

Lithium-Ion Batteries: The Incumbent Technology

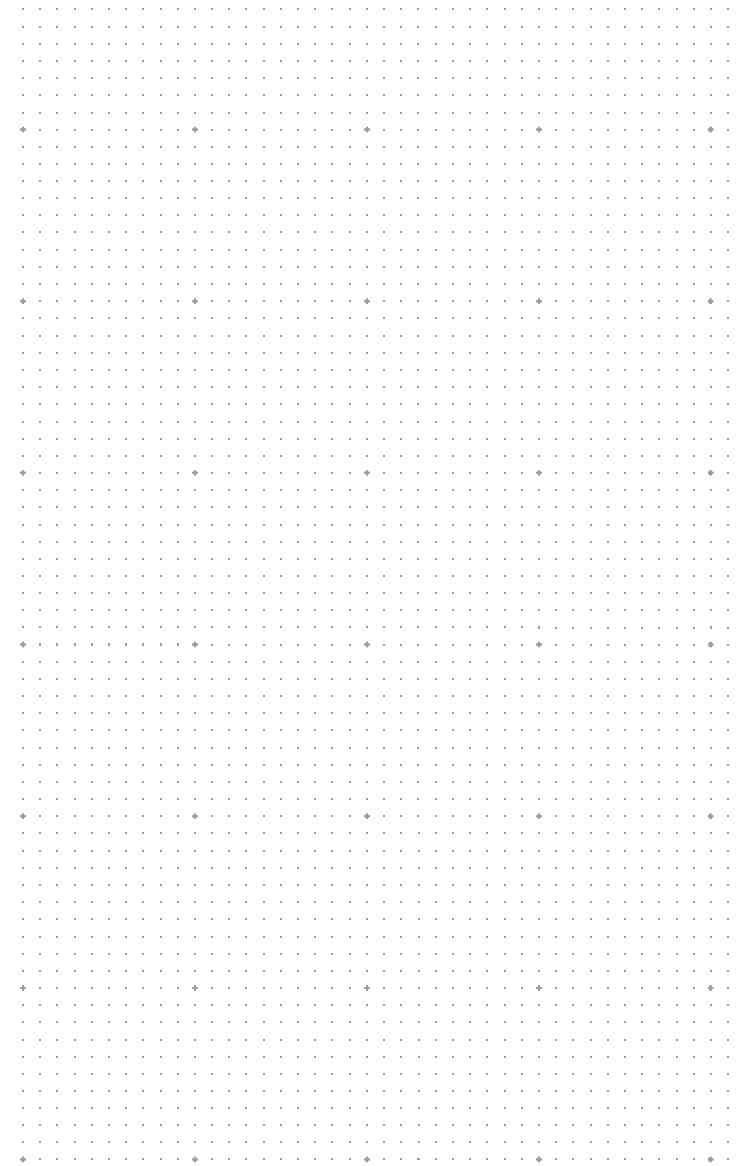
Platform for Coal Regions in Transition

James Frith

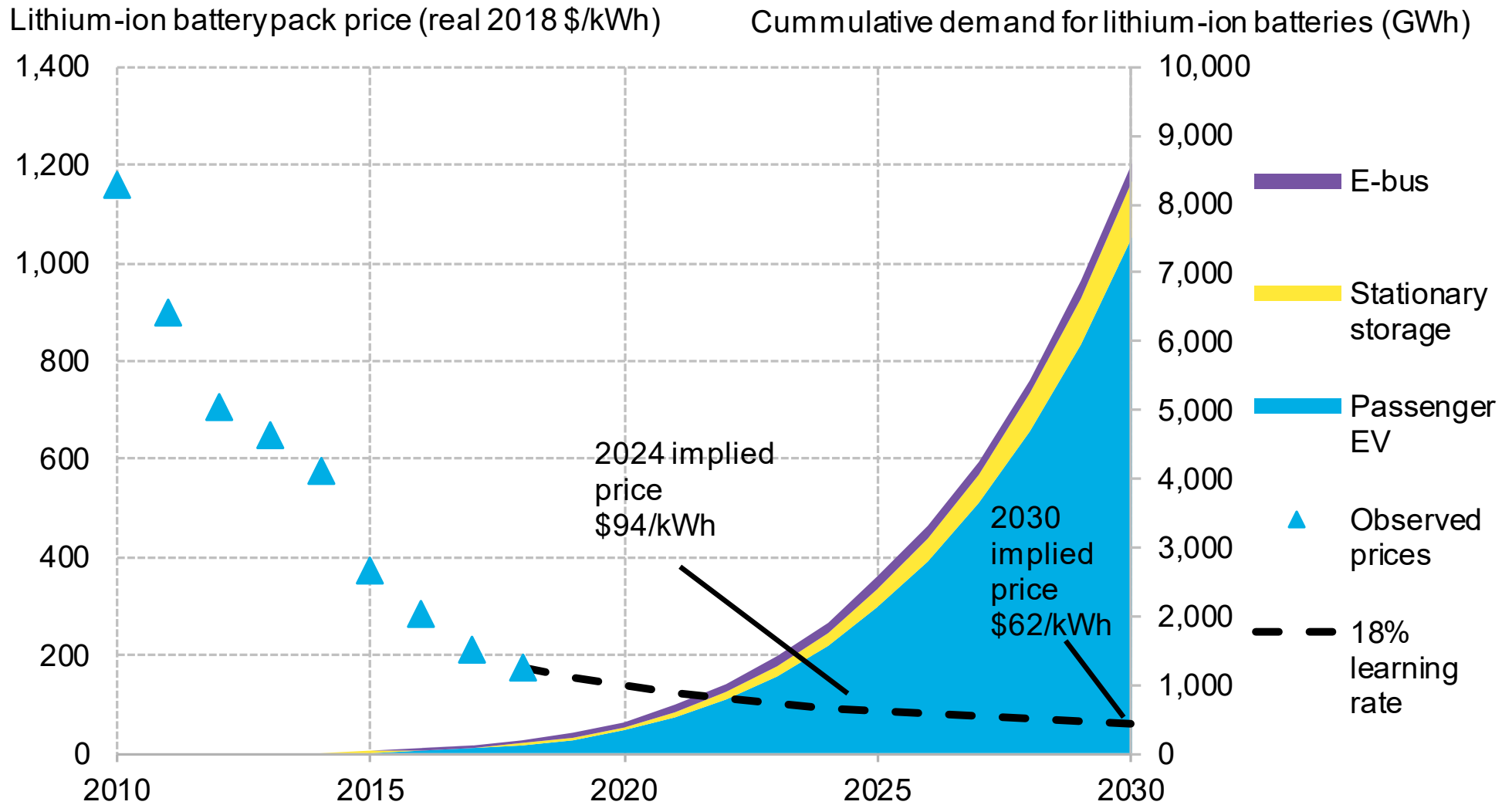
April 08, 2019

BloombergNEF

Prices



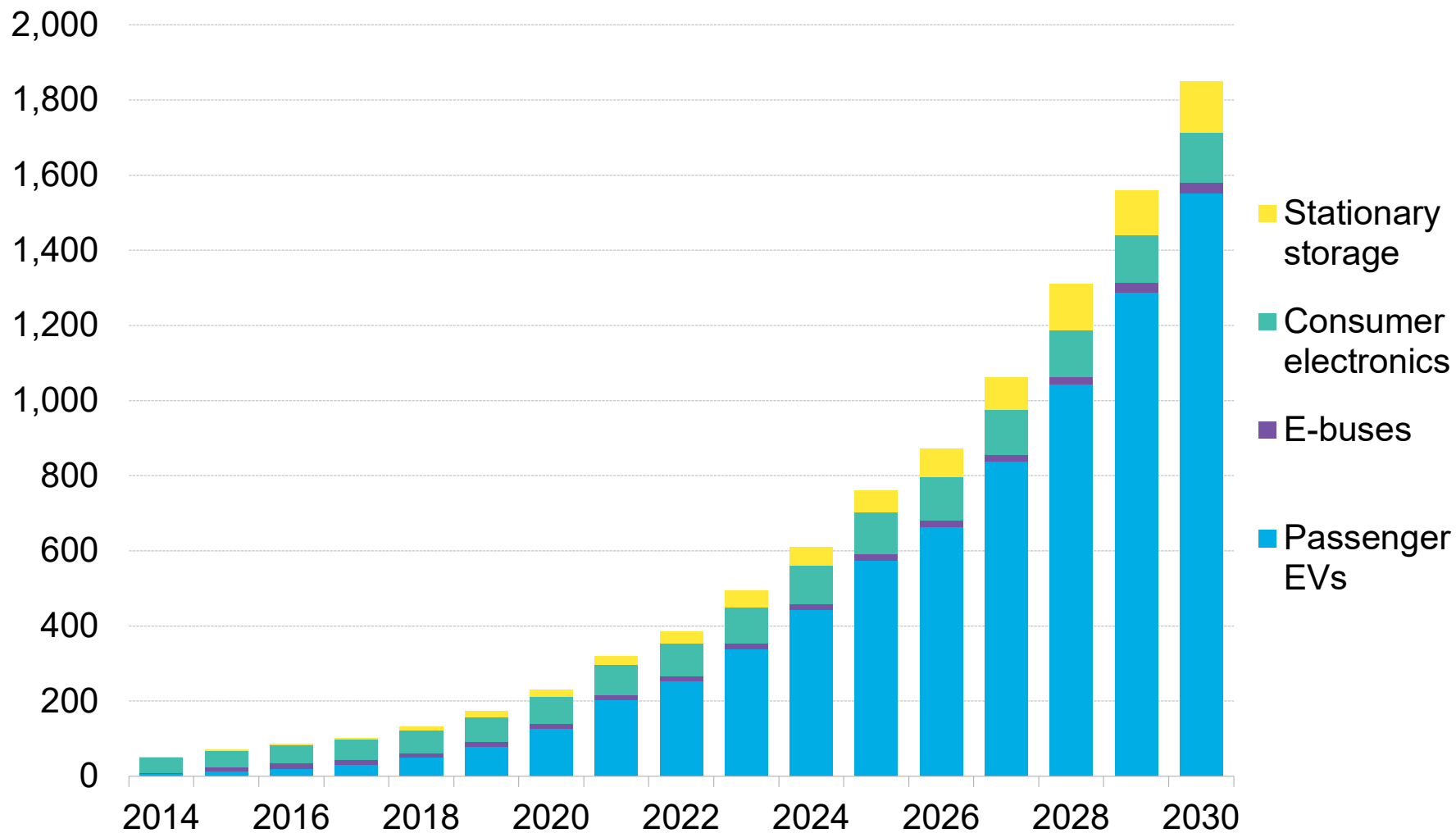
Lithium-ion battery prices have fallen 85% since 2010



