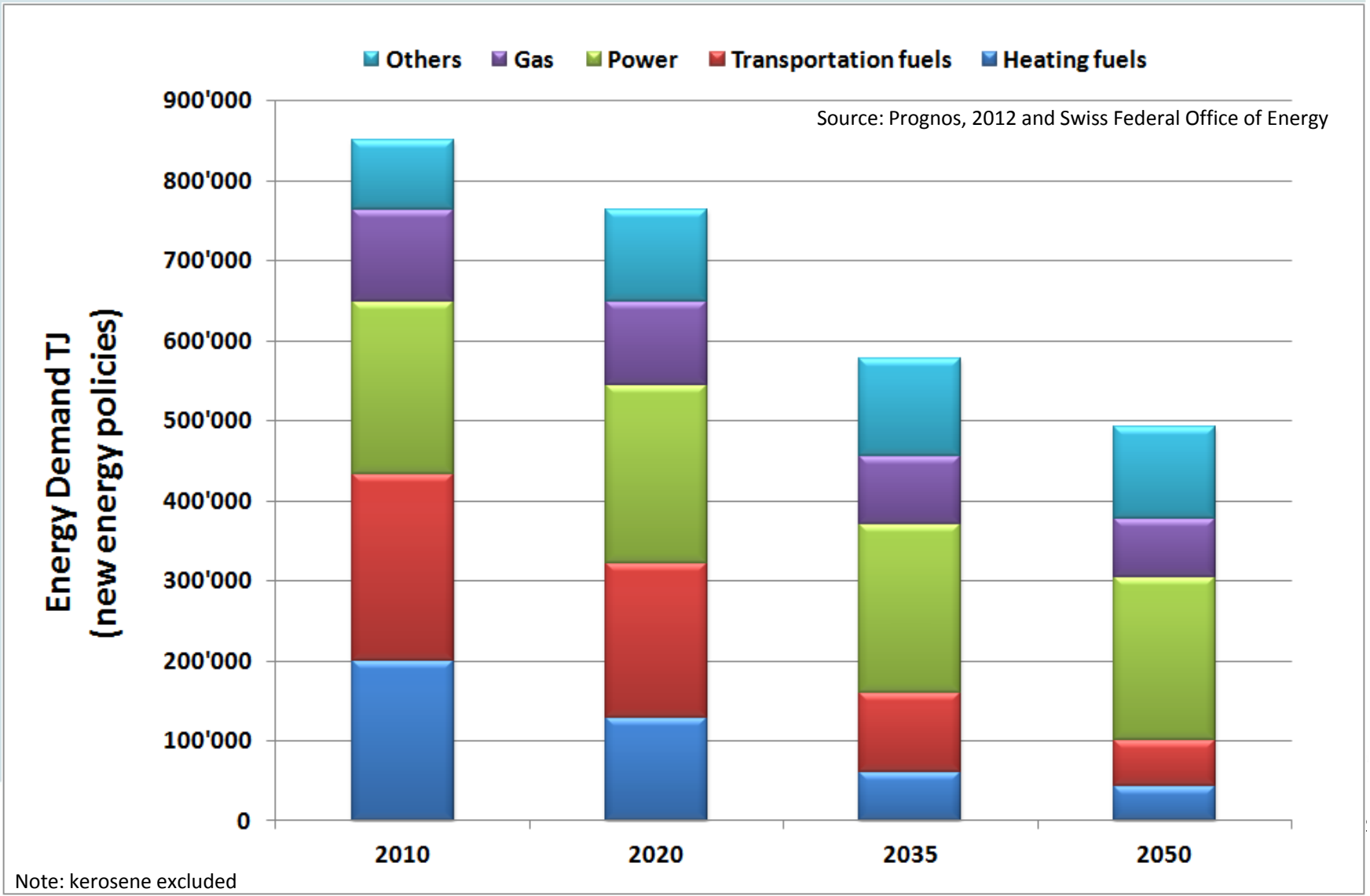
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Office fédéral de l'énergie OFEN
Ufficio federale dell'energia UFE
Swiss Federal Office of Energy SFOE

