

Power Finance & Risk



BATTERY STORAGE ROUNDTABLE 2019

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NOTE FROM THE EDITOR

It has been observed wryly at energy conferences at many cities in the U.S. and abroad that battery energy storage is “the bacon of the grid” because no matter where you put it, it makes everything better. Bacon can be enjoyed on its own or as part of a dish with other ingredients. Similarly, storage can work on a stand-alone basis or coupled with wind, solar or other technologies. It is not clear who originally landed on this comparison, but it may have been Kelly Speakes-Backman, CEO of the Energy Storage Association. Other imagery has also been used. Storage is caviar, a Swiss army knife, a grenade, depending on the speaker.

The bacon metaphor is compelling but—like any figure of speech deployed to simplify a complex subject—flawed. For one thing, what are vegetarians and others who do not eat pork products to make of it?

More importantly, perhaps, battery storage differs from bacon in that you cannot sprinkle it carelessly into the grid and expect a great result. Battery storage can provide eight different services, a handful of which can generate the predictable cash flows needed for project finance. Bacon ultimately serves only one purpose, and no one needs to convince a credit committee, a tax equity investor or an infrastructure fund of its creditworthi-

ness, eligibility for the investment tax credit or long-term value.

Battery storage project finance is in its infancy. Even in conjunction with solar projects, it is a novelty for most project finance desks, never mind as a stand-alone unit or distributed system. That’s why PFR has brought together three developers, a private equity investor and a lender to explore the various regulatory environments, revenue streams, financing structures and risk mitigation strategies that are developing. The result is a fascinating and frank discussion in which fundamental assumptions are challenged. Should sponsors by-pass the strictures of tax equity financing altogether? Why enter into a hedge when a reserve account will do just as well?

The debate around the best way to finance battery storage is far from over—and may never be definitively settled—but we hope this riveting roundtable discussion will move the conversation forward.

Richard Metcalf

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**SPEAKERS:**

Shravan Bhat Reporter, *Power Finance & Risk* (moderator)
Santosh Raikar Managing Partner and Head of Renewables, **Silverpeak**
Anneli Alers Vice President, Structured Finance, **Invenergy**

Randolph Mann President, **esVolta**
John O'Brien Director, **Siemens Financial Services**
Jon Poor Director, Business Development, **Engie Storage**

PFR: Which states have the best policies to grow storage and what are the lessons that can be learned from their experiences?

Santosh Raikar, Silverpeak: In my opinion, Massachusetts has some of the best policy incentives. They came up with the SMART programme, which has adds available for battery storage that provide a significant economic boost to returns. That's where we have seen a lot of activity in the battery space.

Jon Poor, ENGIE Storage: I'd agree with Santosh. I would add that **ISO New England** is perhaps the most advanced ISO for monetizing energy storage. There's a number of ways that you can enroll energy storage currently in the capacity and ancillary service markets. We spend a lot of time

focusing on Massachusetts because of 1) the bankability of the utility offtake for the SMART program, and 2) also being able to derive additional revenues from the market, which was the intention of the program. We hope similar models that leverage market revenues start to develop in other states.

Randolph Mann, esVolta: I think if we're talking about states you have to give a shout-out to California, where I come from. The state-level mandate that requires utilities to procure or develop storage has really created a large market.

John O'Brien, Siemens Financial Services: There's also a difference between large-scale utility incentives like those in California and New York, and smaller stuff in Massachusetts and around Hawaii, along

with the desire to have solar-plus-storage in the Southwest. The biggest limiting factor is the lack of established markets to sell your battery into.

Mann, esVolta: Yes, I like the way you said it, because you can also have indirect policies that create the right environments that are supportive for storage and an active wholesale market that doesn't discriminate against storage is one of them. A high RPS [renewables portfolio standard] for example, like you have in Hawaii, is going to move a lot of storage. Those types of supportive environments are really what storage needs, more than necessarily a direct tax credit or a mandate. Let's create the environment where storage can do what it does best, which is help integrate renewables, help provide reliable peaking

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capacity and do so in a zero emissions way. I think if you allow the utilities and wholesale ISO markets to value those things then storage will grow.

PFR: Clearly, some markets have moved faster than others. You mentioned California, and I wanted to ask you about Pacific Gas & Electric, because they handed out some huge storage contracts. What do you think is going to happen with those?

