

Linklaters

Energy Storage: Charging up the future

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Introduction

What has been a **game changer** in energy storage:

- > increased reliance on renewables
 - challenges to the grid as a result of intermittent nature
- > decarbonisation – energy storage as a cleaner alternative to natural gas peaker plants, diesel generators
- > technological advances in battery storage, especially lithium-ion

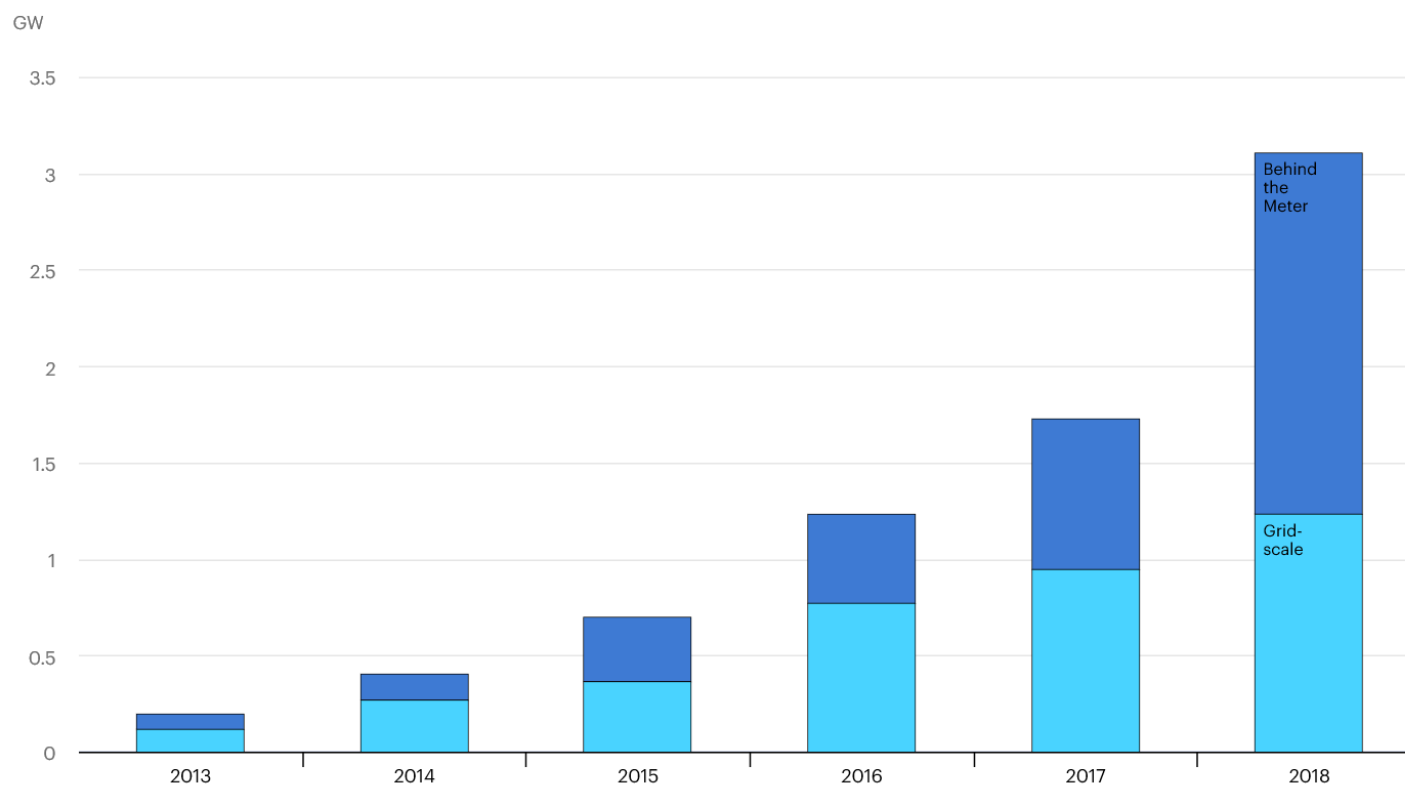


State of the market

Battery storage systems continue to gain traction around the world

> Location of battery storage systems:

- Installation with generator
- Installation with grid
- Installation “behind the meter” by end-user



Source: IEA, *Annual storage deployment, 2013-2018*, IEA, Paris <https://www.iea.org/data-and-statistics/charts/annual-storage-deployment-2013-2018>

Energy storage technologies

- > Chemical / electro-chemical storage – batteries, flow batteries, solar heat & salt, hydrogen
- > Potential storage – compressed air, pumped hydro
- > Kinetic storage – flywheels
- > Thermal storage – heat and cooling

