

## Energy Storage in Germany – demand, market environment and regulatory framework

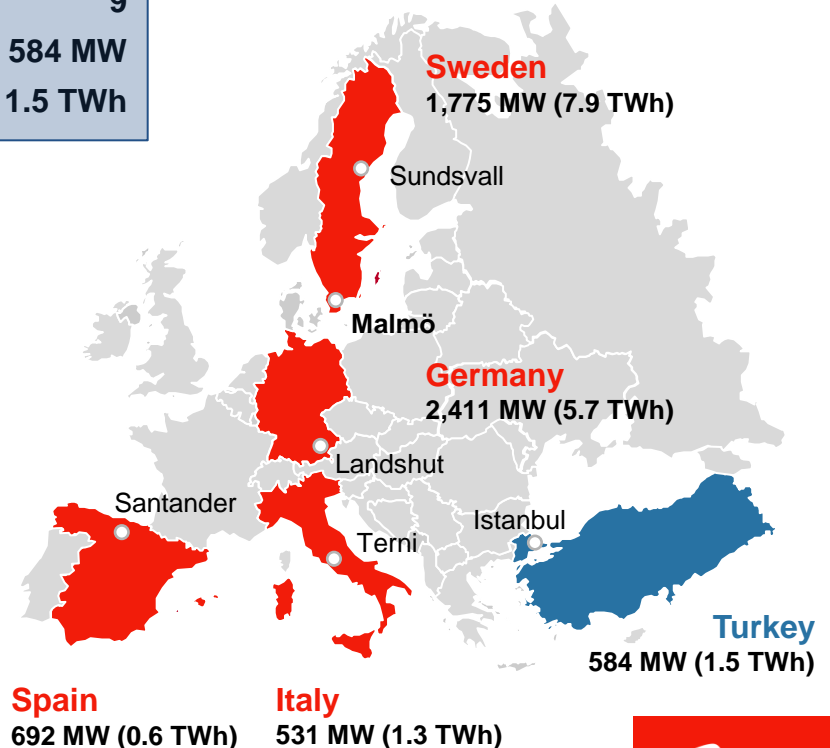
HydroBalance Kick-off meeting

Trondheim, 23<sup>rd</sup> of October 2013

Michaela Harasta, E.ON Global Unit Generation

# E.ON is an experienced operator of a European hydropower portfolio totaling nearly 6.000 MW

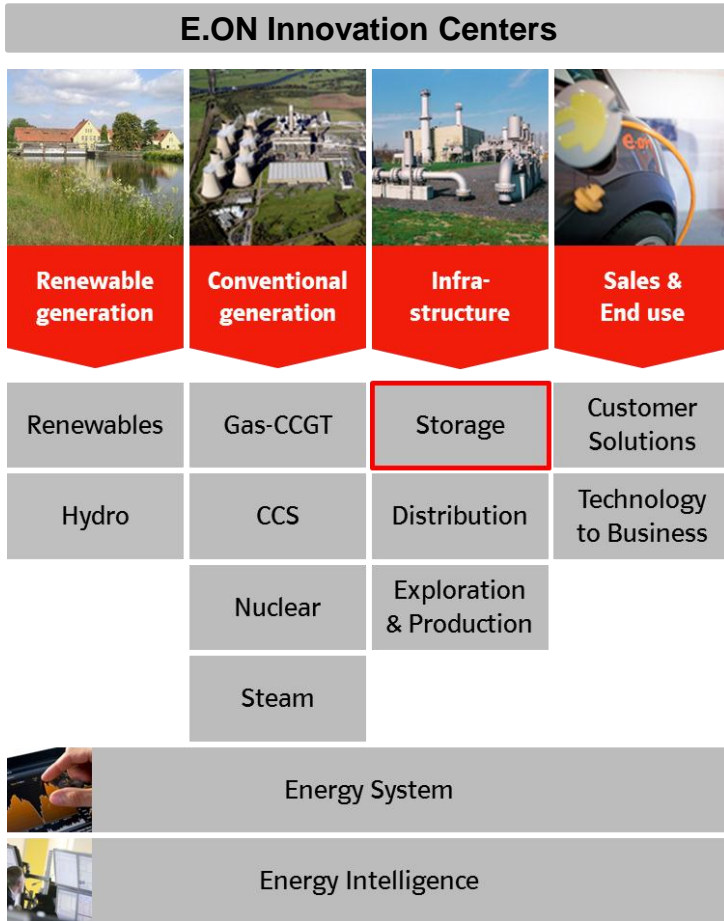
E.ON Generation				E.ON Intl. Energy		
Steam	CCGT	Nuclear	Hydro	Turkey <sup>3</sup>	Brazil	
No. of operated hydropower plants				209	9	
Efficient capacity (net installed capacity) <sup>1</sup>				5,409 MW	584 MW	
Annual net generation <sup>1, 2</sup>				15.5 TWh	1.5 TWh	



