

How energy storage applications are finding their role in the energy system

Energy Storage Europe 2018

Düsseldorf

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In Germany, the energy storage market has become an important industry sector

German Energy Storage Market – Key facts & Figures

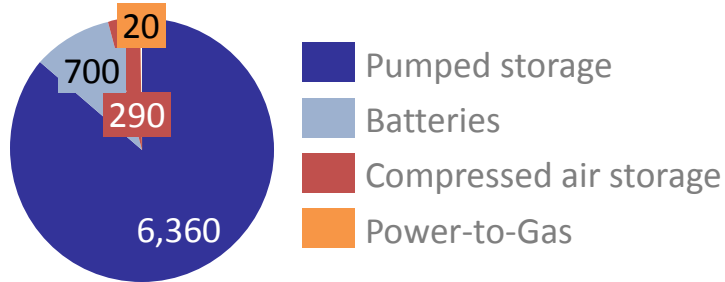


- Revenues of 4.6 bn. € in 2017, in 2018 expected to grow beyond 5 bn. €
- 11,000 employees in 2017
- Half the size of German coal (lignite) industry (in terms of revenue and employees)
- Power storage capacity: 7.4 GW in 2017
- Heat storage capacity: Able to absorb power volume of 30 TWh p.a.
- Significant potential of power and heat storage to play a role in the energy system to solve problems of German energy transition (e.g. load fluctuations, power curtailment)

Source: Analysis of TEAM CONSULT in co-operation with German Energy Storage Association (BVES)

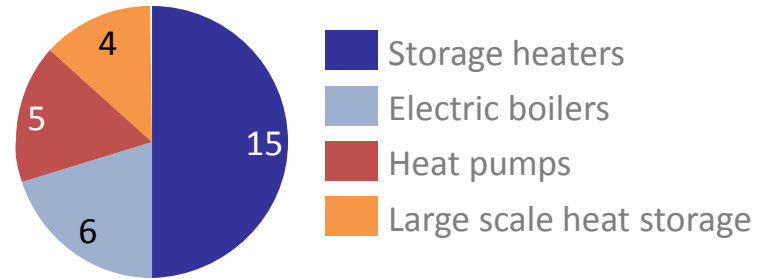
Energy storage appliances play an important role for the German energy system

Power storage (Capacity in MW) 2017



- Installed power storage load: 7,370 MW
- Power storage capacity: ~39 GWh
- Storable power volume: ~9.8 TWh p.a.*
- Corresponds to annual power consumption of ~6.3 million inhabitants**