Mann, esVolta: We have a strong interest in it because we have Hummingbird, which has a 300 MWh PPA with PG&E and our strong view is that we would really like to do the project. We think it's a well-developed, well-priced project and a good fit for the needs of that particular area of the California power grid. And it would be beneficial to the ratepayers as well as to the utility. But obviously when you have a bankruptcy situation a lot of things get complicated and slow down and there's going to be a long process to figure out what PG&E is going to look like after the end of that bankruptcy.

PFR: We've seen a lot of storage PPAs handed out by Southern California Edison as well, and though the fallout from the wildfires hasn't yet affected them as dramatically as PG&E, how seriously do you take that risk?

O'Brien, Siemens FS: Well, PG&E is really a non-starter on the lending side. When you look at SoCalEd, it's not in bankruptcy right now and you have the same risks that PG&E had—one spark and a fine of billions of dollars and a bankruptcy. So there's always a bit of hesitancy to go into it. I think what's interesting about a SoCalEd battery project is, the resource adequacy contracts may not be as excessive as some of the wind contracts are. We have a very large portfolio of California PPAs and a real risk is invalidating in the contracts, but an even bigger risk is renegotiating the contracts. If the storage contracts today are at or below the equivalent of a \$75/MWh wind PPA, we're comfortable saying that we may have a bankruptcy risk in there—and we don't like it—however it's not as risky as a legacy wind farm.

PFR: Does it make a difference if the storage PPAs are more like a capacity payment rather than an energy contract?

O'Brien, Siemens FS: The question is: what's the price compared to what you could have today? Obviously, that opens up a few more questions around how much merchant risk you are willing to take on a battery project. But on a strictly contracted basis, which plays into how much we charge for the loan, clearly SoCalEd will probably make a little bit of a premium because there's still some uncertainty now, but there's more of a willingness to do it.

PFR: Santosh, who do you see as the long-term owners of storage assets?

Raikar, Silverpeak: Most of the [long-term] owners are similar to those we see right now with renewable energy project owners. But if you're looking at it as a transition, 15 years ago renewables were owned by strategics—they were the primary drivers. They would buy stakes outright, and then the passive investor got comfortable and now we have pension funds acquiring projects directly. I think you will see a similar story here. However, strategics will have a leg-up compared to other renewable energy assets because inherently there is an element of merchant power risk because, for example, the battery is being substituted purely for arbitraging on-peak and off-peak, and that is a skillset that the likes of ENGIE are much better suited to than passive investors. The technical knowhow will be a driving force. Having said that, several business models and financing models have evolved in the renewable energy space so that there may be a co-investment mechanism.

Anneli Alers, Invenergy: I agree with that. Maybe more IPPs [independent power producers] and developers will initially take them on in an ownership position, but we see more utilities actually wanting the assets and commissioning pilot projects right now in order to learn how they will adopt the technology. I think it will transition more into a utility ownership and eventually a financial and private equity ownership similar to the renewable generation space.

Mann, esVolta: I would agree, though I think in some ways it makes a lot more sense for the utilities to own storage than it did to own intermittent wind or solar because storage can be so integral to the operation of the grid and the reliability factors. But there's also a very good story for why utilities should let the IPP community take ownership and it's that there's a degree of risk in the development and management and long-term operation of the projects, particularly if you have a situation where the projects are participating in the wholesale merchant market in addition to providing contracted services to a utility customer. I also think IPPs can enable savings over a utility-owned model by finding the most cost efficient ways to procure storage equipment and finance storage projects.

Poor, ENGIE Storage: We have actually worked on opportunities where the utility wants to rate base the asset, but they only need to use it for a few hundred hours a year. They want a partner to take the market opportunity and risk and then reduce the contracted price to utility and ratepayers. I see this approach working well with pipes-and-wires utilities in organized markets.

O'Brien, Siemens FS: The topic that you always get hit with at every conference is: "a battery can do eight services but how many are you going to finance?" And my answer is always the same because there's only a viable market for two or maybe three, so I can finance three at most. The reality is



"In some ways it makes a lot more sense for the utilities to own storage than it did to own intermittent wind or solar because storage can be so integral to the operation of the grid and the reliability factors."

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that because there aren't markets, the ideal owner is the utility who can most effectively utilize a battery, even if that use doesn't have a market to monetize or incentivize.

