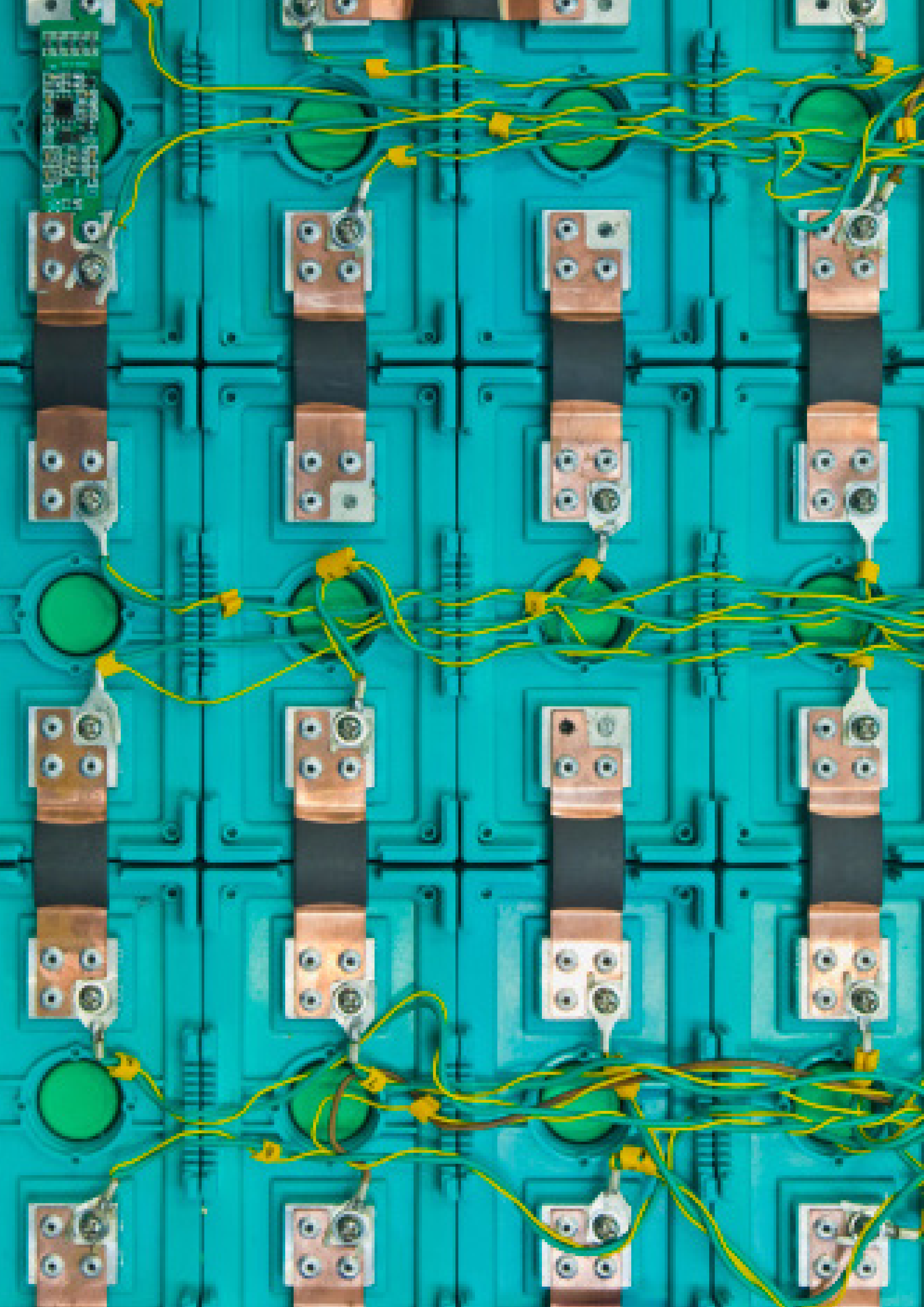
WHITE & CASE

Electric energy storage: preparing for the revolution

Electric energy storage is on the cusp of a commercial breakthrough. Are markets and regulators ready?



An electric energy storage revolution is poised to begin.

This is the time for industry participants, regulators and other stakeholders to brainstorm creatively about what the future of these markets should look like.