Heat storage (Power conversion in TWh/a) 2017

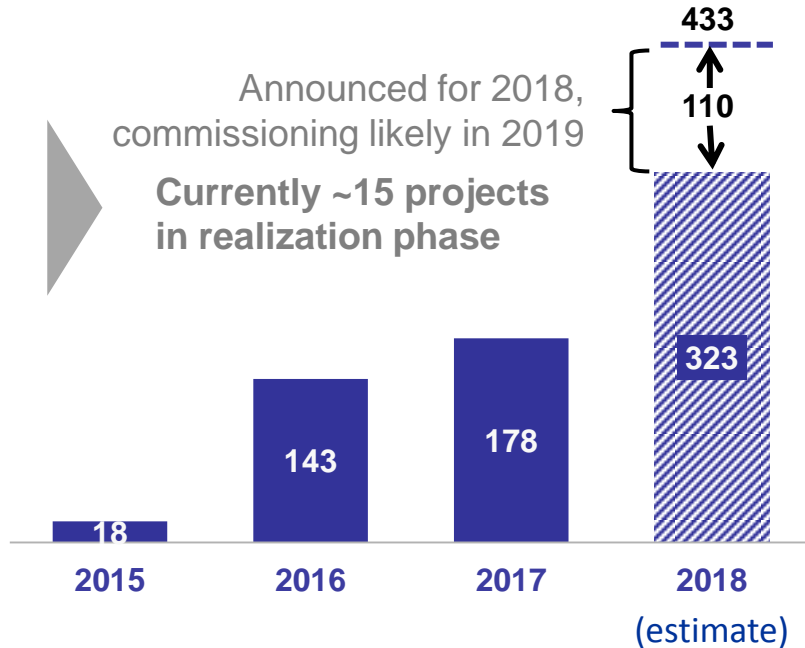


- Around 1.5 million storage heaters, 800,000 el. heat pumps as well as el. boilers and large heat storage
- Power consumption of ~30 TWh p.a.
- Corresponds to annual heat consumption of ~6.8 million inhabitants

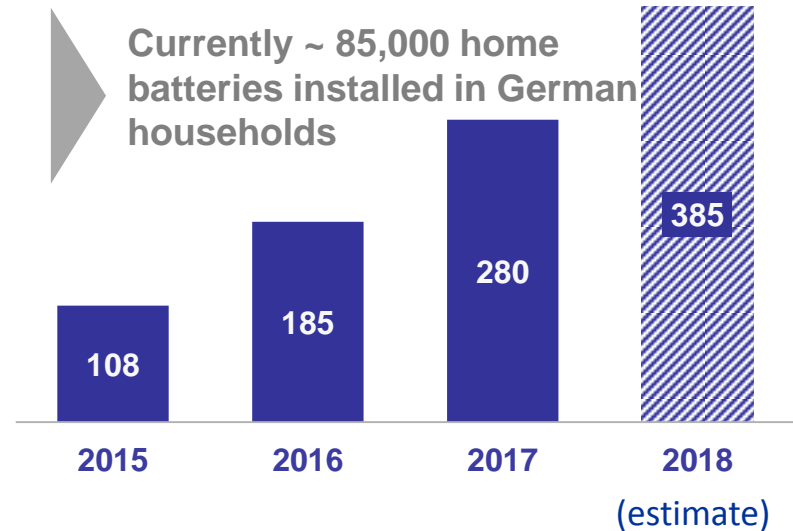
Source: TEAM CONSULT in cooperation with German Energy Storage Association (BVES) * at 250 storage cycles p.a. ** per capita residential power consumption of 1.560 kWh p.a.

Battery capacities have grown / will grow significantly in Germany

Large batteries for grid stabilization (MW)



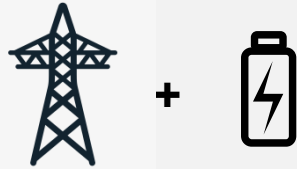
Home batteries (MW)



Source: Analysis of TEAM CONSULT in co-operation with German Energy Storage Association (BVES)

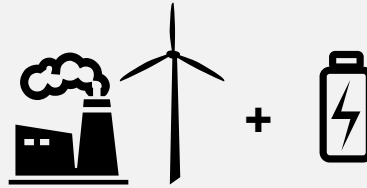
Large scale batteries for systemic application are becoming more popular

Deployment of large scale batteries in Germany



Grid services

- Balancing power, especially frequency containment reserve
- Reactive power provision
- Black start capacity
- Redispatch



Power plant optimization

- Optimization of energy commercialization (time shift)
- Power plant flexibilisation
- Reduction of costs for balancing energy (e.g. for wind parks)



DSM for industrial companies

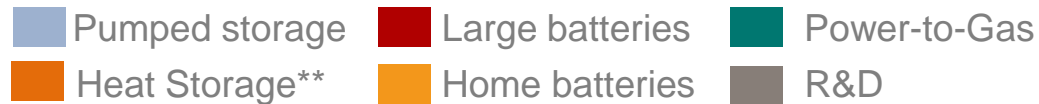
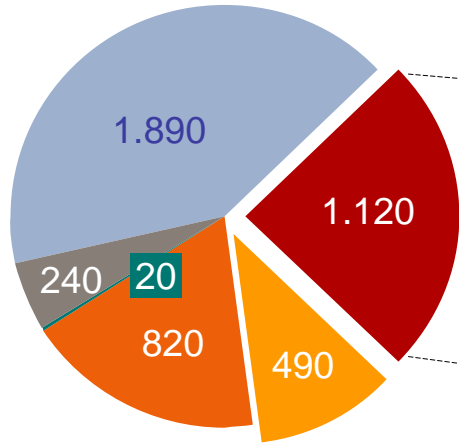
- Peak shaving
- Reduction of grid connection capacity
- Uninterruptible power supply