Raikar, Silverpeak: Looking at this state-by-state is not the right way of looking at it. Humor me for a second. What battery storage needs is the market signal and there are tons of opportunities for batteries in general but unfortunately we don't know where to go and put the next battery. And a battery is a three-dimensional device. It's not about power price alone or even transmission congestion. You now need price signals for frequency regulation, voltage control, on-peak and off-peak demand, etc. And for all this, you need a system-wide set of price signals, and that should come from the ISOs. Some of these ISOs span multiple states. Even in today's economics there are places where you could go and make money because of transmission constraints. ERCOT is screaming out for battery capacity but there is no market signal. Why? Because there's no capacity market. If I had \$100 to spend on lobbying, so to speak, instead of going to the state utilities, I would rather use that for the ISOs or PUCs.

Mann, esVolta: One of the things that I do in my spare time—my hobby—is reading utility IRPs [integrated resource plans]. I would challenge you to find an IRP that was issued within the last 12 months that doesn't talk about battery storage being some part of the utilities grid in the relatively near future, because they're seeing the pricing signal from the battery industry.

Alers, Invenergy: We are seeing the same opportunities from the C&I market, where everyone is asking for solar-plus-storage. We're not transacting as much on that yet but are seeing a lot of opportunity from clients asking to see the storage piece added to see how that looks.

O'Brien, Siemens FS: Following on from what Santosh has found, I see a lot of developers who are probably content with a return that I wouldn't think would be acceptable for the risk taken just to A) get balance of plant in and B) get a seat at the



"You need a system-wide set of price signals, and that should come from the ISOs."

Santosh Raikar, Silverpeak

table. As long as you've made your money back in the five years and you've done your work to get the market where you want it to be, you're actually in the driver's seat because then, *boom*, the day the new rules hit, you put in your new batteries and you're off and running and you've made your real return.

PFR: In my conversations with the folks that hand out storage mandates, they don't really know what they want, and so I guess there's also some scope for the developers to also send market signals out as well. Is that right?

Raikar, Silverpeak: If you think about it, from a system perspective, batteries are much more fundamental than any other equipment that goes into the whole transmission grid. People have used power plants as a spinning reserve, for example, but if you use a battery as a spinning reserve, it's instantaneous. Hopefully, what will happen is in the next five or ten years there will be a mechanism whereby people will start sending the signals. The transmission grid is not going to evolve, because permitting is the main issue. If you look at the load demand picture, there is not significant demand growth. The grid is static in that respect. It's the composition that is changing. And if you want to do that, then batteries will facilitate that particular replacement.

Alers, Invenergy: We're seeing opportuni-

ties in transmission and distribution capacity deferrals, so it is a solution for a specific scope. It's not intended to be a long-term transmission solution, but for the next seven to ten years it gets the utility through those constrained years, especially in tight urban areas.

Poor, ENGIE Storage: It's interesting that a few of the winners for the Massachusetts offshore wind procurement integrated an energy storage component to optimize supply and transmission operations. I'm surprised more transmission developers with FERC Order 1000 competitive projects haven't started to incorporate energy storage to develop more cost-effective solutions.

PFR: What does a standalone storage contract look like that you can go to big banks and actually get financed?

Alers, Invenergy: The capacity payment makes the most sense. No price risk, just straight up you've got 'X' MW and just a true capacity payment. I think that's the easiest and the most straightforward.

PFR: And how should it be structured? There is at least one where the utility can call upon the unit 100 times a year and it gets paid as long as it's available.

Alers, Invenergy: These types of constraints end up being some of the most heavily negotiated provisions in the PPA.

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"We're willing to take a view up to about seven years of the merchant market, because there is a lot of risk."

John O'Brien, Siemens Financial Services

PFR: And ten years is long enough?

Alers, Invenergy: Yes, but we've also seen PPAs beyond ten years.

Poor, ENGIE Storage: We've seen anywhere from seven to 20-year PPAs. The longer-duration terms are for solar-plus-storage.

Raikar, Silverpeak: So you'll be replacing the storage along the way?

Poor, ENGIE Storage: It's an option. It depends on how we and our client use the energy storage system. It comes down to degradation. We've talked to a lot of customers and they said, "Let's just look at ten years and then we'll replace it, and we'll agree to some costs plus margin criteria and we'll go from there."