Until now, there have been only a few, comparatively costly ways to temporarily store large quantities of electric energy—keeping it available for later use, when needed. Technological advances (in battery technology, in particular) are poised to make energy storage efficient and commercially viable in markets across the US. And these technologies are emerging just as environmental pressures are encouraging a focus on renewable energy—typically based on unpredictable sources such as sun or wind—which can only be reliable at every hour of every day if they are paired with effective energy storage.

As a result of these and other factors, energy storage is one of the few areas predicted to have massive growth potential in the current global energy markets. Yet the path ahead is not straightforward.

While the technologies are evolving rapidly, many market practices and regulatory standards have not begun adapting for the changes in structures and conventions that energy storage will require. Everyone with an interest in energy storage and renewable energy needs to start thinking now about the best ways to update our market and regulatory approaches.

If we address these issues thoughtfully in advance, we can be prepared to unlock the full potential of energy storage commensurate with technological advances bringing down costs and making storage widely commercially viable.

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The promise of these new technologies and approaches can only be met if markets are structured in a way to allow these new technologies and approaches to provide grid management services.

Executive Office of the President of the United States. "Incorporating Renewables into the Electric Grid: Expanding Opportunities for Smart Markets and Energy Storage", (June 2016).

ENERGY STORAGE PROVIDES MASSIVE GROWTH OPPORTUNITIES

At least one source projects that the world's energy storage capacity will double within only a year—from 1.4 gigawatt-hours added in 2015 to 2.9 gigawatt-hours added in 2016—and will reach 21 gigawatt-hours by 2025. The US is leading this charge, with 18.3 megawatts of energy storage deployed in only the first quarter of 2016.[1]

Although some energy storage technologies, such as pumped hydroelectric energy storage, have existed for decades, the last five years have brought an explosion of interest in other new technologies, such as battery storage.

A June 2016 US White House report extolled the benefits of energy storage and noted the great strides taken to incentivize deployment of energy storage in the US.[2] Still, as the report acknowledged, considerable obstacles must be surmounted before we can realize the full potential of energy storage.

Some of these obstacles are technical, since many storage technologies remain in a developmental state. Other obstacles are commercial, including building energy storage of sufficient scale and finding financing for nascent energy storage technologies.

But a third, major category of significant obstacles includes regulatory barriers and market structures that have been slow to accommodate the vibrant new potential of energy storage.

REGULATORY AND MARKET OBSTACLES PREVENT THE FULL POTENTIAL USE OF ENERGY STORAGE

Historically, the participants in US interstate wholesale electrical energy markets included electricity generators, transmitters and distributors—each of which was a separate entity with a distinct role in the energy market.

But energy storage is incredibly flexible and blurs long-standing lines between generation and transmission/distribution.

Energy storage can both inject and withdraw electricity from the grid, leading to many applications that transcend the traditional divisions of generation/ transmission/distribution.

In fact, the US Federal Energy Regulatory Commission (FERC) defines energy storage broadly as any "facility that can receive electric energy from the grid and store it for later injection of electricity back to the grid. This includes all types of electric storage technologies, regardless of their size and storage medium, or whether they are interconnected to the transmission system, distribution system, or behind a customer meter."[3]

Our current US systems for regulatory oversight and standard market practices need to be updated before we can take full advantage of the opportunities presented by energy storage.

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To 2.9 gigawatt-hours added in 2016

