



Valuing Behind-the-Meter Energy Storage

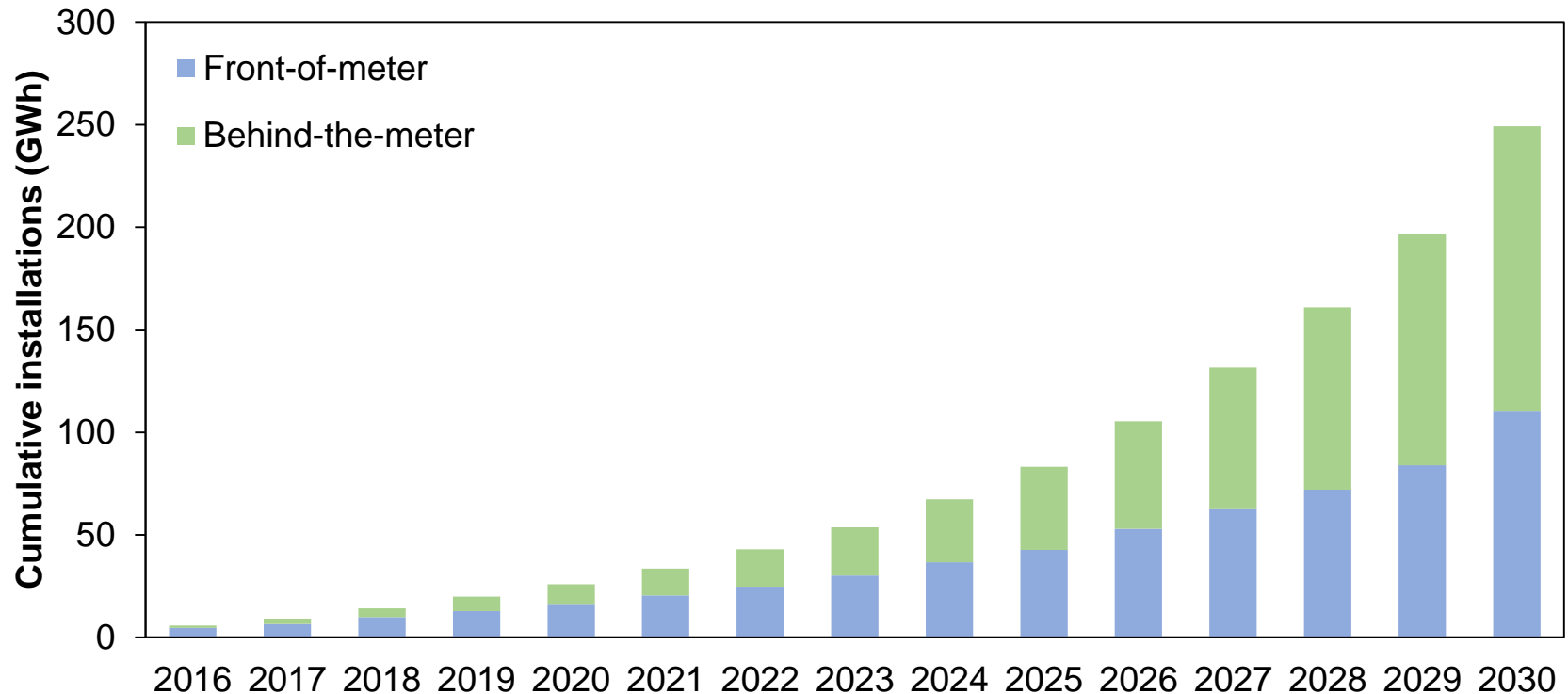
Session: 1

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Behind-the-meter storage is projected to dominate the stationary storage market

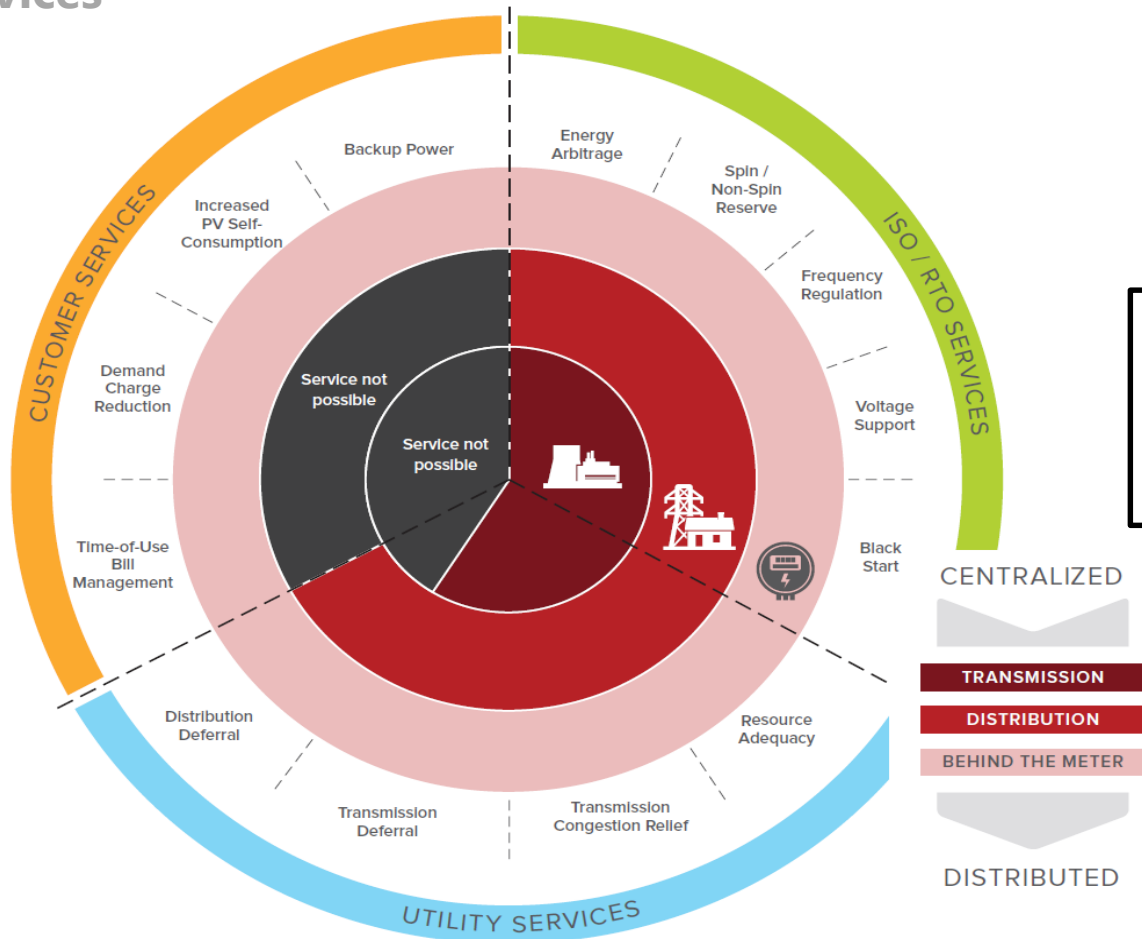
Market Size (Global)



