Which energy storage technology can meet my needs?

Electrical energy storage is key to balancing the supply and demand of energy, optimising our use of intermittent energy sources such as wind or solar, and also enabling the electrification of transport.* Here's our guide to energy storage technologies.

Where is the storage technology needed?

Grid
What will the technology be used for?

Stationary electric vehicles may provide storage for the grid

Transport
What form of transport?

Seasonal storage
Requirement: Large storage capacity, slow discharge
1 5

Daily peak shifting
Requirement: Hours of available supply
1 2 3 5 6 7 8

Grid support / balancing intermittency
Requirement: Fast response, seconds to hours of available supply
1 3 4 6 7 8

Road
Requirement: High power and small unit size
5 6

Shipping / Aviation
Requirement: High power and energy per volume
5

Domestic off-grid / microgrid
(e.g. balancing renewables)
Requirement: Small scale, long lifetime
5 6 7 8




	1 Pumped hydropower	2 Compressed air energy storage	3 Thermal cycle	4 Flywheels / supercapacitors / SMES†	5 Hydrogen electrolyser / fuel cell	6 Lithium-ion batteries	7 Lead-acid batteries	8 Redox flow batteries
Capital cost	$ – $$	$ – $$	$ – $$	$$ – $$$	$$$	$$	$ – $$	$$
Cost per cycle	–	–	–	–	–	–	–	
Response time	Seconds – Minutes	Minutes	Seconds	Milliseconds – Minutes	Minutes	Milliseconds	Milliseconds	Milliseconds
Total deployment	3	2	1	1 / 2 / 1	3	2	3	1
Efficiency (%)	70 – 85	50 – 75	55 – 80	85 – 98	<40 (mature) Up to 66 (developing)	80 – 90	65 – 85	65 – 85
Daily self-discharge	>0.5%	>10%	0.5 – 1%	(100% / 5 – 20% / 10 – 15%)	~0%	~0%	~0.2%	~0%
In a nutshell	Affordable, but large and site-specific	Affordable, but large and site-specific	Potentially affordable, non site-specific	Fast response, but rapid discharge	Potential for long-term storage, currently expensive	High energy density, rapidly developing	Mature, but bulky and toxic materials	High number of cycles in lifetime, but bulky

Capital cost: ($/kWh for 1 – 8hr energy system): $ = 10 – 100, $$ = 100 – 1000, $$$ = 1000 – 10,000)

Cost per cycle: (including capital/cycle life, and operation, and maintenance. units $/kWh/cycle):
= < 0.01, = 0.01 – 0.10, = 0.10 – 1, = 1 – 10

Response time: Time a storage system requires to ramp up supply

Total deployment:
1 = less than 100 MW / 100MWh deployed
2 = 100 MW / 100 MWh to 10 GW / 10 GWh deployed
3 = more than 10 GW / 10 GWh deployed

Efficiency: Energy out divided by energy in

Daily self-discharge: Percentage of charge lost in device each day

* Other measures, such as increased interconnectivity, demand side management, thermal storage and dispatchable generation, also play a part in regulating the supply of electricity

† Superconducting Magnetic Energy Storage

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