O'Brien, Siemens FS: Like everything with storage, there's several different components to what is a good PPA, and a standalone storage PPA that Randy would pursue, which is different than a solar plus. Obviously with the solar plus, there's a lot of financing available today because people go into it saying it's just one big solar contract on demand. The risk is the dispatch characteristics and how that will impact your stated charge and, at the same time, your warranty. There are a lot of little gremlins hiding in these contracts—especially in the solar plus—that maybe are not appreciated.

I know Electrodes is pretty much contracted, but everything you see, especially in RA [resource adequacy], certainly has a merchant component to it. Then there's going to be an ask, or an expectation, that you take some sort of merchant view towards. We handle the contracted part of a battery as a fairly traditional component and we're willing to take a view up to about seven years of the merchant market, because there is a lot of risk. For example, if four or five projects enter a market it could kill your opportunity right there.

Mann, esVolta: I would step back and talk about what standalone storage PPAs look like. I think there's two basic extremes and then there are hybrids in the middle. One extreme is a tolling agreement that looks just like a gas tolling agreement, where the utility is paying you a capacity payment. They're paying for the cost of your fuel, which in this case is charging electricity, and they're getting the rights to dispatch the asset however they want over the term of that contract, maybe within some limits on the performance of the battery. And in that contract, you are guaranteeing the performance standards of the battery, whether that's availability or efficiency or things like that.

And then the other extreme is really just a capacity contract where they're paying you RA or a capacity payment which is fixed over the term of the contract, and you as the owner have the right to choose how you're going to dispatch the battery in the market. I think both are financeable, as John pointed out, but the sizing and tenors are different.

The hybrid is where it gets interesting, where you may have what's predominantly a capacity contract, but where the utility has certain times when they may want to use it. And that could be seasonal or it could be on a day-ahead basis during certain peaks. You can structure the capacity contract to allow for that usage to meet the utility customer's needs.

PFR: I remember seeing solar-plus-storage projects where lenders were not giving any credit to storage revenues. Has that changed now?

O'Brien, Siemens FS: It is specifically written into some PPAs, like the Hawaii ones. You can go onto the utility website and they'll state they're charging their batteries 75% or 70%, 80% with the solar part, so you have to give the battery credit because it really is a battery project that just happens to be charged by solar instead of the grid.

PFR: What is the scope for developers to get hedges for the merchant output that the project can produce and are hedging counterparties available?

Mann, esVolta: I think fundamentally if you're connecting a battery storage project into a liquid wholesale market then the products that we can sell ought to be hedgeable over the period of time.

Poor, ENGIE Storage: I'd agree with that. If you can get a hedge on a wind project, you can get a hedge on a solar project and it's all part of an integrated system and market.

O'Brien, Siemens FS: It's no different than a heat rate call option. Your gas is the power and your O&M is the efficiency of your project.

Mann, esVolta: The only difference is you don't really have that spark spread for it, so the cost of your fuel is the cost of your product, but for the efficiency of your system, it's a pretty good machine to participate in wholesale markets.

O'Brien, Siemens FS: Even the big projects are small from a financing perspective, so it may not even make sense to have a hedge. The argument I would make is, why would I have to take Invenergy's money and throw it away at an investment bank, when it could be shared within the family, a.k.a. the project, and then if everything pencils out right, it goes back to the sponsors. So instead of being capexed day one out the door, it's a reserve. So why size a hedge that will never be exercised just so I can get comfortable, when I can take that same dollar amount, put it as a reserve, and then it all comes back to the original developer. I've got the same essential level of protection, we're working together, and I would believe, from



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where the market is, they get their money back in five to seven years.

I believe that's probably the logical way, as long as these projects remain the size they are today. Once they get to something like a 300 MW battery project and you have to get four banks involved, then that becomes an issue. But as of today, where it's a 100 MW project, you probably don't need to worry about finding a hedge if you can find the right bank.

Mann, esVolta: Obviously, whenever you're buying insurance, the price of the premium has to be worth the benefit, which hopefully would be evident in the availability and cost of financing.

O'Brien, Siemens FS: It always struck me with the HRCOs [heat rate call options] and the revenue puts for a CCGT, what a waste of money that is. But you needed it to get credit so...

Raikar, Silverpeak: I think there will be some physical traders—not financial traders—who might see the value of optionality and they're ready to give someone money upfront so that they can manage the battery as an asset. But it's not for everyone—especially not the investment banks. I have heard about certain deals where someone is going out to a solar developer saying, "Hey, when you add on the battery, we will pay you \$10 million and then we get to manage your project."



