



Battery Storage Systems: Market and Technologies

18th National Photovoltaic Conference

13.03.2020, Lausanne

Dr.-Ing. Kai-Philipp Kairies, Jan Figgenger, David Haberschusz, Prof. Dr. rer. nat. Dirk Uwe Sauer

Chair for Electrochemical Energy Conversion
and Storage Systems



A clean energy future needs new flexibilities

Security of supply vs. volatile generation





Power grids

offer spatial flexibility

Storage systems

offer temporal flexibility



A variety of storage technologies...



...for a variety of applications



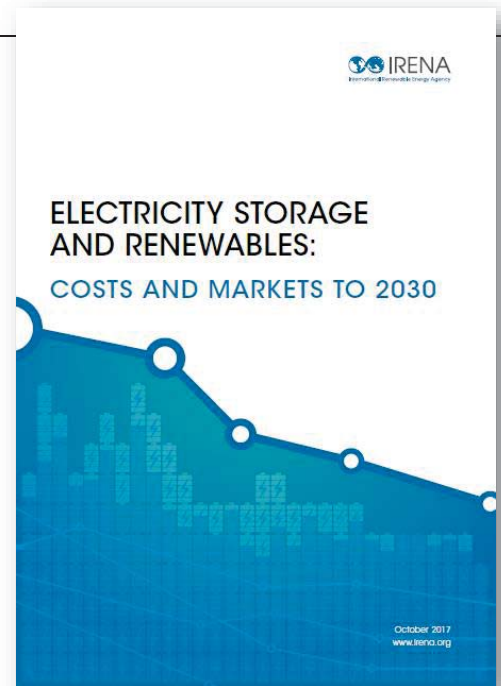
In-depth Information on Electricity Storage

Electricity Storage and Renewable: Cost and Markets to 2030

- Current and future performance and costs of storage technologies
- International markets for storage

- Free download:

<http://www.irena.org/publications/2017/Oct/Electricity-storage-and-renewables-costs-and-markets>



7

03.03.2020 | Kai-Philipp Kairies
Chair for Electrochemical Energy Conversion and Storage Systems

