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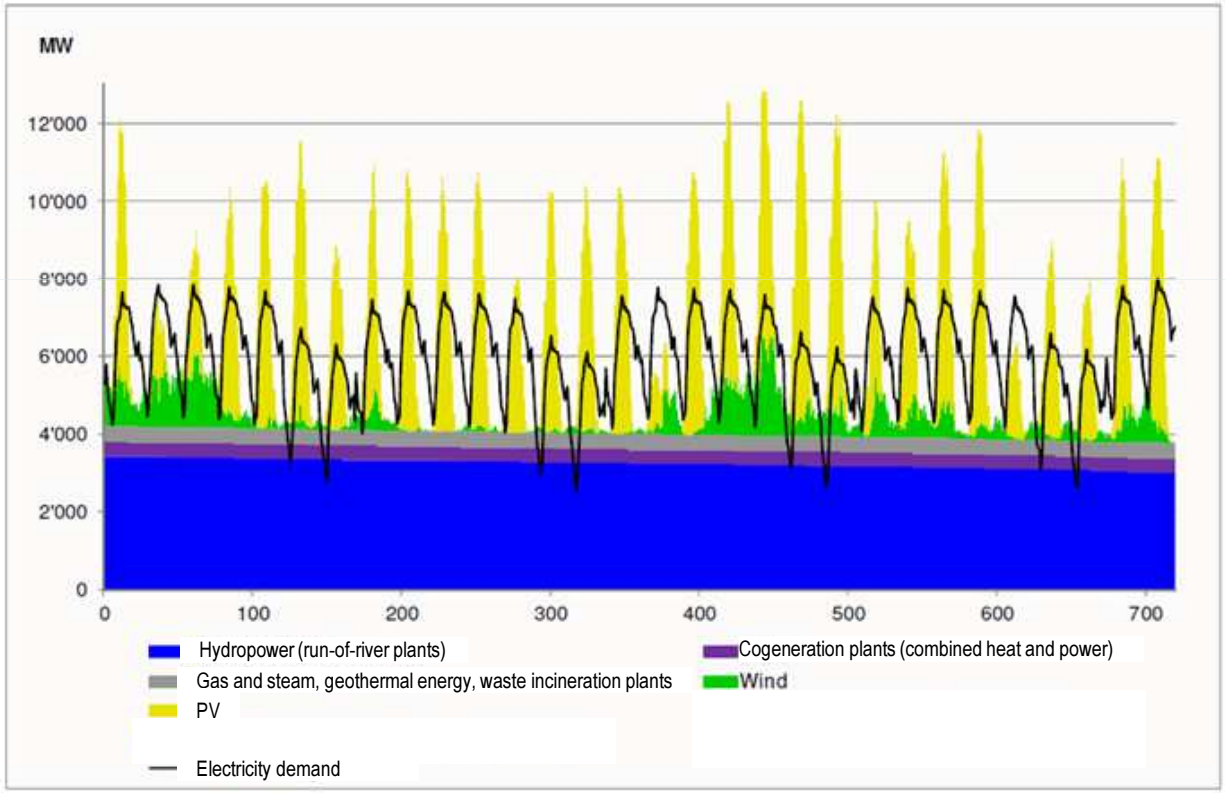
Pumped storage power plants for irregular solar and wind power?