Switzerland's Perspectives on Energy Storage

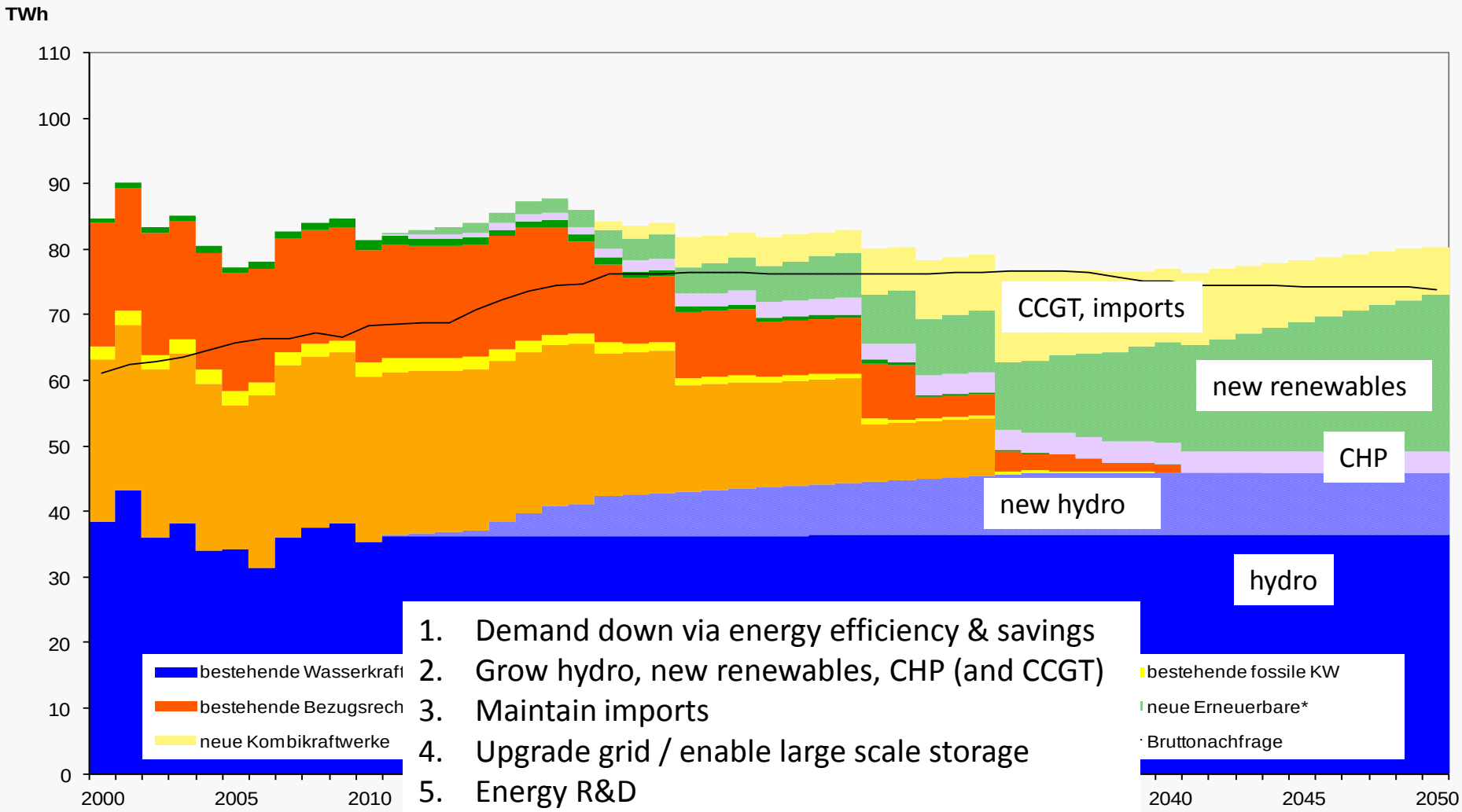
Gunter Siddiqi, Michael Moser, Aurelio Fetz (Swiss Federal Office of Energy)