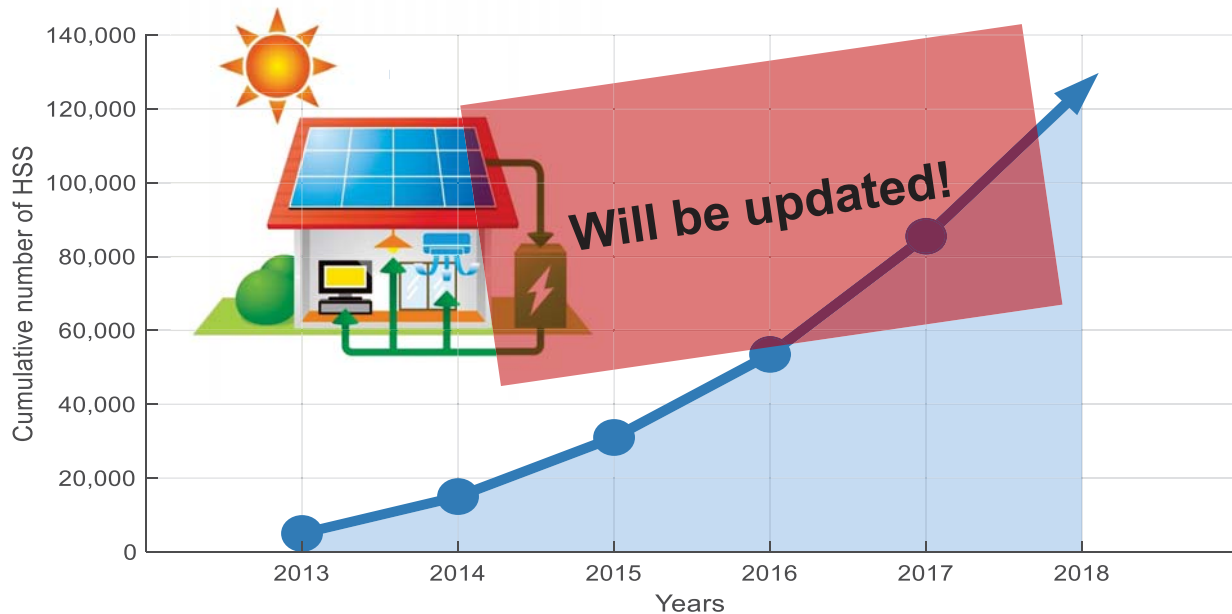


Residential home storage

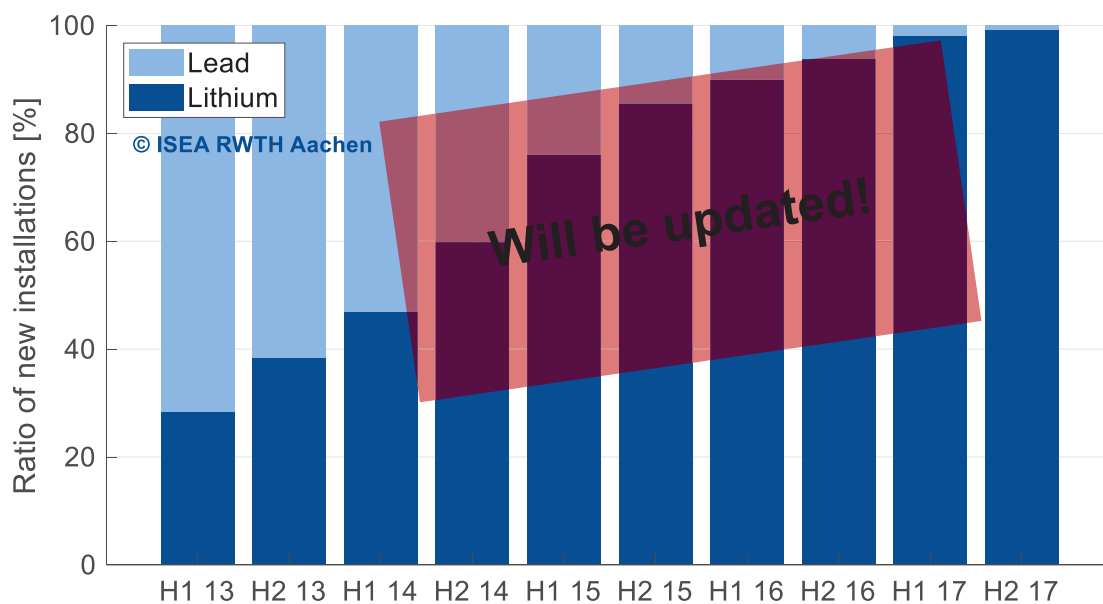