"It's interesting that a few of the winners for the Massachusetts offshore wind procurement integrated an energy storage component to optimize supply and transmission operations."

Jon Poor, Engie Storage

O'Brien, Siemens FS: The worry that I always have goes back to what we talked about at the very beginning: who is going to own the projects and who can trade the asset? I'm actually a little worried about a trader operating the battery because there are a lot of other considerations outside of a monetary market that should be factored in. This is why there many more financial players coming in—I essentially view larger merchant battery projects as being run through an algorithm, which hasn't necessarily been developed yet.

But the algorithms have to consider the revenue and also battery life because that is something that has to get factored into the dispatch decision—not just the ultimate power price.

Poor, ENGIE Storage: I think that the warranty and bankability of an OEM [original equipment manufacturer] and the constraints around how a battery needs to be operated to coincide with certain warranties or degradation curve is new and complex, and it's very different than solar or wind production. After operating energy storage systems for eight years we've determined the software platform to operate that. What is the investment community's comfort with battery software platforms that are available, both from a technical and bankability perspective?

Raikar, Silverpeak: But in your opinion is that a constraint as opposed to the availability of the hedge product? I could see a group like ENGIE, with its physical trading capabilities, also have the capacity to operate the projects. It's been done in natural gas projects, so why is it not happening here? Is it because of software or because of the size? For ENGIE, it needs to be 300 MW as opposed to 10 kW?

Poor, ENGIE Storage: Yes, that's it. It's probably timing, the market and the scale needed to transact with.

O'Brien, Siemens FS: Would a trader be willing to pass up and re-trade if it's going to invalidate a warranty? Unless there's some clawback somewhere, I think that contract might get very difficult and unwieldy.

Poor, ENGIE Storage: Yes, I don't see it, at least in my experience. I don't see an ability to execute a contract with that today.

O'Brien, Siemens FS: We've seen a couple different EMSs [energy management systems] and we're pretty happy with them. Outside of the general secrecy amongst the EMSs, we think finally they all interact well with the battery. So, **LG BMS** [battery management system] works well with **Green-smith** or **Fluence** or whoever is the EMS. I don't think the market has an effective algorithm to integrate all the EMSs together. I don't think anyone's ever bothered trying to show it to me or anyone.

PFR: What role does tax equity have in this space? There was a letter ruling from the IRS saying that if you install storage onto an existing solar project it is eligible for the ITC. How far can that be scaled up, and what about wind-plus-storage?

Raikar, Silverpeak: I believe the guidance on this is still iffy. In my opinion, there is a huge market for new build storage projects where you could put new storage on existing solar. And I think that's where most of the people are focused on. There is already a significantly constrained market for tax equity so tax equity investors generally like those projects. Similarly with repowering, there is a significant amount of tax equity available for new build wind and *some* money available for repowering. It's a similar philosophy. Let's spend money and time on the new build stuff because that's a pretty standard cookie cutter business model. So on solar, it becomes a function of whether your battery is charged by the solar system 75% minimum—that's how the ITC works and most of the projects do satisfy that.

From that point on, really, I've been seeing sizeable solar-plus-storage projects pretty much since 2017. Why it hasn't been done is for the lack of PPAs and development risk, except for a very vibrant market in Massachusetts, because, as I said at the beginning, the economics work. There is a significant regulatory certainty as to how this will work out and the market is small enough that a few tax equity investors can get it going.

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That also comes back to the question earlier as to why there are no wind-plus-storage projects. It's not for the lack of the market or revenue certainty, but it's really from the tax equity perspective that I don't know enough to say, "Oh, this is how the wind-plus-storage will work out," so that's a challenge.

O'Brien, Siemens FS: Do you think that there's a position on the tax equity side to DC couple versus AC, or do you think people don't care either way?

Poor, ENGIE Storage: It depends on the specific opportunity and where you can derive optimal revenue streams

O'Brien, Siemens FS: So you don't think the tax equity are worried?

Poor, ENGIE Storage: They are concerned.

O'Brien, Siemens FS: They're charging from the grid as opposed to the project.

Raika, Silverpeak: Couldn't you make it on the AC side and still not have the grid charge the storage?

O'Brien, Siemens FS: Yes, but I think you remove that risk to a much greater degree by having it all behind the same DC inverter.

Poor, ENGIE Storage: There is some risk with an AC-coupled project, but we believe it's manageable.

