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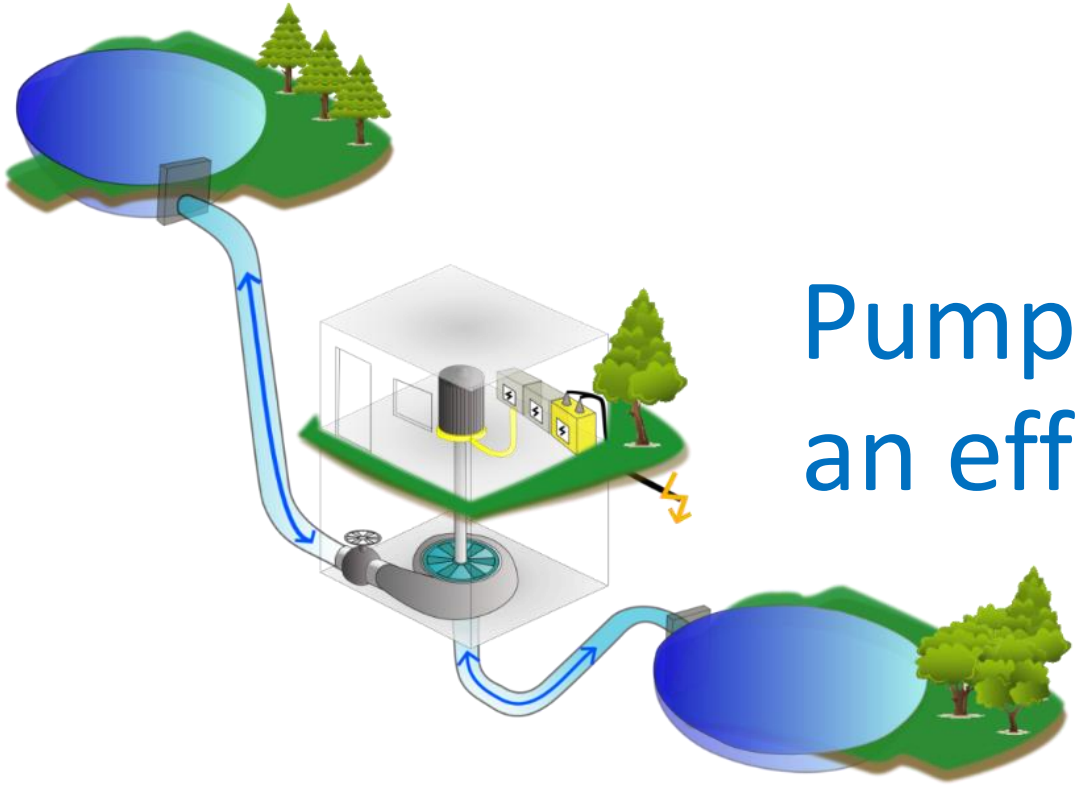
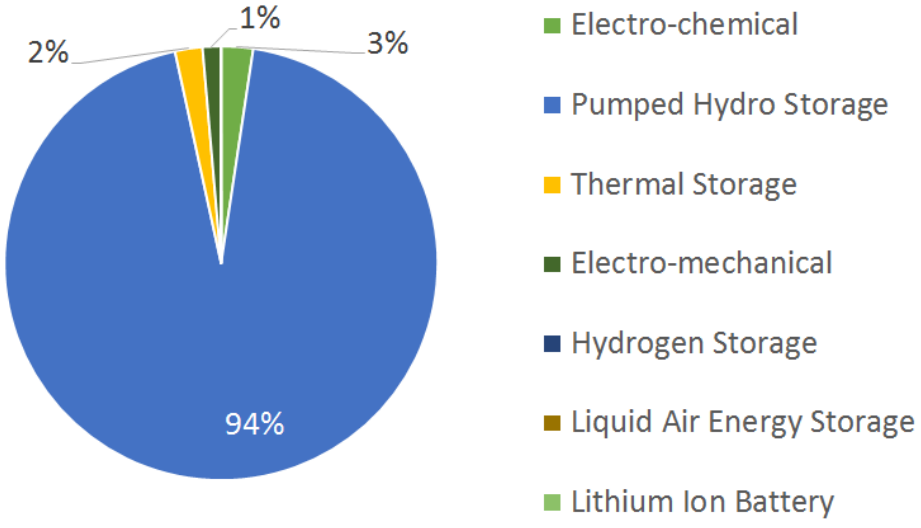
Hochschule für Ingenieurwissenschaften



