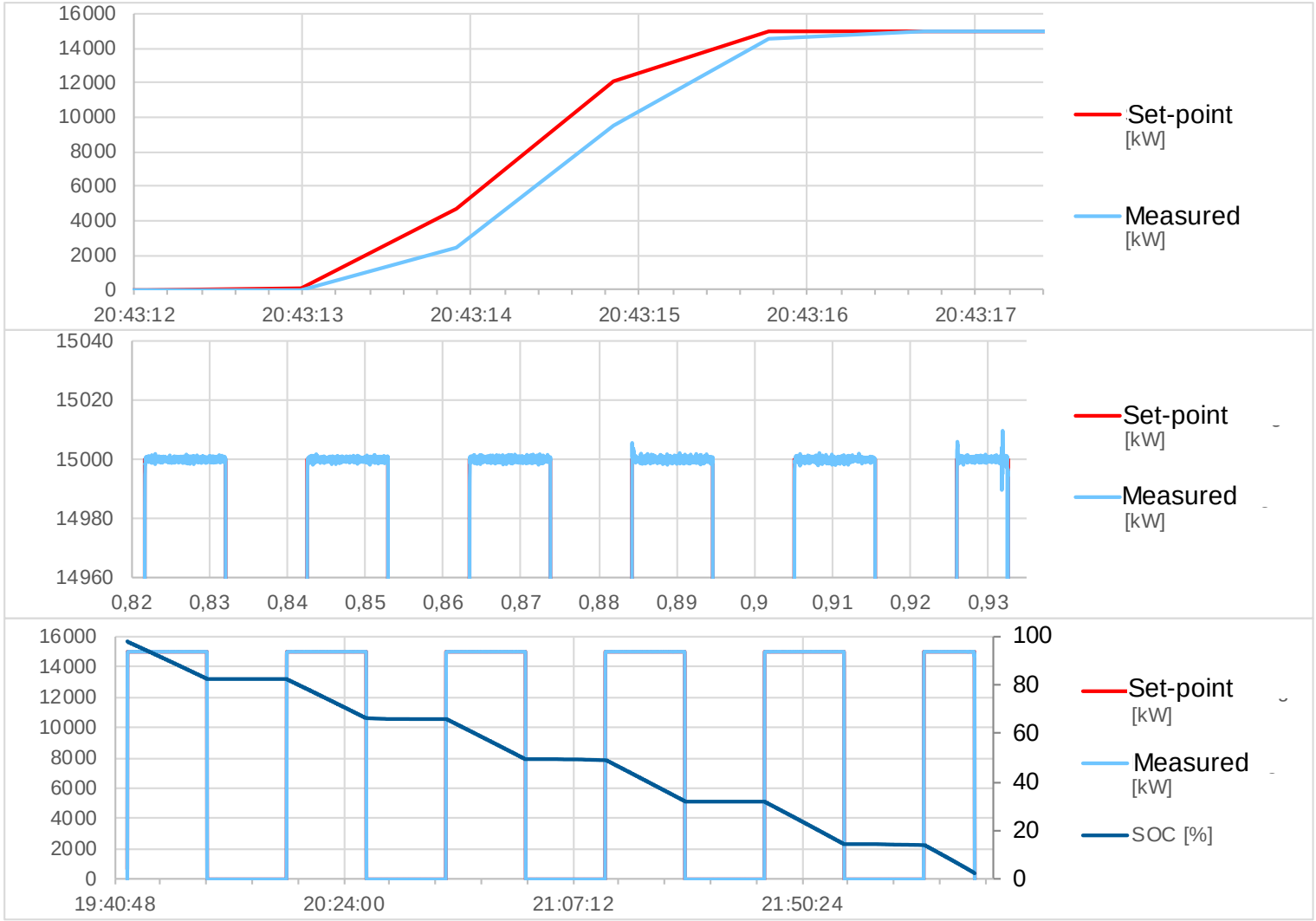
Advantages of large scale battery systems

Large scale battery systems are capable of providing power output in a

very fast and accurate

way but are

limited in capacity.