Raika, Silverpeak: But again, wouldn't that be a problem on a net-meter system, where the electricity can flow both ways, and on systems where we could have a breaker for charging the system? Basically, it could disconnect from the grid charging the battery—wouldn't that be a technical way of solving that problem?

Mann, esVolta: I've got to say, guys, I'm getting frustrated with this discussion, because what are we doing? We're trying to follow a tax rule to optimize for tax, but we're not optimizing the energy system and we're not using the system in the most efficient way. If you took away the tax rules then how would we build the electric grid?

Poor, ENGIE Storage: Probably AC?

Alers, Invenery: But hasn't much of the renewable industry been built around this?

Mann, esVolta: That's my point. My company focuses on standalone storage because we think that's the most valuable thing for the electric grid. It also happens that it doesn't get the ITC, which I think liberates you to do different things in terms of how you're financing it. Ultimately, I think that's where the markets should go. It's difficult to compete against solar-plus-storage when they're getting an ITC and standalone storage isn't, but that is part of the inefficiency that I'm implying.

Raika, Silverpeak: You're right, that's how it should go, but I think it's an idealistic view. When I talked to tax equity investors in my prior role, I used to say, "Hey, everyone complains about how the PPA price is going down. You're not providing a value proposition! Throw in some battery there. You are getting a 30% discount anyway!" And this shows the utility that you are sophisticated because you are trying to tackle the problem that the utility is facing. We have heard from multiple sources that utilities never give it to the lowest bidder anyway, so with the right strategy, maybe they will buy your project.

Also, one more thing which is very unique is that given the erosion of the depreciation benefits and the tax law change, the prices of the panels have come down to the point where, when we throw in the battery, it becomes sizeable enough for tax equity to care about the project. For example, a 100 MW project rarely gets to a \$30 million number [for tax equity]. In the good old days, a 100 MW project could have given \$75 million in tax equity and it was meaningful for someone to get involved. This is one way you could potentially achieve capital efficiency.

PFR: Do you find that that there is lots of financing readily available? Has that ever been an issue for storage?

Alers, Invenery: We have deep relationships on the equity and the debt side and



"We have heard from multiple sources that utilities never give it to the lowest bidder anyway, so with the right strategy, maybe they will buy your project."

Santosh Raika, Silverpeak

everyone we talk to is telling us, "Show us your storage, show us your solar-plus-storage, we want to be involved early on". I think absolutely the interest is there. There just have not been enough fully executed contracts in the market yet, where we're actually getting bids and going through the competitive process of seeking out the best terms. Based on who we've talked to, everyone wants to be in it. I think it's just a matter of having more executed deals that are actively seeking proposals and bids.

Mann, esVolta: And it's just the lifecycle of the industry, right? There's a lot of projects that are still in some development stage—not quite ready for institutional investment financing, but that's coming very soon.

Alers, Invenery: Or they're executed but you're not quite ready to go to market yet because you have another 12 months or so to get through development.

Poor, ENGIE Storage: Yes, I think financing is sufficient.

PFR: How do banks price construction risk versus the operating risk?

O'Brien, Siemens FS: Almost no construction risk, which is funny, because we don't even price construction risk for traditional projects.

Alers, Invenery: We've heard that there

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"There are literally 3,000 modules in a 20 MW plant and if one of them overheats, that's not a huge number."

John O'Brien, Siemens Financial Services

shouldn't be much of a premium over solar on the operating side. Certainly there will be some premium early on, but battery technology is not new. We've used lithium-ion for decades and it's just a matter of using it in a new application.

Raikar, Silverpeak: What is the construction timeframe for a sizeable project?

O'Brien, Siemens FS: Six months.

Raikar, Silverpeak: What I'm trying to get at is that construction also factors into the whole calculation. We're talking about just getting the battery from somewhere and installing it.

O'Brien, Siemens FS: It's hard enough to get the battery, so you can't factor that into the time, and there's a lot of dead money hanging out there. The other thing to think about is who's developing the projects. There are still a lot of smaller developers who, a lot of the time, would be equity first. Another thing is, depending on the size of a loan, does it make sense to do a construction loan? A lot of times, probably no.

PFR: Did you see the news about the fire at a storage facility? Does that have any impact on how lenders look construction or operating risk?