Aurelio Fetz, Market Regulation

Energy Platform Workshop, 13 February 2014

Storage is of growing importance for the future energy system

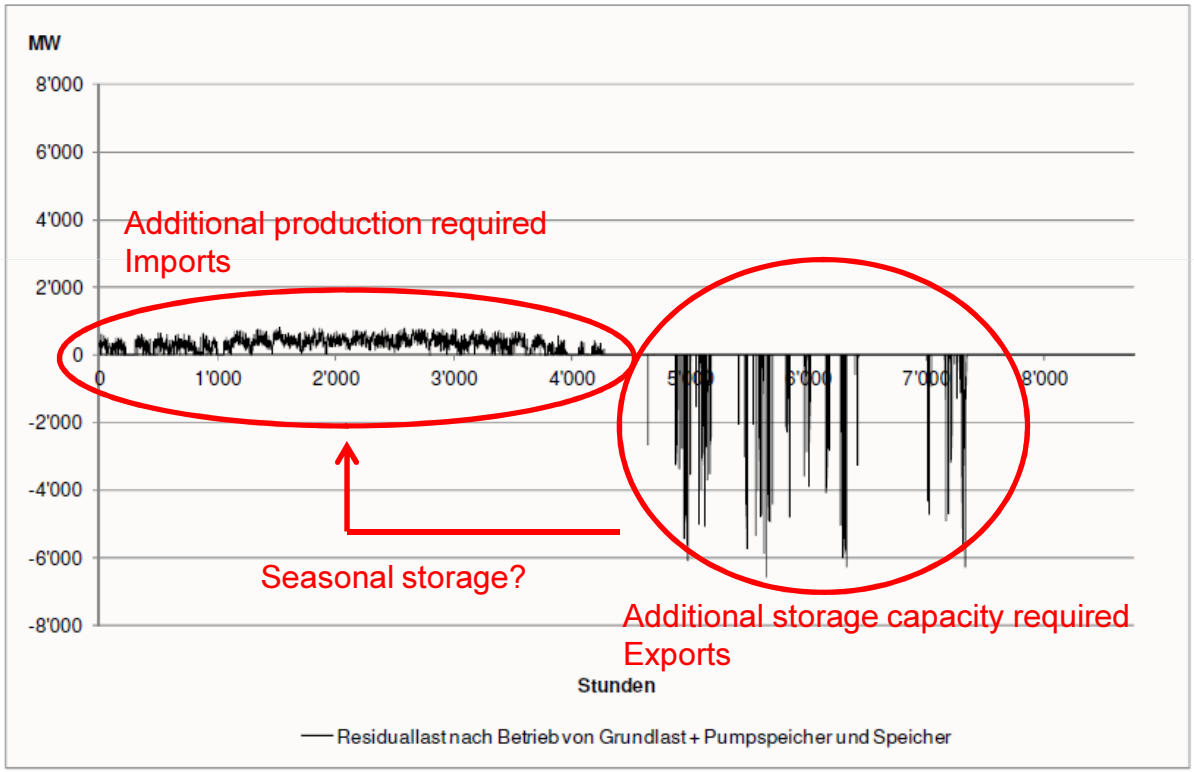
Figur II.3-22: *"New Energy Policy" scenario, C&E option*
Electricity production from base load power plants and renewable energy, and electricity demand in June 2050, in MW



Quelle: Prognos 2012

Storage is of growing importance for the future energy system

Figur II.3-29: *"New Energy Policy" scenario, C&E option*
Residual demand (electricity demand after production from renewable energy, base load power plants and storage power plants) during the year (2050), in MW



Quelle: Prognos 2012

Challenges on the electricity market

For the integration of renewable energy, a future supply system calls for the following technologies:

- **Storage technologies**, in order to be able to store any supply surplus electricity and release it in the event of excess demand
- **Flexible power plants**, in order to be able to meet excess demand in the event of a production shortage
- **Demand-side management**, in order to be able to adapt demand behaviour to the supply situation
- **Efficient operation and expansion of networks** and development of **smart grids** for increased feed-in at the lower network level and in order to more purposefully link consumers and producers