The market for behind-the-meter storage will grow substantially

This is driven by the range of services behind-the-meter storage could provide

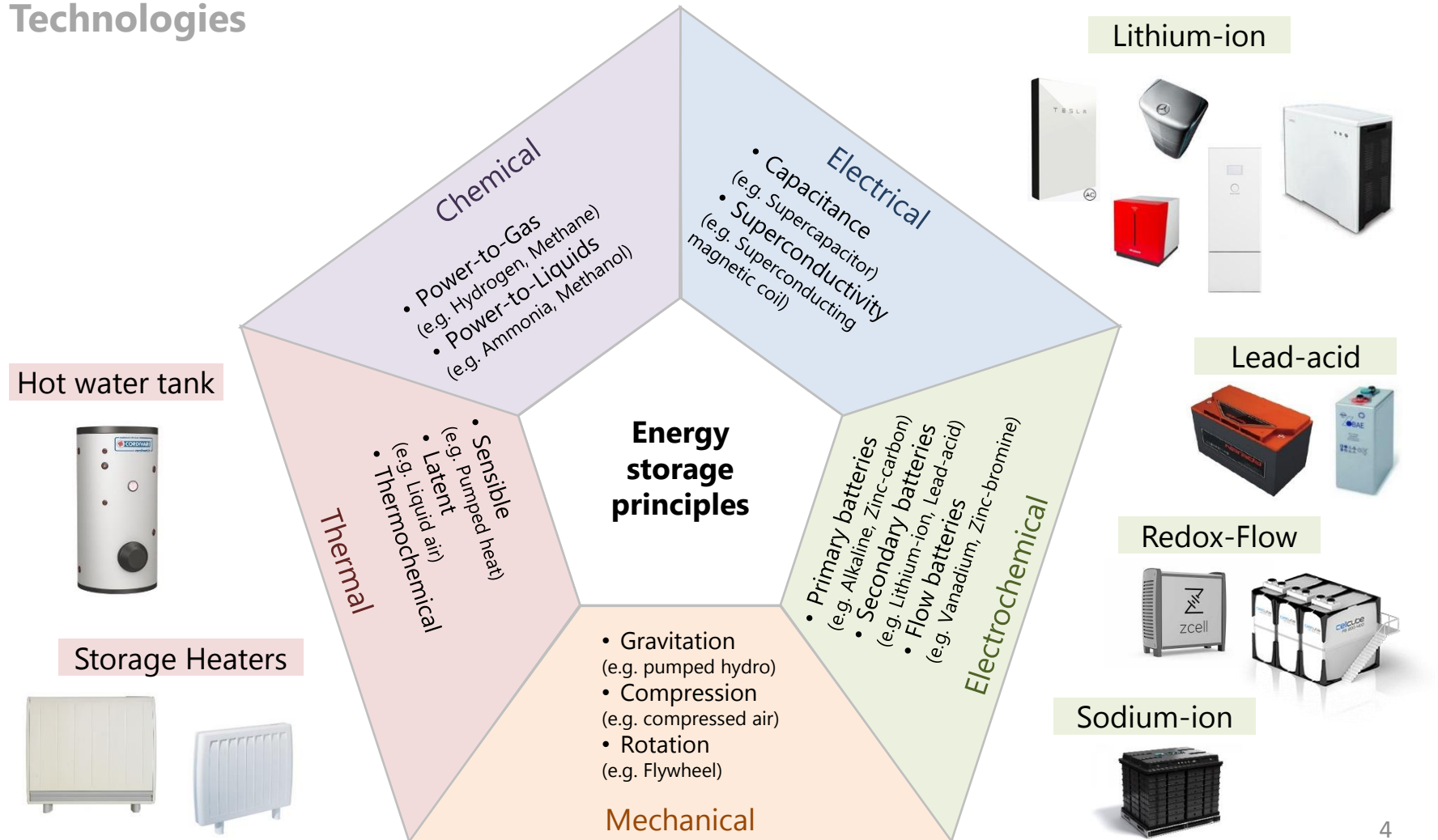
Services



Behind-the-meter storage can provide all customer, utility and network services

In theory, all energy storage technologies could be installed behind-the-meter

Technologies



But, residential behind-the-meter electricity storage is not profitable

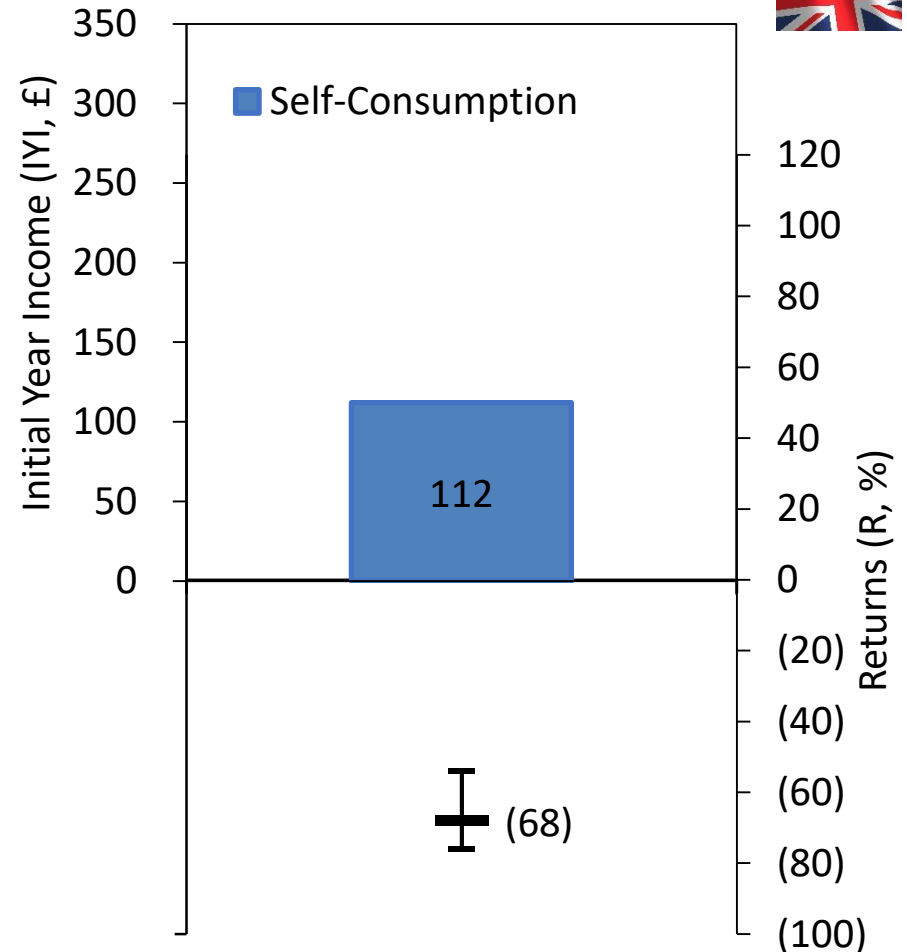
UK Case Study

Setting & Use Case

- Residential home with PV system
- PV self-consumption
- Retrofit battery

Model parameters

- Year: 2020
- Technology: 4 kWh li-ion battery
- Cost: £ 3,400 (all-in)
- Lifetime: 15 years
- Degradation: 1% pa (90% DoD)
- Power price: 14 p/kWh (exp: 4.9p/kWh)
- Discount rate: 5% (0% - 10%)



We identify 6 policy barriers that prevent a positive residential business case...

Policy barriers

1. Lack of Time-of-Use tariffs
2. Lack of valuation for network services
3. Regulatory barriers for benefit-stacking
4. High VAT rate for retrofit installations
5. Lack of subsidies
6. High financing cost