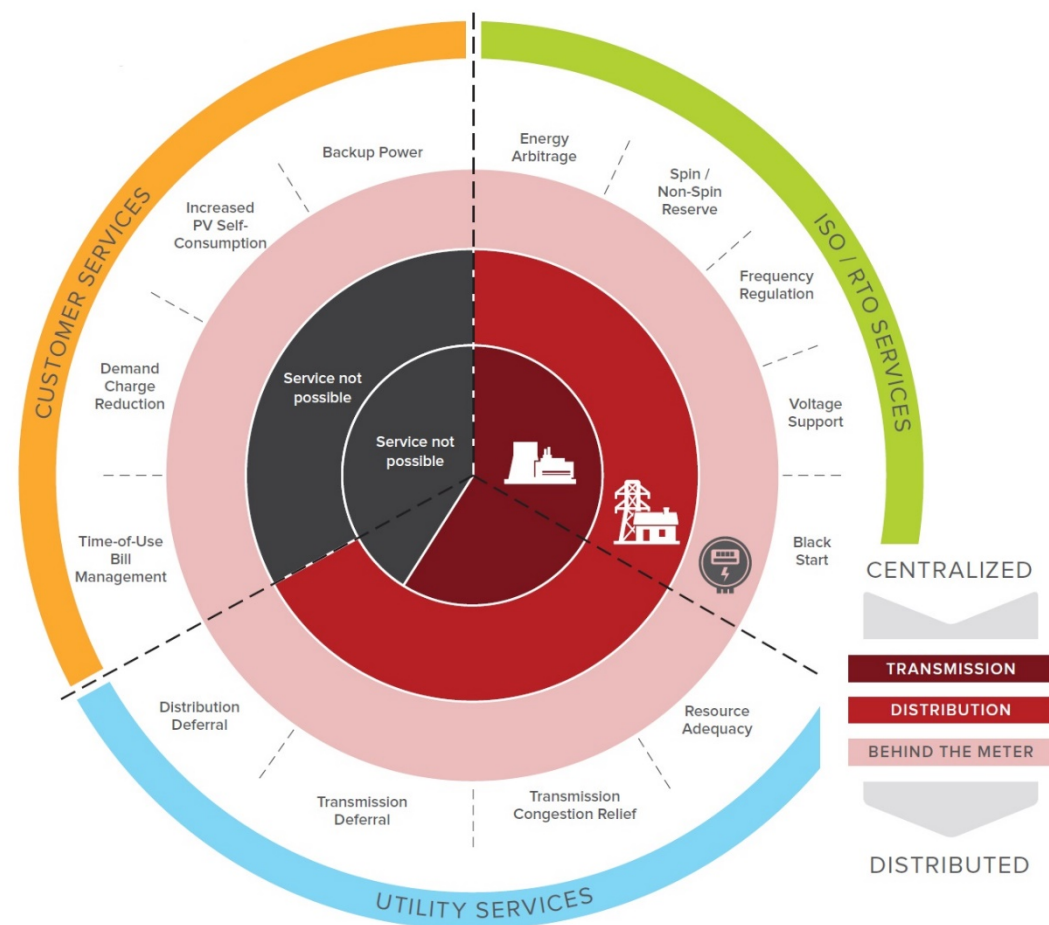


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Lithium-ion batteries Lead-based batteries Flywheels Flow batteries Sodium sulphur batteries Compressed air Supercapacitors Zinc air Other

Source: IEA, *Technology mix in storage installations excluding pumped hydro, 2011-2016*, IEA, Paris <https://www.iea.org/data-and-statistics/charts/technology-mix-in-storage-installations-excluding-pumped-hydro-2011-2016>

Uses of energy storage



Source: Fitzgerald, Garrett, James Mandel, Jesse Morris, and Hervé Touati, *The Economics of Battery Energy Storage: How multi-use, customer-sited batteries deliver the most services and value to customers and the grid*, Rocky Mountain Institute, September 2015, http://www.rmi.org/electricity_battery_value

Policy and regulatory issues

- > Regulatory uncertainties pose a challenge to investors / financiers
- > Regulatory framework needs to catch up with the technology
 - how to best capture the full range of application and flexibility of energy storage – need for a new regime?
 - arbitrage vs financial incentives
 - technology agnostic

Bankability issues (1)

> Structure and financial modelling

> Revenue

- Stand alone storage: short/medium term contracts vs PPA model
- Attached to another renewables projects: single or separate revenue streams?
- Costs of importing power to charge storage

> Financing:

- For co-storage projects – to what extent project finance debt can be used to fund riskier element

Bankability issues (2)

> Construction and O&M

- Type of contracting model
- Limited performance warranty coverage
- Degradation – 10 year lifespan vs 20-25 year PPA?
- Noise coverage guarantees

> Environmental and Social

- Supply chain considerations
- Safety

Conclusion

Thank you | Questions?

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Private and confidential



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