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ENERGY STORAGE UPDATE

2014 California Storage RFO

by Les Sherman and Rohit Sachdev

ORRICK

Orrick and Clean Energy Pipeline have launched a series of reports dedicated to exploring investment opportunities and challenges in the global renewable energy sector. In the first issue, we analyzed the investment opportunities arising from the U.S. Department of Defense's major renewable energy procurement initiatives. In the second issue, we explored the evolving dynamics of the UK solar market as the industry moves towards the end of the Renewables Obligation subsidy regime. In this issue, we focus on the challenges and opportunities in the U.S. energy storage market, with specific focus on California's energy storage procurement program.

The spotlight on energy storage has only intensified since we released our first article on the subject, *Energy Storage: Opportunities, Challenges and Solutions*, in February of this year.[1] Last month, Southern California Edison (SCE) announced the results of its 2013/14 Local Capacity Requirements RFO (LCR RFO) in which SCE awarded over 260 MW of new energy storage contracts. Additionally, California's three large investor owned utilities (IOUs) have now issued their energy storage solicitations required under California Assembly Bill 2514 (AB 2514, described in our February article) for approximately 119 MW of storage projects, and industry participants are keenly focused on those solicitations.

Our February 2014 article summarized key opportunities and challenges presented by energy storage, provided an overview of California's procurement process for energy storage projects under AB 2514, and highlighted contractual issues in SCE's pro forma storage contract included in SCE's LCR RFO. This article contains the following important updates relating to the IOUs' current solicitations issued in connection with AB 2514 (the Storage RFO):

- Current Status of the Storage RFO
- Key Issues in the 2014 Storage RFO Pro Forma Agreements
- Financing Issues for Storage Projects

This article also contains interviews with a number of senior industry executives on energy storage issues, including insights into construction and technology risks, energy storage financing issues, lessons learned from operating storage projects, and the future potential growth of the energy storage industry.

"All three IOUs submitted energy storage procurement applications (the IOU Applications) earlier this year which provide important insights into their actual procurement objectives. "

Current Status of the Storage RFO

The California Public Utilities Commission's (CPUC) October 2013 Decision (13-10-040) (the CPUC Initial Storage Decision) required all three California IOUs to issue Storage RFOs by December 1, 2014. As part of the Storage RFO for the 2014 biennial period, the California IOUs were initially required to procure an aggregate of 200 MW of storage capacity. All three IOUs submitted energy storage procurement applications (the IOU Applications) earlier this year which provide important insights into their actual procurement objectives.

In October 2014, the CPUC released Decision 14-10-045 (the CPUC Approval Decision), under which the CPUC largely approved the IOU Applications and the IOUs' proposed procurement targets. In the CPUC Approval Decision, the CPUC approved the final storage targets in the chart on the following page, which reflect each IOU's application of existing projects to offset the targets required by the CPUC Initial Storage Decision.

The chart on the following page also includes each IOU's final energy storage procurement targets, calculated based on information provided in the Storage RFOs. SCE's Storage RFO, entitled "2014 Energy Storage RFO", can be accessed through SCE's Energy Procurement website.[2] Because SCE's LCR RFO procurement results may have already satisfied one or more of the Final CPUC Energy Storage Procurement Targets for SCE, SCE's minimum target in the Storage RFO is now 16.3 MW. PG&E's Storage RFO, entitled "2014 Energy Storage Request for Offers", can be accessed through PG&E's Wholesale Electric Power Procurement website.[3] Finally, SDG&E's Storage RFO can be found on SDG&E's RFPs and RFOs website, and was issued in part in September as one element of SDG&E's "All Source" RFO, entitled "SDG&E's Energy Storage System – 2014 Local Capacity Requirement Request for Offers", and in part this month, entitled "SDG&E Energy Storage System 2014 Distribution Reliability / Power Quality Program RFP".[4]

[1] See *Energy Storage: Opportunities, Challenges and Solutions* attached at the end of this article.
[2] SCE's Storage RFO can be accessed directly at https://scees.accionpower.com/, or otherwise at www.sce.com under the Energy Procurement / Solicitations / Energy Storage links.
[3] PG&E's Storage RFO can be accessed at www.pge.com under the Business to Business / Energy Supply / Electric RFO / Wholesale Electric Power Procurement links.
[4] SDG&E's Storage RFO can be accessed at www.sdge.com under the RFPs and RFOs link.

Final IOU Energy Storage Procurement Targets (in MW)

Storage Grid Domain (Point of Interconnection)	CPUC Initial Storage Decision Targets	Procurement Targets Proposed in IOU Applications	Final CPUC Energy Storage Procurement Targets	Final IOU Energy Storage Procurement Targets
Southern California Edison				
Transmission	50	0[5]	0[6]	0 – 16.3
Distribution	30	16.3	16.3	0 – 16.3
Customer	10	0	0	0
Subtotal SCE	90	16.3	16.3	16.3[7]
Pacific Gas and Electric				
Transmission	50	50	50	50
Distribution	30	21.5	24	24
Customer	10	6.5	6.5	0[8]
Subtotal PG&E	90	78	80.5	74
San Diego Gas & Electric				
Transmission	10	10	10	0 – 25
Distribution	7	6	6	4 – 29
Customer	3	0	0	0
Subtotal SDG&E	20	16	16	29[9]
Total – all 3 IOUs	**200**	**110.3**	**112.8**	**119.3**

[5] Subject to SCE's LCR RFO results.

[6] Subject to SCE's LCR RFO results.

[7] SCE does not allocate the procurement target in its Storage RFO between transmission-connected and distribution-connected projects.

[8] PG&E states in its Storage RFO that it has satisfied 9 MW of its 10 MW customer-connected energy storage target with existing energy storage projects, and expects to satisfy the remaining 1 MW through other programs, but will still consider offers for customer-connected energy storage projects in the Storage RFO.

[9] The 29 MW target is comprised of (a) 25 MW which SDG&E seeks to procure through its All Source RFO, all of which will be through either transmission-connected or distribution-connected projects, and (b) 4 MW which SDG&E seeks to procure through its Distribution Reliability / Power Quality Program RFO. SDG&E intends to apply procurements made through its All Source RFO to both the CPUC Initial Storage Decision requirements and SDG&E's Local Capacity Requirements

Q&A

Southern California Edison

Mark Irwin
Director of Technology Development, Advanced Technology Department
Southern California Edison

Photograph: © 2014 Edison International

What are the greatest challenges the U.S. energy storage industry faces?

The challenges vary depending on where you are in the U.S. Nationally there is a question about what the level of commitment to energy storage is. California has made a big commitment and said they know they need this at scale in the not too distant future. California has decided that the only way to get there is to start now, when it is not necessarily economic. The same thing happened with renewable energy with the introduction of RPS. There are also some smaller markets such as Hawaii, which have big plans for energy storage in the near term, but nationally the level of commitment is more unclear.

Once you are in a market that has demand for storage such as California, other challenges may emerge such as the interconnection process, which can take two years in certain areas. We also have a contracting process that is new and contracts will still need regulatory approvals. Entitlement/ permitting probably won't be a huge problem but it is still a required step.