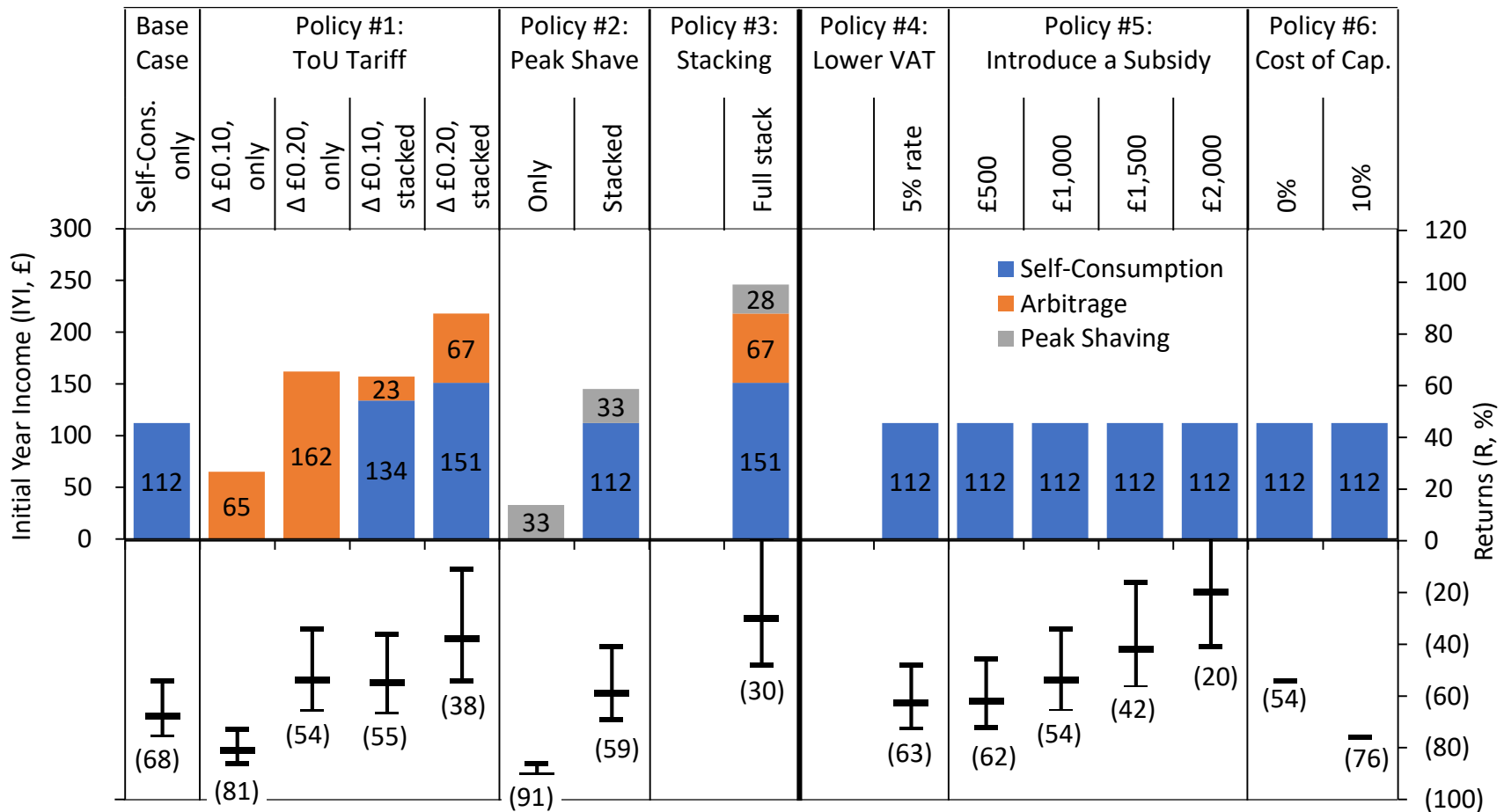


Valuation of services provided by residential storage

Financial support for residential storage

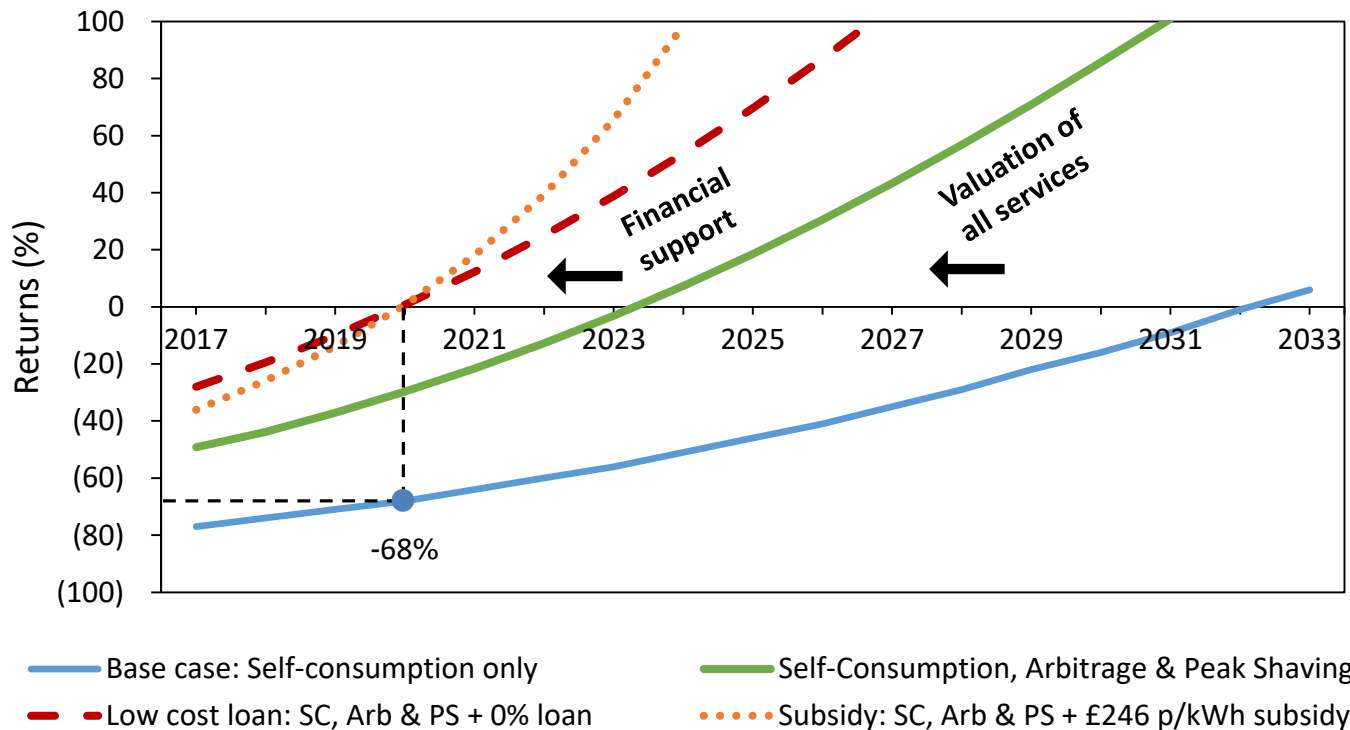
... and quantify the impact of resolving these barriers with policy measures