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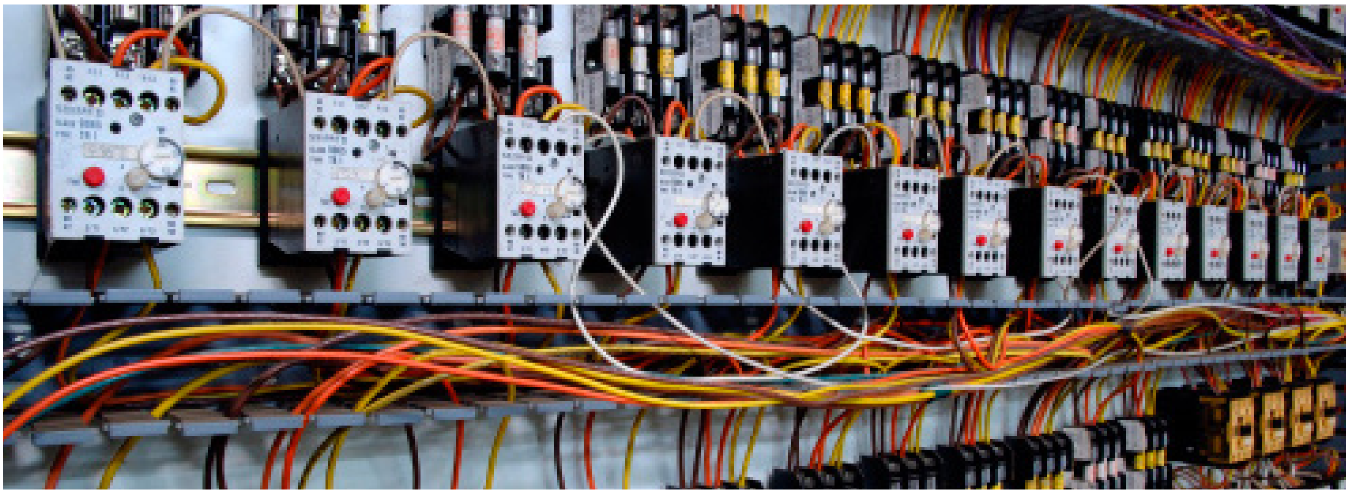
Regulatory uncertainty and lack of clarity are based on outdated assumptions

Since the early 1990s, FERC has regulated wholesale sales of electricity by generators very differently than sales of transmission services. FERC deregulated generation, allowing many entities to sell wholesale energy at market-based rates into organized markets for energy, capacity and other related physical and financial products. Transmission, on the other hand, remains largely subject to cost-of-service ratemaking and strict adherence to open-access transmission tariffs and non-discriminatory service to customers.

Energy storage can act both like a generator—by injecting electricity onto the grid—and like a transmitter or distributor—by providing applications such as frequency response and load management. FERC has recognized on many occasions that energy storage can serve many different purposes that cross the previously siloed categories of generation, transmission and distribution. Despite this recognition, an individual energy storage provider must choose between participating solely as a generator in the organized wholesale markets or only as a transmitter that receives cost-based returns through an open access transmission tariff (OATT) or transmission revenue requirement.

By assuming that every energy storage resource must choose only one method of participation in the energy markets, FERC limits the full range of potential value that energy storage could provide in the years ahead.

In addition, the US rules on how to connect energy storage to the electricity grid are often poorly defined and based on technologies that are markedly different from energy storage. In April 2016, FERC issued multiple data requests to each of the Regional Transmission Organizations and Independent System Operators (RTOs/ISOs) with initial data requests to RTOs/ ISOs about barriers to storage participation. While the RTOs/ISOs reported some progress in permitting energy storage to participate in existing market constructs, commenters noted myriad examples of market rules



OUR NEED FOR UPDATED GRID INTERCONNECTION RULES

In early 2016, the Midcontinent Independent System Operator (MISO) filed a generator interconnection agreement (GIA) for a battery storage installation at an existing generator site.[4] Indianapolis Power & Light Company (IPL), the project sponsor, objected to using a GIA to connect its storage resource to the grid, saying the storage was intended to be used like a transmission asset to provide frequency response and black start capabilities and that MISO's pro forma GIA was not drafted with the unique characteristics of energy storage in mind—but that the only way to get interconnection service in MISO's area was through a GIA. FERC accepted the GIA, but noted that the MISO pro forma GIA "was not originally intended to govern the interconnection of electric storage resources" and that FERC is "exploring issues related to the interconnection of electric storage resources."

that create systemic barriers to energy storage participation. FERC is reviewing the comments it received, but it will likely be a long time before any changes occur in the markets as a result.

Extra charges create disincentives for adding energy storage capacity

Utilities and consumers that add energy storage capacity could potentially keep their electric grids stable and manage imbalances—by injecting and withdrawing electricity at different times, as needed—without necessarily needing to generate more electricity.

This seems like the type of energy conservation the US now seeks to encourage. In fact, though, our current regulatory approach has the opposite effect—by imposing extra costs and charges on energy storage due to its withdrawal of electricity from the grid that are not imposed on traditional generators (such as coal or natural gas).