What storage technologies are best positioned for near term deployment?

Energy storage technology that is leveraging off battery technology used in the auto industry is positioned best for near term deployment. There are still questions about what the best energy storage technology is for the long term. Technologies might come forward that surpass lithium-ion batteries in their capabilities. If you don't have a space constraint, then the choices may be broader. But as you get into a situation where space is restricted, energy dense technologies such as lithium ion will be better positioned.

Lithium ion is clearly now in the lead. I expect that the majority of projects we will do in the next few years are highly likely to be lithium-based, although there will be competitors such as sodium nickel chloride or sodium sulphur technology. These are closer to market than anything else out there other than lithium. There are also some disruptive technologies that are maybe 3-5 years from market that have the opportunity to compete with lithium. But right now lithium has both the space and scale advantage.

To what extent do you expect the cost of storage technology to decrease in the next five years?

There is a DOE forecast for lithium cost reduction from 2011-2020. During that period a 50% price decline is predicted. There are two kinds of cost reduction lithium will go through. First is product development, so developing more efficient and effective products. The other is scaling manufacturing. The scale of manufacturing will be smooth and linear, but bringing new tweaks into the manufacturing processes will be lumpier and will have just as large, if not a larger impact.

Do you expect storage projects to be project financed in the next three years? What are the requirements for storage projects being financeable?

Utilities have built most of the projects that exist today. There have not been a lot of projects that haven't been developed by utilities, except for projects that are integrated with renewables. For example, Hawaiian storage projects have often been integrated with wind farms that are required to control ramping. For these projects there has been an overall project finance package.

We are about to sign contracts in one of our RFOs for a services product as opposed to a utility-owned project. The contracts we will sign are clearly going to be project financeable. You might see highly leveraged transactions on the back of contracts that walk and talk like a classic gas tolling agreement or something similar. The classic model of utilities going on balance sheet and IPPs doing project finance transactions on the back of contracts will emerge. We might also see project finance transactions done on the back of a market revenue expectation, where someone might build a project in PJM for example. You won't be able to get as much leverage for this type of project.

What do you anticipate the mix between utility-owned and procured energy storage will be in the CPUC program?

This will still be up in the air for a while. Each of the utilities have programs and are starting to see what the opportunity looks like and how and where they should deploy storage. Utilities can only do up to half themselves. If we choose to build, we have to go to the commission and ask for funding. If we procure, we still have to get approval of the contracts. There is an application process where every two years we put in a plan and apply for approval. That process ends up yielding a cost recovery structure that we can all rely on. All three utilities made applications in March 2014. We have to make a second application in March 2016 and then in 2018 and 2020.

In the 2014 application, we did not propose any utility-owned projects. We were not in the position to be able to do that. In the 2016 application it is likely we will propose some utility-owned storage. We are working on a program that maximizes the value to our ratepayers of the storage mandate. At this point our hypothesis is that this includes a substantial amount of utility-owned storage, but I don't know for sure yet.

Do you think the CPUC energy storage program will be successful?

I think we will successfully reach the targets. All the utilities have the capability to procure and the development community has the capabilities to finance and construct these projects. There is a ramp to it. We are contracting now. Moving from contracting to operations is a multi-year process though. We have to sign contracts, make a financial commitment and get projects online by certain dates.

Another question is whether the entire program will be successful in transforming the industry from something that is expensive, not well understood and where there is not a lot of activity, to something that is common, useful, well understood and cost effective. I believe there is a very good chance this will be the outcome from the mandate.

Key Issues in the 2014 Storage RFO Pro Forma Agreements

All three IOUs' pro forma energy storage agreements (ESAs) included in their Storage RFO materials are structured similar to SCE's LCR RFO energy storage agreement described in our February 2014 article.[10] Each ESA incorporates a tolling structure with fixed capacity and variable O&M payments, subject to price reductions for reduced availability, capacity and/or efficiency of the project. It is noteworthy that SCE issued its ESA in two separate forms – a purchase agreement for the Resource Adequacy (RA) benefits associated with the storage project, and a similar RA purchase agreement which includes an Energy Put Option (SCE Energy Option Agreement) allowing the seller additionally to sell to SCE the capacity, energy and ancillary services of the associated storage project. The SCE Energy Option Agreement will be considered SCE's ESA for the purposes of this article.

Many of the key issues we described in our February 2014 article pertaining to SCE's LCR RFO energy storage agreement apply to the current ESA forms. These issues include substantial IOU discretion in exercising termination or approval rights, potentially out-of-market seller default cure and notice periods, and the need for additional review of testing, operating and other technical matters from the perspective of each individual project.

In addition, based on our review of the three IOUs' current ESA forms, we identify several other issues below which bidders may need to address depending on the circumstances of an individual project.[11]

Interconnection Costs and Schedule

The CAISO and CPUC standards for interconnecting storage projects are currently under consideration and may change in the future. The CAISO and CPUC have been engaged in proactive efforts over the past year to address a spectrum of interconnection issues which are implicated in interconnecting a storage project to the CAISO grid. Their progress – and several of the interconnection issues at play – is largely summarized in the Draft Energy Storage Roadmap for California issued by the CAISO, CPUC and CEC in October 2014, the Staff Proposal issued by the CPUC in July 2014, the Issue Paper & Straw Proposal issued by the CAISO in June 2014, and the Energy Storage Interconnection – Draft Final Proposal issued by the CAISO last month (CAISO Papers).

The totality of the details of interconnection issues facing storage projects is beyond the scope of this article. However, given the complexity of the issues combined with the pending and completed proceedings to resolve many of the issues (e.g., accommodating storage as a source of generation and as a load source), storage projects may face a greater possibility for delays and increased costs in satisfying interconnection obligations. Consequently, storage project sponsors must consider the level of protections required in a form ESA for any given project, including potentially for interconnection schedule/delay relief and cost overruns.

Compliance with Laws and Industry Standards

As expected, each of the ESAs requires the seller to comply with all laws and industry standards, a concept which appears reasonable and customary. However, many industry standards applicable to storage facilities are still evolving and may change in the future. These include standards set out in the CAISO Tariff, CPUC rules, and other applicable industry norms commonly thought to come within concepts of "good utility/ engineering practices". To the extent any individual applicable rule or industry standard is not legally mandatory, but compliance would benefit the IOU, bidders must consider the extent to which compliance

[10] The ESAs are included as part of each IOU's Storage RFO materials, and include: (1) "Resource Adequacy Purchase Agreement" and "Resource Adequacy Purchase Agreement (Energy Storage Option)" issued as part of SCE's Storage RFO; (2) "Pro-Forma Energy Storage Agreement" issued as part of PG&E's Storage RFO; and (3) "Energy Storage System Power Purchase Tolling Agreement" issued as part of SDG&E's Storage RFO.

[11] In the Storage RFO, all three IOUs have issued requests for offers for power purchase tolling arrangements with storage resources. In addition, PG&E and SDG&E are seeking to enter into alternative arrangements, such as the purchase of storage assets or EPC arrangements for storage assets.

should be limited through compliance expenditure caps (annual and/or aggregate over the term) or otherwise.

