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ENERGY STORAGE: DECOUPLING DEMAND FROM SUPPLY

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With the widespread deployment of renewables, attention is beginning to turn to another important part of the energy transition: storage. However, when people think of storage, they immediately think of batteries, but there are many different energy storage technologies that are expected to play a role in the transition.

In part four of this six-part series, we expand on earlier discussion of the energy transition, energy efficiency and renewables to look at the supporting role of energy storage.

Catalysts for change

The ability to decouple energy generation from demand and to store energy for when it is needed has been called the "holy grail" of the renewables industry.[1] While every effort is made to achieve alignment, often energy demands don't coincide with the physical phenomena powering renewables. For instance, the sun doesn't shine at night and it is not always windy, which makes the ability to store energy an invaluable part of a net-zero energy system.

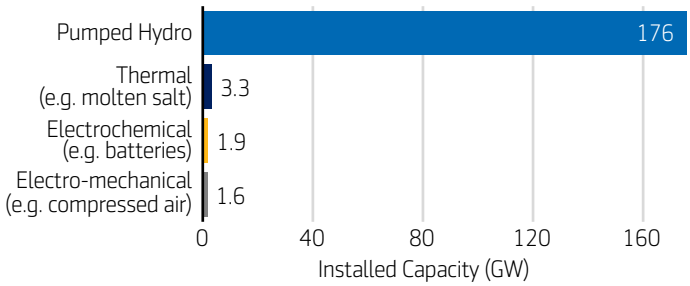
For electrical energy, there are a wealth of options for storage: traditional lithium-ion batteries but also new chemistries (e.g. flow batteries), thermal storage, gravity, compressed air, pumped hydro, hydrogen, flywheel, capacitors, etc. All of these have different advantages and disadvantages which means there is no one-size-fits-all solution. The two leading applications are electricity grids and electric vehicles (EVs). For electricity grids, storage can be used to improve grid resilience and stability while supporting an increase in carbon-free generation along with other ancillary benefits such as bill management and on-site or emergency power. For EVs, storage is a critical core component without which operation would be impossible.

It is also important to remember the importance of thermal energy storage. With more than half of energy demand in buildings stemming from space heating, cooling and hot water[2], the ability to store and deliver thermal energy on demand can improve energy efficiency and lower utility bills. By far the most common example of this is the domestic water heater, where water is heated and stored for daily use. However thermal storage systems can also help balance demand and supply on a weekly or even a seasonal basis using storage mediums as simple as water, sand or rocks.[3]

Environmental and economic implications

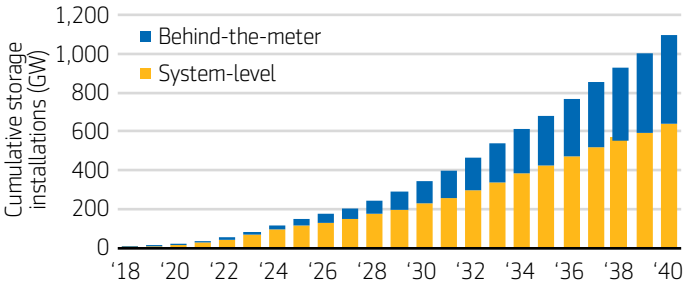
Current storage capacity is dominated by pumped hydro systems[4], with growth expected to continue largely in utility-scale installations rather than consumer or site-level "behind-the-meter"[5] applications.[6] This boom in storage is estimated to require USD 0.8 trillion of investment in batteries alone, potentially driving the cost down by some 50% over the next decade through economies of scale.[7] And while storage can support a net-zero energy system, care must be taken when looking to reduce carbon emissions: acting as essentially temporary containers for energy, storage systems are only as carbon-free as the energy that goes in them.[8]

Exhibit 1: Current operational electricity storage capacity



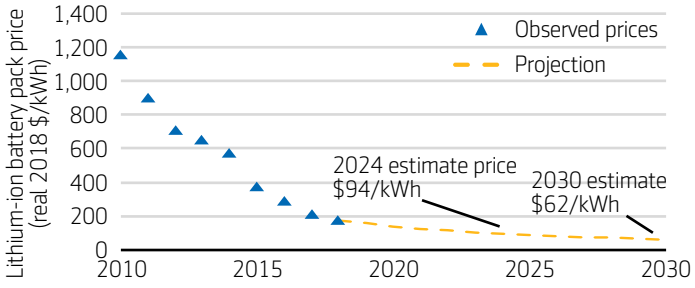
Source: International Renewable Energy Agency. As of 2017.