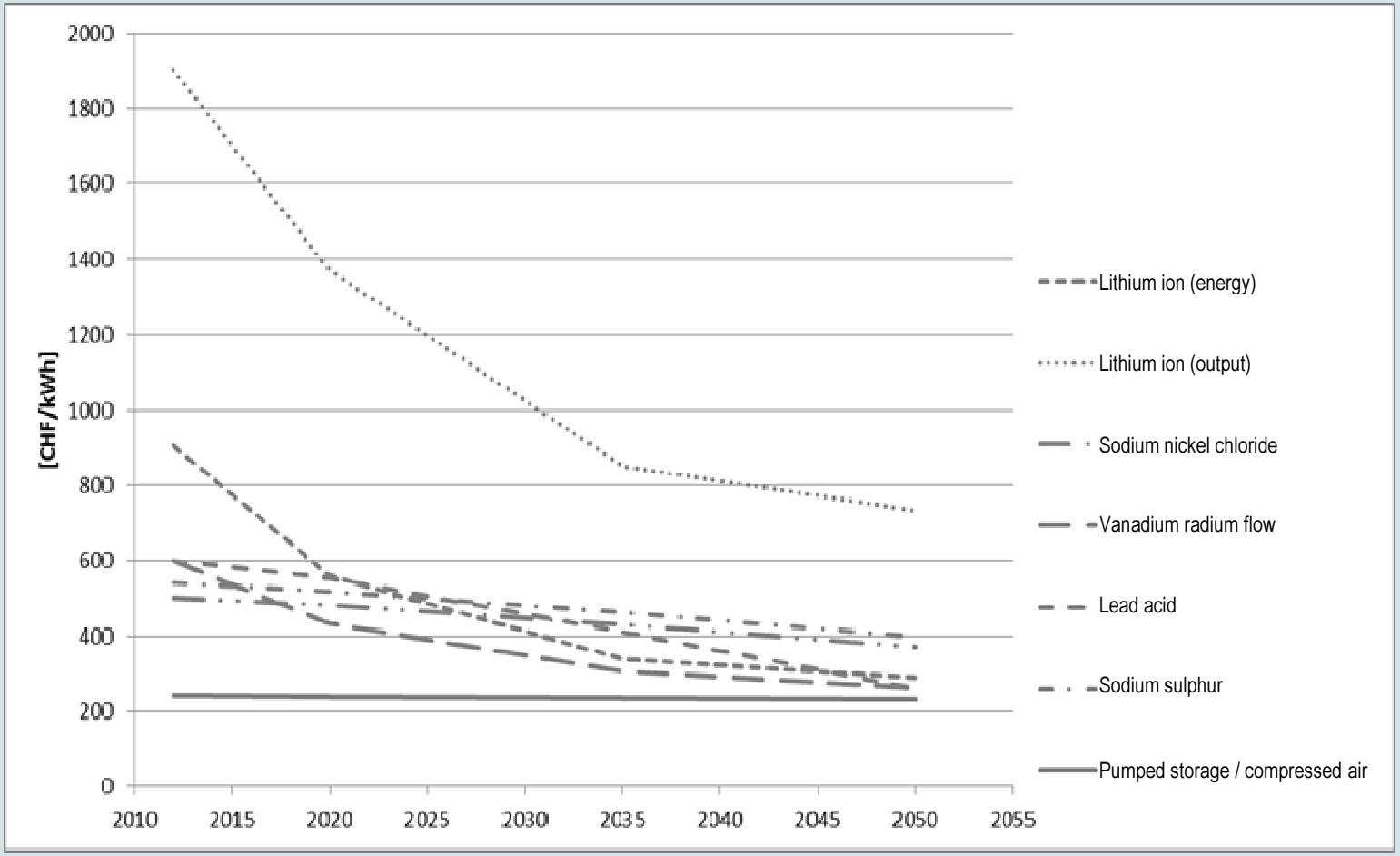
→ Additional investments will be required for renovations

→ Efficiency increases will be necessary in order to avoid major price increases

How important will pumped storage power plants be in the future electricity market?

- With Energy Strategy 2050, will additional storage facilities be required?
- If so …
  - … How much capacity?
  - … Which technologies?
  - … Commencing when?
  - … Where?
  - … Economically viable?
  - … Which market model?

Projection of cost trends for various storage technologies



Quelle: DNV KEMA (2013)

Demand analysis

Findings of DNV KEMA study (2013) regarding technical storage requirements in the future electricity supply

- **In the short to medium term (up to 2020)** no additional storage requirement exists in the examined scenarios and supply options.
  Reason: Comparatively minor increase in volatile production technologies in the period up to 2020.
- For the **period up to 2050**, however, the need for a technically related storage capacity for avoiding inadmissible network overloads has to be anticipated, especially for rural networks.
  Reason: Sharp increase in decentral volatile production technologies, which will give rise to local excess feeds into distribution networks.

