Storage triumphs at Aliso Canyon

Credit AES Energy Storage

Grid storage | A natural gas leak in California in 2015 raised the prospect of widespread power outages in Los Angeles until a rapid procurement of large-scale storage projects saved the day. Danielle Ola reports on how storage's stock has risen since this unexpected opportunity to demonstrate its capabilities in bolstering grid networks

In the summer of 2016 , Southern California witnessed an environmental disaster when a major leak was detected at the Aliso Canyon natural gas storage field. The leak prompted a shutdown of the facility and left power generators in the region braced for blackouts, with plants providing nearly 10,000MW of peak-time power to the Los Angeles Basin forecast to be affected.

Time was of the essence, prompting California governor Jerry Brown to declare a state of emergency in January 2016. In order to mitigate any predicted power disruptions, regulators called for alternative measures, with energy storage at the forefront of those plans, alongside solar PV, solar thermal, energy efficiency and demand response.

It was then up to regulators and utilities to calculate what and how much additional generation was needed to fill the projected shortfall in peak energy capacity. Peaking capacity is a service that has historically been provided by thermal generators, but in this instance utilities needed to act much more quickly, and batteries were a solution that could be deployed quickly enough. This freed up utilities to start procuring batteries. And procuring lots of them.

The big battery test

In a landmark resolution, the California Public Utilities Commission (CPUC) in May 2016 expedited direction to utility Southern California Edison (SCE) to procure energy storage projects on an emergency basis. Likewise, San Diego Gas & Electric (SDG&E) issued a 'request for offer' (RfO) to expedite energy storage projects that they had already had in development.

"We had already pre-qualified a number of those bidders and as a result we could move very, very quickly," says Josh Gerber, SDG&E energy storage and smart grid expert. "We still had to get the contracts completed, get projects identified and ultimately built, but it was really because we already had that RfO in process that we were able to mobilise things so quickly."

One of the storage projects in California commissioned following the Aliso Canyon leak

In a similar vein, SCE was already running a procurement process, and was able to ask involved bidders with 'shovel-ready' projects to ask if they could meet the timelines proposed. These projects would have to be commissioned in record time, with SCE imposing a 31 December 2016 deadline and SDG&E 31 January 2017.

Rapid procurement

"In between May and July 2016 we identified the sites and selected the contracts," says Gerber. "We ultimately submitted that to the regulators by 18 July and got approval to proceed one month later on 18 August."

In total, the two utilities sought to procure just over 100MW of storage (250MWh+) through projects ranging in size from 2-30MW – with the vast majority of it being longer-duration, four-hour systems. Utilities were looking for suppliers who could mobilise the resources necessary to

put the project together expeditiously, as well as those with a solid track record of experience to implement a safe and reliable system. The main system suppliers selected were AES, Greensmith Energy, Tesla, Powin Energy, GE and Western Grid Development.

Contractors were given just a few months to advance their projects and have them grid-ready, putting significant pressure on a process that under normal circumstances could take years, according to Powin Energy president Geoff Brown.

"From the date the RfO came out in late May, to when the batteries and inverters were fully installed and ready to go in December, was less than six months from start to finish. It was the work of our director of engineering applications, Stephan Williams, to be able to get the project through the permitting process, the land leasing process, the engineering and construction process.

"Any of those typical processes should take six months alone, and to do all of them simultaneously shows a lot about what the technology is capable of."

The Aliso Canyon storage procurement did indeed show what energy storage was capable of, setting records for both the fastest grid-scale storage deployment and the world's largest lithium-ion battery facility. With the four-hour duration projects, it also demonstrated energy storage is capable of offering economic capacity products, in addition to shorter-duration products, and that storage has the ability to provide valuable functions for utilities in the electricity market.

'World's largest'

AES Energy Storage was the powerhouse behind the largest battery storage facility built to date. When combined with the other mammoth battery plants built by Tesla and AltaGas, the three constitute around 15% of the entire battery storage capacity installed across the planet last year.