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Our large scale battery systems (GBS)

Six (five) large scale battery systems based on Lithium-Ion technology

Provision of primary control power/FCR (15 MW each/in total 90 MW)

Modular container based design

Capacity (> 20 MWh each / > 120 MWh in total)

Start with the first installation in April 2016

Commissioning of all sites finished end of 2016

Successful commercial operation since 2017

- Very good reliability
- High utilization rate due to proper price predictions

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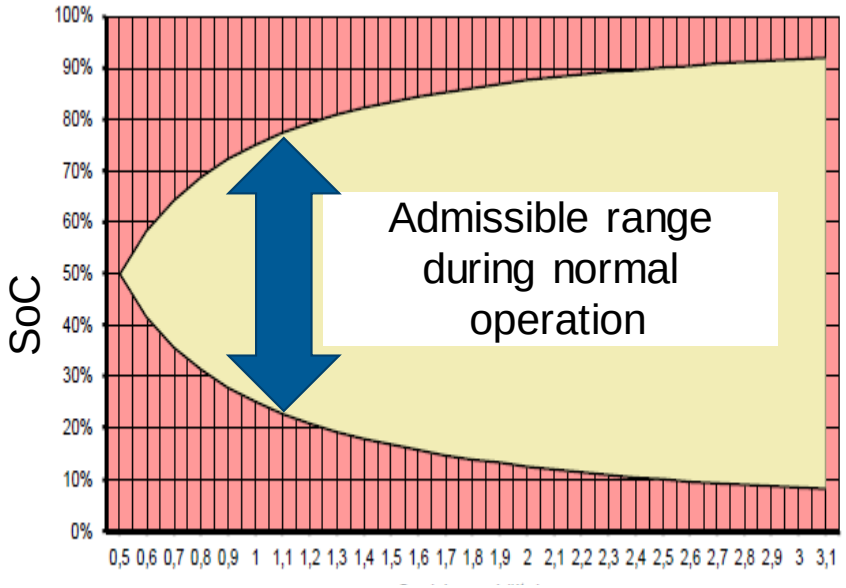
The framework for operating storage systems might rapidly change

Current situation in Germany:

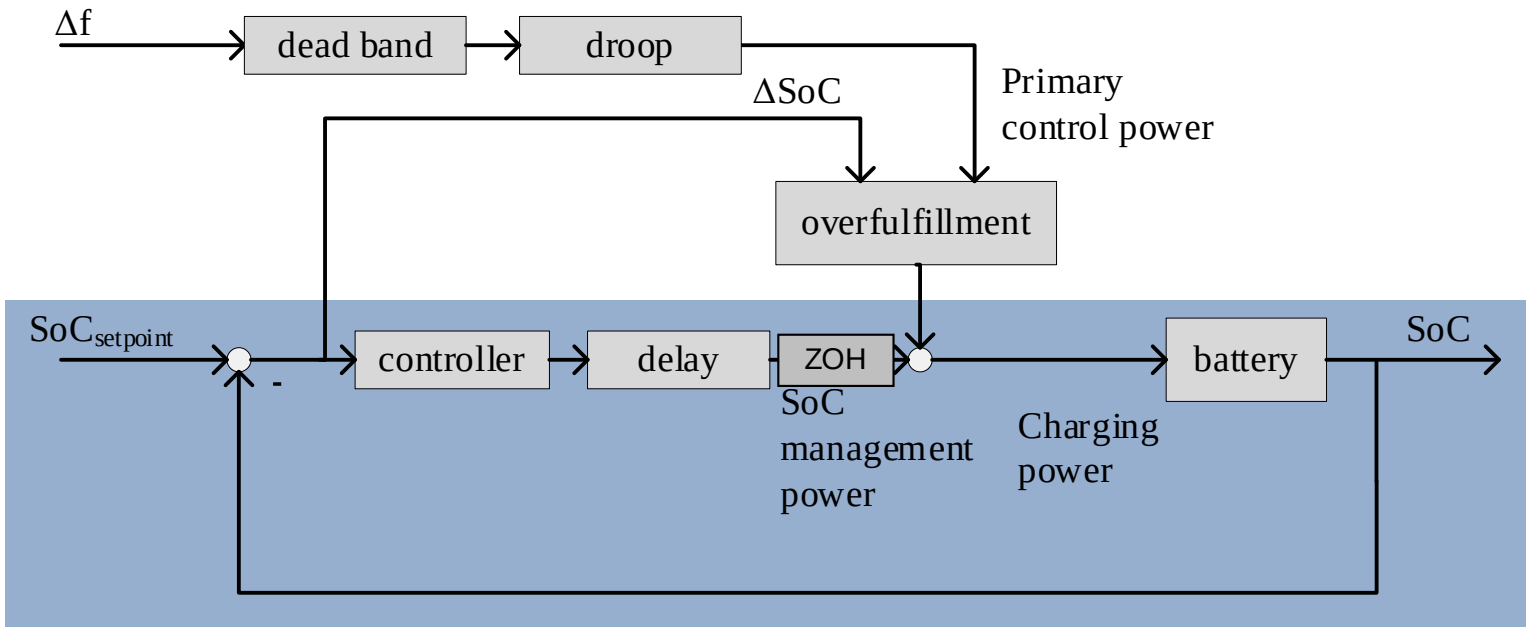
- Market design has been / will be changed
- ~~Low auction prices (primary control)~~
- Unclear regulatory framework: 15 min vs. 30 min
- Superior storage technologies potentially available in near future