1) Incl. power-procurement rights  
 2) Annual generation excluding pumped storage power plants  
 3) Status January 2013; 0,8 GW under construction, 0,8 GW under development



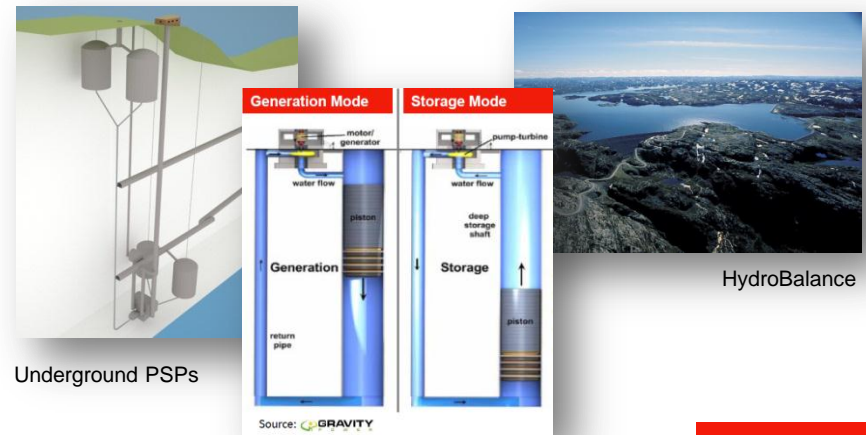
# Innovation topics at E.ON are managed by Innovation Centers in co-operation with experts in operative units