→ **The comprehensive use of new types of energy storage in Switzerland only appears to be necessary and purposeful in the long term, i.e. in the period after 2035.**

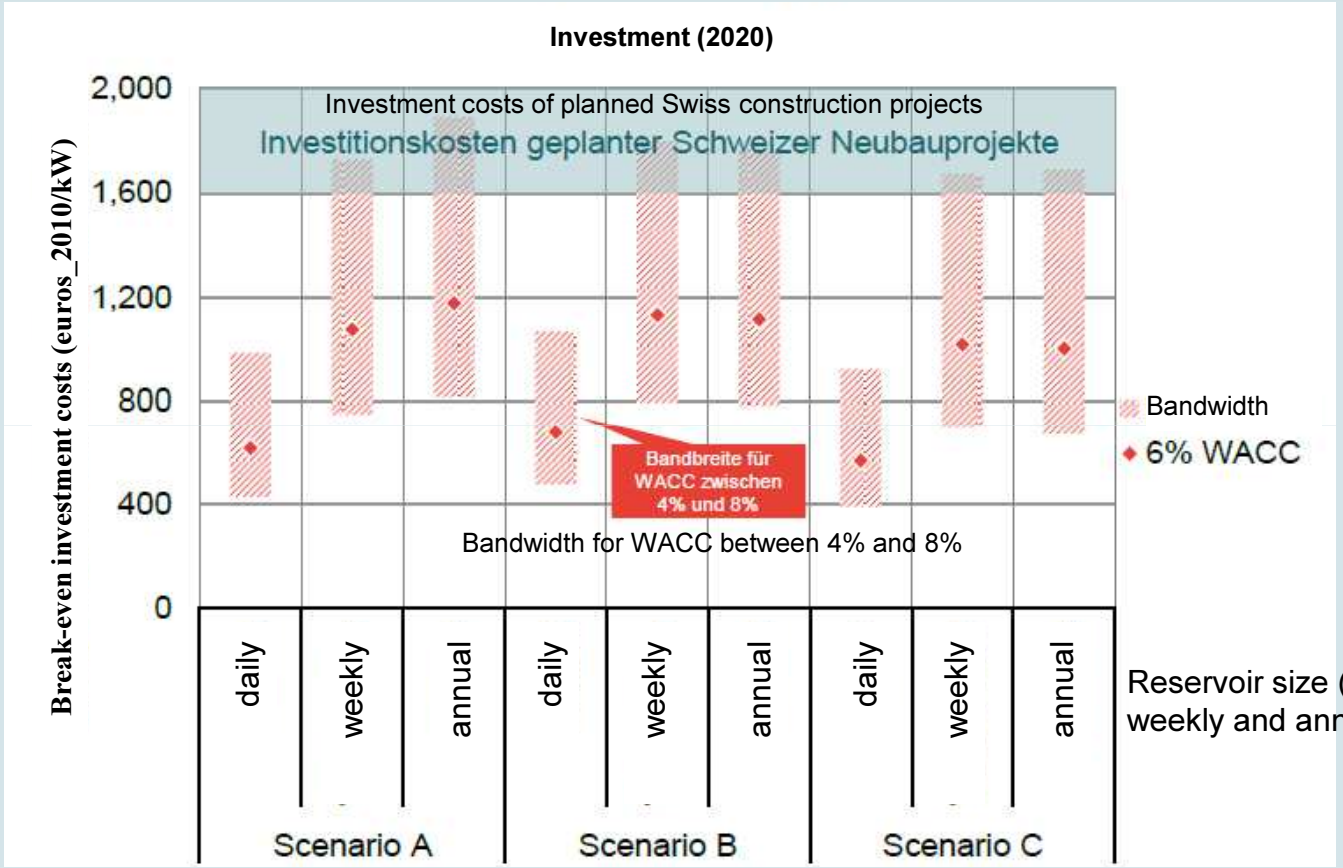
Theoretical storage requirement at system level with and without cross-border exchange in 2050

	Domestic		With exchange		Reduction through exchange	
Scenario	Peak Output [MW]	Storage Capacity [GWh]	Peak Output [MW]	Storage Capacity [GWh]	Peak Output [%]	Storage Capacity [%]
New Energy Policy C&E	8025	680	6850	62	15	90
Political Measures C&E	8082	680	6850	64	15	90
Business as Usual-C	1600	10	0	0	100	100