Quantifying policy measures



A combination of low cost policy measures enables profitable b-t-m storage by 2020

Combining policy measures



Policy action required to ensure valuation of all services

Behind-the-meter storage requires policy action for full valuation of its services

Conclusions

1. Market for behind-the-meter (b-t-m) storage will grow substantially
2. B-t-m storage can provide all customer, utility and network services
3. Profitable business cases stack multiple value streams
4. Policy action required to ensure valuation of all services

Q&A

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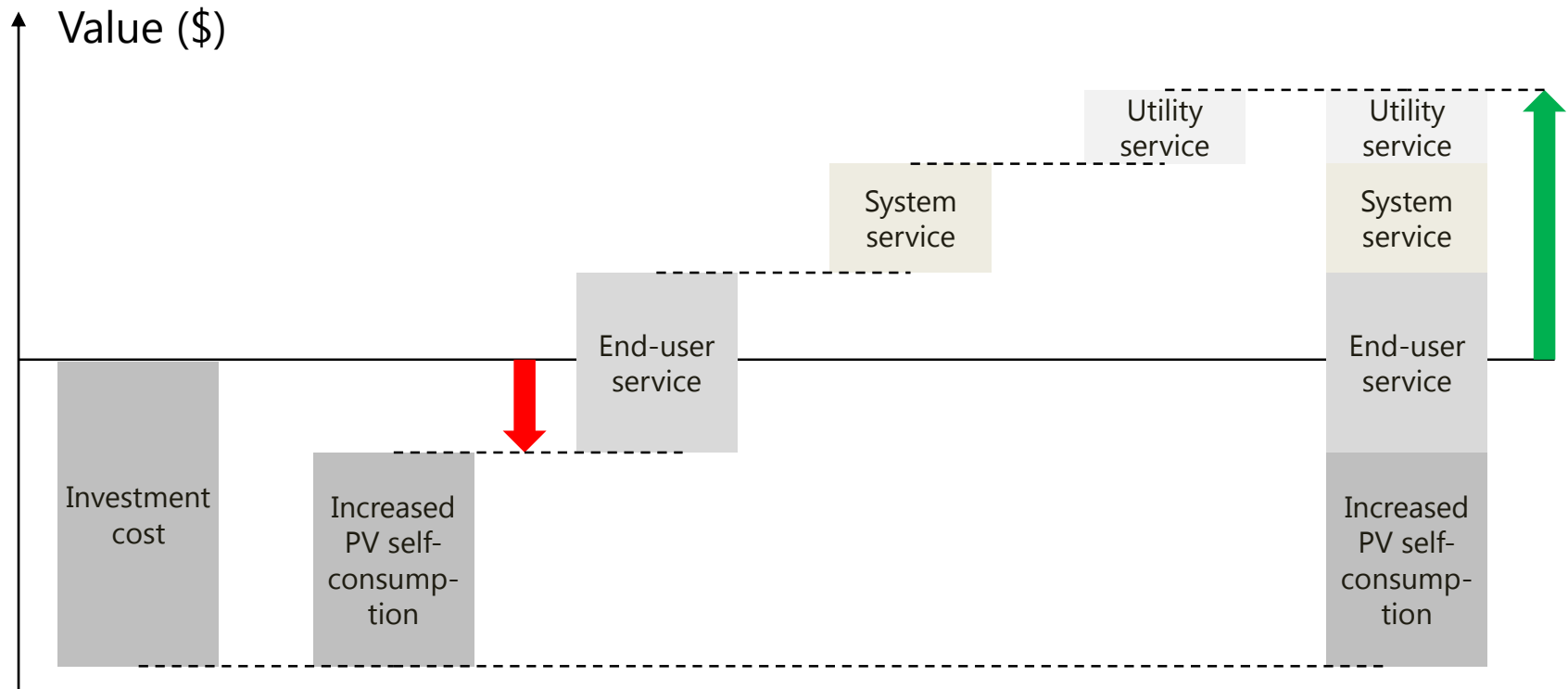
Storage Lab

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The stacking of multiple revenue streams is seen as the path to profitability