Technology (e.g. renewables, Fukushima) and external factors (e.g. MENA) impact scenarios for future energy demand



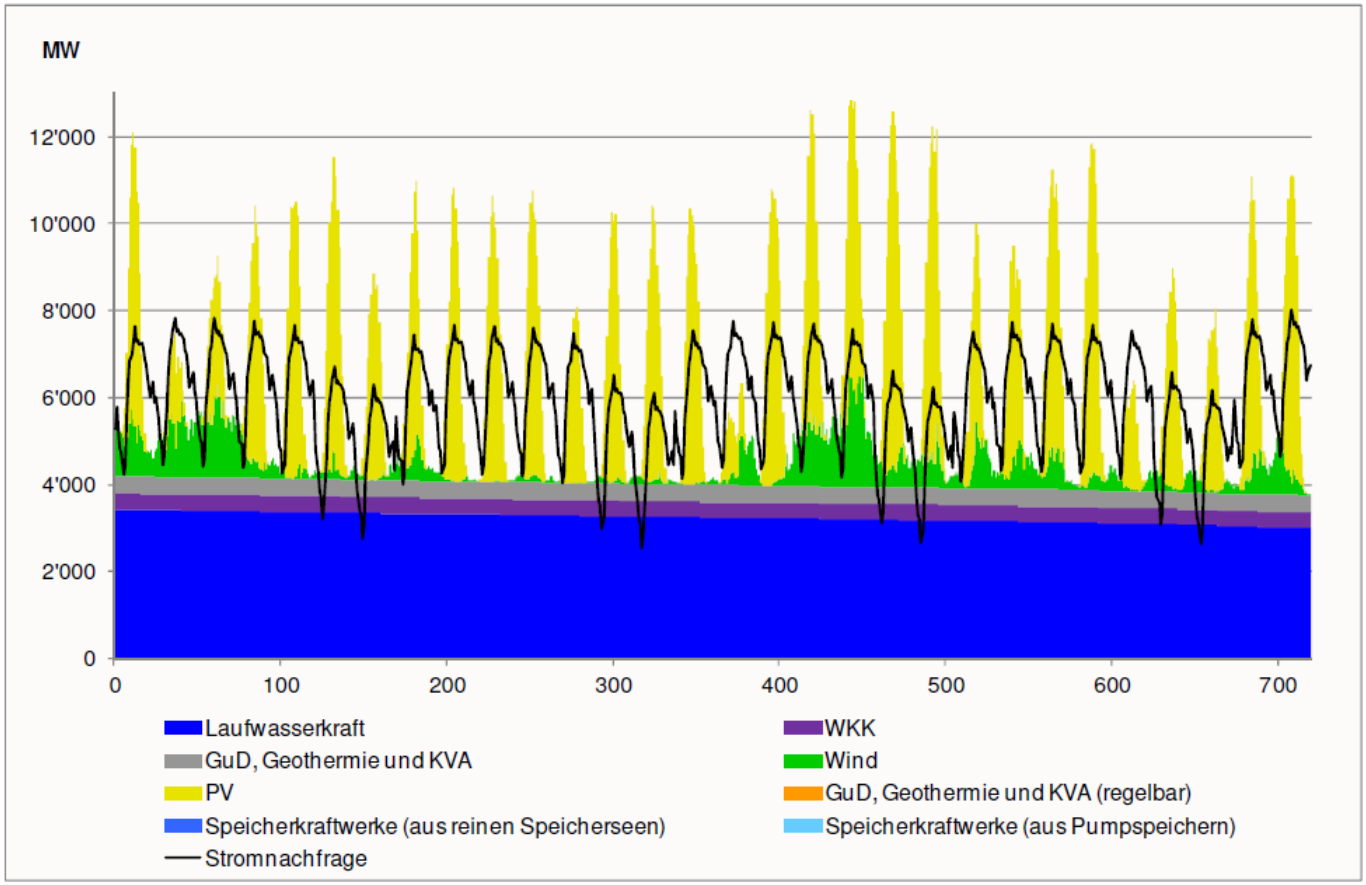
Note: kerosene excluded

Scenario for future power supply and demand in Switzerland – drive the development of energy policies