The DIY energy transition



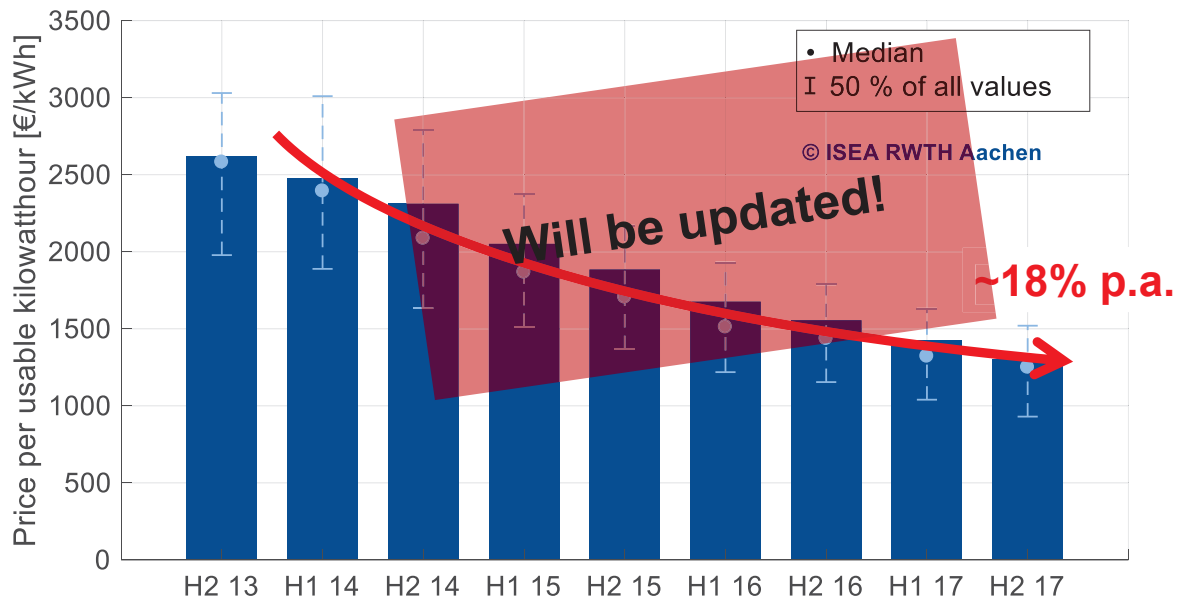
Residential Home Storage: A Booming Market, in Germany and Beyond