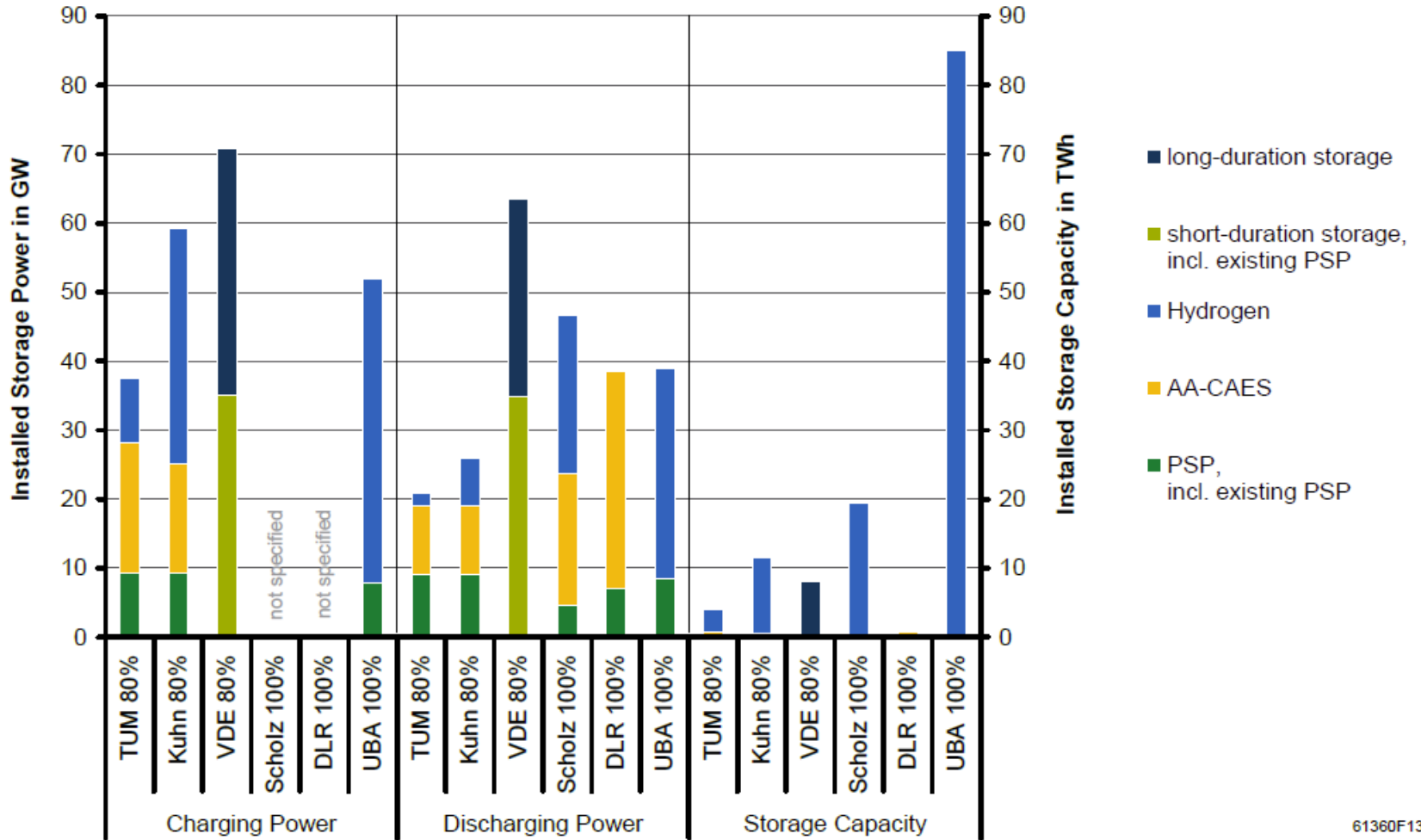
## Main topics of E.ON Innovation Center Storage

Assessment and development of storage technologies:

- Battery storage
- Power to gas
- Compressed air energy storage
- Thermal energy storage
- **Pumped-storage plant innovations**, where the EIC co-operates closely with the Hydro Fleet, such as:



# Demand for energy storage in Germany in 2050



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# Conclusion from existing energy demand studies

## Drivers for energy storage demand


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- ↑ **Share of RES** in generation mix
- ↑ **Total energy consumption**
- ↓ **Amount of import and export**
- ↓ **Number of E-vehicles** with “smart” charging
- ↓ **Degree of demand side management**
- ↓ **Distribution grid** improvements
- ↓ **Transmission grid** extensions

## Comparing various studies

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- **Significant variation** of study results
- **Comparability** of results is **rather low** due to differences in:
  - **Study purpose** (determining storage demand, optimal RES generation etc.)
  - **Methodology and optimization algorithm** (system cost minimization, residual load minimization etc.)
  - **Input parameters** (transmission constraints, technology costs etc.)

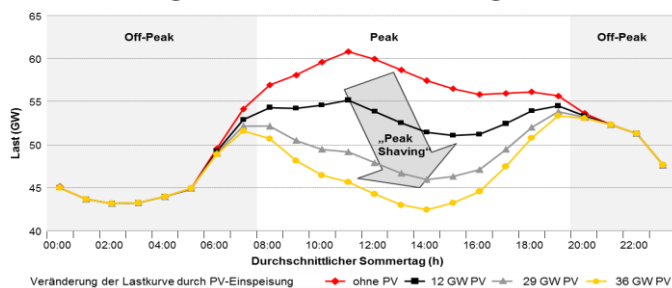


There is no clear view on how much storage capacity will be needed exactly, but there will be a large demand in the long term future. Hence, we have to develop efficient energy storage solutions for the system already today.