Energy Storage (e.g. in the power sector) is key for large scale uptake of new renewables & participation in European markets

Figur II.3-22: Szenario „Neue Energiepolitik“, Variante C&E Stromerzeugung durch Grundlastkraftwerke und Erneuerbare und Stromnachfrage im Juni 2050, in MW



Quelle: Prognos 2012

Energy storage in Switzerland – establishing the need, scoping the economics and identifying the appropriate framework

Ongoing framework study (to be finalized by Q4-2013)

- Trends to 2050 in technology and cost
- Analysis of energy storage demand in Switzerland against the backdrop of the scenarios of the energy strategy 2050
- Grids, markets and recommended actions for Switzerland

Assessment of Switzerland‘s pumped storage hydro power generation

- Role of pumped storage within the framework of Switzerland‘s energy strategy 2050
- Commercial viability of Swiss pumped storage hydro power generation and the commercial drivers
- Optimal regulatory framework against the backdrop of Switzerland‘s energy strategy 2050

Framework for Research, Development & Deployment

Studies:

- Technology review
- Need of storage for Switzerland
- Potential of demand-side participation
- Operational concepts / grid integration
- Regulatory framework

Behaviors:

- Incentives for demand-side participation

Technologies / Piloting:

- Batteries ($NaNiCl_2$)
- NaMCl batteries for grid-use
- Solar-thermal storage
- Electro-thermal energy storage (ETES)
- Adiabatic compressed air energy storage (ACAES)
- Deep-underground thermal storage
- Production and storage of hydrogen
- Pumped storage hydro
- Power-to-gas

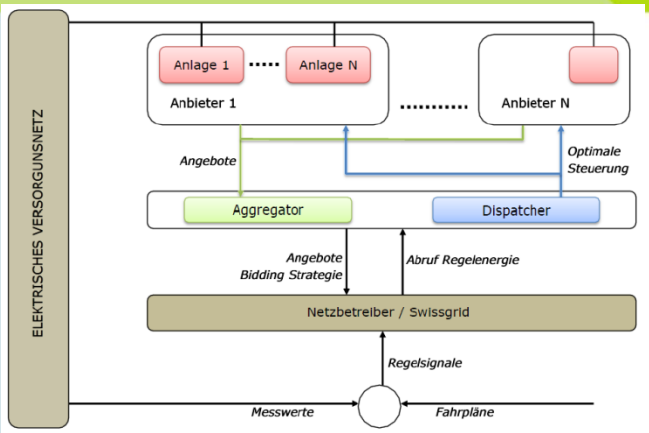
Enabling Technologies

- Power electronics
- Load-management of large infrastructure
- Fuel cells
- Integration of hydrogen in mobility

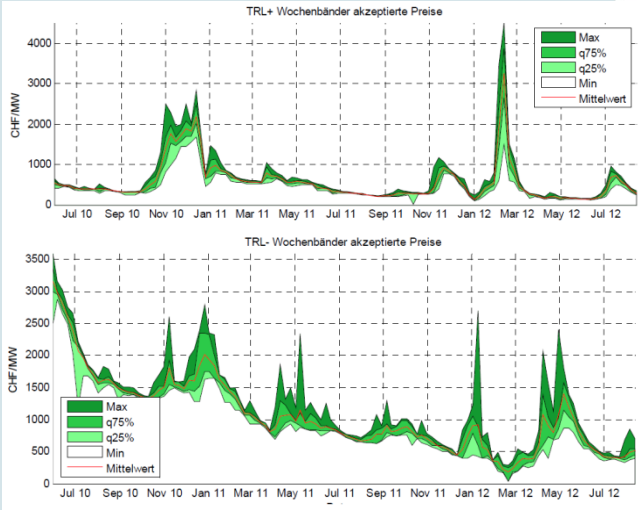
Integration and management of heat/cold storage for grid balancing power