Source: BloombergNEF

This is largely thanks to the EV industry

Annual GWh demand



Source: BloombergNEF, Avicenne



Source: OERhub.net



Battery rack costs



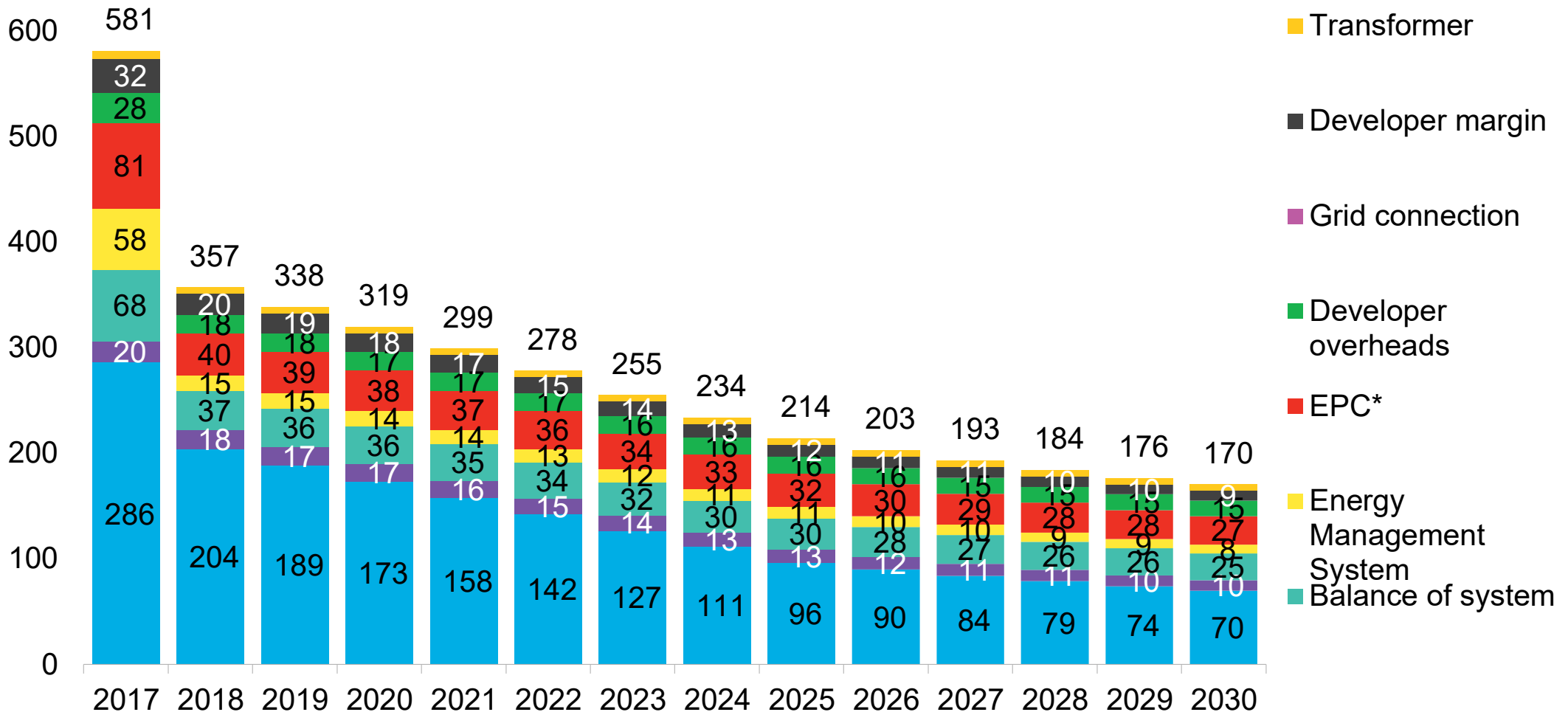
Other costs

Source: OERhub.net

System level prices continue to fall