# Market design is to be revised to set investment signals for Energy Storage

## Facts

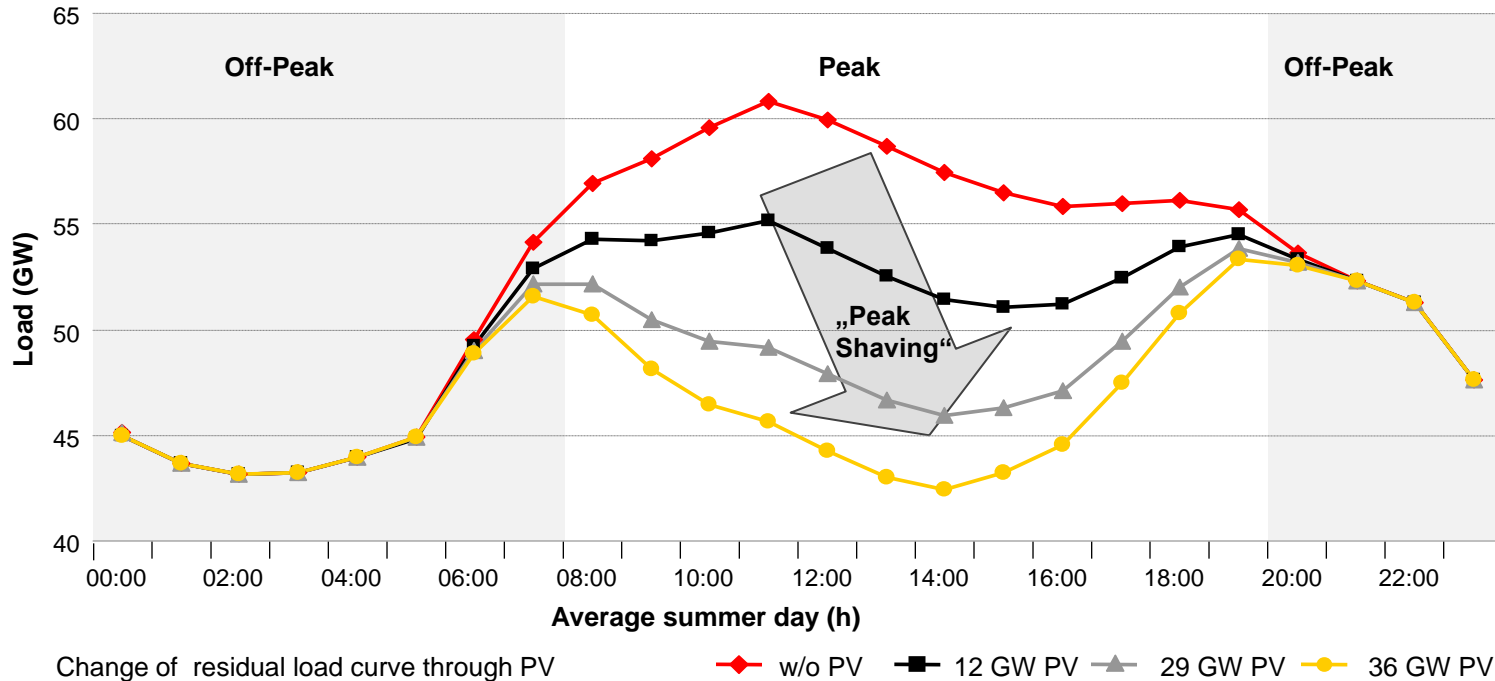
- **“Peak shaving”** through PV → main remuneration component for PSPs shrinking
- **Alternative “products” not remunerated** by current market mechanism
- Thus, **reduced profitability** with missing investment signals



## Conclusions

- Current remuneration concept (peak-offpeak spread) does not generate enough income
- New remuneration concepts for demanded system services is required → new market design and/or products to be introduced
- Operational profitability and investment risks currently not acceptable → reliable framework to be developed shortly