Quelle: DNV KEMA (2013)

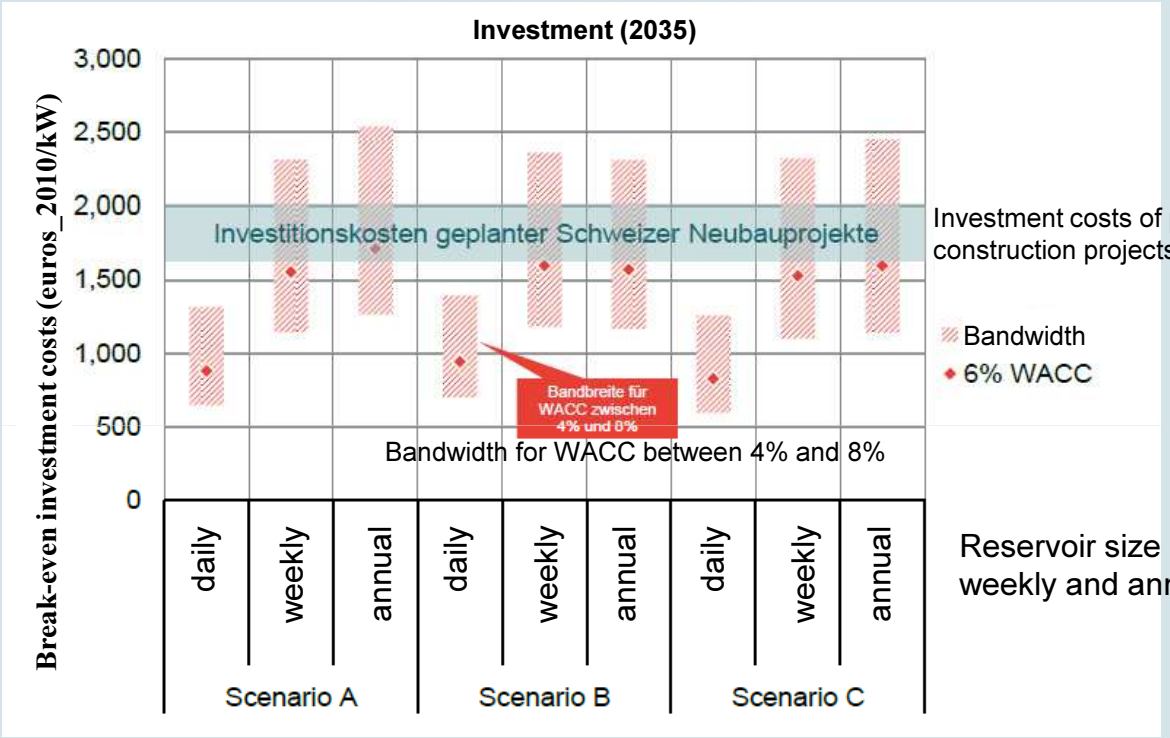
- Significant reduction of storage requirement at system level thanks to inclusion of interconnector capacities resulting from exchanges with neighbouring countries.
- **Coordination** of increase in storage capacities: Declaration by Germany, Austria and Switzerland regarding a joint initiative to develop additional pumped storage power plants.

Pumped storage projects are at risk in the short to medium term (up to 2020)



Source: Frontier Economics and SwissQuant Group (2013)

Greater economic viability to be anticipated in the long term (after 2020)