AES delivered two projects for SDG&E – the 30MW/120MWh Escondido project, just north-east of San Diego, and the 7.5MW/30MWh El Capon project. Both projects were sold under an EPC contract and used four-hour lithium-ion batteries in modular containers.

The 30MW project – the world's largest grid-scale lithium-ion facility – was contracted in just three weeks, according to the company, with the entire system being delivered in approximately six months.

"Obviously the short timeframe was challenging," says Kate McGinnis, AES market director for the Western US. "We were able to overcome those challenges through our collaborative working relationships. We had actually started working with our suppliers early in the spring when it looked like there was going to be the possibility of a procurement. That early work helped to shape our knowledge of how much and how fast we'd be able to deliver a project."

"In the case of Escondido, there were five billion pounds of batteries that had to be delivered to the site – it was over 100 truckloads of just the batteries," adds Gerber, highlighting the scale of the projects.

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'World's fastest'

Leader in energy storage software and solutions, Greensmith Energy, secured the title for the world's fastest grid-scale energy storage deployment. Its 20MW/80MWh project in Pomona was deployed in a record four months – a couple of months earlier than any of the other projects' impressive feats.

Greensmith handed over the regulatory process to Canada-based energy infrastructure company AltaGas, who was the project developer and owner of the San Gabriel facility.

Greensmith's CFO and COO Jim Murphy notes that the main technical obstacles in delivering the project were around supply chain "traffic jams". Otherwise, the process for this 20MW project was not materially different to its other ventures.

"The process was just condensed from a timing perspective," says Murphy. "Keep in mind, Greensmith has delivered 18MW sites in about six months in the past. For Aliso Canyon, the construction subcontractors required significant amounts of overtime as AltaGas had the teams operating on a 24-hour basis to meet the deadline. At one point there were over 200 electricians working on the project, completing wiring and battery installation."

Technological advances

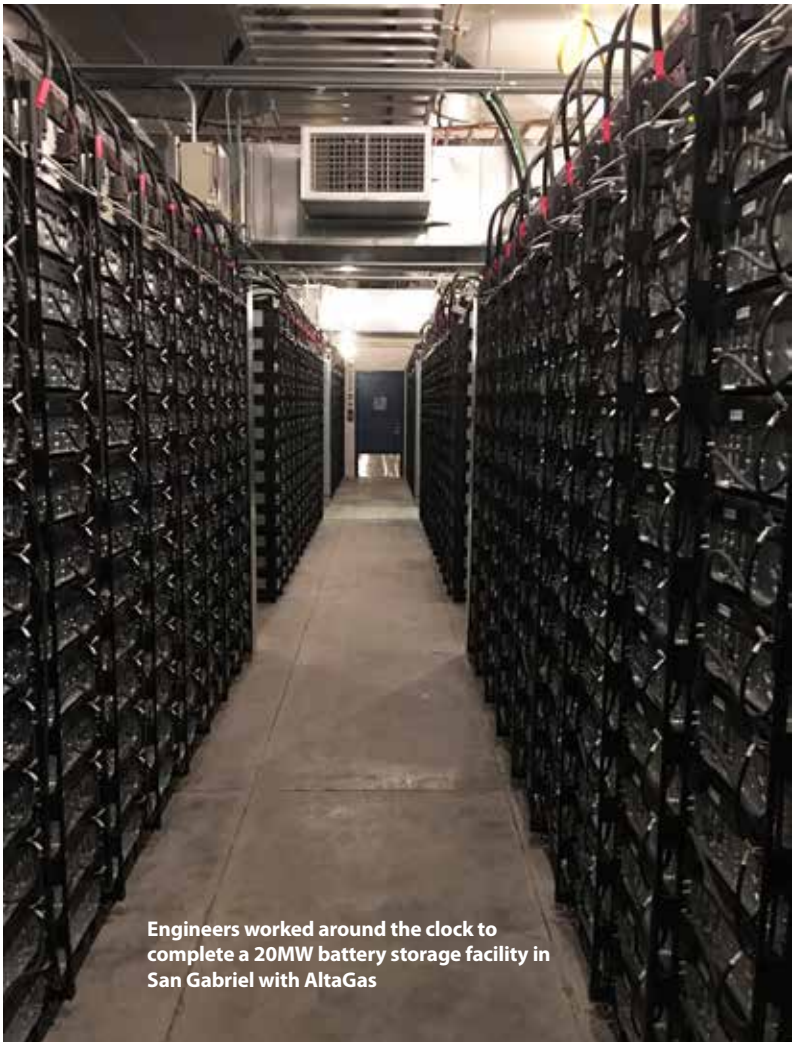
It was a smaller project that SCE mandated Oregon-headquartered Powin Energy to build. The 2MW/8MWh Grand Johanna project is a perfect example of one of the benefits of the technology, in that project sizes can be customised to fit the specific need and application of any individual site.