O'Brien, Siemens FS: Well, it was an operating APS asset and someone asked me if it wor-

ried me and I said, "Is it any different than a gearbox failure or a blade throw?" And it's not. You know what the risk is, and you try and work around it and have proper controls.

"Will a battery overheat?"

Yes, a battery will overheat.

Sometime in the first year, two years, three years, you'll have one overheat.

But there are literally 3,000 modules in a 20 MW plant and if one of them overheats, that's not a huge number. As long as your system shuts it down before it starts a fire, it's fine. Just put in a new one. It's just something you have to get used to.

Mann, esVolta: So from a project owner perspective and someone who's the president of a company that owns projects in operation, this is something that we take super seriously. Safety is the foremost thing that we think about every day, and so when something like that happens, yes, absolutely we notice it. We actually took a safety stand-down and looked at our operating projects—that are completely different than that particular APS project—different design, different configuration, different chemistry, different control system—nonetheless we still took a safety stand-down because we saw that as an opportunity to review other projects and make sure that what we're doing is prudent and intelligent. We expect our partners and our suppliers to do the same thing. It's a young industry so there are still standards being honed. There are still protocols being developed and there's

still thought going into this.

Alers, Invenergy: As an owner operator, I completely agree with that. It's like any piece of machinery: You just don't treat it lightly and you operate it properly to the design specifications.

Raikar, Silverpeak: There is a disproportionate amount of publicity as well. I don't want to make light of it, but if a **Tesla** catches fire, it's all over the internet. But no one talks about internal combustion cars that face similar problems on a regular basis.

PFR: What have been some of the lessons that you've learnt from the deals that have been done, small or large as they may have been?

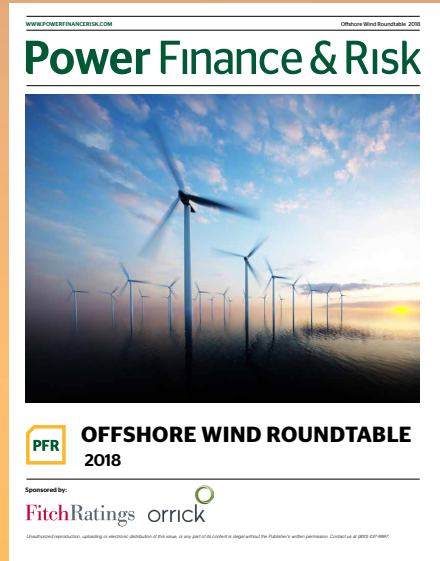
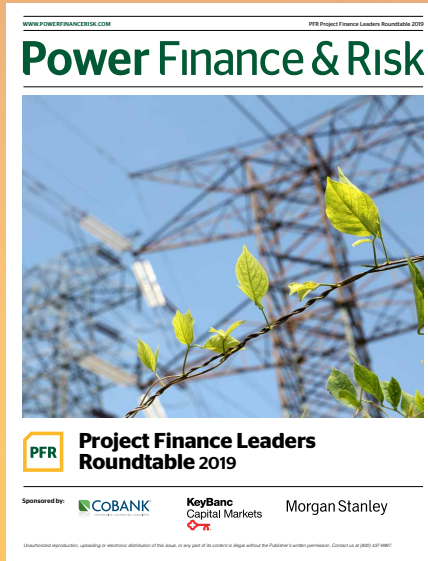
O'Brien, Siemens FS: Over the weekend we closed our first standalone project, and we have another one that's going to be closed soon. What we've learned is that it takes a lot of time and effort to get commercially where we need to be. But there's a lot of technical knowledge we learned, especially in terms of software controls, the ancillary parts, and how your HVAC is set up. Is it set up appropriately for today or for five years from now? How are you handling battery replacement? Things like that.

Frankly, you have to almost be a developer yourself on the financing side to effectively do it because there are so many little risks here and there that are not known or underappreciated on the financing side, that it would almost scare you if you realised all of it. But you also learn how you can safely mitigate it in different ways and which ones can be looked at and pushed to the side, versus which ones need to be managed.

Alers, Invenergy: So far, we've utilized mostly vendor financing for our storage projects. Each is very unique to that exact application and that equipment and there are new lessons learned on every project.