When a generator with energy storage draws power from electric grid to charge its system, RTOs/ISOs often impose transmission access charges, uplift charges and other costs on load. Traditional generators do not incur these added costs. Some RTOs/ISOs, such as the California Independent System Operator (CAISO), have provided guidance through stakeholder processes clarifying that they will not impose these charges on energy storage resources that participate in the wholesale energy markets, but other RTOs/ISOs have not been clear.

And in some instances, FERC has upheld imposing these charges on energy storage. For example, FERC approved Consolidated Edison's distribution access charge for a PJM Interconnection (PJM)energy storage resource (even though ConEd exempts generators that use its system from these charges), because the energy storage charging activity had a different impact on ConEd's system.

Current market participation rules were not designed with energy storage in mind

Most RTOs/ISOs have made efforts to allow energy storage to participate (at least to some degree) in their markets. But latent biases embedded in US market participation rules often create barriers for energy storage.

For example, the new capacity market rules in PJM and ISO-New England (ISO-NE) provide enhanced revenue streams for capacity resources that clear, and they impose significant penalties on capacity resources that fail to dispatch during emergencies or shortage events. However, these market rules do not apply maximum duration limits for shortage events associated with penalties, and they do not limit the number of shortage events per hour that a capacity resource must respond to in order to avoid the penalty.

This is not an issue for traditional generators, which can continue

1 GTM Research, "U.S. Energy Storage Monitor: Q2 2016 Executive Summary" (June 2016).

2 "Incorporating Renewables into the Electric Grid: Expanding Opportunities for Smart Markets and Energy Storage", Executive Office of the President of the United States, (June 2016).

3 Electric Storage Participation in Regions with Organized Wholesale Electric Markets, Docket No. AD16-20-000, Data Request issued Apr. 11, 2016.

4 *Midcontinent Independent System Operator, Inc.*, 155 FERC ¶ 61,211 (2016).

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The current lack of clarity in the rules makes investment and financing decisions difficult.

to generate electricity for long periods, if needed, and can respond to multiple discrete shortage events. But energy storage resources must be recharged after they fully discharge their stored electricity, and most storage resources (particularly battery storage) discharge completely after 4 to 6 hours. Energy storage resources cannot respond to shortage events that last longer than their maximum discharge duration or to multiple shortage events within a period of time that is too brief for them to recharge appropriately. Thus, exposure to these penalties is a significant deterrent to energy storage participation in the capacity markets.

In other respects, some RTOs/ISOs have shoehorned energy storage into existing products and markets without fully reviewing their current data collection limitations and requirements—which can be ill-suited to energy storage. For example, CAISO only recently began allowing market participants to submit "state of charge" as an operating parameter for their energy bids. This allows greater energy storage participation by mitigating the concern that CAISO would try to dispatch an energy storage resource beyond its stated limits due to not taking its state of charge into account. Similarly, other RTOs/ISOs have added explicit language to their tariffs regarding energy storage's ability to participate in frequency response markets as a consequence of FERC's Order No. 755, but have not added explicit language addressing energy storage's participation in other capacity, energy and ancillary service markets.

Many states limit local utilities' ability to own energy storage

In many states, one legacy of the state's deregulation of retail electric service is a state law prohibiting local wires utilities from owning any generation resources. This can discourage utilities from investing in energy storage, especially if it is unclear whether the energy storage will be viewed as a generation resource.

This is a problem for the emerging energy storage industry, as many energy storage projects still struggle to find necessary financing. Allowing wires utilities, which often don't need bank or project financing, to invest in energy storage would benefit the entire industry by increasing energy storage participation in the electric grid and energy markets while also allowing lenders to gain more experience and comfort with energy storage and its commercial viability.

THINKING BOLDLY ABOUT THE FUTURE OF ENERGY STORAGE

With energy storage technologies on the verge of commercial viability, this is an opportune time for industry participants, regulators, investors, consumers and other stakeholders to brainstorm creatively about what the future of those markets should look like.

Here are several possible approaches to incentivize energy storage (some of which likely are more easily implemented than others).