«WARMup» (R&D)

- Goal: Development of a control system that utilizes a pool of thermal storage devices to balance the electrical grid: determination of the storage potential, development of simulation tools, and establishing boundary conditions for the flexible deployment of heat storage pool (load shift, storage and balancing power)
- Project partners:
  Misurio, Elimes, IBM, ewz, EnAlpin,
  ETHZ, HES-SO VS, Cimark, BFE
- Period:
  2012-2013



Quelle: Misurio/ETHZ

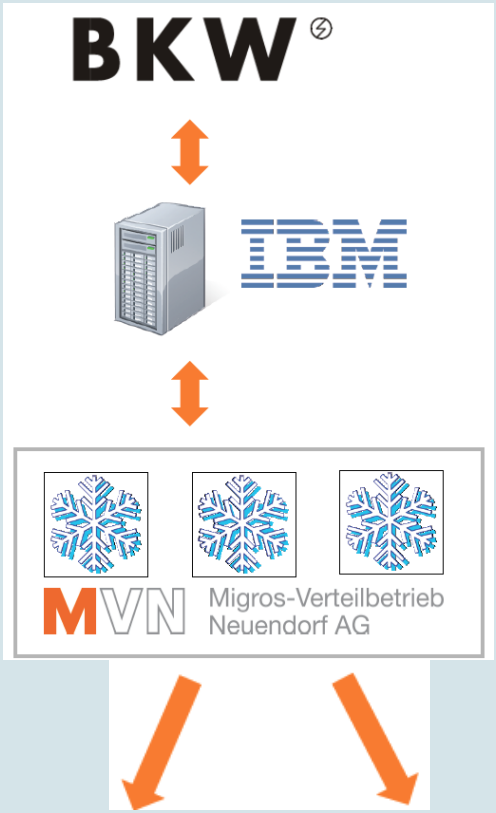


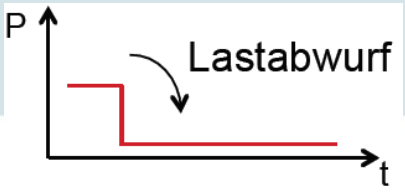
Systems services / Load transfer

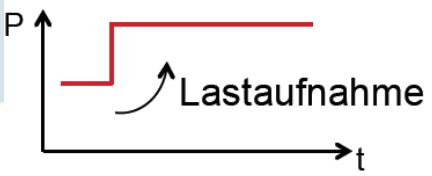
«FlexLast» (P&D)

- Goal: Demonstrate supply of balancing power through dynamic load management of large consumers (here: refrigerated warehouses)