Benefit-stacking



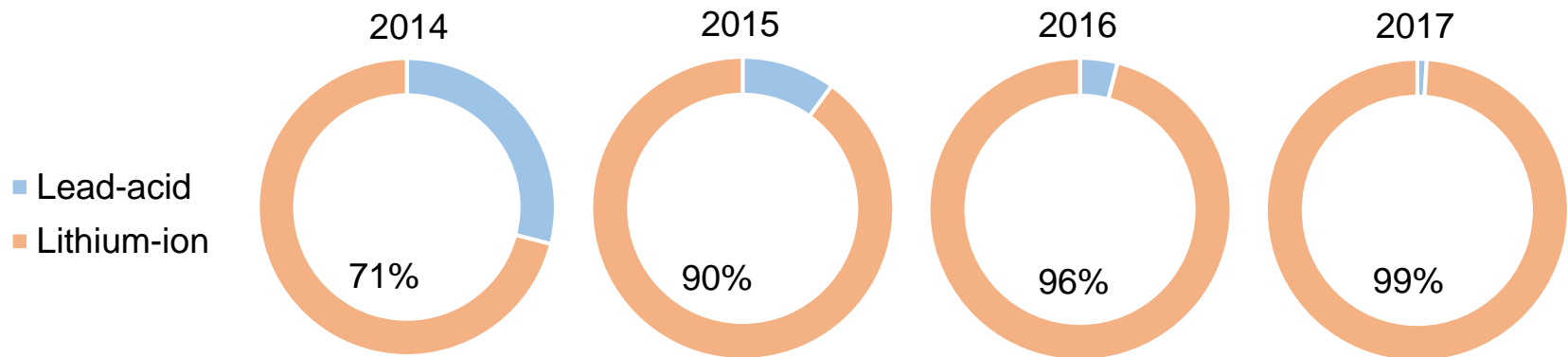
Profitable business cases stack multiple value streams

However, recent years have seen increasing dominance of one battery technology

Technologies – German Residential Market

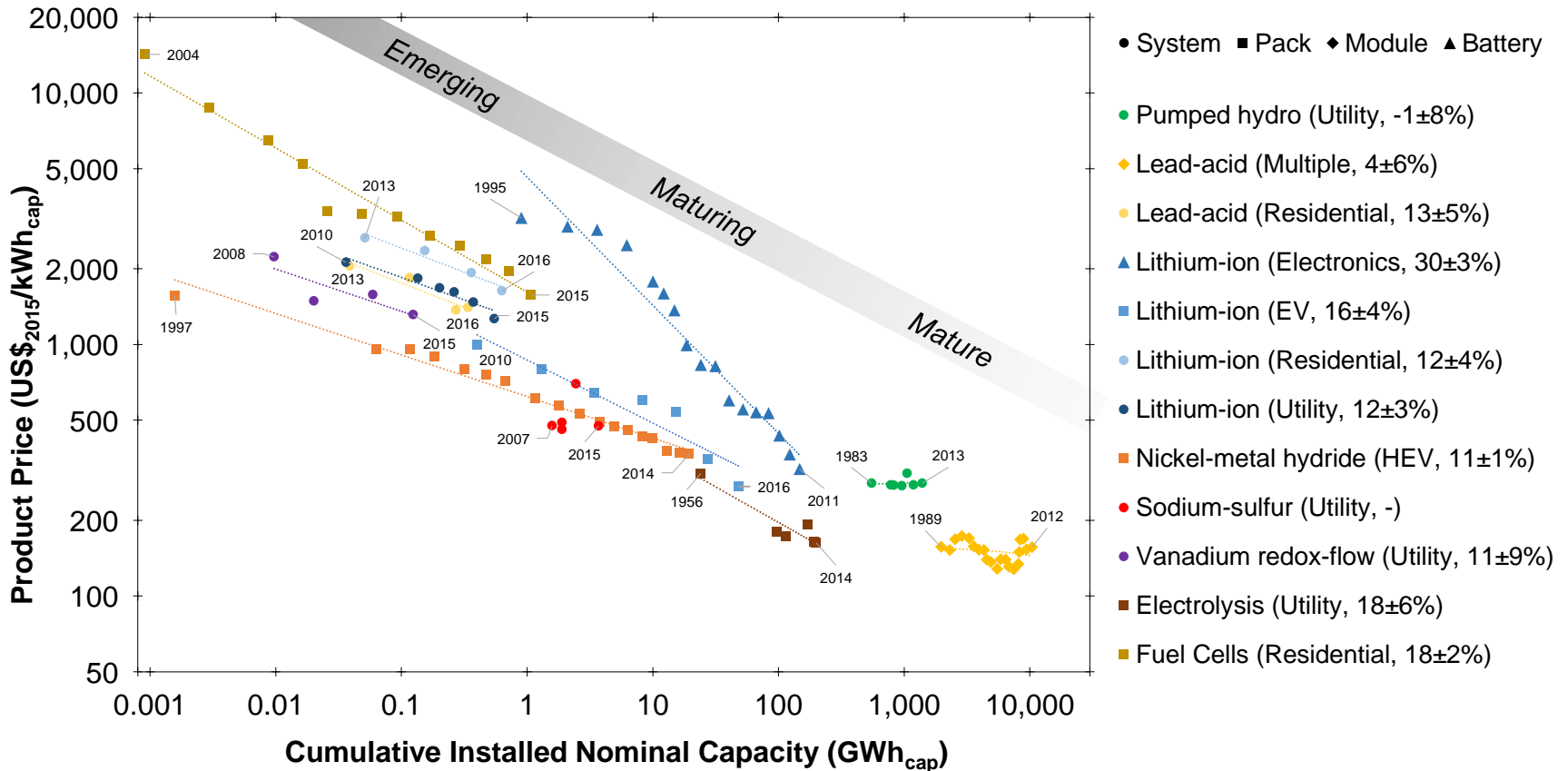


Proportion of lead-acid / lithium-ion systems ≤ 30 kWh installed behind-the-meter:



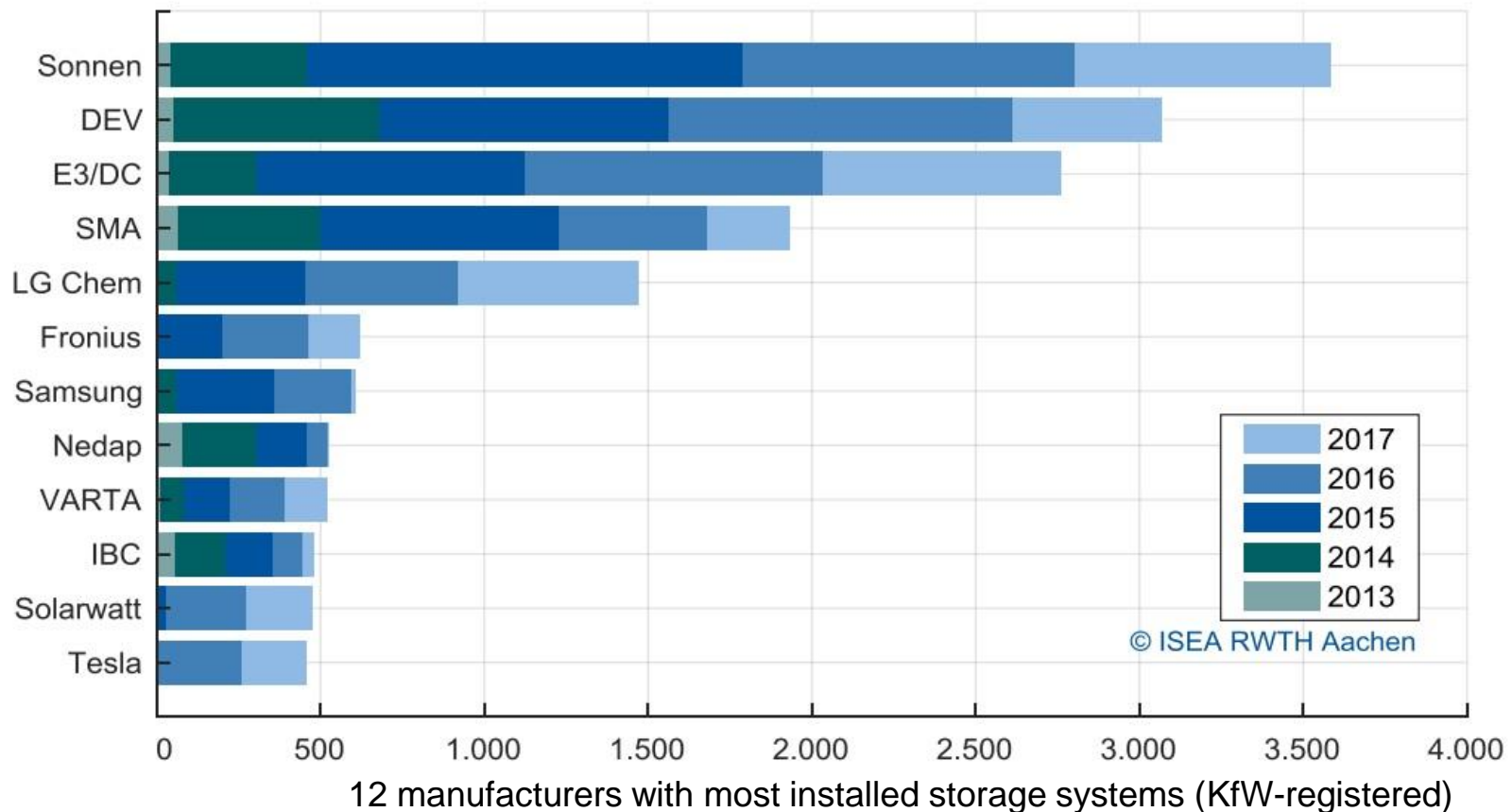
Experience curve dataset for electricity storage technologies