Develop brand-new wholesale market products designed specifically for energy storage

We all could start by asking what products—ideally—would fill the current and future needs of our energy markets. Since energy storage blurs traditional lines and has multiple potential uses, visionary innovators could take full advantage of energy storage's benefits and flexibility to create completely new types of products that benefit our electric grid, protect our environment, lower energy costs, reduce consumer burdens, enable new types of technologies—and so on.

For example, CAISO has developed a Flexible Capacity product that is intended to address the challenges of operating the electric grid with the ever-growing participation of variable resources such as wind and solar. This product focuses on procuring resources with fast upward and downward ramping capabilities that can counteract the sudden output changes of such variable resources. Although not limited to energy storage resources, this product is uniquely suited to energy storage's technological strengths, and CAISO has designed flexible capacity rules to accommodate energy storage participation.

Revise existing rules to eliminate latent biases

RTOs/ISOs could revise their existing market rules and product definitions to improve the ability of energy storage to participate

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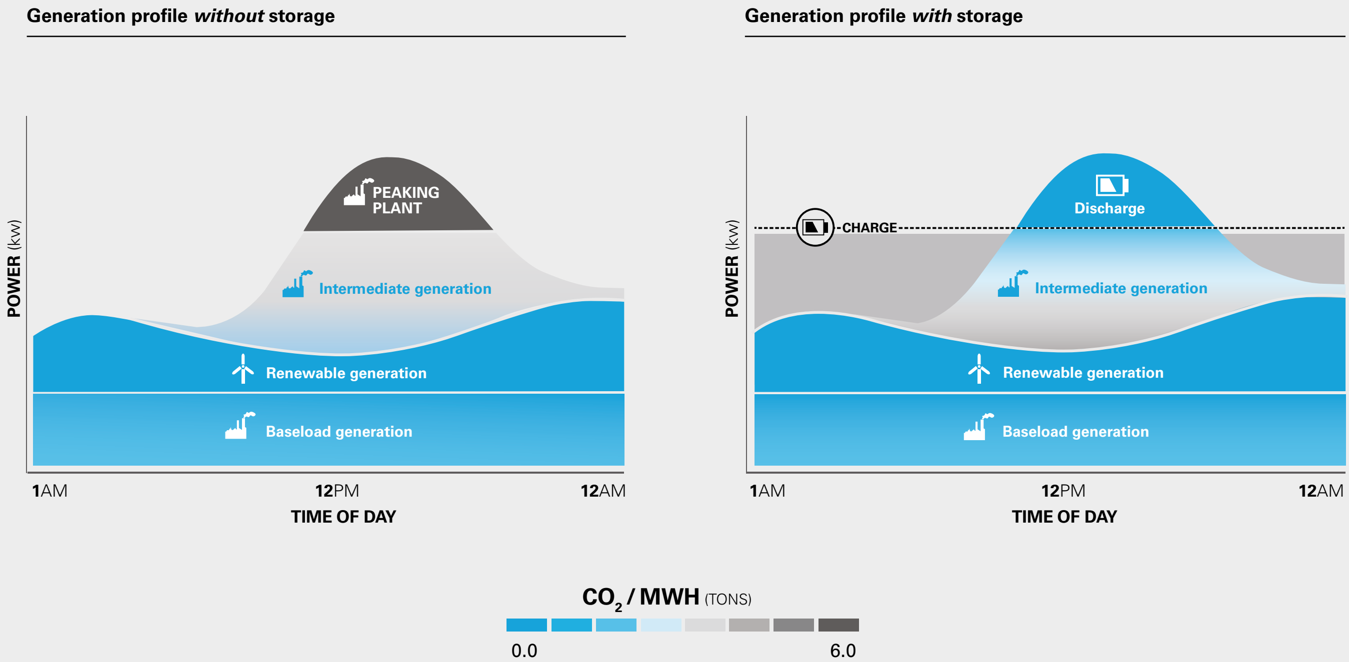
[A] market that in the United States could reach US$2.5 billion by 2020—six times as much as in 2015. ... as the technology matures, we estimate the global opportunity for storage could reach 1,000 gigawatts in the next 20 years.[5]