- Project partners:
  IBM, Migros, BKW, Swissgrid,
  BFE
- Period:
  2012-2013







Source: IBM

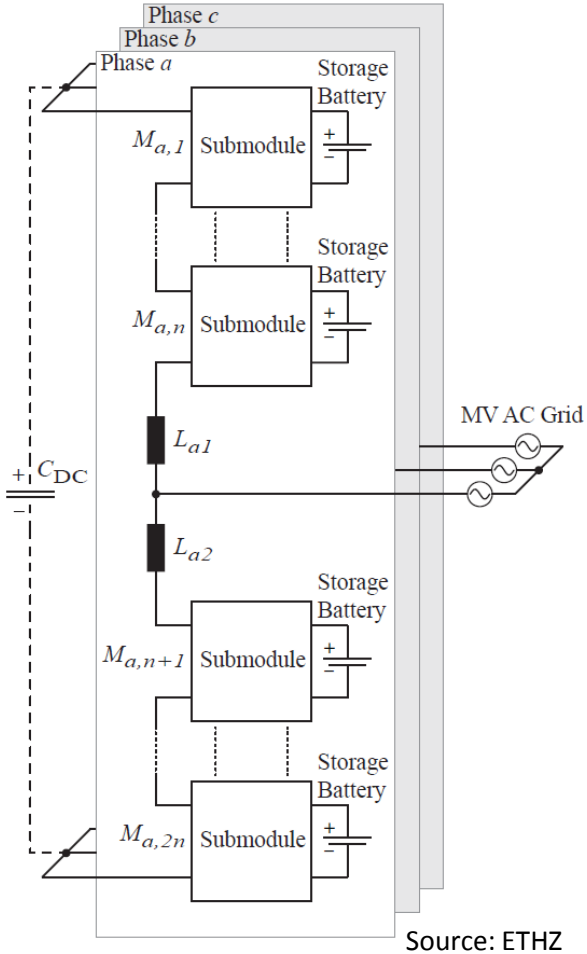
Battery storage

«Power Electronic Converter Systems for Modular Energy Storage based on Split Batteries» (R&D)

- Goal: Development, optimization and verification of new power electronics systems for modular battery storage solutions in a medium voltage grid. Construction of a 3 kV, 100kW, 25 kWh prototype (reduced power level).

- Project partners:
  ETH Zürich, ABB, BFE
- Period:
  2012-2015

Source: EKZ



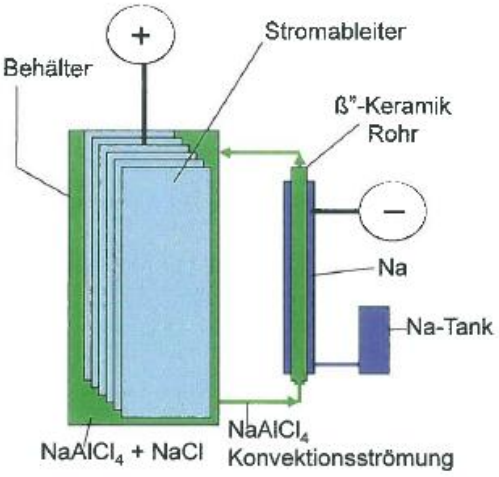
Source: ETHZ

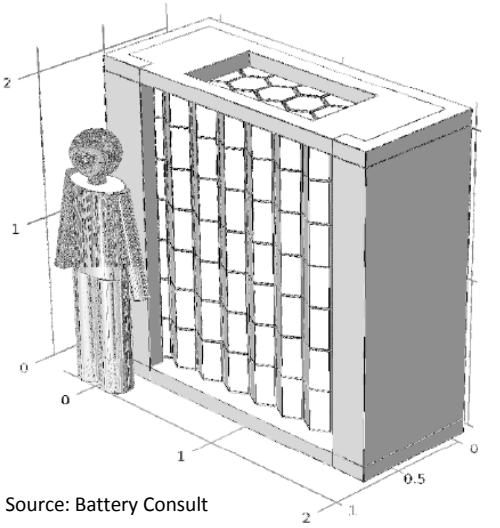
Flow batteries

«Flow battery based on a $NaMCl_2$ salt» (R&D)

- Goal: Development of a flow battery concept based on Al and NaCl as active components and a β‘‘-alumina electrode. Optimization for stationary applications. Construction of a 100 kW, 200 kWh prototype.