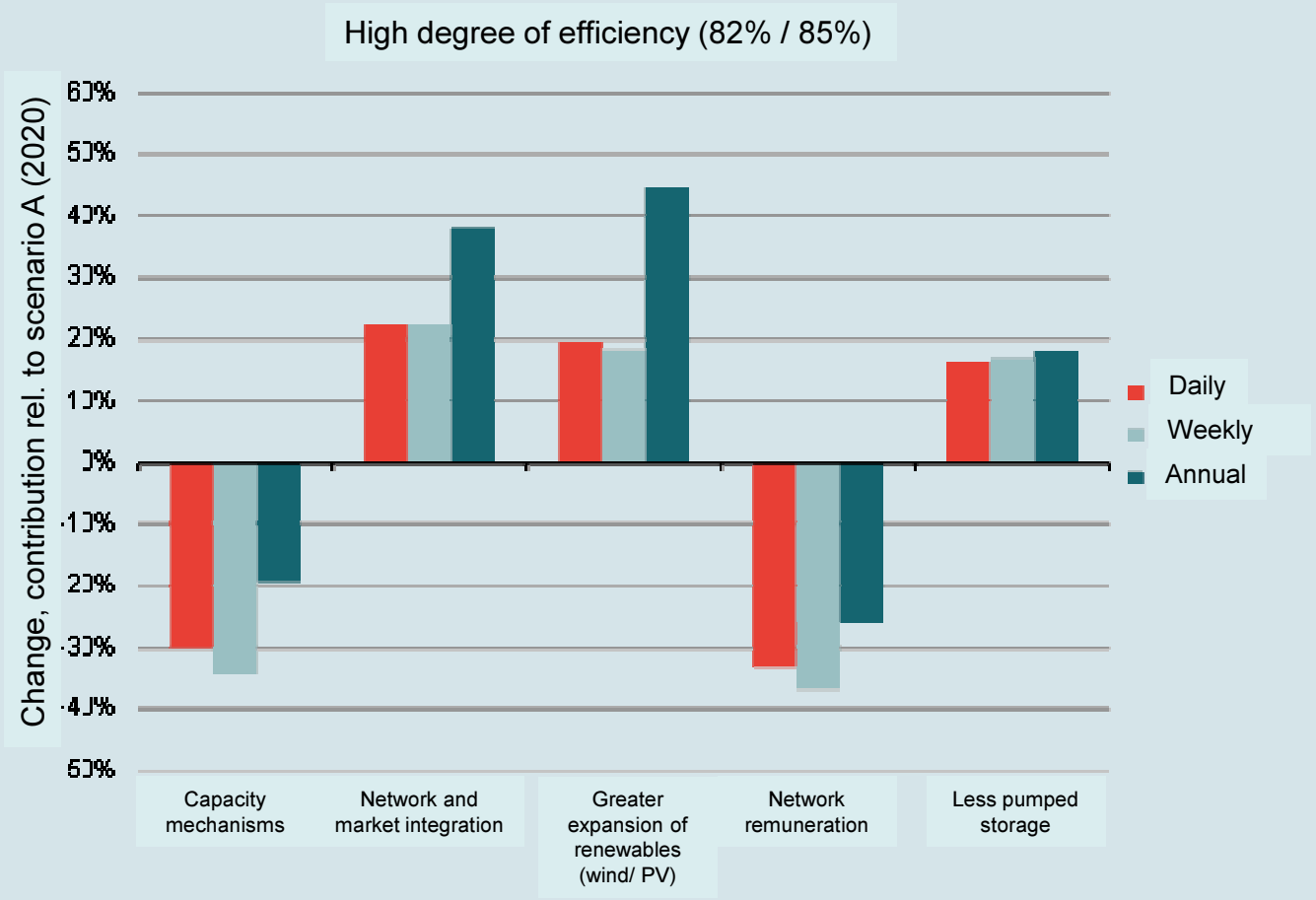


Source: Frontier Economics and SwissQuant Group (2013)

Despite the assumed comprehensive expansion of networks, electricity tariff volatility – and thus storage value – increases in Switzerland's electricity system, driven by:

- The further expansion of wind and photovoltaic energy in Europe;
- Higher hourly electricity prices without feed-in of wind and photovoltaic energy.

Regulatory framework has a major influence on the viability of pumped storage power plants



Source: Frontier Economics and SwissQuant Group (2013)

Conclusions regarding requirement for pumped storage power plants

- Pumped storage power plants are the most efficient and cost-effective available large-scale storage technology.
- Pumped storage power plants are an important technology for integrating new renewable energy forms.
- However, other flexibility options represent alternatives and competition to pumped storage:
  - Greater flexibility of demand
  - Demand-based production, e.g. from gas turbines or through greater controllability of renewable energy
  - Network expansion and market integration
  - Other storage technologies

Thank you for your kind attention!