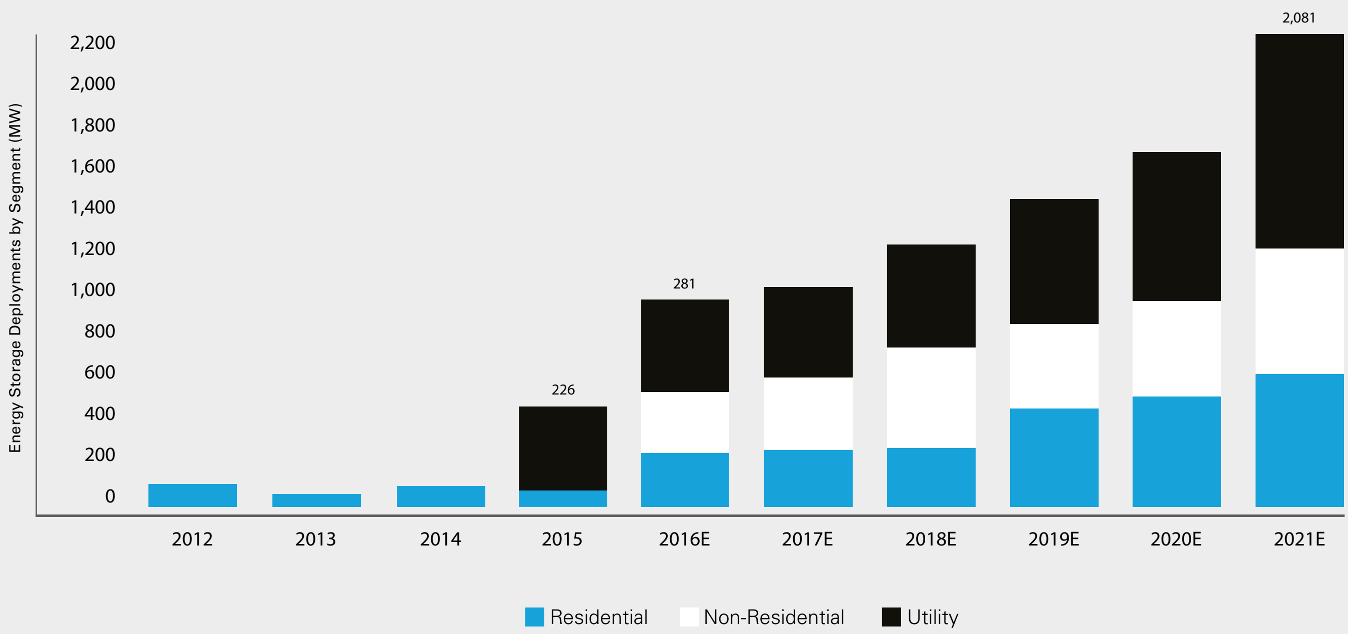
5 "The New Economics of Energy Storage", McKinsey & Company, August 2016

EOS Energy Storage – Opportunity to Provide Clean & Efficient Peaking Capacity



Source: EOS Energy Storage

Annual US Energy Storage Deployments (MW), 2012-2021E



Source: GTM Research / ESA U.S. Energy Storage in energy markets or, at a minimum, be clear about how and where energy storage resources can participate in the markets.

Grow the symbiotic relationship between energy storage and renewable energy

Renewable energy is a growing presence on the electric grid, and current US policies aim to increase the amount of energy generated by renewable sources even further.

Energy storage can help renewable energy overcome several obstacles. For example, wind and solar sources tend to start and stop suddenly (depending on the availability of the wind or sun), which can create grid management issues. Energy storage can help smooth out these starts and stops with flexible ramping up and down of its output. In addition, because wind and solar resources tend to generate peak production during off-peak load periods, they typically miss putting electricity into the grid at times with the most lucrative locational marginal pricing (LMP). Energy storage could help renewable energy generators "time shift" when they inject energy on the grid, and thus capture higher LMPs.

Until now, this symbiotic relationship has been slow to develop, in part due to uncertainty as to whether energy storage facilities can be deemed "qualified energy property" for purposes of the federal investment tax credit (ITC). However, the IRS may soon propose new regulations to clarify this issue. And recent deals demonstrate a growing interest in combining renewable energy with energy storage. In 2016, Tesla (a battery storage developer) announced US$2.6 billion plans to purchase SolarCity (a rooftop solar developer), and Total (which owns a controlling stake in the solar panel maker SunPower) agreed to acquire Saft (a French battery company) for US$1.1 billion.