Source: TEAM CONSULT

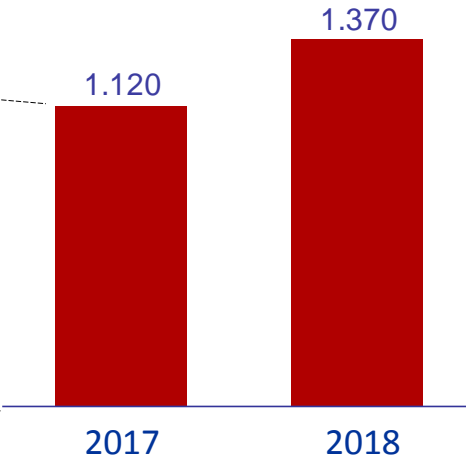
The segment of batteries for systemic application will drive revenues in 2018

Revenues of German energy storage industry* in 2017 (in mill. €)

∑ 4.580 Mio. EUR



Battery storage for systemic application



* Revenue of companies located in Germany in- and outside Germany, incl. Installation
 ** incl. el. Heat pumps and large scale heat storage

Source: Analysis of TEAM CONSULT in co-operation with German Energy Storage Association (BVES)

Buffer battery storage devices are increasingly used in the context of e-mobility and extension of charging infrastructure

New appliances: Buffer storage for E-Mobility

Product example – ads-tec StoraXe PowerBooster+



- Quick charging in limited capacity distribution networks
- Charging capacity: 150 kW (DC) respectively 60 kW (AC)
- Battery capacity: 75 kWh – 300 kWh
- Simultaneous charging of four vehicles possible
- 3 different connector types

Product example – enercon



- Quick charging station with pre load storage
- Provides a charging capacity of 350 kW (DC)
- Planned commissioning in Aurich (Germany) on 14th of March 2018

Source: TEAM CONSULT; ads-tec, enercon

Role of energy storage appliances around the world (selected examples)

USA – Large Scale Batteries for grid stabilization



- 1 GW battery storage capacity in 2017, mainly for grid stabilization
- In California investment target of 1.3 GW until 2024 and 3.3 GW until 2030, funding program of 55 mill. US\$ until 2020
- In state of New York investment target of 1.5 GW until 2025

Source: Chamber of foreign commerce, California Public Utilities Comm, E-Storage Assoc.

Australia – Batteries to increase self-sufficiency and to replace Diesel generators



- Around 20,000 home batteries installed in 2017
- In South Australia funding program of 150 AU\$
- Commissioning of worldwide largest battery storage with 100 MW capacity in 2017 by Tesla to supply 30,000 households (North of Adelaide)

Source: Climate Council, Government of South Australia

Africa, e.g. Ruanda & Tanzania – Batteries to secure water supply



- In Tanzania: More than 100 mini grids with batteries to secure power supply in hospitals and water supply
- In Ruanda: Goal of 100% electrification with on- & off-grid concepts until 2020*

Source: Global Climatescope, PV-Tech, Offgrid Electric * Currently around 31%

Asia, e.g. Japan – Hydrogen and redox-flow batteries



- Government goal to realize 800,000 fuel cell cars and 1.5 mill. fuel cell heating systems until 2030
- Funding program for H2 cars, filling stations and heating systems of 100 mill. € in 2017
- Redox-flow batteries installed: ~25 MW/75 MWh

Source: Ministry of Economy, Trade and Industry Japan, Hzwei US DOE Storage Database

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