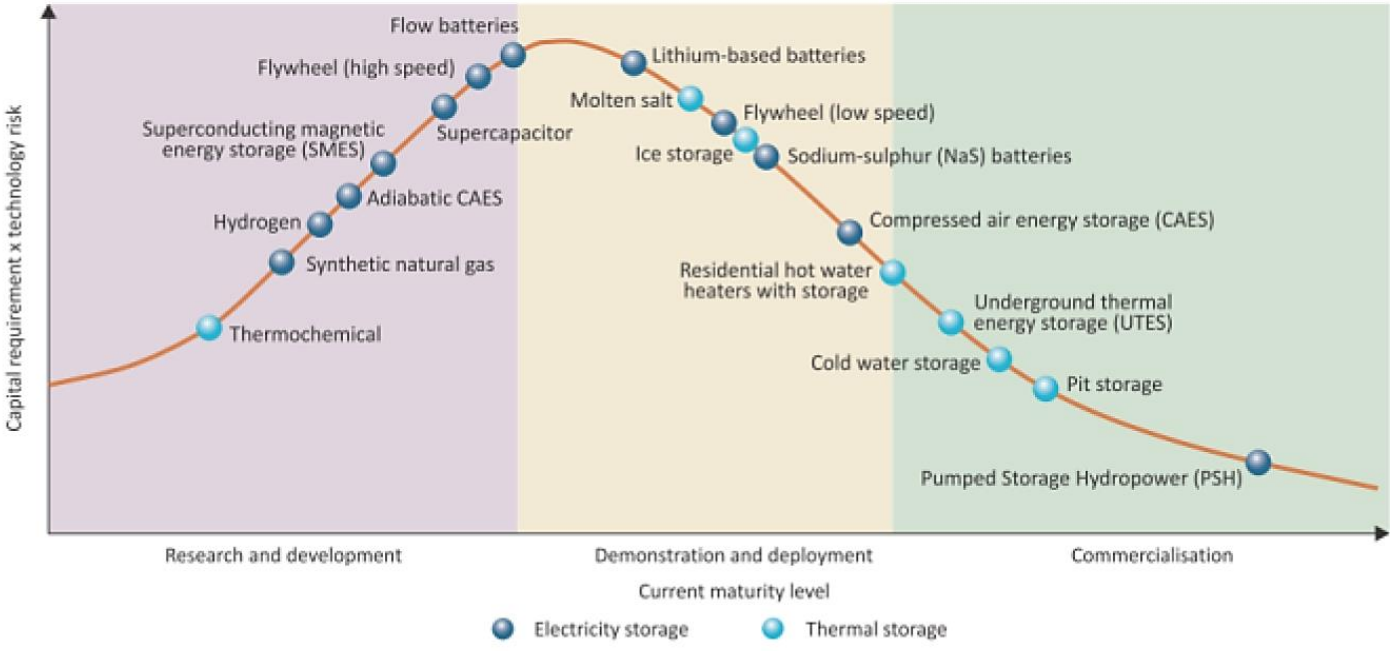
Pumped storage, large or small, an efficient way to store energy

Prof. Cécile Alligné-Münch
Hydroelectricity Group
HES SO Valais

Storage technologies ?