Increase states' support for energy storage

As of September 2016, only three US states—California, Oregon and Massachusetts—had laws requiring utilities to procure energy storage as part of their resource mix. These programs provide an obvious boost to energy storage by ensuring a market and providing a revenue stream for financing projects that sell energy storage services to utilities. The programs also help clarify wires utilities' role in energy storage rollout, by explicitly allowing these utilities to own energy storage resources.

While a start, each of these programs is very small—representing only 1-2% of peak load in their respective states. Expanding these programs and developing similar programs in other states could drive further energy storage growth, just as similar state programs that mandated renewable energy procurement spurred growth in wind and solar resources. California is doing just that now, proposing to increase its statewide mandate for energy storage by 500 MW, among three other proposals that are intended to boost energy storage.

Update FERC's rules

FERC is cautiously exploring the regulatory and market obstacles to energy storage growth. Storage developers, transmission owners and grid operators have been vocal in their support for FERC to mandate market changes to remove these obstacles. On the other hand, some trade associations representing generator interests have warned FERC against mandating many

IRS DETERMINATION OF QUALIFIED ENERGY PROPERTY

The IRS issued Notice 2015-70 in October 2015, seeking comments on what kinds of storage should qualify as qualified energy property for purposes of the ITC. Among other questions, the IRS asked "whether only property that actually produces electricity may be considered energy property or whether property such as storage devices and power conditioning equipment may also be considered energy property" that are entitled to tax credits. Comments were due in February 2016. It is unclear whether the IRS will issue new regulations or guidance, and it can be a multi-year process for IRS to issue new regulations. So there may be uncertainty about the federal tax treatment of energy storage resources for a while longer, as the IRS considers next steps.

STATE ENERGY STORAGE PROGRAMS

CALIFORNIA

California was the first state to enact an energy storage mandate with AB 2514. This law requires California's three investor-owned utilities to procure a total of 1,325 MW of energy storage by 2024. These IOUs can own up to 50 percent of the storage resources procured under the mandate; the rest must be purchased from independent storage providers.

OREGON

Oregon's legislature passed HB 2193 in 2015, which requires Portland Gas & Electric and PacifiCorp to bring a minimum of 5 MWh of energy storage online by January 1, 2020. Details regarding implementation of Oregon's program remain under development by the Oregon Public Utilities Commission.

MASSACHUSETTS

In July 2016, Massachusetts passed H 4568, which requires its Department of Energy Resources (DOER) to determine by the end of 2016 whether to implement a procurement target for energy storage systems by January 1, 2020. If DOER finds it appropriate to develop a procurement target, then DOER has until July 1, 2017, to adopt specific targets. The legislation also mandated that energy storage may be owned by electric distribution companies in Massachusetts.

changes quickly solely to create incentives for energy storage. For example, in response to FERC's recent inquiries about energy storage, the Electric Power Supply Association warned FERC to preserve "a level playing field for all suppliers." It may be a long, slow road to change if traditional generators defend their competitive market positions and work to ensure that any new rules do not give energy storage an unfair advantage over other resources.

Grow demand response and behind-the-meter storage capacity

Demand response—programs that allow energy consumers to voluntarily reduce or control their energy usage at specific times (for example, during peak hours when electricity costs are highest)—is another burgeoning area in the energy industry.

As smart technology has rolled out to large energy consumers, such as commercial and industrial customers, those consumers began to reduce their costs by managing their energy use closely to avoid peak prices. Then, after FERC issued Order No. 745 in 2011 (setting certain standards for demand response practices and pricing), large energy consumers began seizing new opportunities to turn their demand response programs into new revenue streams by selling their reduced energy use to RTOs/ISOs.

While markets still have a long way to go to fulfill the potential of demand response programs as a supply resource, there is considerable policy support for doing so. Energy storage can provide a behind-the-meter source for electricity, allowing consumers to manage their withdrawals from the electric grid in accordance with their positions in the market. Tesla and others are developing storage products with just this application in mind. In the long run, energy storage may be instrumental in unlocking the ability of residential consumers to eventually sell their demand response ("the amount of energy I did *not* draw from the electric grid because I used stored energy") in energy markets.