- Project partners:
  Battery Consult, PSI, BFE
- Period:
  2012-2015



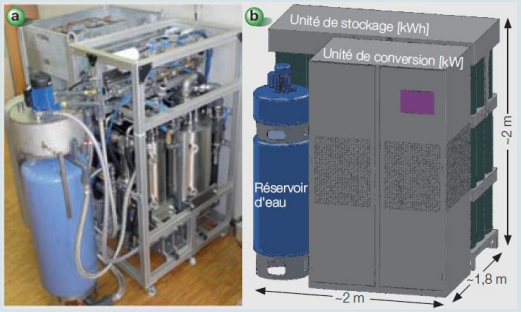


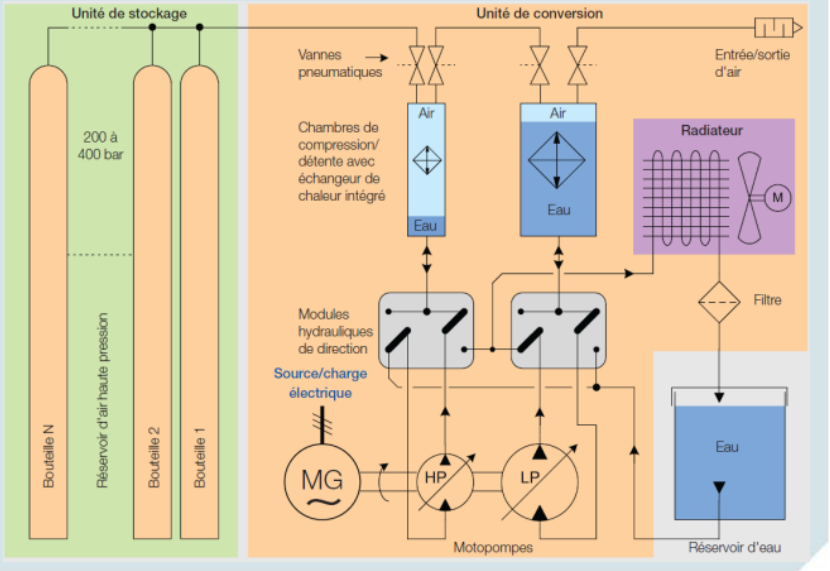
Source: Battery Consult

Example of compressed air energy storage

«Réalisation d'un Prototype de Système de Stockage Hydropneumatique d'Energie» (R&D)

- Goal: Verification of an isothermal compressed air storage concept. Construction and performance monitoring of a 15 kW, 30 kWh prototype
- Project partners: Enairys Powertech, BFE
- Period: 2008-2012



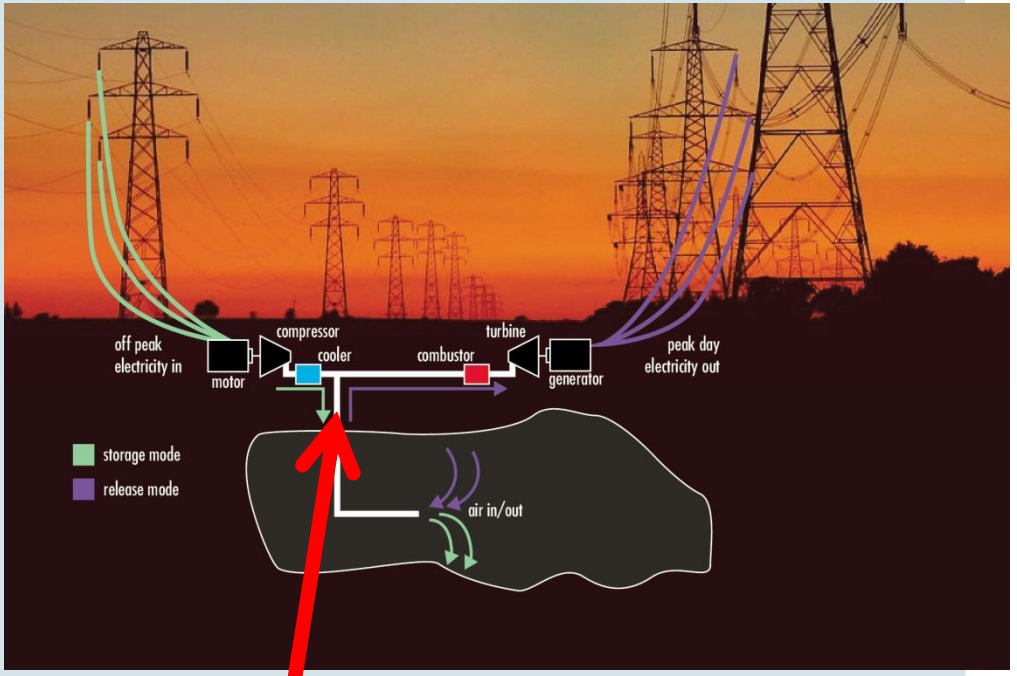


Souce: Enairys Powertech

Compressed air energy storage (Outlook – pilot project)

«Advanced Adiabatic Compressed Air Energy Storage» (AA-CAES)

- Goal: Verification of an adiabatic compressed air energy storage concept in combination with heat storage. Construction of a pilot project in tunnel shaft.