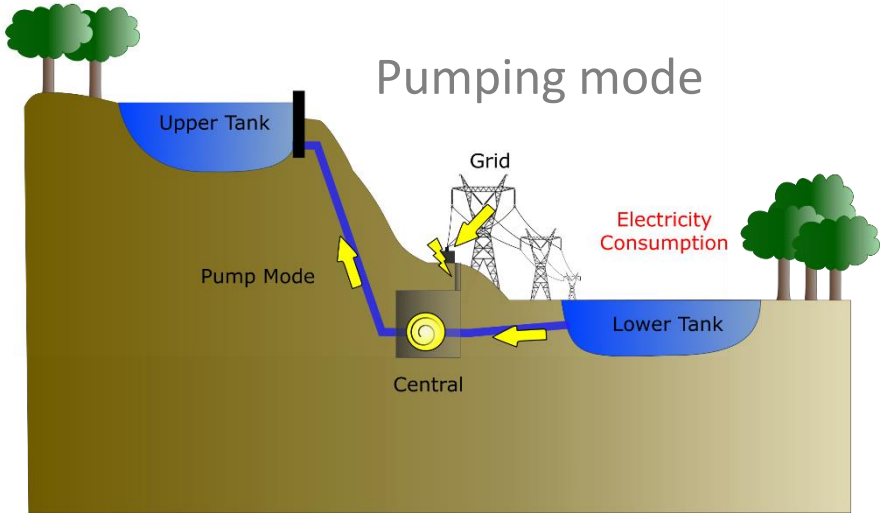


Source : DOE Database, 2018



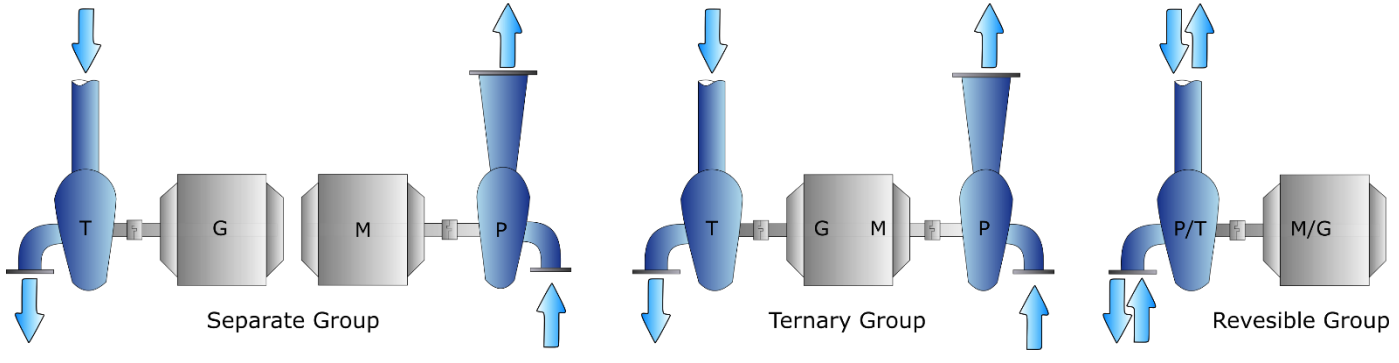
Source: Decourt, B. and R. Debarre (2013), "Electricity storage", *Factbook*, Schlumberger Business Consulting Energy Institute, Paris, France and Paksoy, H. (2013), "Thermal Energy Storage Today" presented at the IEA Energy Storage Technology Roadmap Stakeholder Engagement Workshop, Paris, France, 14 February.

Pumped storage



- ✓ Large storage capacity
- ✓ Flexibility
- ✓ Ancillary services to the grid

- ✓ High efficiency ~ 80%
- ✓ Reliable technologies
- ✓ Competitive costs



Pumped storage : Switzerland & US

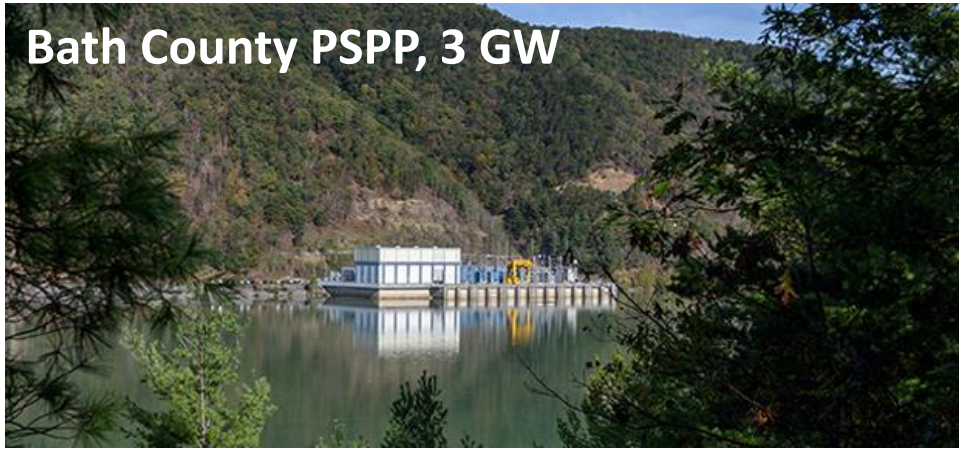
In Switzerland, 3 large recent projects:

- ✓ FMHL : + 240MW
- ✓ Linthal : + 1’000 MW
- ✓ Nant de Drance : + 900 MW

Source : Axpo

In US

- ✓ 40 operational power plants
- ✓ 20 GW of installed power
- ✓ 95 % of the US storage capacity



Source : Dominionenergy

Pumped storage : Small scale ?

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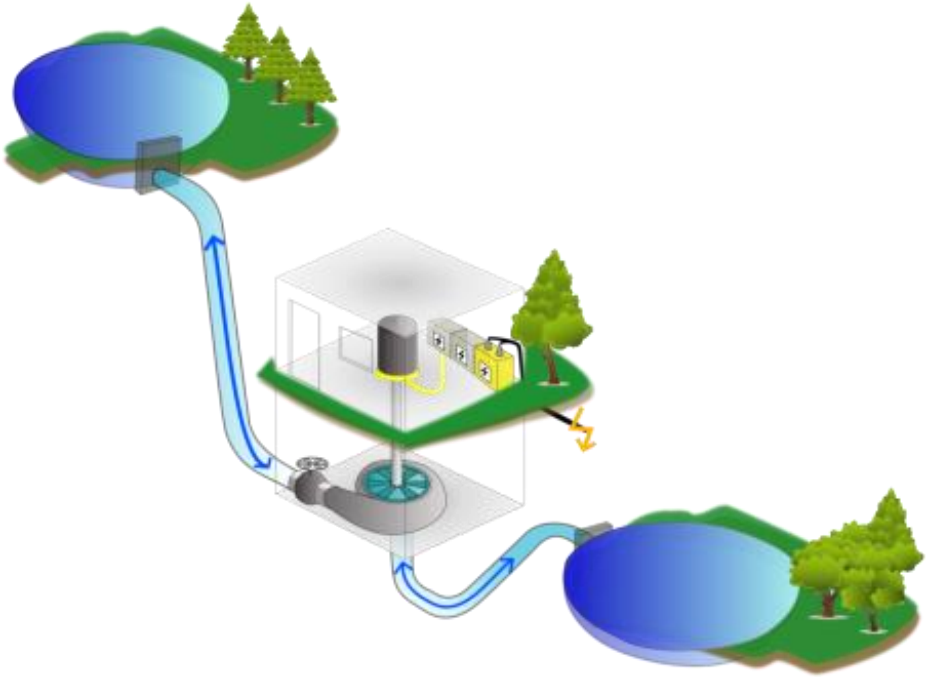
Specifications:

- ✓ Installed power between 1 MW and 10 MW
- ✓ Storage capacity between 1h and 12h
- ✓ 1 to 2 cycles per day

Advantages:

- ✓ Decentralized storage
- ✓ Balance energy at a local scale
- ✓ Peak power erasure
- ✓ Ancillary services to the grid
- ✓ Hybrid renewable energy production and storage
- ✓ New "label of origin"
- ✓ Multi-usage of existing reservoirs



Sites identification : Existing reservoirs !

Pumped storage : Small scale ?

Study on 20 potential sites in Valais/Vaud:

Example: Montana – VS

Two existing reservoirs : 100’000 m^3 /185’000 m^3
Storage capacity: 7 MWh
First costs estimation: 8 MCHF

Mean costs for the 20 sites :

- Existing reservoir : 3’300 CHF/kW
- Existing turbine or pump : 2’000 CHF/kW

Large Hydro: 500-2’500 CHF/kW

Small pumped storage …
… a competitive & renewable option !