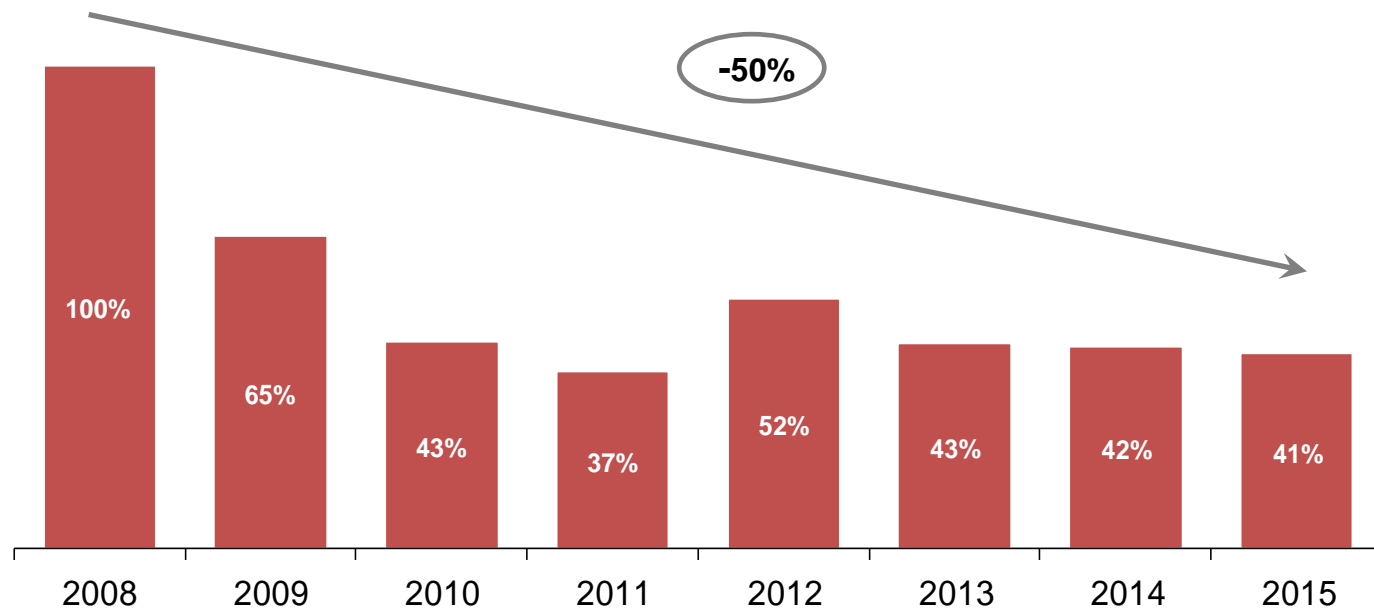
# “Peak shaving” by feed-in of RES generation reduces profitability of pumped-storage plants in Germany



Especially subsidized PV-feed-in “shaves” price spikes and decreases achievable peak/offpeak-spread for pumped-storage plants → the original wholesale arbitrage business model does not generate sufficient profit anymore.

## The achievable wholesale arbitrage profits decreased by approx. 50% since 2008

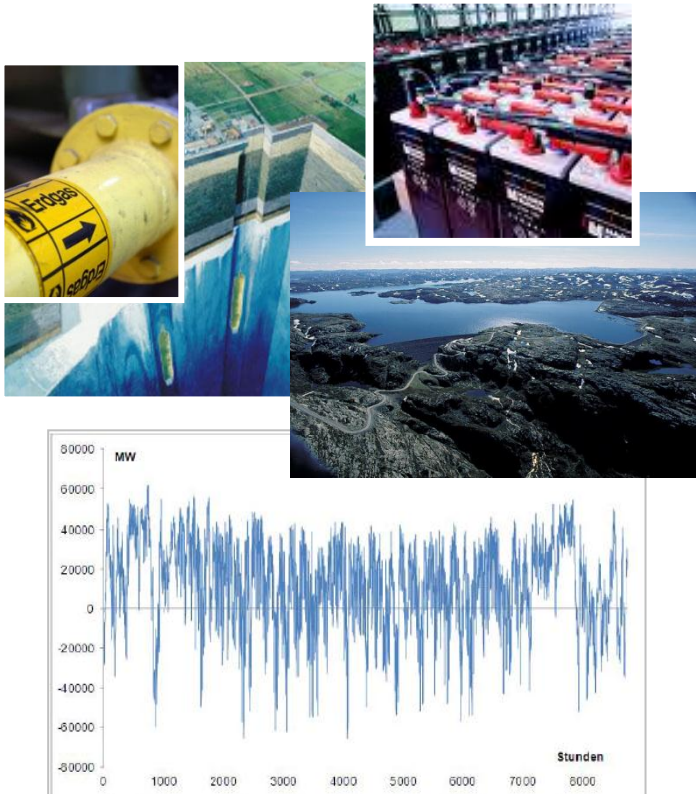
Wholesale market optimization of a generic pumped-storage plant:



The market conditions are currently very challenging for operation of pumped-storage plants and energy storage in general.



# Introduction of new products could facilitate investments in energy storage and help the “energy transition”



*Residual load curve 2050, with steep gradients and high fluctuation, source Prognos*

- Controversial discussion in Germany as to which **extend a market for flexibility is needed**
- Some **markets for flexibility are established** already, e.g. reserve, intraday, balance energy
- But **demand for flexibility and system services** that facilitate the challenges of the energy transition **will increase** in future
- Respective **products and remuneration concepts** do not exist
  - Storage
  - Congestion management
  - Forecast error mitigation
  - ...

New products and remuneration concepts would have to be initiated by politics, but once introduced, these products should be traded based on market principles.

# Regulation: The existing regulatory framework leads to disadvantages for Energy Storage

## Facts

- Energy storages are regarded as final consumers and hence subject to **grid fees**
- **EEG<sup>1</sup> regulations** focus solely on RES generation but do not cover storage/ balancing requirements for the system
- **TSOs as storage operators** discussed



## Conclusions

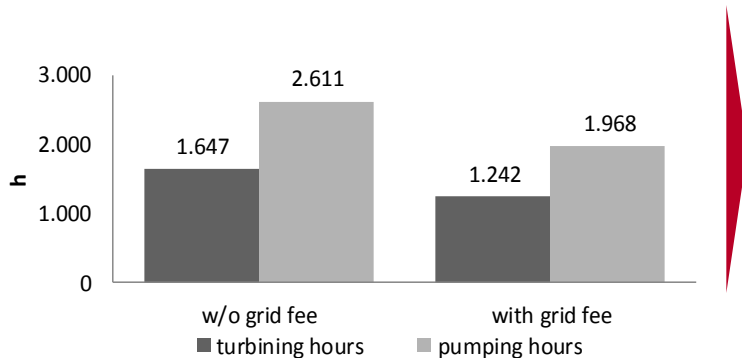
- a Grid fees impose a massive economical burden to PSPs today and deteriorate profitability even more
- b EEG subsidies in Germany avoid investments into required storage technology for RES integration → macro-economically inefficient
- c Operation of storages by the TSOs would eliminate market principles e.g. for reserve capacity
- d Energy storage needs an own regulatory framework

1) German renewable energy act

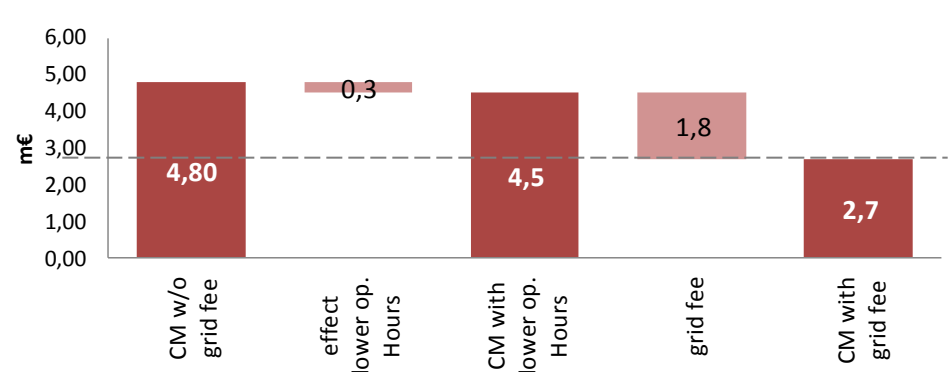
# Grid fees for final consumption reduce the profitability of a pumped-storage plant by approx. 50%

- **Generic pumped-storage plant** optimized in wholesale market
- Two effects impact profitability:
  - **Lower number of operating hours** (energy fee reduces spread and leads to different optimization)
  - **Capacity and energy fee** in its absolute height

Operating hours: -25%



Achievable Contribution Margin (m€): -45%



In the current demanding market environment with low spreads the grid fee burden can hardly be born anymore → profitable operation is in danger and investment signals are not given (neither new build nor refurbishments of existing assets).

