# The rise and rise of US storage

**Storage |** Energy storage in the US is being propelled forward by falling costs and increasingly favourable markets and policy. But for the full value of storage to be realised, numerous regulatory and fiscal barriers must still be surmounted, writes Matt Roberts

Credit: S&C Electric

**Increased deployment is proving the value of storage in the US across a wide range of use cases**

Energy storage in the United States is going through a meteoric rise, fuelled by a combination of increasing value and market access, enhanced regulatory structures and plummeting system costs.

This ascent is taking different forms across the country. Last month, Massachusetts became the third state in the US to pass energy storage procurement goals, following a trend born on the West Coast. California is pursuing a goal of 1.325GW of energy storage by 2020 for its public utilities and Oregon has followed suit with its own targets.

Also in California, anticipated gas shortages, underpinned by the largest ever natural gas leak in the US, have propelled utilities to rapidly procure energy storage to prevent system capacity shortfalls. New Jersey is seeking storage to ensure system reliability in the face of increasingly intense superstorms, and to enable customers to have backup power and consume their own solar energy even when the grid is down. In New York, Con Edison is procuring storage to defer the cost of a major substation upgrade, while Indianapolis Power & Light just completed the installation of 20MW of storage to help balance the grid and provide black start capabilities in the state.

At the federal level, the White House convened the "Summit on Scaling Renewable Energy and Storage with Smart Markets" earlier this summer. The summit resulted in new executive actions, and 33 government and private sector commitments representing nearly $1 billion of new investments and 1.3GW of additional new deployments. Congress has introduced bipartisan legislation supporting storage advancement, the IRS is revising its guidance on storage and the Investment Tax Credit, and the Federal Energy Regulatory Commission (FERC) is reviewing treatment and qualification of storage systems across the ISO/RTO markets.

What this confluence signals is critically important: the energy storage industry, after decades of work and hundreds of successful and reliable deployments, is being accepted as a critical facet in securing the nation's energy future and modernising the grid. But while these milestones are momentous to the industry, there is critical work to be done to establish fair, competitive markets that capitalise on the value of energy storage.

## What storage is today

Our electric grid is one of the longest supply chains in the world with very little storage capacity built in. We stockpile fossil fuel, and some of our advanced hydroelectric facilities even run water uphill and back down again – but once energy is generated our ability to do anything other than consume it is very limited. Since the advent of the electric grid we have known the inherent value of stored energy and sought to deploy it – even Edison's Pearl Street Station incorporated battery storage in the 1880s to help ensure reliable electricity supply for his first 82 customers.

The term energy storage defines a suite of technologies – batteries, flywheels, compressed air, thermal, flow batteries and more. While each of these systems may operate differently on the inside, their fundamental value is the ability to store energy when it is plentiful and utilise it when it is needed or most valuable to the grid.

Energy storage systems make a more reliable electric grid possible, creating flexible, decentralised reserves of energy that can be tapped in to on demand. Faster-responding storage allows us to operate the grid more efficiently, instantly balancing our ever-fluctuating supply and increasingly dynamic demand. These systems are also used to defer or avoid costly investments in excess capacity and infrastructure currently needed to serve our nation's growing peak loads.

Customer-sited energy storage enables homeowners and businesses to drastically lower their consumption while avoiding more expensive demand charges and time-of-use rates. Storage provides backup power and enables solar customers to generate on-site and consume their own energy even when the grid is down. High-tech industries with exacting power specifications can use storage for reliable,

unvarying supplies of energy.

Through these various applications energy storage enables end-users to be partners in creating a more reliable and affordable electric grid, and means that utilities can deliver more sustainable energy from a more resilient system while adapting to the changing needs of businesses and homeowners.

## What storage is not

The oft made analogy is that energy storage resembles the solar industry circa 2005. Though from my seat – sitting at the nexus of technology, policy and markets at the Energy Storage Association – the road ahead looks very different than that of the past decade for renewables.

According to the 'U.S. Energy Storage Monitor' [1], in 2015 we saw more than 250% growth in system deployments – doubling the entire US installed capacity. In just the last quarter of the year there was more energy storage deployed than all of 2013 and 2014 combined. By the beginning of next decade, more than 6.5GW of energy storage will already be deployed (Figure 1).

In just the past 18 months, energy storage system costs have declined more than 70% [2] and the balance-of-system costs are projected to decline another 41% [3] before 2020. Ramped up manufacturing and production supported by expanded market access will depress prices for storage technologies even further, and the ES Monitor projects more than 25% in additional cost declines before 2018.

While these trends may closely mirror the acceleration in solar, they also mirror the advancement of nearly any energy technology – higher value coupled with lowering costs equals industry success, Economics 101. For energy storage though, the drivers of that success and the challenges ahead are markedly different from the growth in solar.

Energy storage has a fundamentally distinct value proposition when compared to renewable generation, and benefits the grid in very different ways. Storage is, in effect, an energy service; the valuable utilisation of energy when and where it is needed most. It doesn't fit neatly into traditional asset classes like generation, transmission, or load; it can perform as any one of them or all three, adapting to the changing needs of the system in real time.