As just one example, each of the pro forma ESAs requires that the seller take all actions necessary to ensure the IOU can use the resource adequacy benefits generated by the project, and certain ESA provisions require the seller to maintain full capacity deliverability status throughout the delivery term. In the CAISO Papers, the CAISO takes the position that projects requesting full capacity deliverability status will be tested at the highest steady-state discharge output level in MW sustainable for 4 consecutive hours during the peak period, consistent with CPUC resource adequacy counting rules. However, the CAISO also acknowledges that this conventional approach of studying a resource's 4-hour capacity at peak conditions may not be the appropriate strategy for a storage project. Because these protocols and related rules may change in the future, bidders should carefully consider the specific contractual obligations relating to deliverability or resource adequacy as applied to each project, and any exceptions or limitations that may be advisable to qualify the compliance obligations.

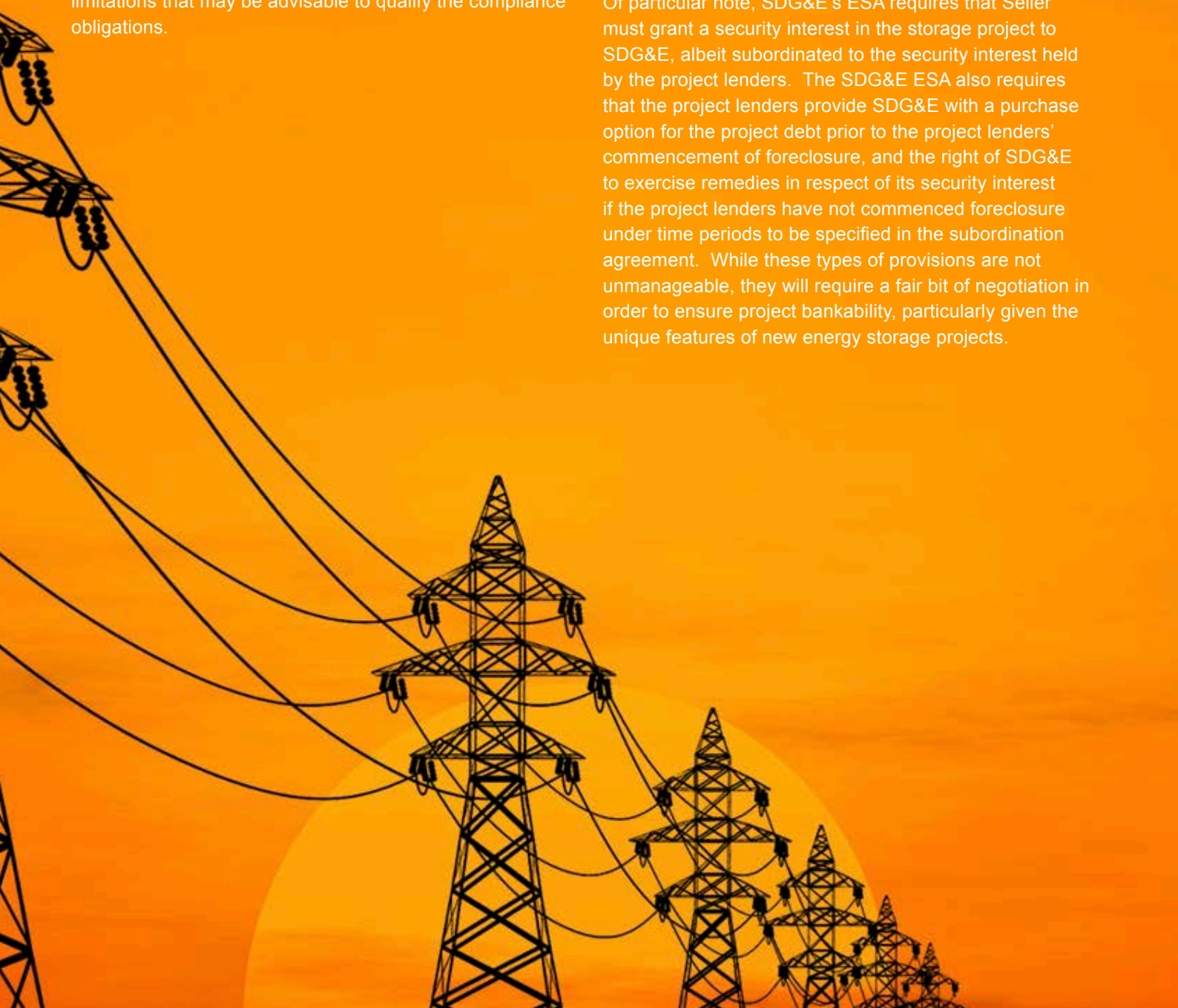
Completion Schedules and Initial Delivery Date

The pro forma ESAs contain customary provisions setting forth milestone schedules and guaranteed completion dates. However, the provisions may not provide adequate schedule extension provisions and other protections for the benefit of seller. For example, certain ESAs do not provide schedule relief for permit or interconnection delays, and the SDG&E ESA only provides 90 days of extension for force majeure events. Additionally, the conditions to the Initial Delivery Date (IDD) definitions in each of the ESAs requires revision to clarify ambiguity and adequately protect seller.

Project Financing Provisions

As mentioned in our February 2014 article, the ESA provisions relating to project financing do not reflect "market" standard provisions, and will need revisions or clarifications either in the ESA itself or the consents to collateral assignment executed by financing parties.

Of particular note, SDG&E's ESA requires that Seller must grant a security interest in the storage project to SDG&E, albeit subordinated to the security interest held by the project lenders. The SDG&E ESA also requires that the project lenders provide SDG&E with a purchase option for the project debt prior to the project lenders' commencement of foreclosure, and the right of SDG&E to exercise remedies in respect of its security interest if the project lenders have not commenced foreclosure under time periods to be specified in the subordination agreement. While these types of provisions are not unmanageable, they will require a fair bit of negotiation in order to ensure project bankability, particularly given the unique features of new energy storage projects.



Operating Restrictions

The ESAs contemplate that a storage project will be a stand-alone resource dispatchable by the IOU on demand. All of the IOU's dispatch and scheduling rights (and seller's related obligations) under the ESA must be subject to the technical operating limitations of the project. Although the ESAs incorporate these limitations to some extent, certain of the limitations need to be supplemented or modified to expressly reflect the parties' intent.

Payment Formulas and Provisions

Each of the ESAs contemplates that seller will be compensated in the form of a fixed capacity payment and a variable energy/O&M payment, subject to adjustments for decreases in capacity, availability or efficiency of the storage project. Our review of these provisions and formulas suggests that certain capacity reduction penalties may be double-counted and, in any event, these formulas must be thoroughly reviewed by bidders and their technical and financial teams.