Our answer:

- Leading edge in operational experience
- Continuous optimization enables new applications
- Know-how transfer to similar applications

Optimization of the SoC management plays a crucial role



Crucial task of storage systems: SoC Management

- potential efficiency booster
- key enabler for new applications

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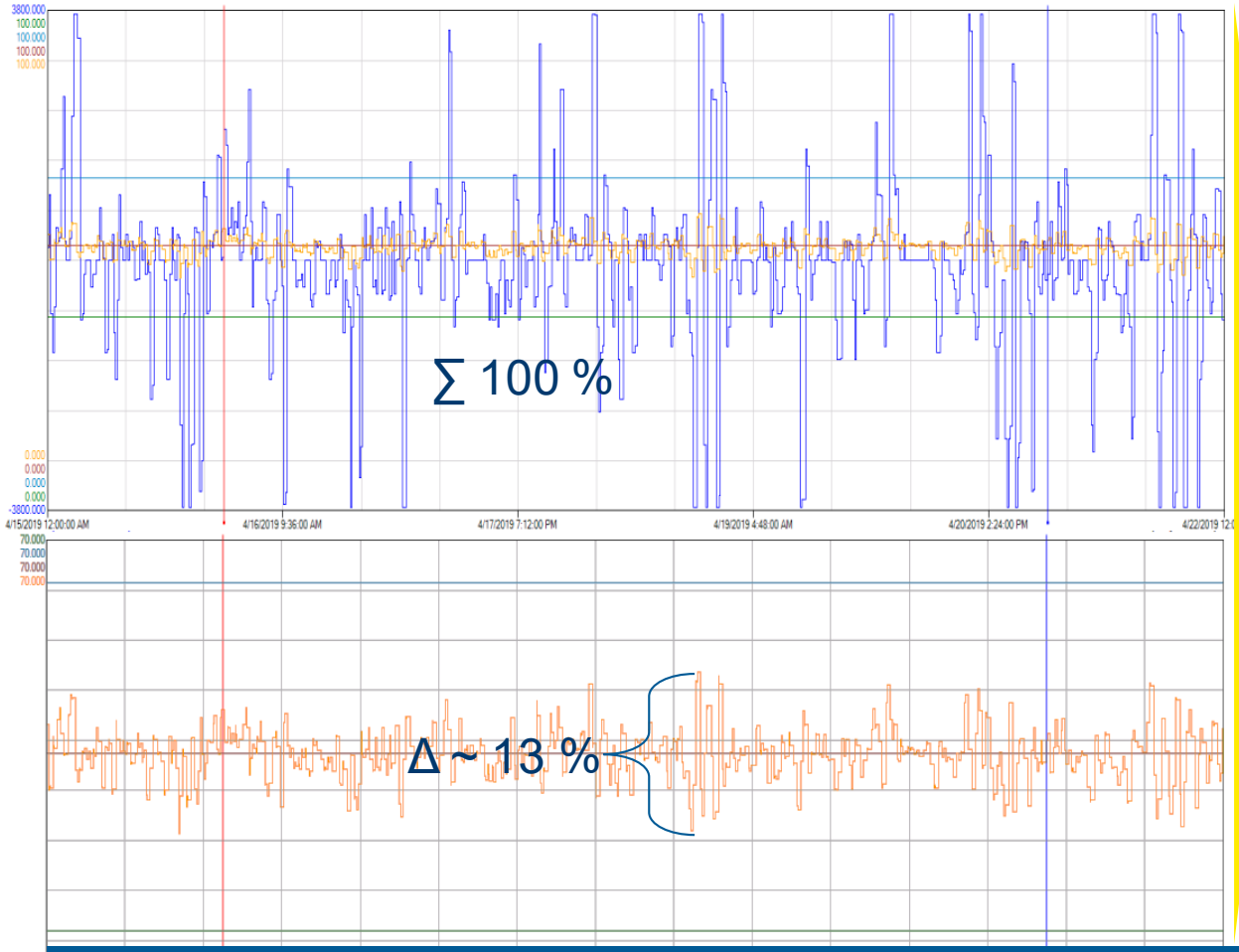
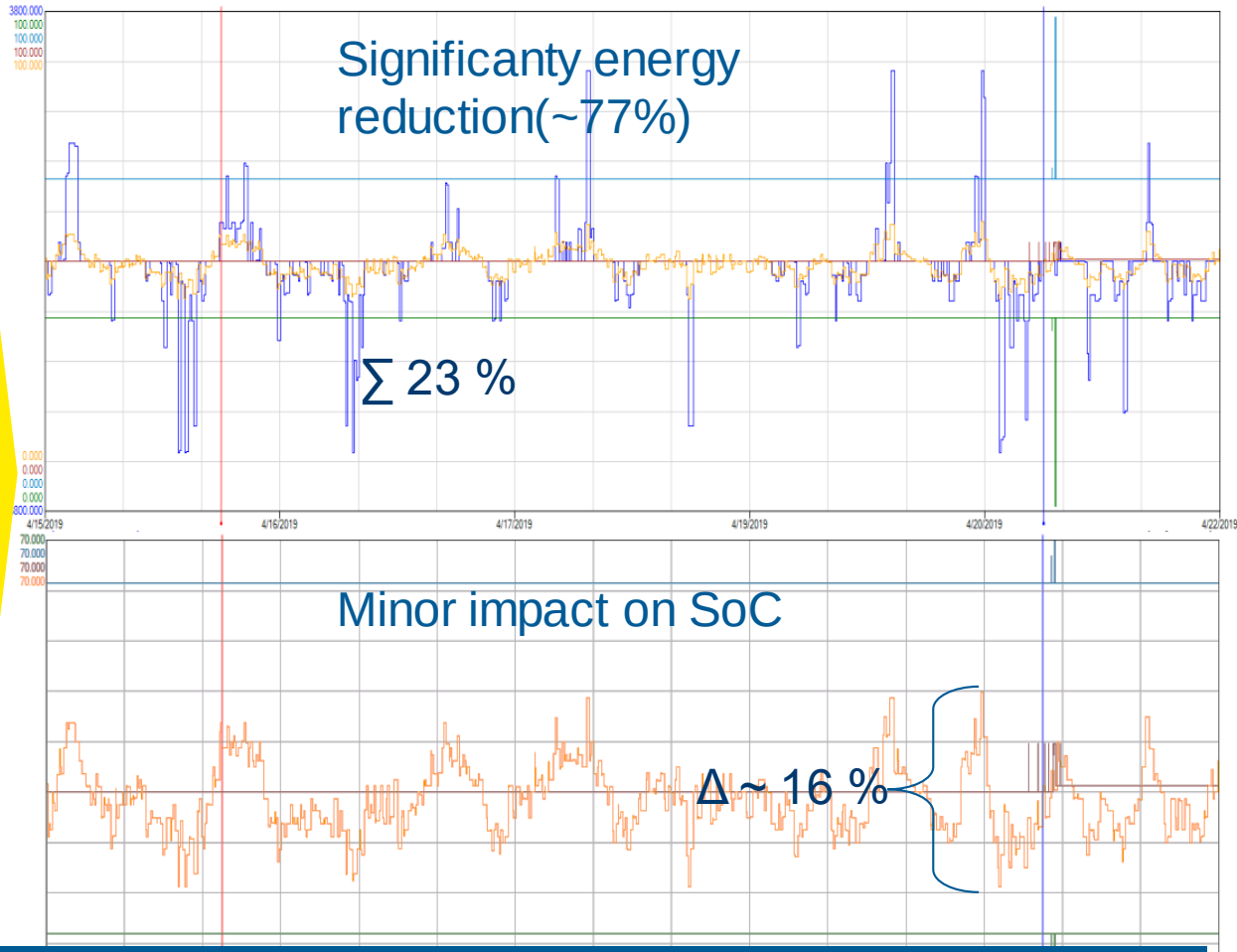
The energy througput can be significantly reduced