Additionally, energy storage is often held up as the saviour of renewables, here to address intermittent generation – this is an oversimplification. Intermittency hasn't 'broken' the grid as some proclaim; rather dynamic generation has shown that our current electric grid is insufficient and outmoded.

Energy storage can rapidly balance *all types* of generation and load, allowing fossil plants to run more efficiently and maximising renewable output. Variable generation and mutable loads combine to produce an ever-fluctuating system that energy storage addresses, helping us operate the grid more reliably and affordably. Energy storage has a critical role to play, regardless of how our generation mix and customer behaviour evolve in the future.

## Applications and value of storage systems today

Today, the majority of energy storage systems being deployed are in front of the meter, connected directly to the grid and serving in various roles and applications. But customer-sited storage is catching up quickly and the market for these distributed systems is expected to eclipse grid installations before the end of the decade [4].

In wholesale markets storage is designated as an 'Exempt Wholesale Generator' by FERC –meaning that it can provide capacity, energy and ancillary services in ISO/RTO markets. Energy storage has notably been active for many years in PJM and NY-ISO providing ancillary services, and is quickly being adopted by the remaining wholesale markets as well.

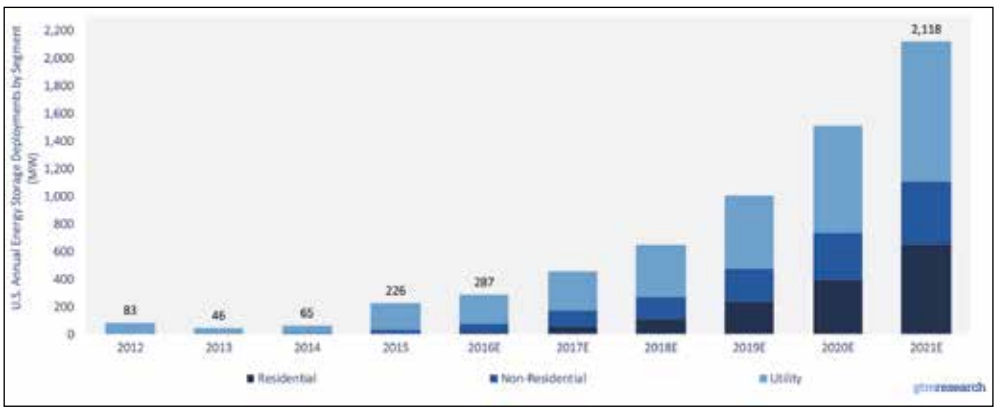
In PJM in particular, this required market changes that separated resources such as fossil fuel plants, which follow a traditional, slower grid signal (RegA) from energy storage systems and other technologies that can follow a quicker, faster-responding grid signal (RegD). The RegD signal is able to meet the dynamic needs of grid operators much more efficiently, reducing energy consumption across the multi-state region through increased performance while saving millions of dollars.

When utilities weigh storage side by side with other solutions, it proves to be a cost-effective replacement for traditional fossil assets like local capacity or 'peaker' plants. Under the guidance of the California procurement targets, when utility Southern California Edison examined energy storage against traditional solutions for local capacity requirements, it decided to procure nearly 264MW of storage in one fell swoop, more than five times what was required – on both sides of the meter.

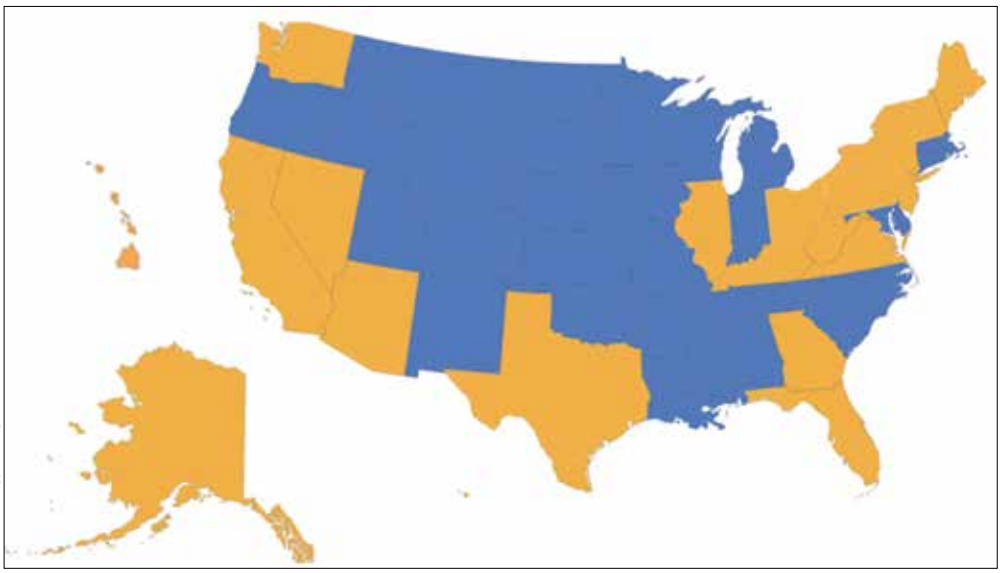
In customer-sited systems, energy storage is helping to defray the cost of demand charges for businesses and helping customers avoid time-of-use rates and consume more of their own on-site energy. Project developers are even building aggregated storage systems and virtual power plants that tie multiple installations together, working in concert to address system needs and creating an entirely new distributed tool for grid operators to call upon. These types of applications empower homeowners and businesses to be active participants in the grid – helping improve system performance, efficiency and reliability along with the utilities.