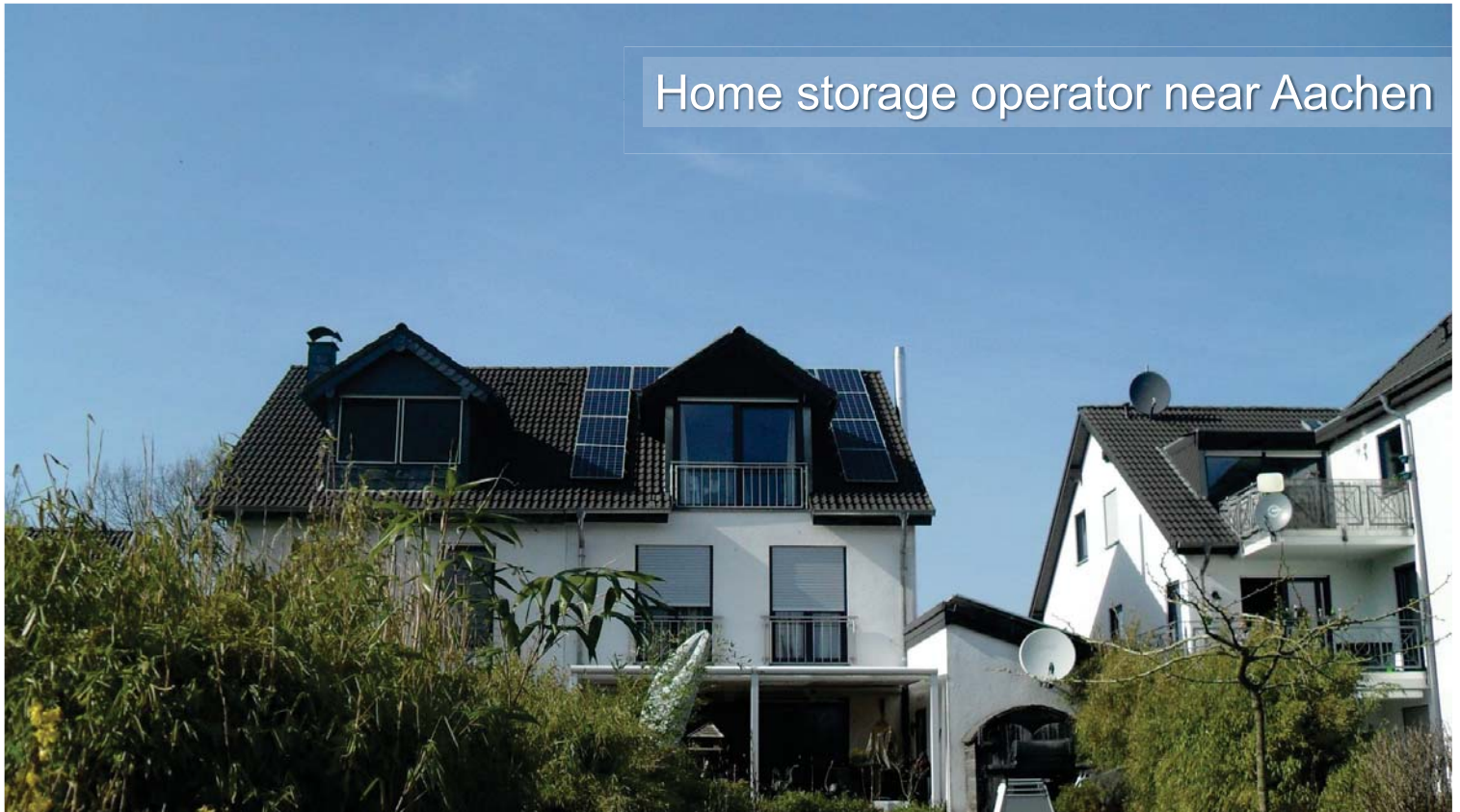
Development of Battery Technologies



Retail Price Development of Home Storage Systems in Germany (incl. VAT)



Home storage operator near Aachen





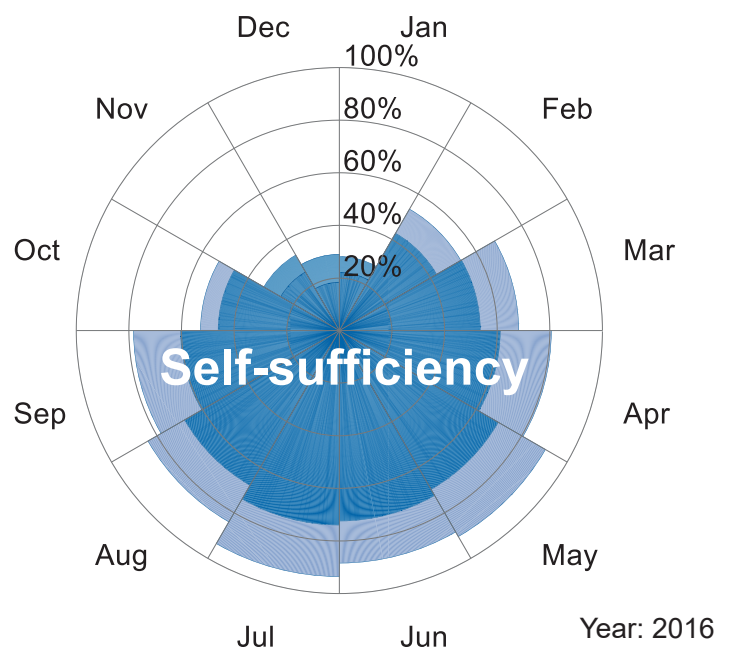
Impact of Home Storage Systems on Electricity Sales



- PV-system:
9,94 kWp



- Storage capacity:
7,02 kWh
- Annual generation: 7.696 kWh
- Annual consumption: 5.114 kWh
- Self-sufficiency w/o storage: 37 %
- Self-sufficiency with storage: **50 %**