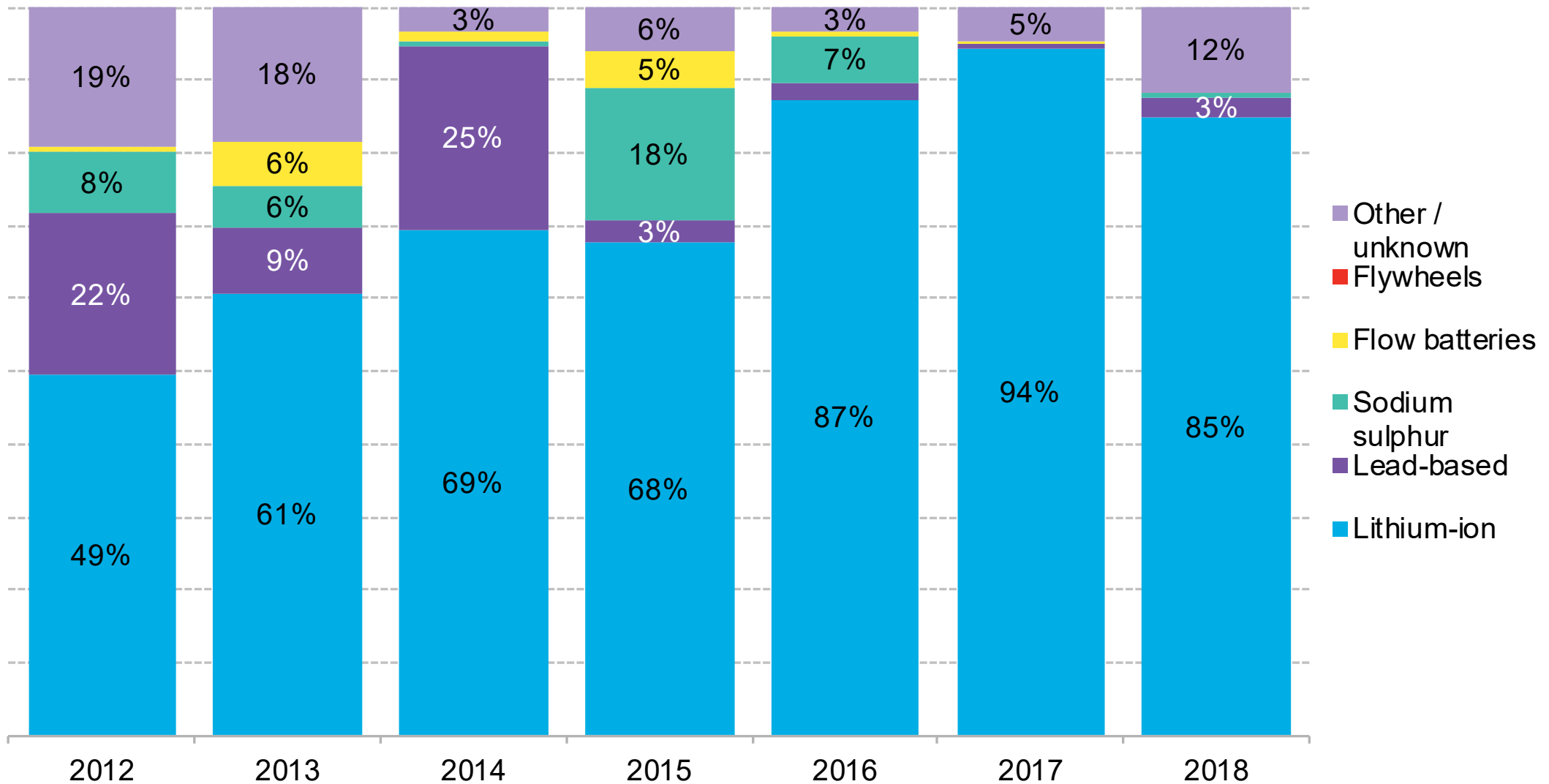
20MW/80MWh system

Real 2018 \$/kWh



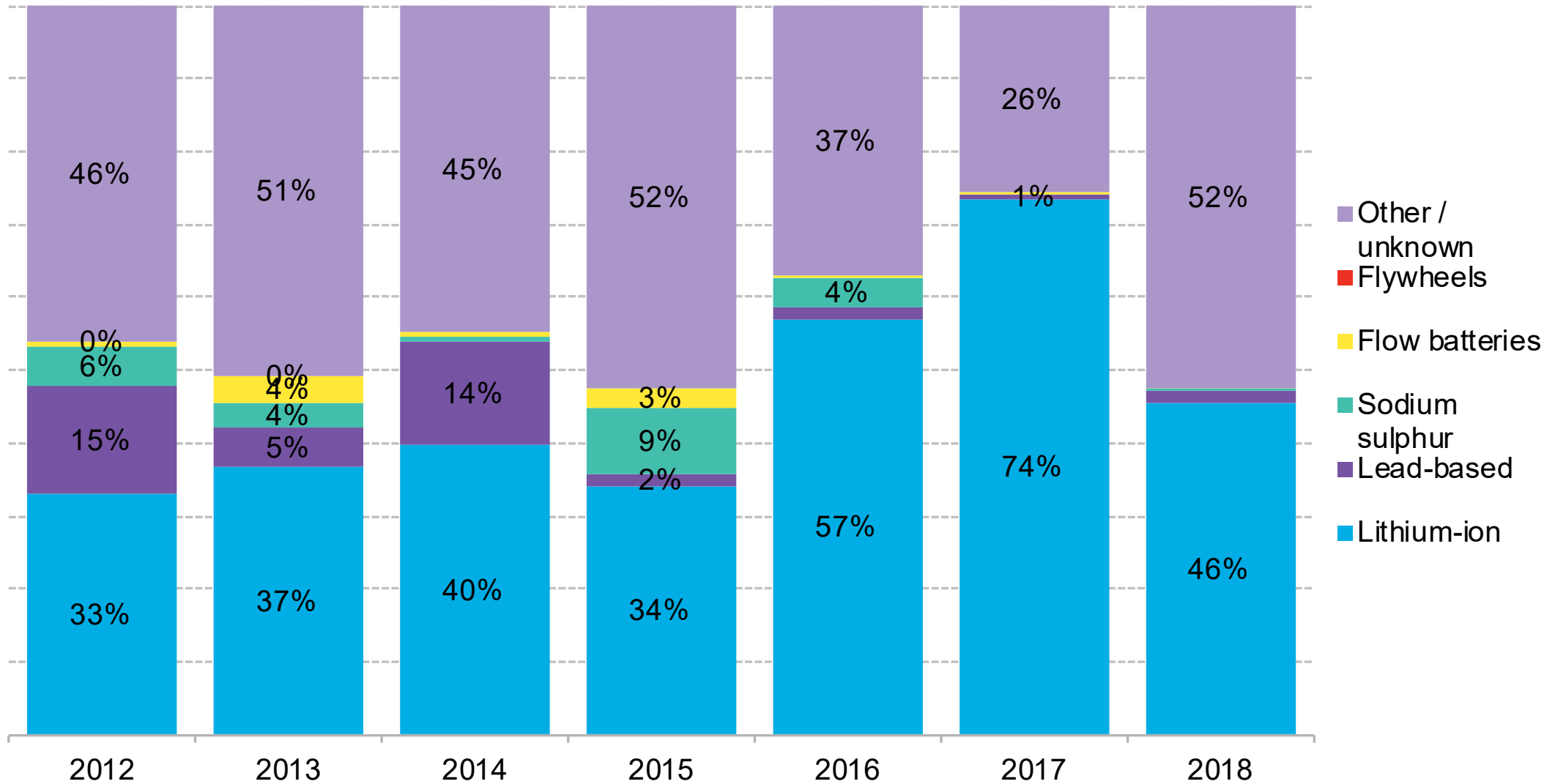
Source: Bloomberg New Energy Finance. Note * Includes a 10% EPC margin. Developer overheads set at 5% of total system costs, and developer margin set at 10%.