Exhibit 2: Expected growth



Source: Bloomberg New Energy Finance. As of 2019.

Exhibit 3: Observed and projected battery price



Source: Bloomberg New Energy Finance. As of 2019.

Batteries are critical components for EVs and battery electric vehicles (BEVs) are currently the most readily available and cost-effective option for the electrification of transportation. It is hard to dispute the energy density benefits of fossil fuels such as gasoline, but standard internal combustion engines are only some 30% efficient resulting in a lot of wasted energy and unnecessary pollution. Studies have shown, however, that despite the increased emissions associated with battery production, battery electric vehicles are responsible for considerably lower greenhouse gas emissions over their lifetime than conventional internal combustion engines – even in countries that may still have a coal-intensive electricity grid.[9]

Industry disruption and investment opportunities

Bloomberg New Energy Finance expects the continued growth of energy storage – specifically utility-scale storage installations largely driven by moving from stand-alone installations to integrated solutions; in other words, designing and installing storage to complement renewable energy systems and take advantage of completely carbon-free energy. A recent example is the USD 68 million hybrid energy park project from Vattenfall which is combining solar, wind and batteries in the North of the Netherlands to provide enough power for 40,000 homes.[10]

But the key to further disruption is scale. Ramping up production and deployment is expected to drive down costs through economies of scale, further improving the economics of storage itself as well as integrated systems and EVs. For example, in 2014 when Tesla and Panasonic announced plans for the first "Gigafactory", they expected to invest over USD 6 billion in order to produce batteries for some 500,000 vehicles while reducing costs by at least 30%[11]—a critical cost reduction where some 40% of the pre-tax retail price of an electric vehicle is reported to be determined by the price of the battery.[12]

Despite opportunities, challenges remain

The primary hurdle to broader adoption of energy storage is cost. Even with recent decreases from scale and innovation, high capital costs—certainly relative to the renewable energy systems they are often coupled with—is the determining factor for deployment.[13] The other significant barrier is technology uncertainty. Outside of pumped hydro and lithium-ion batteries, many storage technologies have limited operational track records and questions remain regarding durability, lifetime and future innovation. Another emerging issue is supply chain risk. Many of the minerals used in common lithium batteries, in addition to being in potentially short supply, come from countries with poor governance records – for example, over 60% of the world's cobalt is supplied by the Democratic Republic of Congo[14] – and manufacturers are expected to face increasing levels of scrutiny of their supply chains.[15]

Key themes and investment considerations

No longer a niche or standalone product, energy storage plays an ever-increasing integral role in the net-zero energy transition. In order to capitalize on that role and help accelerate the transition, companies will need financing to grow production. For example, Tesla issued USD 1.6 billion in debt to help fund the aforementioned "Gigafactory" and well-known global companies with regular access to capital markets such as Panasonic and LG Chem are leading producers of lithium-ion batteries[16]. Businesses developing new and innovative storage solutions, such as smaller companies like Gravitricity and Hydrostor, are working to commercialize emerging gravity- and compressed air-based solutions, respectively. And while utilities and other project developers will have access to traditional forms of finance, there is likely to be the opportunity for consumer-focused financing to support "behind-the-meter" installations.

There is also the supply chain. New technologies come with a need for critical raw materials. By re-focusing away from dying commodities such as thermal coal to minerals such as lithium, nickel, or cobalt, mining companies can remain attractive long-term investment opportunities and help secure the long-term supply of these valuable commodities. Investors can also work to provide increased market liquidity via new spot-market mechanisms as well as futures and derivative products for these growing supply chains.[17]

Looking ahead

In the next edition of this series we will discuss low-carbon fuels—alternative energy vectors to common fossil fuels—as we continue to explore the opportunities and challenges related to the energy transition.