Residential Home Storage: Requirements



Typical sizing

- 2...5 kW
- 2...20 kWh



Typical load profile

- ~220 eq. full cycles per year



Additional requirements

- Compact systems
- High safety
- Maintenance free



Storage Technologies

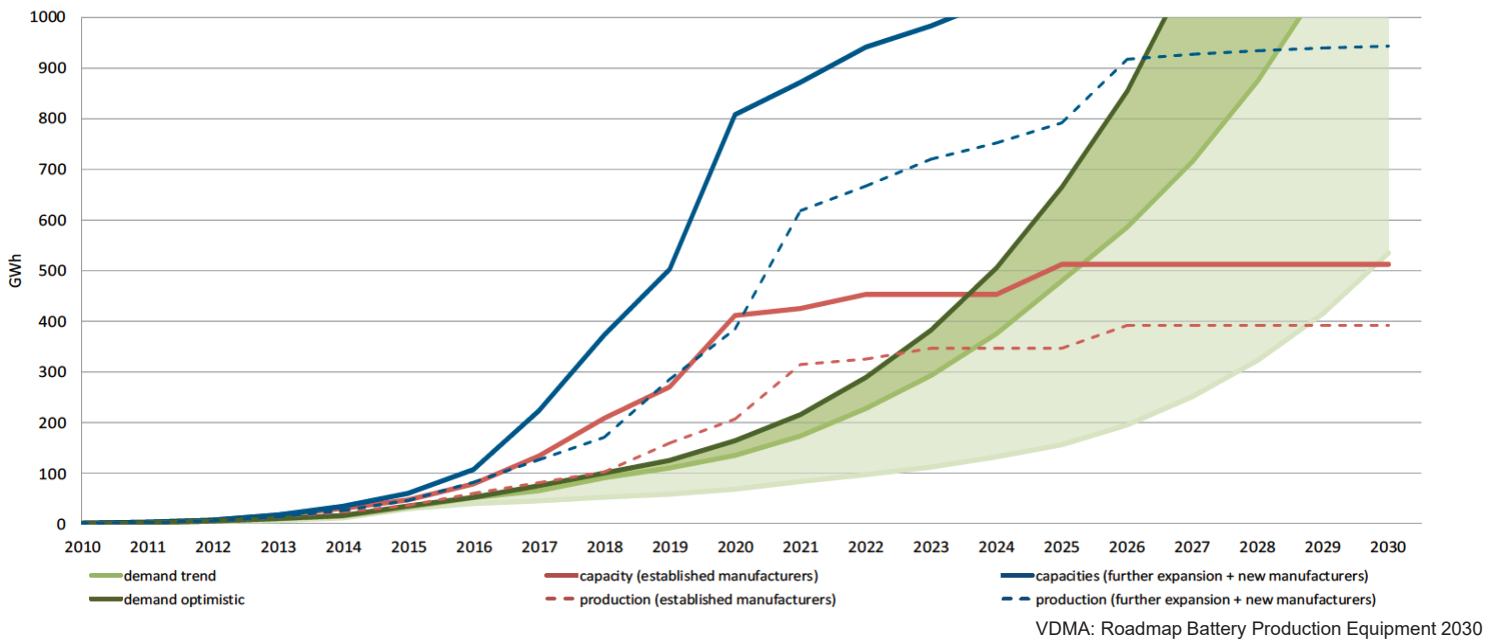
- Lead-Acid Batteries
- Lithium-Ion Batteries
- Redox-Flow Batteries
- High-Temperature Batteries
- Pumped Hydro Storage
- Flywheel
- Thermal Storage
- Power-to-gas

Batteries are everywhere

...but where do they come from?