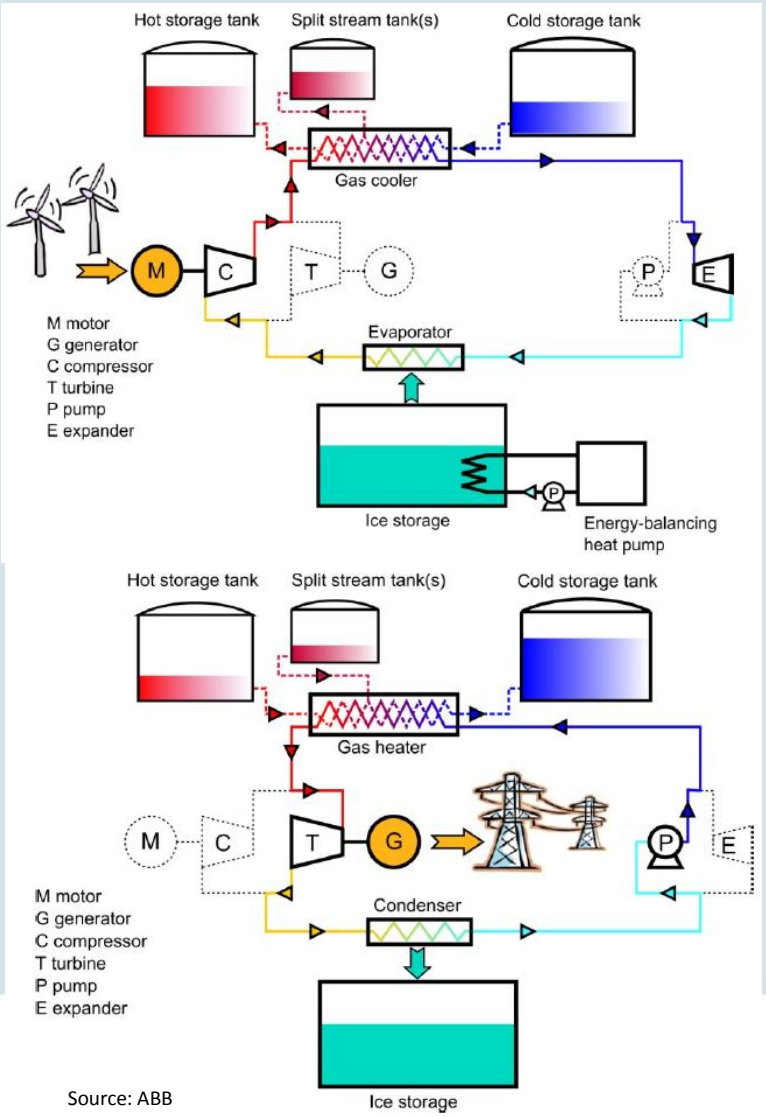
Source: Urner Wochenblatt, Airlight Energy

Estimated conversion efficiency:
75-80% !

Electrothermal energy storage (Outlook – pilot project)

«Piloting ETES»

- Goal: Verification of a new concept for electrothermal energy storage concept using (i) reversible heat pumping using vapor compression, (ii) thermal energy storage, and finally (iii) back conversion of thermal energy into electricity via a thermal engine.
- Storage medium: water; working medium: transcritical CO_2.
- Scalable from pilot of 5 MW / 20 MWh
- Compact lay-out covering 2000 m^2
- Highly dynamic (minutes) and adequate efficiencies expected (60-70%)



Source: ABB