In 2015, 20 states installed energy storage systems in 2015, signalling that these opportunities are widespread and economically attractive in multiple applications and environments (Figure 2). In front of the meter, PJM and California are the two markets with the most deployments in the last three years, followed by states like New York, New Jersey and Hawaii that are starting to accelerate. On the customer side of the meter, California has led the industry on deployed storage systems in recent years, followed closely by Hawaii and then a collection of states experiencing their first waves of installations.

**Figure 1. The US energy storage market will grow nine-fold from 226MW in 2015 to 2.1GW by 2021**




Source: GTM Research



Source: Energy Storage Association.

**Figure 2. In 2015, 20 US states installed energy storage systems**

These systems have proven themselves a cost-effective solution in many roles in wholesale, competitive and vertically integrated markets across the country. And while this convergence of factors is driving immediate success, there are changes to regulatory and market structures that are needed to ensure that we can access and utilise the full value of these innovative energy systems.

## What barriers exist for energy storage?

While the US electric grid is becoming increasingly outdated and is in need of substantial improvements, we are burdened with archaic regulations and practices that govern the system and hinder our ability to capitalise on advances in technology.

When energy storage is interconnected in wholesale markets it is defined as a generator – even though a storage system does not 'generate' any new electrons. This constrains the system's potential to perform specified functions and contribute to certain markets, and can limit which entities are allowed to own and operate storage systems on the grid.

Within utility resource planning, energy storage is markedly undervalued by current methodologies and modelling and therefore often not even considered alongside other options. Given the limited role that energy storage has played on the grid historically, most of the traditional utility planning models were not designed to assess energy storage alternatives. And as storage defies simple classifications, it's often difficult if not impossible for the generation, infrastructure and load forecasting segments within a utility to determine how to appropriately quantify the value of storage under current planning methodologies.

In our energy tax code, energy storage is not listed as a qualifying energy property under the rules of the Investment Tax Credit. While storage can be included as part of the equipment within a qualifying renewable energy installation, owners are not able to invest in energy storage alone under the same terms. This is despite its ability to lower electric bills, enhance renewables penetration and improve system reliability.

These types of challenges and market nuances exist throughout the US, with differing federal, state and local policies and regulations governing the energy industry. While numerous best practices and precedents are in place, there is still a need to adopt regulations that ensure we are properly valuing, integrating and operating energy storage systems for maximum benefit. In short, it is imperative that regulations keep pace with advances in technology or else we are working against ourselves in the pursuit of grid modernisation.

## What lies ahead?

The energy storage industry is not just about what traditional assets can be displaced, it is also about how we create new markets and drivers that capitalise on the performance of advanced energy systems. With the right competitive markets and deployment goals, we can ensure affordable and reliable energy for everyone – and achieve the nation's clean energy and resiliency objectives.

We are no longer debating if energy storage systems are reliable, or if they are cost-effective, or if they can perform various applications – hundreds of installations operating for multiple years have shown this to be true. Still to be determined though is exactly how markets will adapt and which states will follow the lead of California, New York, Massachusetts and Hawaii and benefit from the economic activity and job growth that is enabled by creating vibrant storage sectors.

By restructuring markets to reward system performance and delivered value while providing the same tax credits that other clean energy technologies are afforded, we can hasten efforts to create truly integrated resource planning that prioritises innovative solutions over the status quo. Additionally, enabling more opportunities for utilities, businesses and residences to own energy storage will ensure that markets are open and competitive while keeping electricity costs affordable for everyone.

The Energy Storage Association is excited to work with so many pioneering states and markets leaders to implement policies that accelerate energy storage adoption. In 2015 we saw 20 state and four regional markets, as well as the federal government, deploy energy storage. Led by the innovative work of our more than 200 members across the globe we are reshaping the way that energy is generated, distributed and consumed, and are paving the way for the meteoric rise of energy storage systems deployed on the grid. ■


## Author

Matt Roberts is the executive director of the Energy Storage Association, overseeing operations and strategic initiatives for the industry's trade association. Based in Washington, DC, he has more than 12 years of experience in clean energy policy and market development, with a recognised expertise in storage, renewables and sustainable infrastructure. Matt also serves on the board of directors of the Global Energy Storage Alliance (GESA), as a co-founder and communications officer on the executive committee.



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