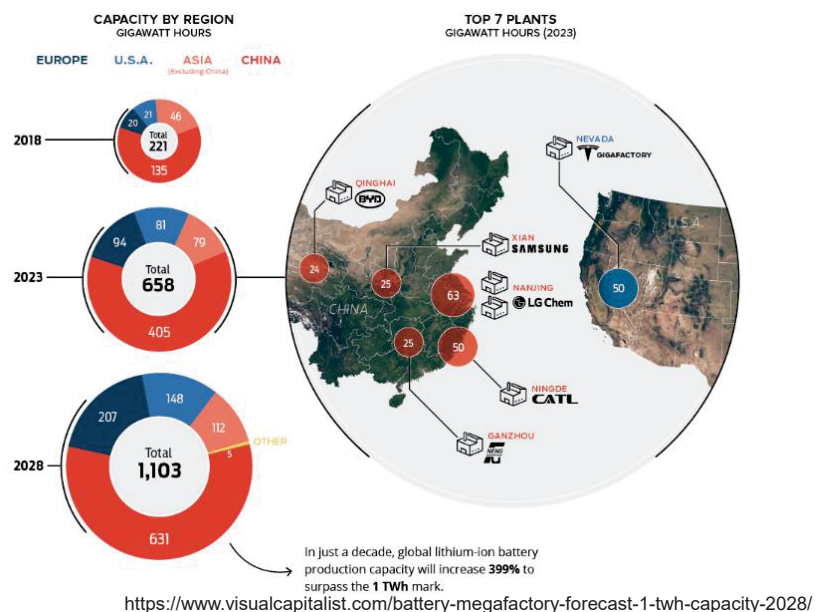
Global Demand and Production Capacities of Lithium-Ion Batteries



17 03.03.2020 | Dr. Kai-Philipp Kairies, Jeanette M nderlein, Michael Merten
Chair for Electrochemical Energy Conversion and Storage Systems

Global Lithium-Ion Battery Cell Production Capacities: China and US

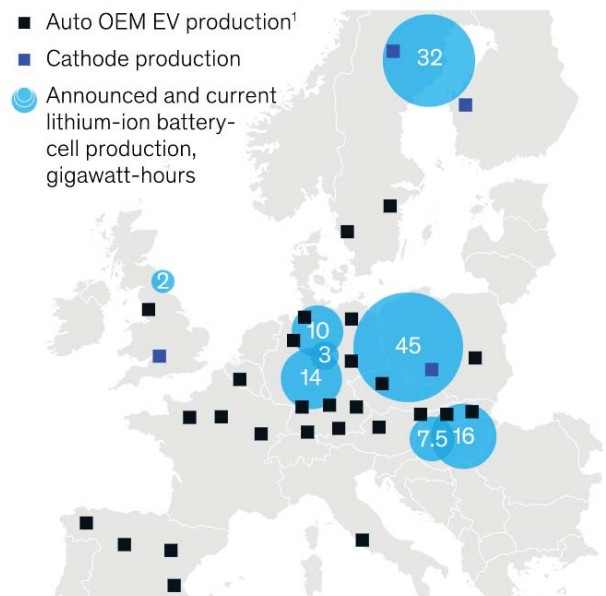
- The international battery market is dominated by Asian companies.
 - 6 out of 7 of the top production plants are located in China
 - Chinese market share will be above 60% in the short- and long-term
- The Tesla Gigafactory 1 today as a production capacity of all battery factories in Europe, combined.



18 03.03.2020 | Dr. Kai-Philipp Kairies, Jeanette M nderlein, Michael Merten
Chair for Electrochemical Energy Conversion and Storage Systems

What about Europe?

- Europe is becoming an attractive location for battery cell production due to its strong automotive sector.
 - Main motivation: Reduce costs of logistics.
- Many international companies are currently developing production capacities in Europe:
 - LG Chem is operating a cell production in Poland.
 - CATL will start production of battery cells for the German car industry in Erfurt by 2021.
 - BYD is considering cell production in Europe
 - Northvolt has announced a large-scale “European” battery cell production in Sweden.
 - Tesla recently announced to build its next Gigafactory near Berlin.



Battery Storage Systems: Market and Technologies

18th National Photovoltaic Conference

13.03.2020, Lausanne

Dr.-Ing. Kai-Philipp Kairies, Jan Figgenger, David Haberschusz, Prof. Dr. rer. nat. Dirk Uwe Sauer



Sector Coupling