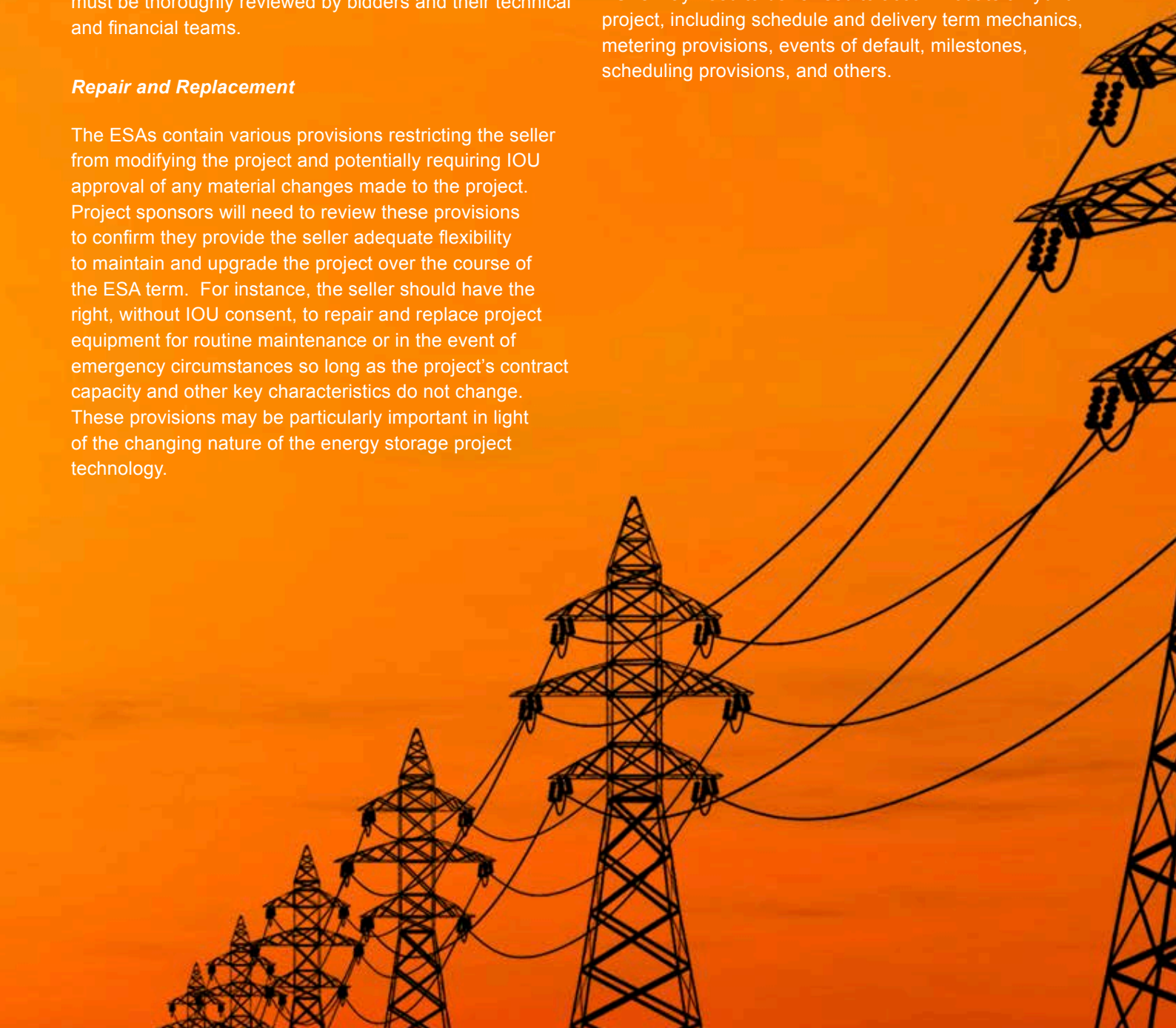
Repair and Replacement

The ESAs contain various provisions restricting the seller from modifying the project and potentially requiring IOU approval of any material changes made to the project. Project sponsors will need to review these provisions to confirm they provide the seller adequate flexibility to maintain and upgrade the project over the course of the ESA term. For instance, the seller should have the right, without IOU consent, to repair and replace project equipment for routine maintenance or in the event of emergency circumstances so long as the project's contract capacity and other key characteristics do not change. These provisions may be particularly important in light of the changing nature of the energy storage project technology.

Hybrid Storage/Generation Projects

The ESA forms contemplate a stand-alone storage unit or multiple storage units, but do not account for a hybrid project – one in which a generation unit (whether gas, solar, wind or other) is operated in conjunction with a captive storage project. PG&E's Storage RFO does, however, contemplate that hybrid storage units may be added to existing contracted generation projects, which would require amendments to existing tolling or RPS contracts.

For the ESA forms to accommodate a hybrid storage-generation project, the forms will need substantial revision in several areas. Among other things, the forms do not address how IOU and CAISO dispatch arrangements will work with a hybrid project. Similarly, charging/discharging, commissioning, testing and completion arrangements between the storage and generation projects will need to be integrated. Additionally, several other provisions in the ESAs may need to be revised to accommodate a hybrid project, including schedule and delivery term mechanics, metering provisions, events of default, milestones, scheduling provisions, and others.



Q&A

Sempra U.S. Gas & Power

Larry Folks
Regional Vice President, Renewables Development
Sempra U.S. Gas & Power

Does Sempra plan to invest in energy storage during the next 18 months?

We are interested for several reasons. One is that we have an operating battery storage project at our wind farm in Hawaii, so we have some experience from operating this facility for almost two years now. In California, we are trying to develop appropriate sites to position ourselves to be competitive in the major utilities' RFO for storage projects that is going to come out late fourth quarter this year. We are also looking at the possibility of other states including Hawaii as utilities there are asking for additional storage projects.

What are the main lessons you learned from the construction and operation of your storage project in Hawaii?

The most important lesson is that you must be very focused on the credit worthiness of your supplier. Originally the battery storage space for grid projects was dominated by two companies - A123 Systems and Xtreme Power. We selected A123 for our battery project in Hawaii, but unfortunately both companies went bankrupt a year or so after our selection, when we were right in the late stages of construction and implementation. That caused a tremendous amount of challenges, because A123 was not only providing the batteries but also the battery control systems, the balance of plant systems, the construction work and the commissioning work.

As a result of the A123 bankruptcy, we ended up in a very challenging situation where we didn't have the final product, we didn't have the final testing and we didn't have the final control system. We had to fill in the gaps using our own expertise and outside third parties that we had to contract with and pay for. We also ended up having to replace the control system completely because we never really got our final product from A123.

From an operating perspective, an important lesson is that the control system really is at the heart of the system. If you don't have a functioning control system, it doesn't matter how good the battery technology is, it simply won't work properly. It is very important to design and fully test your control system so you are sure it is going to work for the application that you want. You might buy a system that is great for load shaving, but not very good for ramping, or vice versa.

We learned another important lesson from an operating perspective by looking at what happened to the Xtreme Power battery at First Wind's Kahuku facility in Oahu, Hawaii. We decided early on that all our batteries should not be put in one building, as was the design at the Oahu facility. Instead, we put the batteries in nine separate shipping container-type structures, all with separate fire suppression and cooling. This cost more but is intended to keep a fire isolated to one ninth of the facility instead of 100%.

The last lesson is that lithium ion batteries can be temperamental and some modules don't accept a charge when they should. So we have decided to oversize facilities with some spare capacity to deal with the fact that not only is there potentially a degradation profile but there is also an availability component to manage.