This has led to Lithium-ion dominating the storage market (on a power basis)



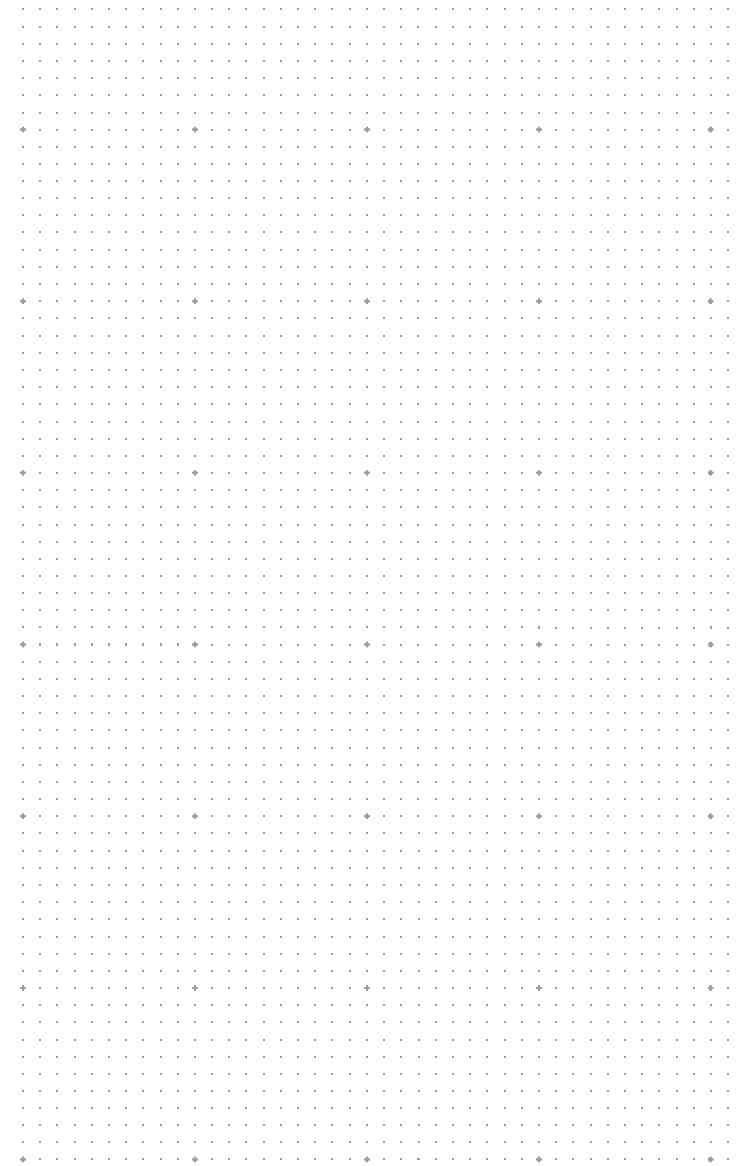
Source: Bloomberg NEF. Note: Excludes pumped hydro. If multiple technologies are selected, the capacity is divided equally amongst them.

But other technologies can be better on an energy basis



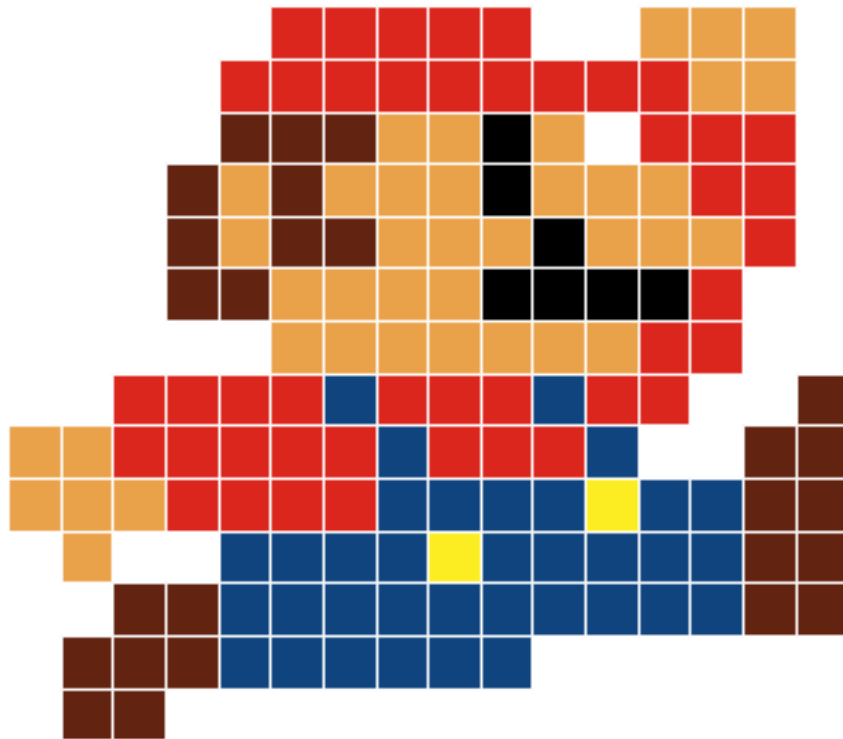
Source: Bloomberg NEF. Note: Excludes pumped hydro. If multiple technologies are selected, the capacity is divided equally amongst them.

The Good & Bad



Why use storage? (and particularly lithium-ion)