Energy markets in the US may be a largely untapped resource for energy storage thus far. But these and other innovations could increase the outlook for energy storage—and help continue to improve the global energy markets.

New electrical transformers at a storage facility

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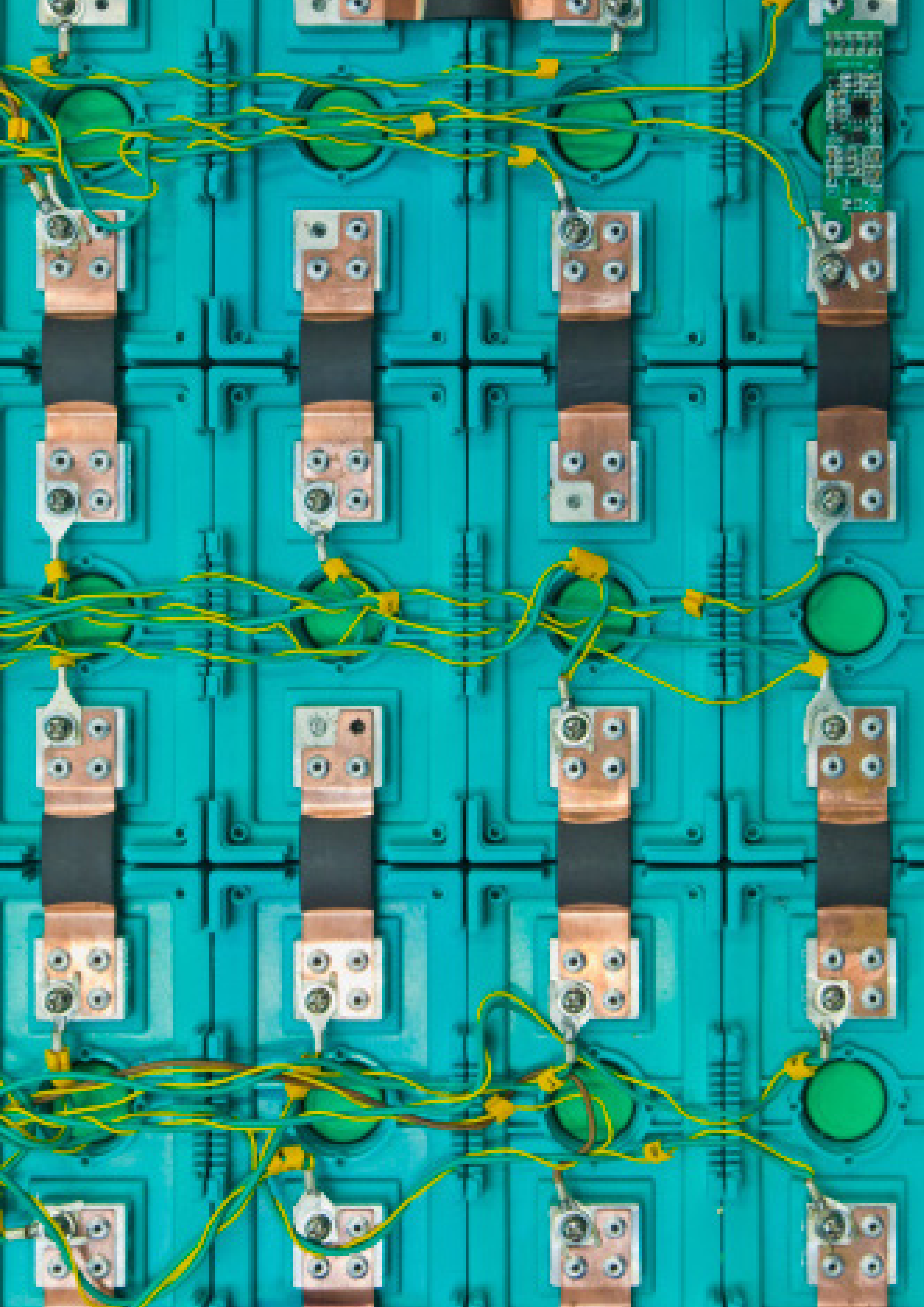

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