"There is going to be a lot of lithium ion batteries manufactured for the electric vehicle market, so this technology will achieve cost reductions faster than other technologies that won't get as much business."

Have lithium ion batteries emerged as the standard technology for grid storage projects or is there potential for others to play a role?

The market is still in its infancy and there are a lot of interesting technologies out there. But that said, lithium is the current leader in market acceptance. There is going to be a lot of lithium ion batteries manufactured for the electric vehicle market, so this technology will achieve cost reductions faster than other technologies that won't get as much business. It is really going to be a volume game. This is how the cost of wind turbines and solar PV panels came down. It is a self-fulfilling prophecy that the technology with the most production volume ends up with the fastest cost reduction profile. I think lithium ion technology currently has a strong lead in terms of what is going to be deployed in the next five years.

Is there potential to finance storage projects with project finance structures?

We financed our Hawaii project on balance sheet because it was a small wind farm and the overall total cost wasn't that great. But we are currently getting offers from lenders to project finance the combined project which includes the battery storage facility. The battery storage facility is not really a revenue driver, but is a necessary component of the wind farm.

For standalone battery storage projects, whether you can use project financing or not will depend on the contract you get for the offtake and the ability of the technology to last for the life of the contract.

A project would only be project financeable if a creditworthy utility or grid operator awards us something similar to a tolling contract, which is a contract where we build the asset and the utility leases and operates it for 20 years themselves, and they give us a guaranteed tolling or capacity payment. The second big risk for banks is whether the batteries will last 20 years. But if there is a merchant revenue structure where projects are selling ancillary services on the spot or short-term market, or there is not a lot of comfort that the batteries will last long enough to pay the loan off, project financing will be difficult.

What types of warranties would banks need to invest in storage projects?

It is always very important to have the standard set of performance guarantees and warranties, but for storage projects it will be more important. I think we will see a drive for longer term warranties in the battery market. I think initially banks will certainly want to see strong performance guarantees and extended warranties for the equipment.

"We will get the RFOs when they are issued late this year and we will then know what the utilities are asking for. We need to know what kind of product they are looking for, and how they are going to look to structure the contracts and the pricing."

Do you have any concerns about how the CPUC storage program is structured?

It's early still and we don't know exactly what the utilities are going to ask for. We don't know whether they will want a pure tolling arrangement, or a services arrangement, or some kind of other structure. We will get the RFOs when they are issued late this year and we will then know what the utilities are asking for. We need to know what kind of product they are looking for, and how they are going to look to structure the contracts and the pricing.

How big could the storage market become in the U.S.?

It has the potential to be very large. I foresee 10 GW of batteries being installed during the next two decades or so. But market growth will depend on the extent of cost reductions. Batteries have to try to get to cost parity with combustion turbines. They have a way to go, but at that point they could essentially compete against peaker units ■

Financing Issues for Storage Projects

Much has been said about the financeabilty of energy storage projects. Overall, our experience has been that the general types of issues arising in a non-recourse project financing of a storage project are no different than those arising when financing a typical generation project, whether solar, wind, gas or otherwise. However, given the novelty of energy storage project contracts, and the lack of O&M track records for most storage equipment and technologies, two issues are key to any energy storage project financing.

First, a storage project must have an enforceable revenue contract with a creditworthy offtaker (typically a utility) under which the offtaker is subject to a clear obligation to take or pay for the storage product being provided. Although there is little (if any) history of financing of the IOU pro-forma ESA contracts, these contract forms are based in large part on the IOU gas project tolling contracts, which have been financed for decades. With proper negotiation and modification of the IOU ESA forms, such forms should provide financeable contracts.

Second, long-term equipment warranties with robust remedies will be critical for storage project financings until battery and other storage technologies have a much longer track record. The warranties must also be backed by creditworthy entities, particularly in light of various battery manufacturer bankruptcies in recent years. Depending on project circumstances, long-term warranties may come from the storage technology vendor or manufacturer, the EPC contractor or other project participant. To some extent, project lenders may be more lenient on the required duration and terms of equipment warranties if a project's debt/equity ratios are reduced, or substantial equipment repair and replacement reserve accounts are funded, however those solutions may not be optimal.

Q&A
First Wind

Tom Siegel
VP of Transmission
First Wind

To what extent do you plan to invest in energy storage in the next three years?

We have developed two storage projects, both of which were affiliated with wind projects in Hawaii, but only one of these continues to operate. The other was destroyed in a fire. We are optimistic that there is a continuing opportunity for storage in the U.S., but finding the right market and the right conditions has been a challenge for us.

We are seeing limited opportunities for bundled storage projects with either wind or solar, so are now just focused on standalone storage projects. The markets for these are PJM or New York, or the RFP type of market that is in California or Hawaii.

What do banks require to finance storage projects?

We actually acquired and built a demonstration storage project ourselves. We did this to prove the technology sufficiently so that a loan guarantee could be obtained for our Kahuku project. We used this experience to go out to banks and show them that the technology functioned. Our second project was financed by more traditional bank lenders.

For debt financing, having a revenue contract is essential. The PJM regulation market is an interesting opportunity but not one that we can really participate in because you won't be able to get a long-term contract there. Banks are not prepared to lend to projects that have market exposure.

Secondly, warranties are now more critical than when we were financing because a number of storage companies have gone bankrupt. There is now much greater scrutiny on the company providing the warranty – how is it backed up? Is the financial surety there? This is certainly one of the gating items for securing financing for energy storage projects.

It is important to remember that while virtually every vendor is willing to offer a warranty, that warranty is only as good as the financial backing of the company. It is much more challenging for small independent storage companies to offer a warranty that is bankable.

Do you expect lithium ion technology to dominate the storage market in the next three years?

The technology is dependent on the functionality you want to secure from the storage. A lot of attention is being paid to lithium due to the rapid price declines, the improved performance and the entrance of very large players in the market. The automotive market is also moving more towards lithium.

Most of the lithium being put into grid-scale facilities is being used for regulation service and it works really well for that. But for functions such as energy arbitrage or storing large quantities of energy, lithium is probably not going to be the best technology. In addition, there are some technologies that might be more suited for other functionalities, such as small-scale, behind the meter storage ■

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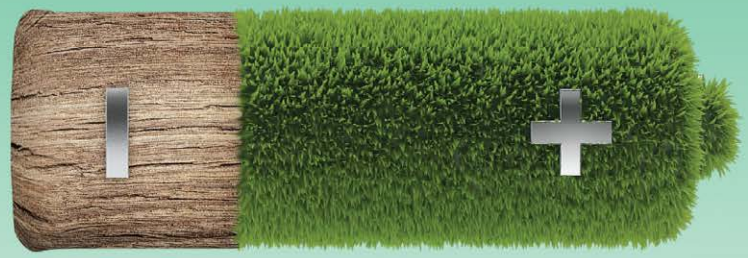

Energy Storage

Opportunities, Challenges and Solutions

by Les Sherman

As our nation pursues ambitious goals towards substantially increased renewable energy resources and reduced greenhouse gas emissions, new energy storage projects will play a major role in achieving these goals.