	**Energy efficiency**	Doing the same with less		**Low-carbon fuels**	Using alternatives to common fossil fuels
	**Renewables**	Generating energy without carbon emissions		**Carbon capture**	Capturing, storing and using carbon
	**Storage**	Decoupling energy demand from generation			

References

[1]Eckhouse, Brian "Siemens, AES Join in $2.5 Billion Storage Market Opportunity" Bloomberg.com (11 July 2017) https://www.bloomberg.com/news/articles/2017-07-11/siemens-and-aes-teaming-up-for-global-energy-storage-venture

[2]International Energy Agency for the Global Alliance for Buildings and Construction 2018 Global Status Report (7 December 2018) https://www.worldgbc.org/news-media/2018-global-status-report-towards-zero-emission-efficient-and-resilient-buildings-and

[3]International Renewable Energy Agency (IRENA) Thermal energy storage: Technology brief (January 2013) https://www.irena.org/publications/2013/Jan/Thermal-energy-storage

[4]International Renewable Energy Agency (IRENA) Electricity storage and renewables: Cost and markets to 2030 (October 2017) https://www.irena.org/publications/2017/Oct/Electricity-storage-and-renewables-costs-and-markets

[5]Behind-the-meter refers to the position of an energy system on the customer-side of a utility meter, providing energy directly without necessarily interacting with the electricity grid or utility

[6]Bloomberg New Energy Finance (BNEF) 2019 Long-Term Energy Storage Outlook (31 July 2019) https://www.bnef.com/core/insights/21113

[7]Bloomberg New Energy Finance (BNEF) New Energy Outlook 2019 (August 2019) https://about.bnef.com/new-energy-outlook

[8]Roberts, David "California solves batteries' embarrassing climate problem" Vox.com (2 December 2019) https://www.vox.com/energy-and-environment/2019/12/2/20983341/climate-change-california-batteries-emissions-watttime

[9]Hausfather, Zeke "Factcheck: How electric vehicles help to tackle climate change" CarbonBrief.org (13 May 2019) https://www.carbonbrief.org/factcheck-how-electric-vehicles-help-to-tackle-climate-change

[10]Vattenfall "Vattenfall combines wind, solar and batteries in new hybrid energy park" (12 August 2019) https://group.vattenfall.com/press-and-media/news--press-releases/pressreleases/2019/vattenfall-combines-wind-solar-and-batteries-in-new-hybrid-energy-park

[11]Ohnsman, Alan "Musk's $5 Billion Tesla Gigafactory May Start Bidding War" Bloomberg.com (27 February 2014) https://www.bloomberg.com/news/articles/2014-02-26/tesla-plans-1-6-billion-note-offering-to-fund-gigafactory

[12]Bloomberg New Energy Finance (BNEF) "Electric Vehicle Cost Competitiveness" (29 October 2019) https://www.bnef.com/core/themes/123

[13]US Department of Energy "Market and Policy Barriers for Energy Storage Deployment" (accessed 18 June 2020) https://www.energy.gov/eere/analysis/downloads/market-and-policy-barriers-energy-storage-deployment

[14]NS Energy "The world's biggest cobalt producing countries" (4 May 2019) https://www.nsenergybusiness.com/features/top-cobalt-producing-countries/

[15]Amnesty International "Amnesty challenges industry leaders to clean up their batteries" (21 March 2019) https://www.amnesty.org/en/latest/news/2019/03/amnesty-challenges-industry-leaders-to-clean-up-their-batteries/

[16]Yang, Heekyong and Jin, Hyunjoo "Factbox: The world's biggest electric vehicle battery makers" Reuters (26 November 2019) https://www.reuters.com/article/us-autos-batteries-factbox/factbox-the-worlds-biggest-electric-vehicle-battery-makers-idUSKBN1Y02JG

[17]McKinsey & Company "Lithium and cobalt: A tale of two commodities" (22 June 2018) https://www.mckinsey.com/industries/metals-and-mining/our-insights/lithium-and-cobalt-a-tale-of-two-commodities

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