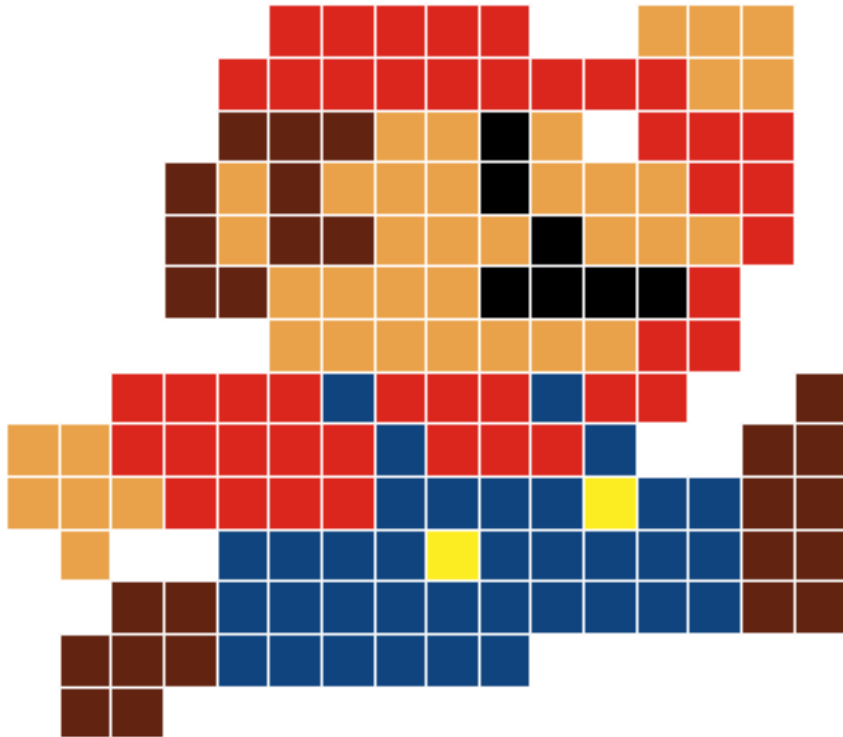
Fossil Fuel generator providing frequency response



Source: [Pixelartmaker.com](https://www.pixelartmaker.com)

Generating assets aren't good for quick response

Fossil Fuel generator providing frequency response



Source: Pixelartmaker.com

Battery storage providing frequency response

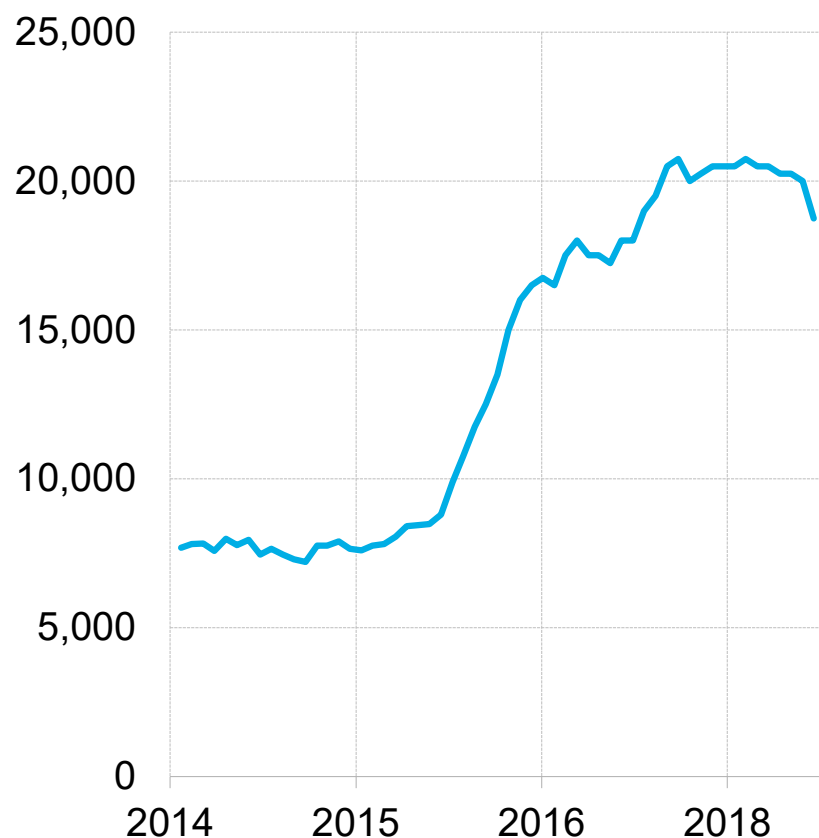


Source: Groundreport.com

Lithium-ion batteries biggest weakness is commodity prices

Lithium hydroxide price - Asia

\$ / metric ton



Source: Bloomberg New Energy Finance, Benchmark Minerals, Antaika Note: prices correct as of January 28, 2018