Indeed, CPUC Commissioners have said that "energy storage has the potential to be a 'game changer' for our electric grid,"[12] and the U.S. Department of Energy in its December 2013 comprehensive study of Grid Energy Storage noted that the "energy storage business could grow from $200 million in 2012 to a $19 billion industry by 2017."[13]

"Given the tremendous growth in intermittent renewable energy projects in California, particularly photovoltaic solar, California has among the greatest needs of any major grid system for energy storage."

Augmenting this general trend, the three branches of the U.S. military (which are already committed to purchasing over $20 billion in renewable energy by 2025) have officially communicated their desire for increased energy security for U.S. military installations, in the form of both micro-grid and energy storage solutions. Therefore, developers bidding on military renewable energy procurements are increasingly proposing energy storage options to offer more attractive bid packages.

While energy storage presents tremendous opportunity, successful project development presents significant barriers, risks and other challenges. Long term industry challenges include proving the cost competitiveness of energy storage relative to alternative grid solutions, and validating the reliability and performance of storage technologies. In the short term, two key challenges for project developers include the need to structure workable and financeable commercial and contractual arrangements to carry out individual projects, and the need to optimize project tax benefits.

As we seek solutions to these challenges, the California market presents instructive insights. Given the tremendous growth in intermittent renewable energy projects in California, particularly photovoltaic solar, California has among the greatest needs of any major grid system for energy storage. Moreover, California has led the nation in enacting energy storage related legislation and the issuance of utility RFOs to promote energy storage projects.

This paper examines certain aspects of the current status of energy storage in California in order to provide insights into some of the key challenges to the successful development of energy storage projects.

[12] See CPUC Decision 13-10-040, October 17, 2013, Concurrence of Commissioner Mark J. Ferron and President Michael R. Peevey.

[13] See "Grid Energy Storage", U.S. Department of Energy, December, 2013, page 9, citing to IMS Research Report "The Role of Energy Storage in the PV Industry -- World -- 2013 Edition."

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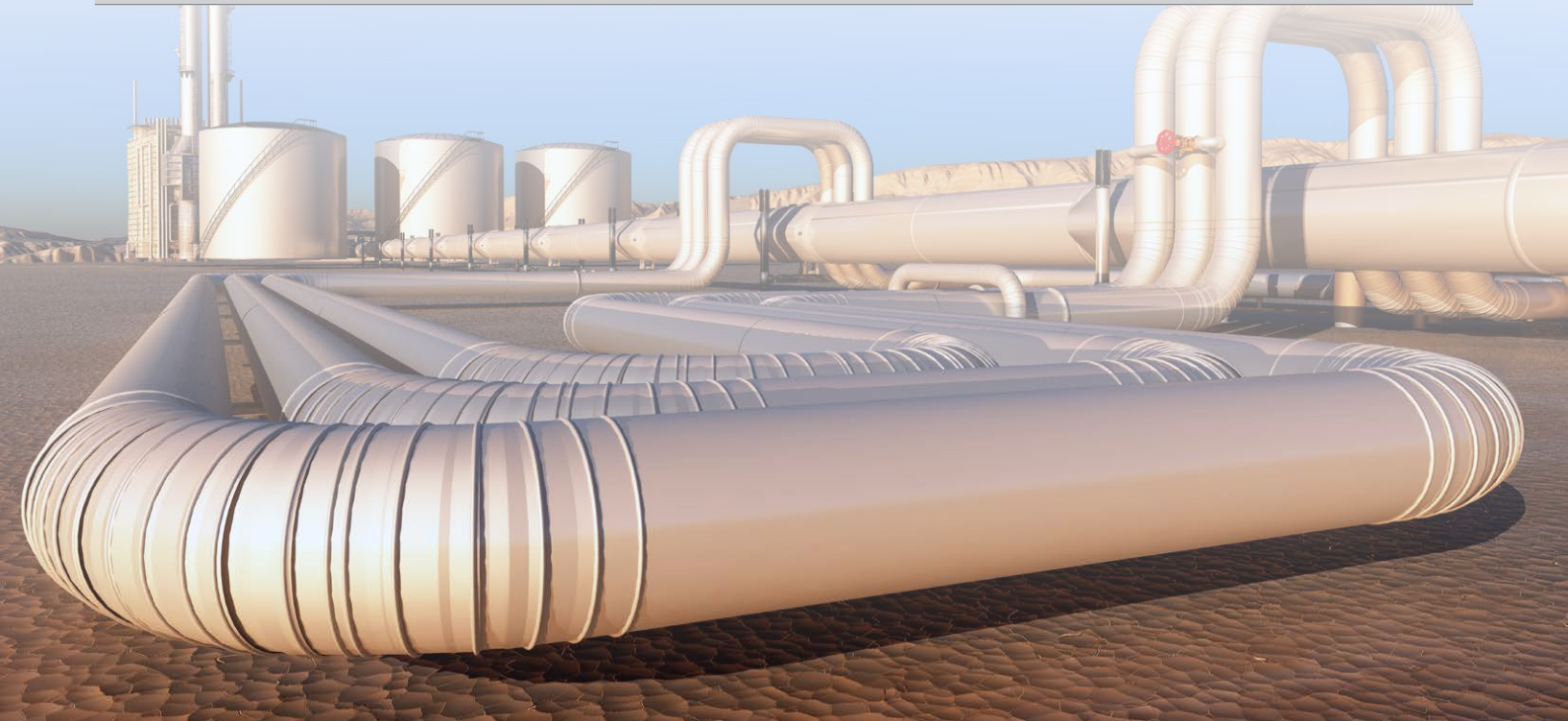
An Industry Poised for Take-Off

At the end of 2010, the California legislature enacted Assembly Bill (AB) 2514, directing the CPUC to set energy storage procurement targets for California investor owned utilities (IOUs) and other load serving entities.

Thereafter, in February 2013, the CPUC issued a decision requiring Southern California Edison Company (SCE) to seek proposals to procure at least 50 MW of energy storage resources to meet local capacity requirements (LCR) in the Los Angeles basin. Bids to provide LCR storage to SCE were due this past December 2013. More significantly, in October 2013, the CPUC issued its critical Decision (13-10-040) (the CPUC Energy Storage Decision) requiring the three California IOUs to procure an aggregate of 1,325 MW of energy storage by the end of 2020, with installations by the end of 2024. The CPUC's specific procurement target breakdown is as follows:

Energy Storage Procurement Targets (in MW)

Storage Grid Domain (Point of Interconnection)	2014	2016	2018	2020	Total
Southern California Edison					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal SCE	90	120	160	210	580
Pacific Gas and Electric					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal PG&E	90	120	160	210	580
San Diego Gas & Electric					
Transmission	10	15	22	33	80
Distribution	7	10	15	23	55
Customer	3	5	8	14	30
Subtotal SDG&E	20	30	45	70	165
Total – all 3 utilities	**200**	**270**	**365**	**490**	**1,325**



The CPUC Energy Storage Decision also establishes a target for community choice aggregators and electric service providers to procure energy storage equal to one percent of their annual 2020 peak load by 2020, with installation by 2024. The Decision directs the IOUs to file separate procurement applications containing proposals for their first energy storage procurement period by March 1, 2014, and to launch their first solicitations no later than December 1, 2014.

