Energy power storage

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With the rapidly falling costs of solar and wind power technologies, increasing shares of variable renewable energy will become the norm, while efforts to decarbonise the transport sector are being accelerated by the use of electric vehicles. This need to accommodate variable energy supply while providing undisrupted output in the electricity sector, as well as efforts to integrate renewables into the end-use sectors has brought into sharp relief the significant potential, as well as crucial importance, of electrical and thermal energy storage to facilitate deep decarbonisation.

Electricity storage that is based on rapidly improving batteries and other technologies will permit greater system flexibility, a key asset as the share of variable renewables increases. More directly, electricity storage makes possible a transport sector dominated by electric vehicles; enables effective, 24-hour off-grid solar home systems; and supports 100% renewable mini-grids.

et, electricity markets frequently fail to account properly for the system value of storage. The Electricity Storage Valuation Framework report proposes a five-phase method to assess the value of storage and create viable investment conditions to guide storage deployment for the effective integration of solar and wind power.

Thermal energy storage (TES) can help to integrate high shares of renewable energy in power generation, industry, and buildings sectors. TES technologies include molten-salt storage and solid-state and liquid air variants.

TES technologies offer unique benefits, such as helping to decouple heating and cooling demand from immediate power generation and supply availability. The resulting flexibility allows far greater reliance on solar and wind power and helps to balance seasonal demand. TES supports the shift to a predominantly renewable-based energy system and reduces the need for costly grid reinforcements.

The global market for TES could triple in size by 2030, growing from gigawatt-hours (GWh) of installed capacity in 2019 to over 800 GWh by 2030. Investments in TES applications for cooling and power could reach between USD 13 billion and USD 28 billion in the same period. Investments to drive technological development and measures to enhance market pull, combined with a holistic energy policy aimed at scaling up renewables and decarbonising energy use, can unlock rapid growth in TES deployment.

In deeply decarbonized energy systems utilizing high penetrations of variable renewable energy (VRE), energy storage is needed to keep the lights on and the electricity flowing when the sun isn''t shining and the wind isn''t blowing -- when generation from these VRE resources is low or demand is high. The MIT Energy Initiative''s Future of Energy Storage study makes clear the need for energy storage and explores pathways using VRE resources and storage to reach decarbonized electricity systems efficiently by 2050.

The three-year study is designed to help government, industry, and academia chart a path to developing and deploying electrical energy storage technologies as a way of encouraging electrification and decarbonization throughout the economy, while avoiding excessive or inequitable burdens.

The authors find that investment in VRE combined with storage is favored over new coal generation over the medium and long term in India, although existing coal plants may linger unless forced out by policy measures such as carbon pricing.

"Developing countries are a crucial part of the global decarbonization challenge," says Robert Stoner, the deputy director for science and technology at MITEI and one of the report authors. "Our study shows how they can take advantage of the declining costs of renewables and storage in the coming decades to become climate leaders without sacrificing economic development and modernization."

The report says many existing power plants that are being shut down can be converted to useful energy storage facilities by replacing their fossil fuel boilers with thermal storage and new steam generators. This retrofit can be done using commercially available technologies and may be attractive to plant owners and communities -- using assets that would otherwise be abandoned as electricity systems decarbonize.

The study also looks at hydrogen and concludes that its use for storage will likely depend on the extent to which hydrogen is used in the overall economy. That broad use of hydrogen, the report says, will be driven by future costs of hydrogen production, transportation, and storage -- and by the pace of innovation in hydrogen end-use applications.