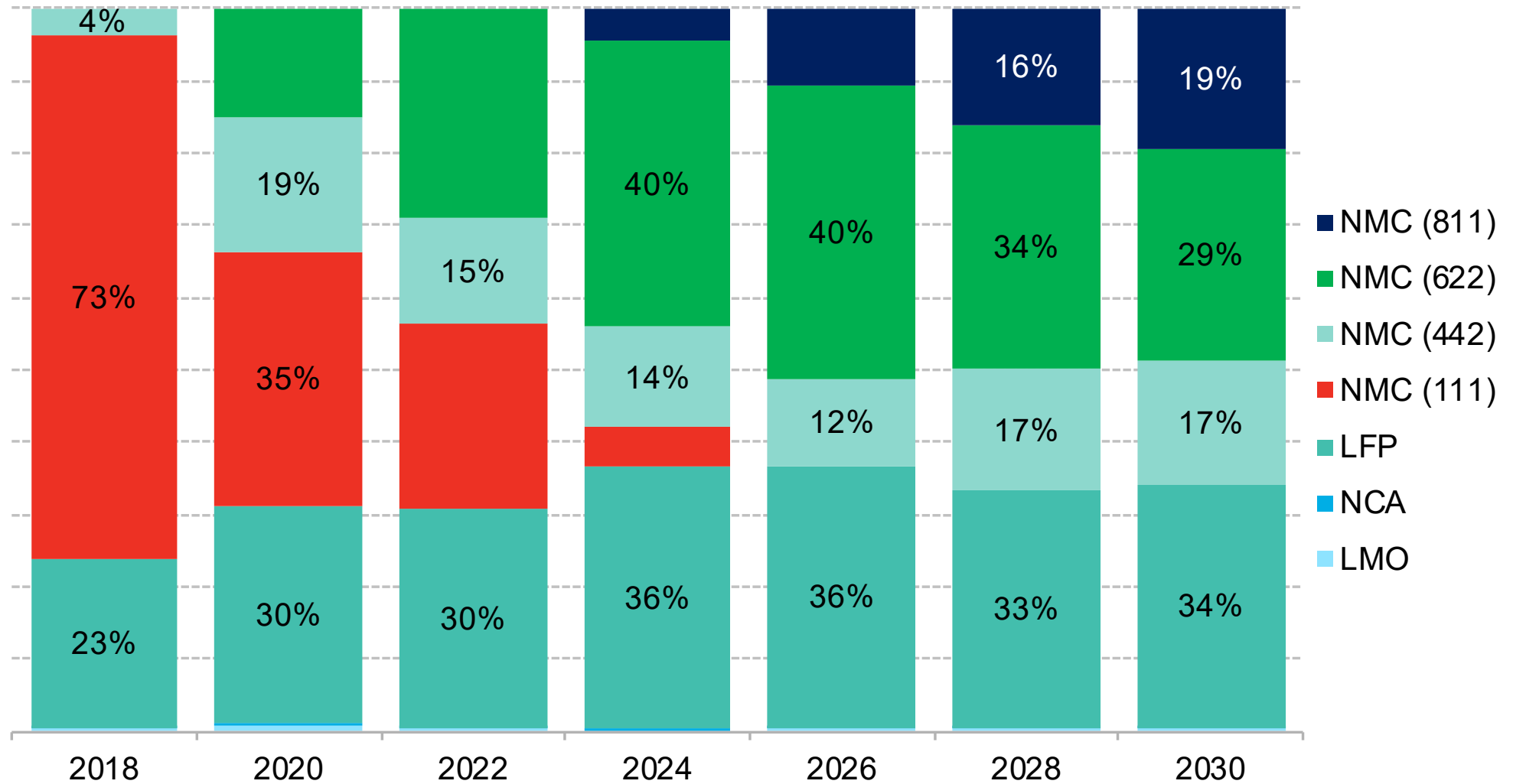
Cobalt spot price - Shanghai

\$ / metric ton



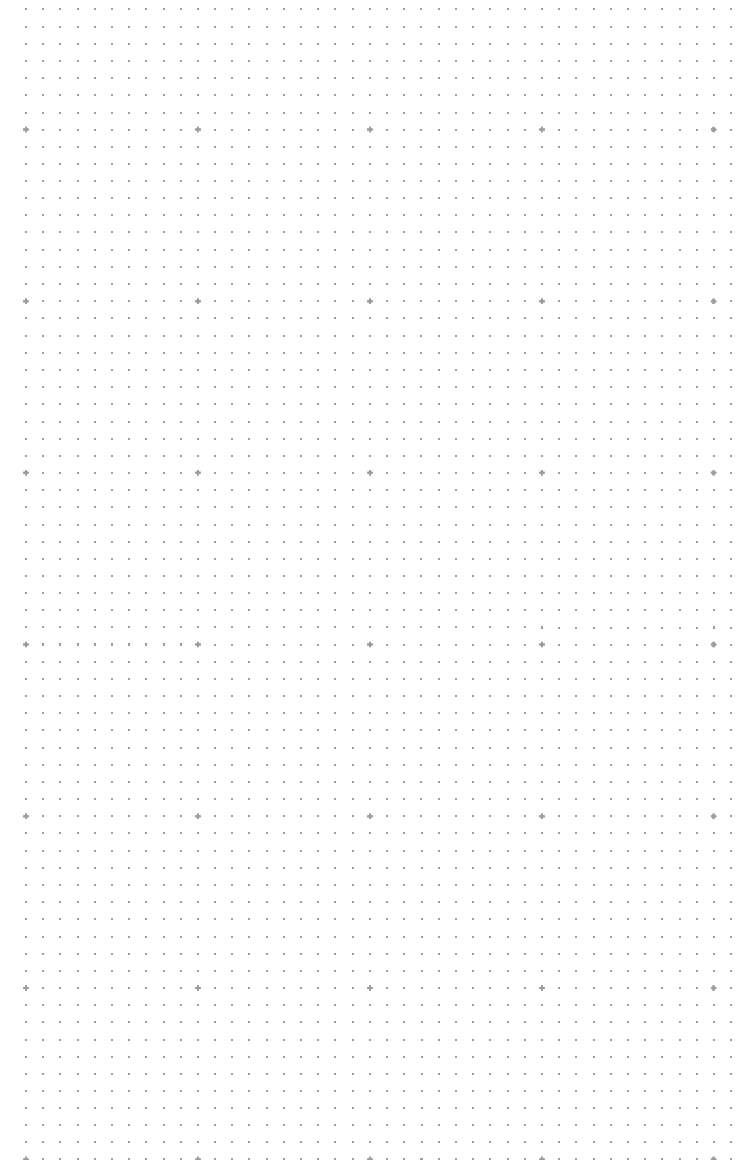
Source: Bloomberg New Energy Finance, Benchmark Minerals, Antaika Note: prices correct as of January 28, 2018

Cobalt can be avoided

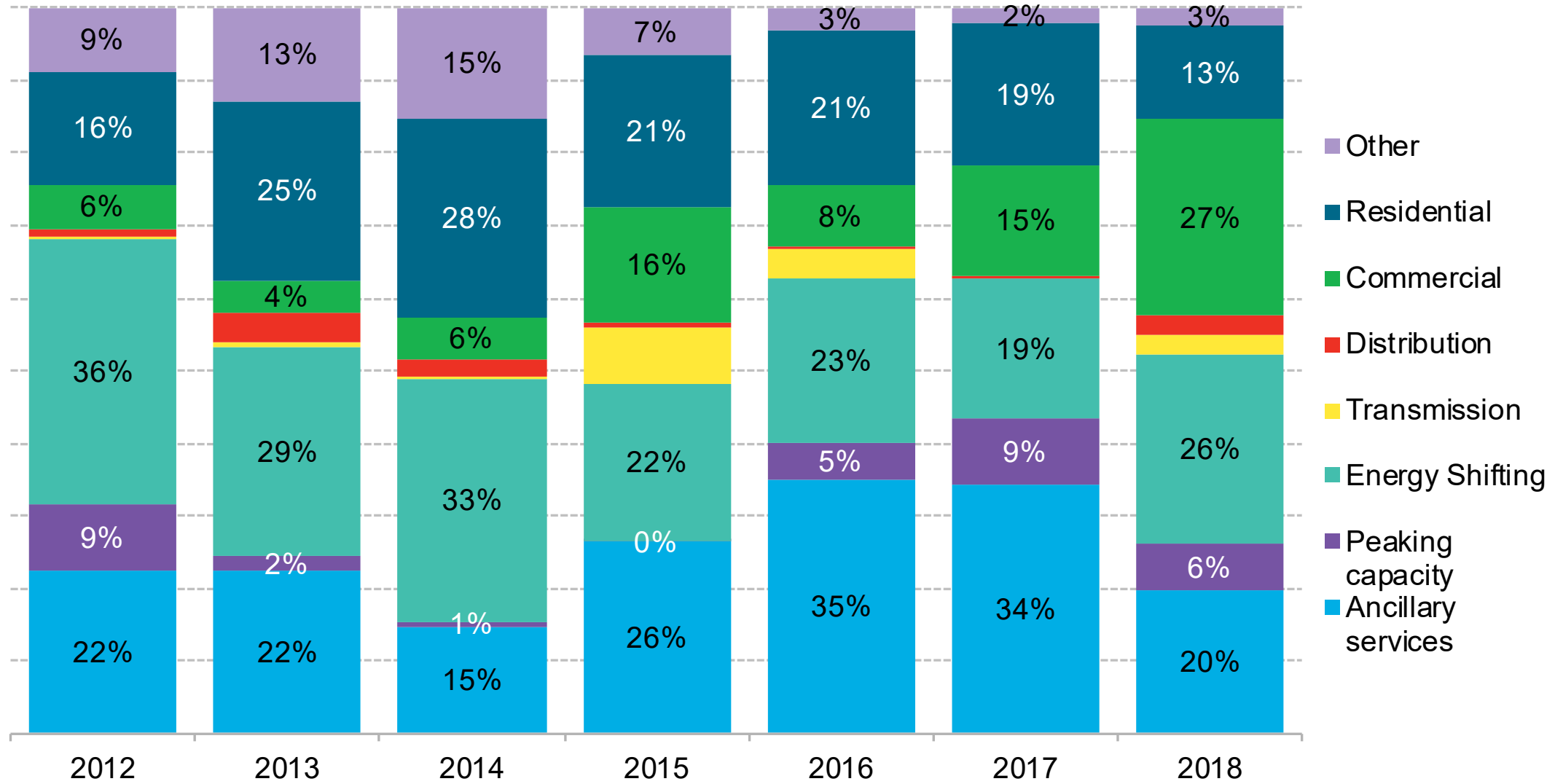


Source: Bloomberg NEF Note: Excludes pumped hydro. If multiple applications are selected, the capacity is divided equally amongst them.