Optimized SoC management enables strategies exploiting the volatility of the electricity market, e.g. by means of AI based approaches.

Projects / Case studies

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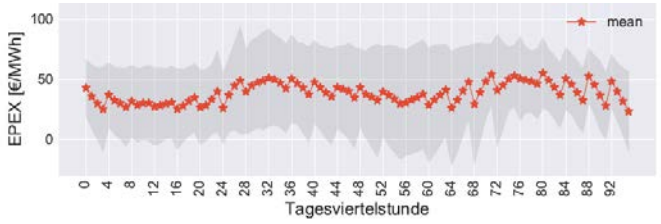
Arbitrage by means of mathematical optimization and AI

Input → Simulation → Output

Prediction based on AI

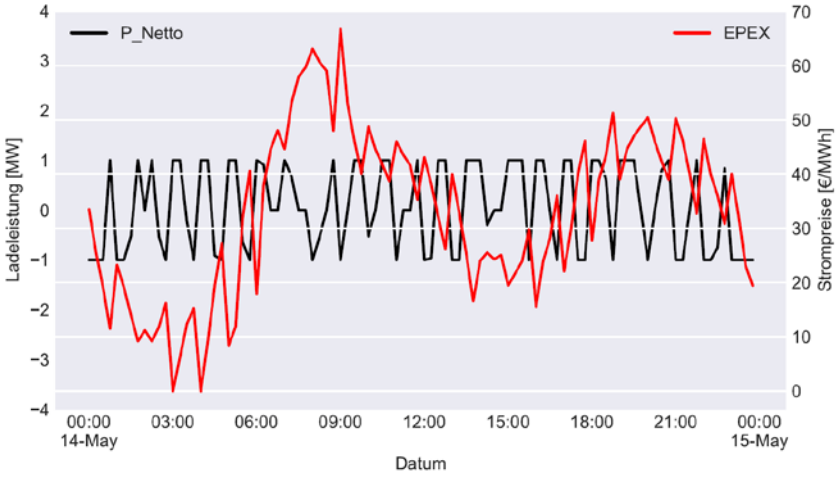


Optimization

$$\min_x \quad f(x)$$
$$\text{s.t.} \quad h(x) = b$$
$$g(x) \leq c$$

MATLAB SIMULINK®

Schedule



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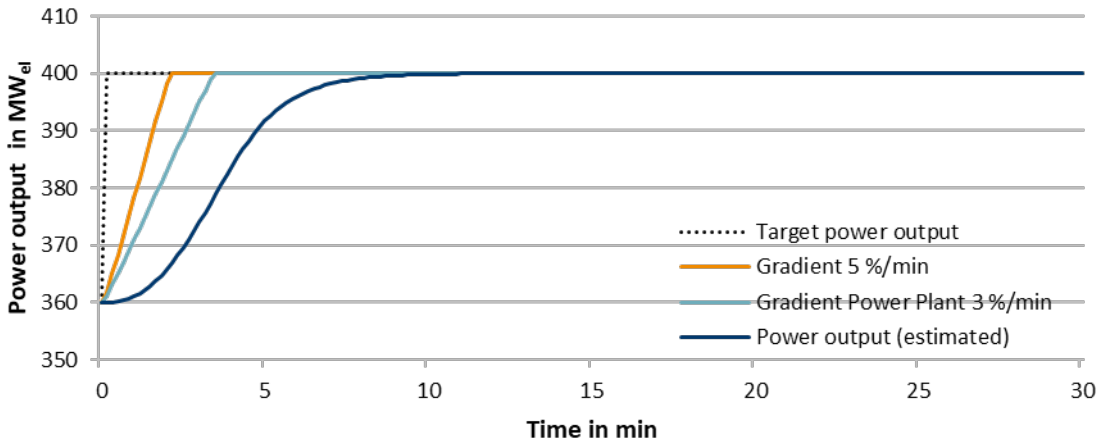
BESS integration for increasing **load gradients**

Assumptions:

- Target load gradient (orange): 5%/min
- Maximum permissible load gradient: 3%/min
- Step response: PT_2 (60 sec)
- Deficit in power and capacity is filled by BESS



→ max. **Power output: 33 MW** → 33 MWh for C-Rate of 1.0

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BESS integration for increasing **load gradients**

