

## Energy storage devices

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If the sun isn't shining or the wind isn't blowing, how do we access power from renewable sources?

With the world's renewable energy capacity reaching record levels, four storage technologies are fundamental to smoothing out peaks and dips in energy demand without resorting to fossil fuels.

Pumped hydro involves pumping water uphill at times of low energy demand. The water is stored in a reservoir and, in periods of high demand, released through turbines to create electricity.

Hydropower - including pumped storage - is expected to remain the world's largest source of renewable electricity generation into the 2030s, according to the International Energy Agency (IEA). It uses the motion of water to generate electricity and plays a 'critical' role, the IEA says, in decarbonizing the power system. It is also key to plugging gaps in energy demand.

While hydro is expected to be eventually overtaken by wind and solar, it will continue to play this important role as a dispatchable power source, the agency says.

Batteries have been around since the 1800s and convert stored chemical energy into electrical energy.

Advances in technology and falling prices mean grid-scale battery facilities that can store increasingly large amounts of energy are enjoying record growth. The world's largest battery energy storage systems include the Moss Landing Energy Storage Facility in California, US, which currently has an energy capacity of 3,000 megawatt hours (MWh) but could eventually host 6 gigawatt hours (GWh) of battery storage.

Other countries investing in utility-scale battery energy systems include Australia, Germany, Japan, Lithuania and Chile

Thermal energy storage is used particularly in buildings and industrial processes. It involves storing excess energy - typically surplus energy from renewable sources or waste heat - to be used later for heating, cooling or power generation.

Liquids such as water, or solid materials such as sand or rocks, can store thermal energy. Chemical reactions or changes in materials can also be used to store and release thermal energy.

Water tanks in buildings are simple examples of thermal energy storage systems. On a much grander scale, Finnish energy company Vantaa is building what it says will be the world's largest thermal energy



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storage facility. This involves digging three caverns - collectively about the size of 440 Olympic swimming pools - 100 metres underground that will store heat and supply a district heating network whenever needed. Vantaa says the site could heat a medium-sized city for a year.

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