What does the future look like?



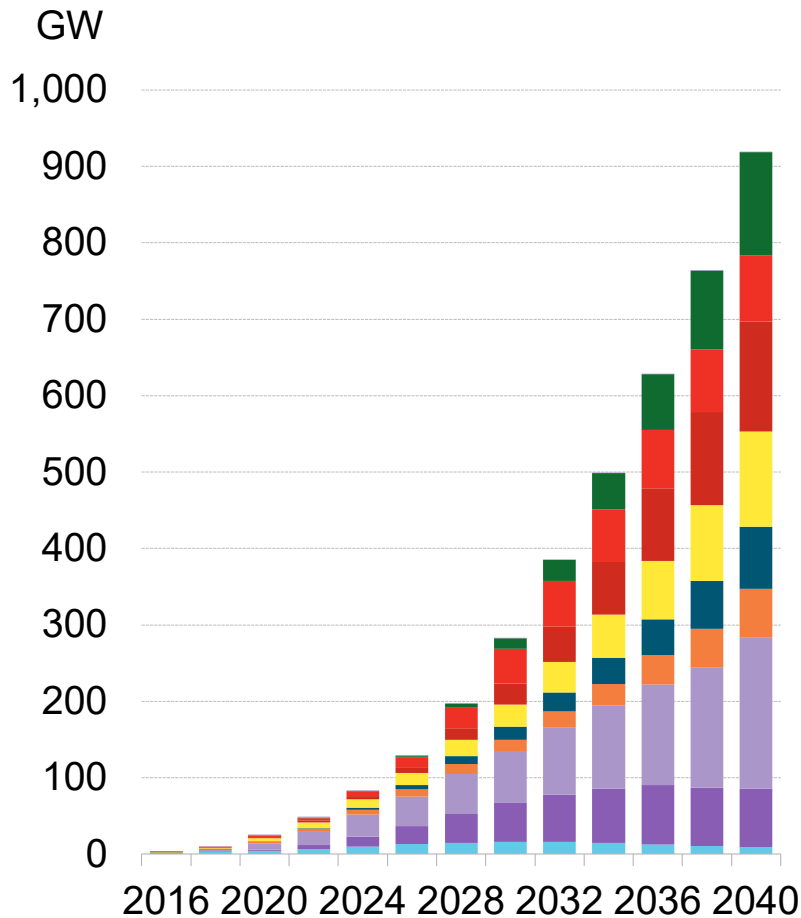
Energy shifting dominates the market



Source: Bloomberg NEF Note: Excludes pumped hydro. If multiple applications are selected, the capacity is divided equally amongst them.

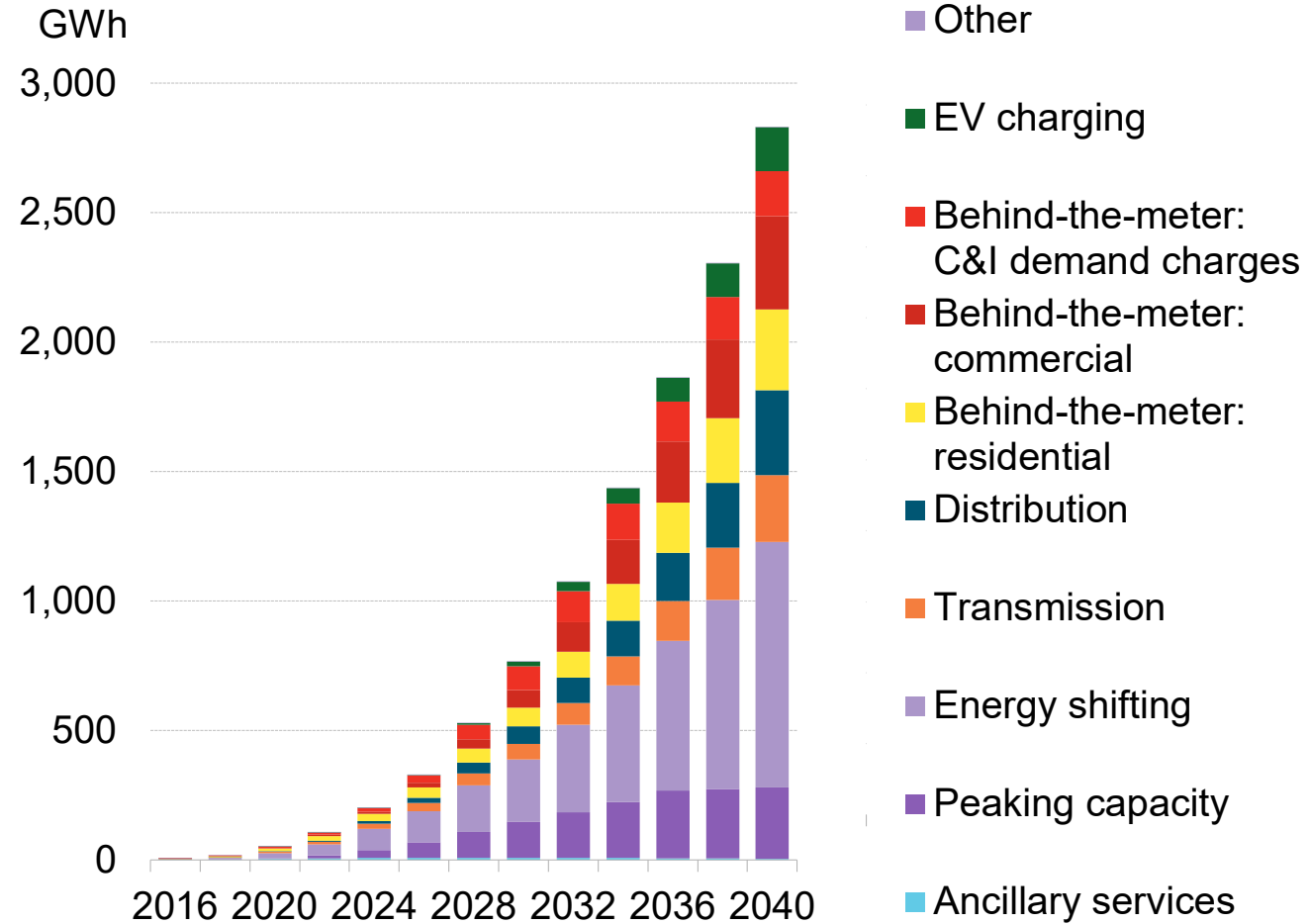
Energy shifting will create new opportunities for storage

Cumulative storage deployments by application, based on power output



Source: Bloomberg New Energy Finance

Cumulative storage deployments by application, based on energy capacity (GWh)