"A distributed deferral application does not really need 20MW of capacity, you can have a longer-duration, smaller power system come in and provide exactly the requirement that is needed for an optimised cost," says GTM Research senior storage analyst, Daniel Finn-Foley. "So being able to scale things so precisely and so effectively is a big benefit for energy storage."

For its project, Powin preassembled lithium-ion phosphate electrochemical battery packs with its battery management software for use at the 35,000sq ft warehouse in Irvine. And it is its patented technology that the company credits for

Credit Powin Energy

Powin Energy commissioned the 2MW/8MWh Grand Johanna storage facilitiy within just a few months of being given approval for the project



Credit Greensmith Energy

Engineers worked around the clock to complete a 20MW battery storage facility in San Gabriel with AltaGas

executing such a rapid procurement.

"In large it was all possible because of the type of technology we are using," says Brown. "It's low impact, inside a warehouse and doesn't have all sorts of permitting challenges. From a land acquisition perspective it was a relatively…I wouldn't say easy process, but it's not leasing out 10,000acres like you would need to do on a wind project. It's just fundamentally different."

This exemplifies why energy storage batteries were an ideal solution to fill the electricity shortage void. Battery projects are fundamentally lower-impact than traditional wind or solar projects and therefore permitting thresholds are lower. And considering just how many batteries can be stacked in a warehouse, space was not as big an issue as it might be with other technologies.

"The patented technology that we have at Powin did allow us to do a lot of pre-commissioning work before we were completely online," says Stephan Williams. "And I don't know that other competitor technologies have that capability. Our technology therefore allowed us to get a bit of a head start and it was great to have that technical element with this timeline."

Powin uses an auxiliary power source to balance their batteries – as opposed to your standard EV-style balancing system which uses the batteries themselves – which enables batteries to essentially be micro-charged, increasing or decreasing the voltage on a much smaller level.

"By the time it was toward the end of the year and crunch time, we already had our batteries balanced relative to each other. That gave us like a 100 metre head start in a 400 metre race," says Brown.

A new blueprint?

After thousands of batteries were individually unwrapped, ribbons were cut and executives took their bows, constituents of California's LA Basin area could safely run their aircon units or cook dinner and run laundry simultaneously without the threat of a peak power shortage.

Largely thanks to California's energy crisis, but also improving economics and state- and federal-level policies, the business case for US energy storage has never been stronger.

"Energy storage is still a relatively nascent industry when it comes to grid-side or front-of-the-meter applications," says Finn-Foley. "So to be able to demonstrate several different capabilities at once during a capacity shortfall that was clearly unpredicted, that was really a big deal."

That being said, did the massive grid-scale deployment provide a blueprint for how procurements should be done in the future?

What it did prove is that storage can be deployed at pace, which makes it different from many of the other typical electrical generation resources that have been deployed in the past.

"This probably gives the industry a test case that this is something that can be used in these emergency situations but also in the normal course can be deployed with a shorter planning horizon than is typically used," says Gerber. "I don't think that it is going to be the norm right away, but I do think that we'll see more like this in the future."