## Current regulations in Germany do not give any incentives to RES generators to use energy storage



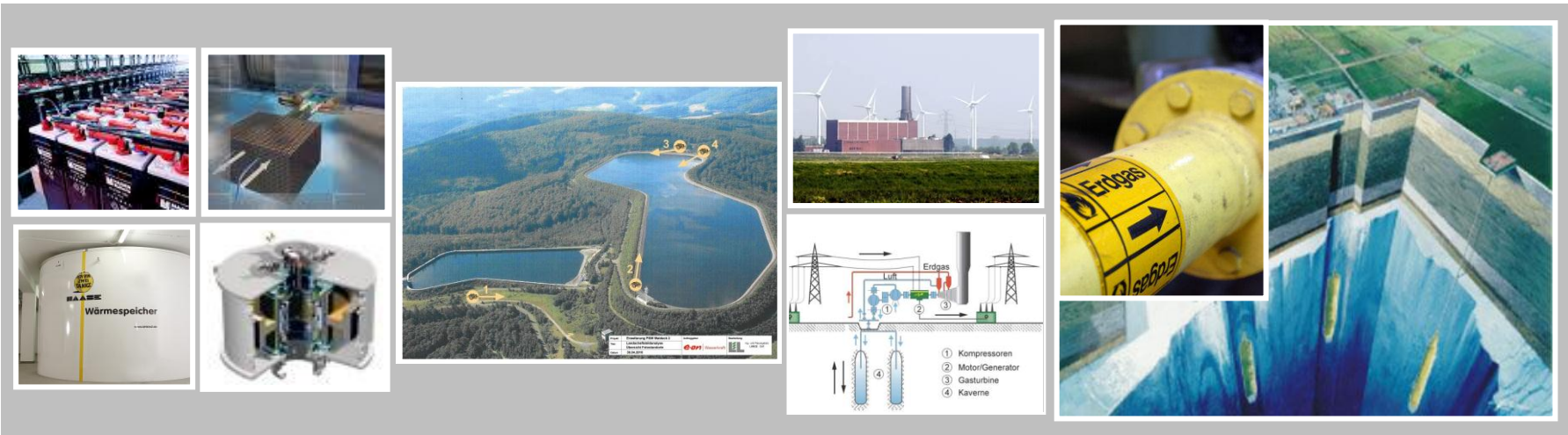
- Subsidies for selected technologies (mainly Wind, PV), but **no view on total system requirements**
- **Granted remuneration** to RES operators, irrespective whether there is a demand of electricity or not
- **Re-dispatch more favorable** for RES generators than use of storage
- **No balancing obligations** for RES generators

Requirement for amendments of current subsidy system to avoid further uncontrolled expansion of RES capacities is recognized and currently discussed:

- **Financing of RES** will also in future be necessary, but **lower returns** intended
- **More coordination** between **RES installations** and extension of **necessary infrastructure**
- **More market-integration** of RES generation into established mechanisms

## Summary and conclusion

- **Storages will play a key role** in the future energy system, but there is no clear view on the exact demand of energy storage yet.
- Storages represent a “**fourth element**” in the system. They are different from the other system participants generation, grid and end consumers. Hence, storages need their **own and technology neutral regulatory framework**.
- Today the **economic preconditions** for investments into energy storages **are not given**, remuneration concepts need to be adjusted.
- Moreover, energy storages should be **relieved from any fees associated with end consumption** as they only defer and convert energy for future use.
- Storage should be part of a **competitive market**, but current legislation and RES subsidies in Germany do not give any **incentive to use storage**.



# Thank you for your attention!

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