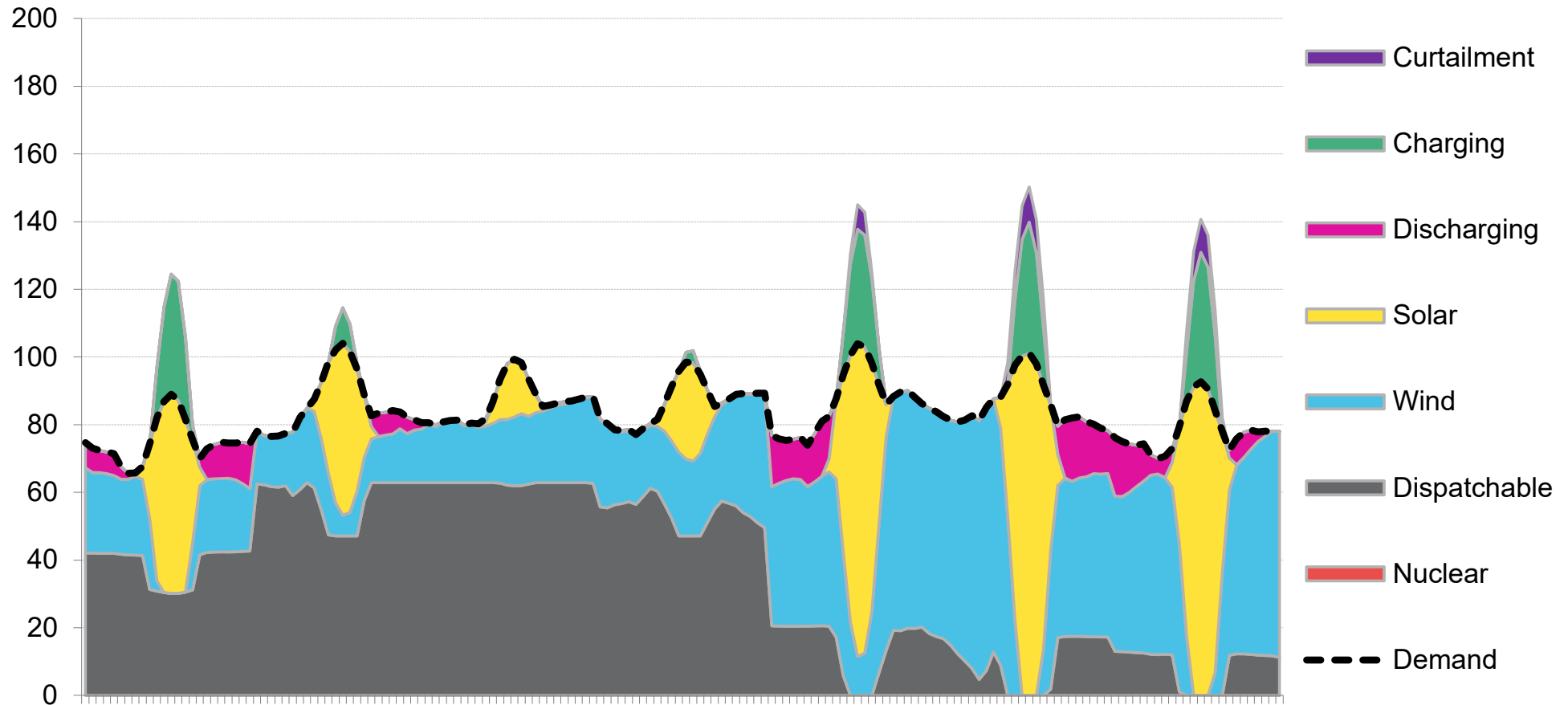


Source: Bloomberg New Energy Finance

There are somethings lithium-ion probably wont be able to do

Generation (GW)

Germany low renewable generation week, 2040

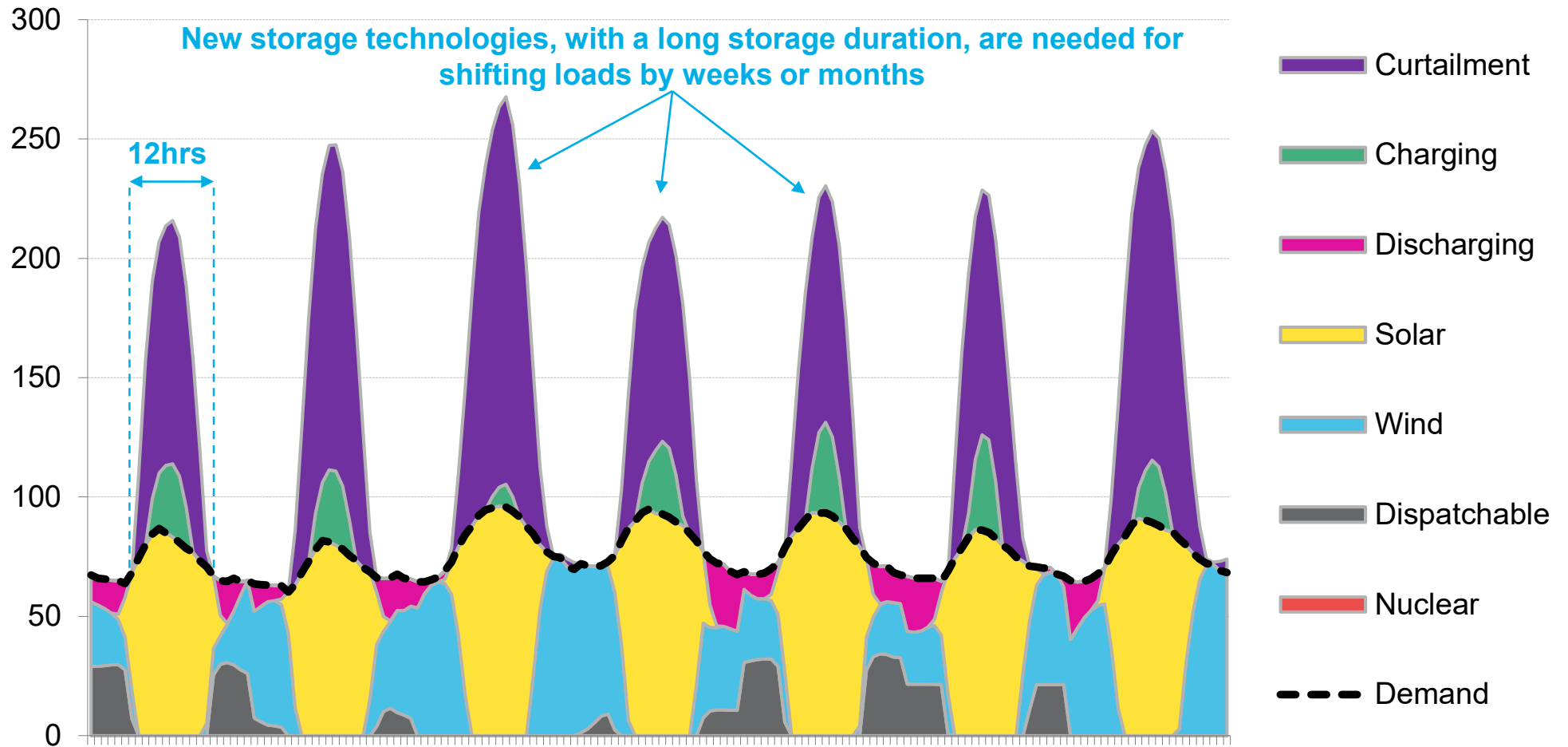


Source: Bloomberg NEF

Particularly long duration energy shifting

Generation (GW)

Germany high renewable generation week, 2040



Source: Bloomberg NEF

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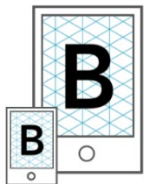
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