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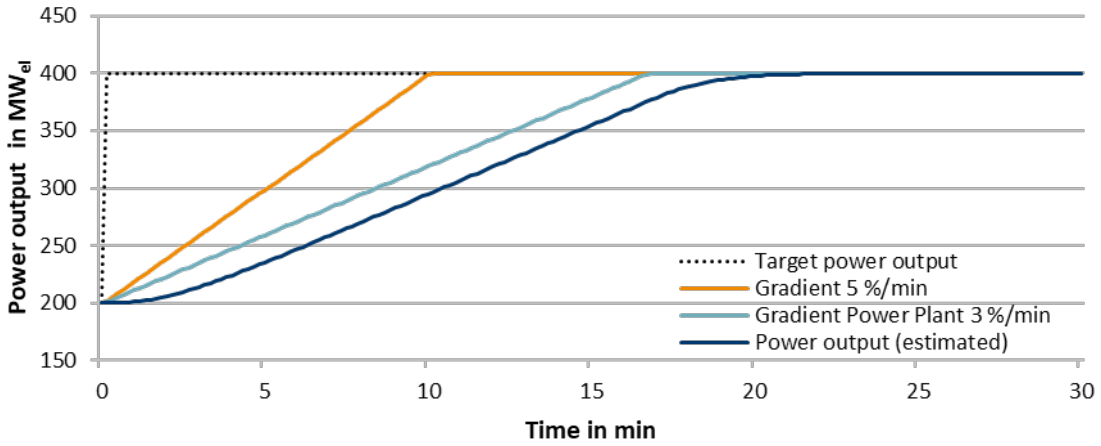

→ max. **Power output: 104 MW** → 104 MWh for C-Rate of 1.0

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Relocation of 15 MW Battery System

- formerly 6 sites, since 2020 only 5 sites left
- Steag relocated the GBS of Lünen site to Bexbach site in Saarland
- Project contains:
  - Logistics for disassembly, transport (compliant with guidelines) and reassembly of battery modules, containers and peripherial equipment
  - Engineering, procurement, construction and comissioning of all interfaces of our large scale battery system
  - The project took around <u>two months</u> from disassembly to hot comissioning

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Questions?

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Get the latest updates on our activities and projects:

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