Dataset



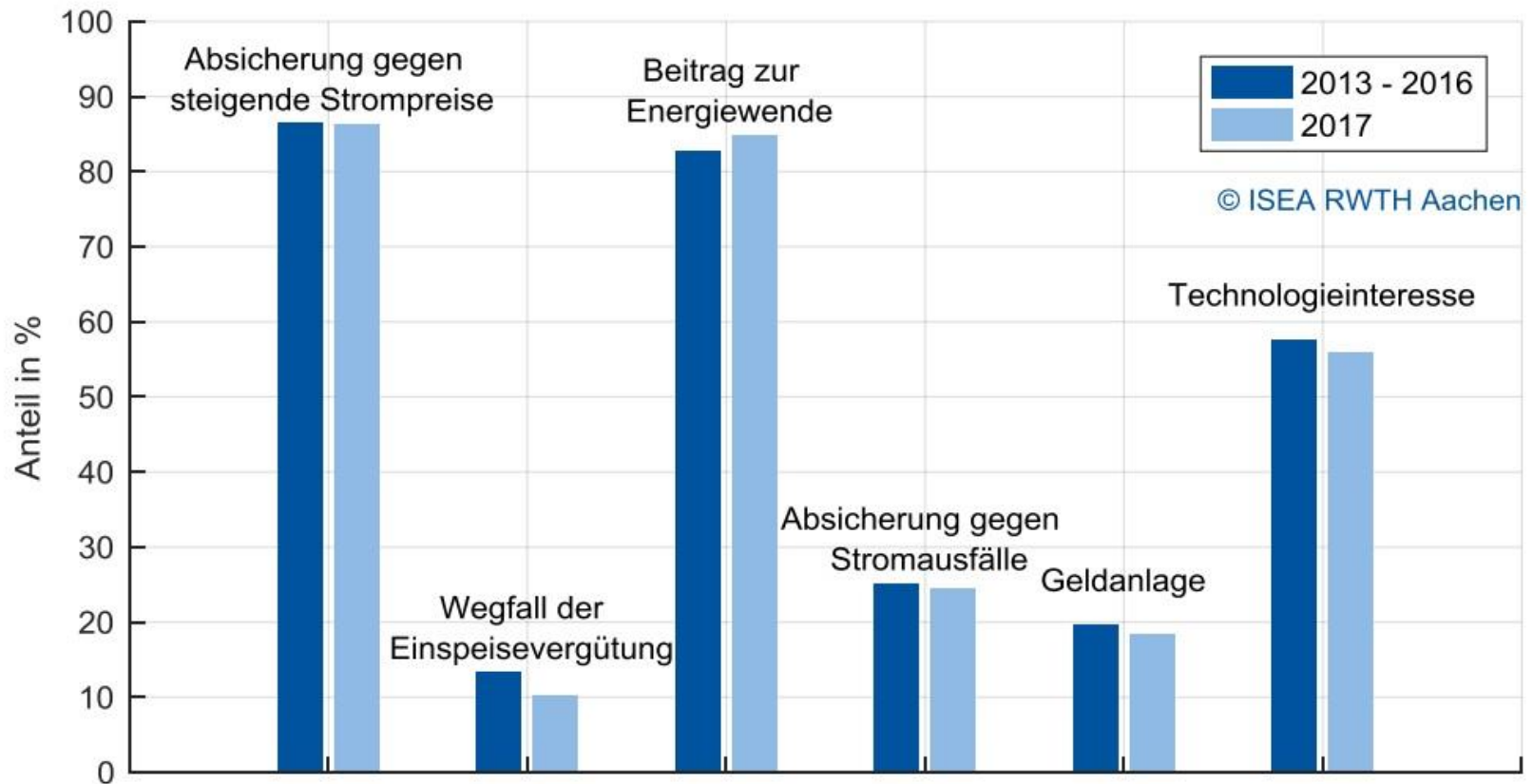
Competitive landscape for residential storage systems in Germany

Residential storage systems - Germany



Motivation for residential storage system driven by fear of

Sales drivers



To enable benefit-stacking, low-cost policy measures can be taken

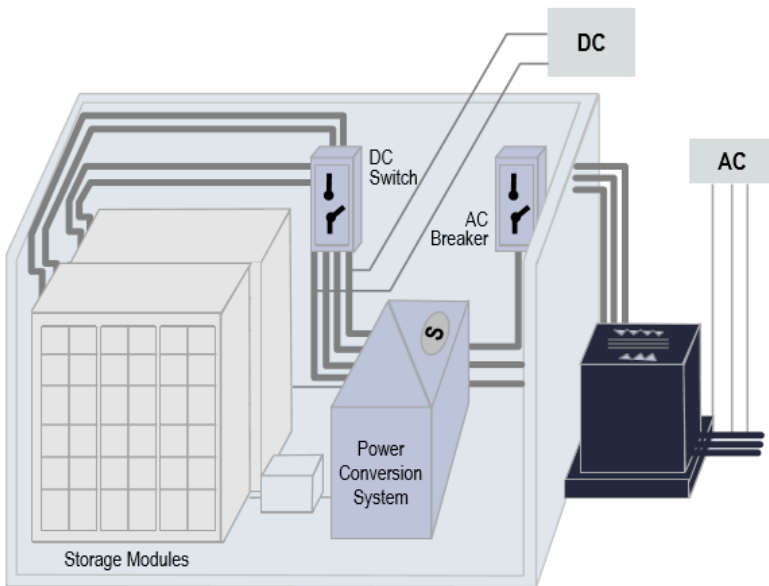
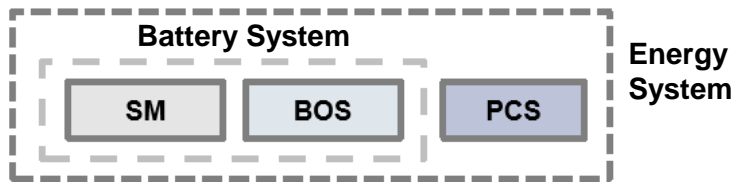
Policy measures

1. Adjust technical standards to open markets for storage technologies (frequency response: reduce minimum bidding sizes, allow assets operating in dispersed fleets)
2. Amend competition regulation to allow combination of value streams (example: regulation in restructured markets like unbundling prohibits simultaneous revenues from generation and transmission)
3. Develop consistent legal definition of 'electricity storage' to stipulate that storage can serve as generation, transmission/distribution and consumption support simultaneously

Energy storage technologies contain a number of components

Technology components

Physical Energy Storage System



Selected Equipment & Cost Components

System Layer		Component
SM	Storage Module	<ul style="list-style-type: none"> Racking Frame/Cabinet Battery Management System ("BMS") Battery Modules
BOS	Balance of System	<ul style="list-style-type: none"> Container Monitors and Controls Thermal Management Fire Suppression
PCS	Power Conversion System	<ul style="list-style-type: none"> Inverter Protection (Switches, Breakers, etc.) Energy Management System ("EMS")
EPC	Engineering, Procurement & Construction	<ul style="list-style-type: none"> Project Management Engineering Studies/Permitting Site Preparation/Construction Foundation/Mounting Commissioning
Other (not included in analysis)		<ul style="list-style-type: none"> SCADA Shipping Grid Integration Equipment Metering Land