One other boost to the nascent energy storage industry occurred just this past month (January, 2014), when the consulting firm Energy and Environmental Economics, Inc. (E3) issued a detailed study (funded in part by the IOUs, SMUD and LADWP), exploring the challenges of integrating renewable resources into the California grid.[14] E3 identified overgeneration as the most important challenge. E3 concluded that overgeneration will be "pervasive" at RPS levels above 33%, particularly when renewables production is dominated by solar resources.[15] Among other suggestions, the study highlighted energy storage as a key solution. The E3 study, now widely publicized, further validates the importance of energy storage, and should encourage development of energy storage projects.

Storage Contract Structures and Issues

Although the energy storage industry is poised for growth, few large independent projects have actually been contracted, and there is little guidance or precedent on the likely structuring of commercial contracts for energy storage transactions. The CPUC Energy Storage Decision provided little direction to the IOUs on preferred or recommended structures, other than to limit the amount of IOU-owned energy storage projects to 50 percent of the total procurement targets. However, for its recent solicitation of 50 MW of energy storage resources to meet LCR requirements, SCE developed and proposed a new pro-forma Energy Storage Agreement (ESA). SCE's pro-forma ESA will likely evolve, but is expected to become the basis for other SCE storage solicitations, as well as an example for other IOUs, and even potentially utilities in other jurisdictions. Therefore, it is worth taking time to analyze both the structure of the ESA and to identify key contract issues that, if not managed, might limit the potential pool of capital available for financing storage projects.

SCE's ESA form was created based upon SCE's standard power purchase tolling agreement, and essentially is an energy storage tolling agreement. The fundamental commercial structure of the SCE form is as follows: (i) Seller (i.e., the project developer/owner) is fully responsible at its own cost to develop, permit, finance, install, own and interconnect the storage project according to mutually agreed schedule milestones; (ii) Seller is responsible for the full operation, maintenance and repair of the project; (iii) SCE is designated as the project's Scheduling Coordinator and is responsible to schedule and pay for all energy deliveries into the project necessary to charge the project, SCE is authorized to send dispatch notices to Seller for the discharge of energy back to the grid, and SCE is entitled to all CASIO revenues arising from dispatches; and (iv) SCE compensates Seller each month through a fixed capacity payment and a variable O&M payment, which payments are subject to various reductions, including for lower than expected project availability, capacity and efficiency.

"Notably, the SCE ESA has numerous circumstances in which SCE has termination rights and/or approval rights, in certain cases based on subjective SCE determinations."

A number of issues need to be addressed in SCE's ESA form, both to protect the Seller, as well as to ensure financeabilty. These issues are also certain to come up in other IOU and other utility energy storage contract forms. A few of the key issues include the following:

Applicable Standards: In recognition that the CAISO Tariff and most industry standards applicable to energy "storage" facilities have not yet been developed with substantial specificity, the parties should agree to cooperate in good faith to apply new rules in a manner that attempts to maintain the fundamental commercial deal and economic benefits and burdens as set forth in the ESA.

Termination Dynamics: Notably, the SCE ESA has numerous circumstances in which SCE has termination rights and/or approval rights, in certain cases based on subjective SCE determinations. Given the likelihood that pricing for storage contracts may decrease (potentially substantially) in the near term, it is in Seller's interest to limit or eliminate all such bases for termination. Doing so will minimize Seller's risk of an ESA termination exercised by SCE (or other counterparty) primarily to replace the ESA with a lower priced ESA, a phenomenon that has plagued the solar industry for the past few years as solar PPA prices have dropped and utilities have tried -- successfully, at times -- to find creative ways to terminate existing (older, higher priced) solar PPAs and replace them with new less expensive contracts.

Pre-COD Damages: As has become common in a number of recent utility pro-forma PPAs, the SCE ESA limits Seller's pre-commercial operation date right to damages from SCE upon a termination due to an SCE event of default to a fixed amount based upon Seller's costs incurred, rather

[14] See "Investigating a Higher Renewables Portfolio Standard in California", January, 2014, Energy and Environmental Economics, Inc.
[15] Id, at pages 10-11.

than the more traditional mark-to-market forward settlement value calculation. These provisions may need substantial modification to protect Seller and to ensure financeability.

Testing and Operations: Particularly given the infancy of the energy storage industry, ESA provisions addressing testing protocols, project operating parameters and related technical matters require substantial consideration and revision for each individual storage project based upon the project's unique technology and operating characteristics.

Defaults: The Seller defaults in the ESA do not include customary cure and notice periods, carve-outs and other qualifications, much less the longer cure periods and greater carve-outs that might be required for new storage technologies.

Capacity Payment Reductions: Provisions resulting in reductions to monthly capacity and O&M charges need significant clarification, including to eliminate potential double counting of penalties.

Project Financing Provisions: The lender financing collateral assignment and consent provisions in the pro forma agreement are not market and either need to be clarified before ESA execution or specified that they will be revised later to accommodate lender requests.

Resource Adequacy Covenants: Storage projects can provide Resource Adequacy benefits, but, because they have different operating characteristics than other RA resources, a number of provisions related to Seller's continuing obligations with respect to Resource Adequacy benefits require clarification.

The foregoing are just a few of the key issues in the SCE form of ESA that are also bound to arise in other IOU and utility storage contract forms. Some of the issues are challenging, but with careful negotiation the issues all should be manageable.

Storage Transaction Tax Issues

Energy storage projects present critical tax issues, including a few unique to California. Additionally, projects that incorporate structures that allow the federal Investment Tax Credit (ITC) to be applied to the project's energy storage equipment capital cost may prove more competitive than storage projects that are not ITC eligible. Set forth below is a summary of a few of the key tax issues applicable to energy storage projects:

Service Contract Issues: As with power sales and other similar energy services contracts, it may be critical that an energy storage contract be structured in a manner that it is considered a "service contract," and not recharacterized as a lease, under federal tax rules. If recharacterized as a lease and the service recipient is governmental or another tax exempt entity (e.g., a municipal utility), then any ITC or accelerated depreciation benefits otherwise available to the project owner will be lost.

General ITC Eligibility for Solar Energy Storage Facilities: ITC for an energy storage component of a solar project is generally available if the non-solar energy (if any) used to charge the storage over the one-year period beginning with the project's placed-in-service date does not exceed 25 percent of its total energy inputs during that period. Moreover, the tax basis of the storage related equipment eligible for ITC includes only the cost of the total equipment that is proportionate to the solar energy inputs. For example, a $100 storage facility where 90% of the electricity it stores during the first year of operation is from solar sources would be eligible for ITC (as 75% or more of the inputs are from solar), but the amount of tax basis eligible for ITC would be limited to $90.[16] If the percentage of input from renewable energy falls below the one-year amount in subsequent years, all or a portion of the ITC may be "recaptured" (required to be repaid to the government), as provided below.[17]

[16] IRS Regulations section 1.48-9(d)(6).
[17] Id.

