Battery materials and technologies for energy storage

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Battery Materials and Technologies group

- University lecturer Ulriika Mattinen
 - PhD Åbo Akademi
 - Post-doc KTH, Stockholm
 - Sensors for Li-ion batteries
- 6 PhD students + 1 post-doc
- Hiring 1-3 PhD students and 1-3 post-docs





German Electricity production

Electricity production and spot prices in December 2016



🚺 usage tips



https://www.energy-charts.de/index.htm

German Electricity Production

Electricity production and spot prices in January 2017





https://www.energy-charts.de/index.htm

German Electricity production

Electricity production ans spot prices in Germany in May 2018



Datasource: 50 Hertz, Amprion, Tennet, TransnetBW, EEX, EPEX Last update: 02 Jun 2018 01:10

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Why we need energy storage?





Energy storage



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https://www.iea.org/tcep/energyintegration/energystorage/





Pump Hydro Nant de Drance

Efficiency 80%



- L'eau est turbinée lorsque les besoins en électricité sont importants pour fournir de l'énergie de pointe.
- Lorsque les besoins en électricité sont moindres ou que la production issue des nouvelles énergies renouvelables est excédentaire, l'eau est pompée du barrage inférieur vers le barrage supérieur pour stocker de l'énergie.
 - 1. Lac de Vieux-Emosson 2. Puits verticaux 3. Cavernes (machines et transformateurs)
 - 1. Galerie d'accès principale depuis Châtelard 2. Galerie d'accès et ventilation
 - 3. Galerie d'accès aux installations supérieures

2 billions CHF investment

Lifetime 80 years 900 MW, 19 h



Energy storage

Storage reached 15 300 MWh as of 2017.



https://www.iea.org/tcep/energyintegration/energystorage/



Li-ion battery





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MIT Review

Cathode on aluminum

Separator

Anode on copper foil Separator Foil pouch

Anode

Results:







Single 18650 Li-ion cell

Dr Jonathan Buston, HSE Science Division (HSL) Health and Safety Laboratory, UK



Power : Surface area Energy : Volume of the tank













Tima Lora-Substation



80 MWh

Lithium-ion battery storage facility - Collaboration between Southern California Edison and Tesla



Energy

Tesla to build world's biggest lithium ion battery in South Australia

Elon Musk's company Tesla will partner with French utility Neoen to deliver the lithium ion battery designed to improve the security of electricity network



🕖 Elon Musk announces Tesla's plan to build world's biggest lithium ion battery in South Australia



100 MW -129MWh battery paired with a wind farm





Megabatteries : A large choice...



Zinc-Iron redox flow battery



EnergyCell Zinc- Bromine flow battery



Vanadium redox flow battery

Eos Aurora 1000 | 4000 Grid-Scale Energy Storage

Zinc- Air battery







What elements?



Fe, Cr, Al, Mn, Cu, Ti

Organic compounds

Vesborg & Jaramillo, RSC Advances, 2012, 2, 7933-7947

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