Whilst this might be ideal, there are however some complexities with the proposition that procurements of this kind should be the new norm. With energy storage, there has to be both a need and a sound business case for it. It is not necessarily for the industry to do anything other than demonstrate that the technology is viable, and that will play a part in its being increasingly accepted and asked for by grid operators and utilities. The latter will procure storage when the value proposition makes sense in comparison to the other options available – and that is when at-scale deployments will be seen across the country.

It might be ideal to conduct future procurements in a similar fashion as Aliso, but not realistic.

"Putting a developer's hat on, all our lives would be a lot easier if we just waived a lot of these permitting and interconnection rules and made procurement faster," says Brown. "There probably is some merit to that, but I can't overstate how much SCE, CAISO and the city did for us in being able to make all this happen. They made it a real priority and pushed off other projects and other work that they had on. I think it would be easier to say, yeah; let's do this on all projects. But that probably minimises the amount of work and extra effort that SCE and CAISO had to do."

A valuable alternative

Even if there is not yet the business case for future procurements to be done at the

same pace and scale as Aliso Canyon, the episode did prove that such projects have a very clear value proposition for utilities.

"It may mean that utilities even move to procure more than they've been mandated to," says IHS senior storage analyst Sam Wilkinson. "It may help to increase the outlook for the US market in that sense, but I think it all just hinges on evidence of the business case that will make other areas of the States more comfortable and confident in the technology."

"Look at energy storage as a new tool in the utility and the developer's tool belt and it has a lot of advantages that traditional generation doesn't have," adds Brown.

The Aliso Canyon leak demonstrated that energy storage can be a solution to extreme and unpredicted events. And if that continues, energy storage could even be seen as a one-size-fits-all solution. However, that is not enough to mould a business model around. Ultimately, this procurement was a demonstration of energy storage's capability, but in order to really be a mature industry, energy storage has to be able to participate in markets on its own, and that is going to be the next big step. ■

What storage proved in the Aliso Canyon saga

Timing

One of the biggest successes was obviously timing. There were, between the initial RfO and commissioning of projects, as little as just a few months. That is the kind of timeline it takes to merely get an environmental permit for a new natural gas peaker plant. The fact that such large-scale projects were able to get off the ground successfully in such short timeframes proves that energy storage can be a very flexible grid solution in a very short order.

Further, it readied a solution that utilities did not even have before. Using batteries on this scale was an idea that has always held far-reaching potential, but the execution was not something that engineers and policymakers had ever attempted.

"It all just really adds up to shattering that concept of needing years to build an asset that actually will have a really big and positive impact on a larger electrical system," says Williams. "That coupled with how fast the price of energy storage is dropping is starting to make heads turn."

Longer-duration storage

This emergency storage procurement was evidence of batteries being able to participate in longer-duration applications, as traditionally the large-scale battery storage market has been dominated by frequency regulation applications, which typically use shorter-duration systems.

"Now, because of the significant cost reductions that we're seeing for batteries, longer-duration systems are making economic sense," says IHS' Sam Wilkinson. "That's why we get the four-hour systems like this that are providing peaking and systems like those that have been announced in the UK recently for capacity auctions as well."

Competitive pricing

Such longer-duration projects were only possible due to aggressive pricing, which demonstrates the ability for storage to be cost competitive.

"It comes down to cost – as battery pack prices decline, it is going to be a lot easier to justify longer-duration, higher-capacity projects," says GTM's Finn-Foley. "The more capacity you have, the more solutions you can provide. I do think that we are going to be seeing fewer 2-5MW projects."

The cost of batteries on a kWh basis has been falling very quickly; with prices of battery system costs dropping 10-14% in the last year alone, according to GTM Research. "Every time you add an hour, you add another number of MWh of batteries, and therefore that US$/kWh is very important," says Wilkinson. "As that number has fallen something around 50% in the last two to three years, it is much more affordable to buy longer-duration systems."

In terms of pricing the projects in this procurement, whilst able to demonstrate to regulators that the systems were very cost competitive compared to previous offers, utilities indicated that there was a significant premium that they paid to have the projects expedited.