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Location and Ownership of Solar Energy Storage Facilities: The location and ownership arrangements of a solar energy storage facility may impact its eligibility for ITC as follows:

- A storage facility owned by the owner of solar generation assets and located on the same site as the generation assets would qualify for ITC as a part of the solar generation assets, assuming the 75% threshold is satisfied.

- A storage facility that is not located at the same site as the generation assets or that is owned by a different taxpayer than the taxpayer that owns the generation assets, but that is "integral" to the operation of specific generation assets, may qualify for ITC, assuming the 75% threshold is satisfied. The "integral" to operation requirement may mean that placing the generation asset into service is dependent on placing the storage component into service. However, federal tax guidelines are not clear regarding whether a particular facility would be regarded as integral to the operation of a solar project, and it may be advisable to obtain a private letter ruling from the IRS for such a structure. Sponsors should expect that it will take anywhere from 6 months to a year to obtain such a ruling, even if the IRS agrees to issue one.

- A stand-alone storage facility that is not dedicated to a particular solar generation asset could possibly qualify for ITC, but this situation presents unique issues and may require the tracing of solar-generated electricity to the particular facility. In practice, it may be very difficult to pursue such a project without further IRS guidance.

ITC Recapture: ITC "vests" at a rate of 20% per year over a 5-year recapture period. If there is a disposition or disqualifying use of ITC property in the first year of operation, there is 100% recapture; dispositions or disqualifying use in the second year result in 80% recapture; and so on through the recapture period. These same rules apply in the storage context with an additional special rule. ITC recapture would apply if, during any year of the 5-year period after the in-service date, solar energy inputs as a percentage of total inputs drop below the percentage determined during the first year of operation. If the solar energy inputs for a year drop below 75%, full recapture of the unvested amount applies. For example, if solar energy inputs on a $100 storage facility were 100% in year one but drop below 75% in year two, 80% of the $30 of ITC would be recaptured. If the drop below 75% in solar energy inputs occurs in year three, 60% of the $30 of ITC would be recaptured. If there is a reduction in the percentage of solar energy inputs below the first year's percentage of solar inputs (but still at least 75% solar inputs), there would be proportionate recapture. For example, if a $100 storage facility qualifies for $30 of ITC based on 100% solar inputs in the first year after the in-service date, but the percentage of solar inputs in year two drops to 75%, then there would be $6 of recapture (25% of 80% of $30).

ITC Eligibility for Non-Solar Energy Storage Projects: For energy storage associated with fuel cell, small wind, combined heat and power, 10% ITC geothermal and ground thermal heating/cooling facilities, the rules similar to those described above for solar energy storage would apply. Under current law, ITC is only available for energy storage associated with large wind, closed-loop biomass, open-loop biomass, 30% ITC geothermal, landfill gas, trash, hydropower and marine and hydrokinetic facilities if construction of the facility began before January 1, 2014 and production tax credits are not taken.

Depreciation Period: If energy storage assets are eligible for ITC, they would also be eligible for 5-year MACRS depreciation. If they are not eligible for ITC, they would appear to be depreciated over 7 years for federal income tax purposes.

California Solar Property Tax Exclusion: Generally, if an energy storage facility qualifies for ITC, it would also qualify for the California property tax exclusion in Section 73 of the California Revenue and Taxation Code. However, under sections 73(d)(2) and (d)(3) of that Code, if the energy inputs to the storage asset include any non-solar energy, it appears that only 75% of the value of the property is eligible for the property tax exclusion.

Energy storage technologies present important solutions for critical energy grid problems. As a result, energy storage projects present significant business opportunities for project developers, vendors, capital providers and other participants. Energy storage projects also present significant risks and challenges, not only on technical issues, but also on basic commercial, contractual and tax structuring issues. The issues are manageable, however, and those who manage the issues effectively will stand most prepared to succeed in helping to solve energy grid problems while earning a profitable return on investment.

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Mr. Sherman is a partner in Orrick's Energy Group. Mr. Sherman has over 30 years experience representing energy and infrastructure project developers, contractors and investors on energy and infrastructure projects. He is named in the Chambers USA Guide as a Leading Lawyer in the area of Renewables and Alternative Energy, by Euromoney as one of the World's Leading Project Finance Lawyers, and was highlighted as a Leading Project Finance Attorney in The Legal 500 Guide to the U.S. Legal Profession.

In recent years, Mr. Sherman has been very active representing clients on the development and financing of solar, wind, geothermal, storage and other renewables projects, as well as traditional gas projects. In Southern California Edison's 2013/14 RPS Request for Proposals, Mr. Sherman and his team at Orrick represented winners of five of the eight PPAs awarded by SCE, approximately 900 MW of the total of 1,500 MW awarded to all winning bidders. Mr. Sherman also advised winners of two large Tolling Agreements in SCE's 2014 RFO for Local Capacity Requirements. In the past few years, Mr. Sherman also represented a number of clients on multiple energy storage projects in California, Puerto Rico, and elsewhere. Mr. Sherman received his law degree from UCLA Law School in 1984, and his B.A. from U.C. Berkeley in 1981 where he graduated phi beta kappa.

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Mr. Sachdev is a senior associate in Orrick's Energy Group. Mr. Sachdev represents project sponsors, developers, contractors and investors in developing, constructing and financing power generation and related infrastructure facilities in both the renewable energy and conventional power sectors. His experience spans projects in the Americas, Asia, Europe and the Middle East, and includes transactions awarded "Deal of the Year" distinctions by Project Finance and Project Finance International.

Mr. Sachdev currently represents several of the most active solar and other project developers in the development of projects located across the United States, and especially in California and the West. In recent years, Mr. Sachdev has served as lead associate in representing numerous winning bidders on hundreds of megawatts of PPAs and tolling agreements awarded by SCE and PG&E in RPS and LCR requests for offers. In 2014, Mr. Sachdev represented several clients on a variety of energy storage projects, including stand-alone and hybrid projects in both California and Puerto Rico. Mr. Sachdev received his J.D. from Columbia Law School where he graduated as a Stone Scholar, his M.B.A. from Columbia Business School where he graduated Beta Gamma Sigma and on Dean's List, and his B.A. from Brown University.

About Orrick

Orrick is a global law firm with 1,100 lawyers that work as an integrated team across 25 offices throughout the globe. Orrick has one of the world's leading energy practices, composed of over 100 lawyers with deep experience in the energy field focusing on projects in the United States, Europe, Asia and Africa. The energy practice is a core part of Orrick's overall strategy, allowing the practice to mobilize internal resources to expand our global outreach and take advantage of market opportunities. We are particularly noted for our leading practices in energy project development and finance, governmental energy funding, public private partnerships, and venture capital and emerging company representation in the clean tech and renewable energy sectors worldwide.

Lawyers in Orrick's renewable energy practice represent developers, lenders and investors in the wind, solar, geothermal, waste-to-energy, ethanol, fuel cell and other clean energy technology sectors. Our lawyers have significant experience in the development and financing of renewable projects all over the world, and they routinely draw upon the experience of members of the firm's securitization, real estate, bankruptcy, regulatory, environmental and litigation practices when handling such matters.

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