O'Brien, Siemens FS: From our perspective, the benefit comes not from the learning before they're closed, but after the close. Where I want to go is to have different investments in each market in order to understand

PFR EXECUTIVE ROUNDTABLES



Once a month the *PFR* editorial team hosts a closed-door roundtable discussion to take a deep dive into power finance issues that are top of mind with our readers. The roundtable discussions include editorial guests and sponsors who are subject matter experts on the topic at hand. These peer gatherings of industry leaders - usually no more than 5 or 6 around the table - are photographed, recorded, transcribed, and published in a subsequent issue of *PFR Weekly* (print and digital editions).

Since starting the series in the fall of 2018, *PFR Roundtable* reports have been getting rave reviews with the *PFR* audience. For sponsors, they deliver both immediate brand recognition and long-term PR visibility - as each report is hosted online and actively promoted to the entire *PFR* membership using digital, email and social media platforms.

We invite you to review the topics we plan to address over the balance of this year:

- **16 July** : M&A in Power Finance: a half-year review of 2019 deals and trends
 - **06 August** : Financing Wind Repowering
- **10 September** : Private Placement: evolving role of institutional investors
 - **08 October** : Power Finance in Latin America
 - **05 November** : Solar Asset Based Securities

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● PFR BATTERY STORAGE ROUNDTABLE 2019



"So far, we've utilized mostly vendor financing for our storage projects."

Anneli Alers, Invenergy

how each application impacts the battery.

PFR: What is the role of mezzanine financing? How can that help developers in this space?

Poor, ENGIE Storage: I think it's valuable for the near term as there's significant complexity with different levels of experience and understanding. I think mezzanine has a place in the near term until there is more experience implementing and operating these complex structures.

PFR: The issue that we always hear is, how will we know how the technology performs over multiple dispatch cycles? What have been some of the insights that you've gleaned from your conversations with the technology vendors?

Poor, ENGIE Storage: We've been operating/contracted about 88 MWh of behind the meter storage systems in California for seven years and most of those are being operated at very high frequency for C&I peak shaving. They're also participating in some of the utility DR [demand response] programs, which are pretty simplistic right now, and in some cases doing some solar firming. But I would say we've been pleased with the reliability of tier one vendors.

I think it is important that the investors understand the value of operational experience and the effect it has on reliability, in addition to hardware and components.

There's one aspect of reliability and there's another aspect, performance, which is more related to operational capability.

PFR: How close were your forecasts when you were planning to what actually happened?

Poor, ENGIE Storage: I'd say, besides a few isolated incidents, better than forecasted.

Mann, esVolta: Yes, we've been operating projects for a year plus now. They're doing what we expected them to do. We think of ourselves as an IPP, developing, financing, owning and managing assets for the long term, and that's really in part intentional because these assets are going to change over their life. And so how you manage your battery system, in terms of the degradation, the augmentation, your products selling in the market, your O&M and performance expectations, all matters. And getting that early experience is really important.

PFR: Do you think that there's any other technology that can or will compete with lithium-ion?

Mann, esVolta: Yes. Today maybe not, but tomorrow, next year, the year after, for sure. Go to any engineering PhD school and you'll find people working on materials, chemistry and material science and so, for sure, that's happening.

Raikar, Silverpeak: I was at the MIT energy initiative just three weeks ago and this discussion came up about storage. My view is that lithium-ion is a very sophisticated battery for a very simple application. It's designed for cars. It's supposed to be compact, lightweight and have much faster recharging cycles. None of that is required in a power plant application. It's like driving a Ferrari to get your groceries. If you're looking to the batteries to deploy in power applications, it's roughly 3% to 4% of whatever you deploy. Cars are driving the cost and whatever cost efficiency we are seeing is coming from vehicles.

If you look at the statistics in the U.S., there are roughly 100 million registered cars. Let us say 50% of those get converted.

Let us say that each car requires 60 kWh—that is what I have from my Chevy Bolt. I call it a poor man's Tesla, which is what I am. If you do the math, it's about 3,000 GWh. If you look into the grid, we have 1,076 GW under the system. I think we need only 20% of that electrified with battery storage because batteries are supposed to be a supplement rather than power the grid itself. If you do the math again, take 20% of that, and if you are charging the battery for an hour it comes to 200 GWh. So the cost curve for the battery will be driven by cars, but at some point because of the differences in application, there will be decoupling, and that's where we'll see a significant demand, because the power application really needs a cheaper battery and it will be reaching that point much faster.

PFR: How do lenders look at the technology guarantees and the warranties ten years down the line? If, for example, Tesla is your manufacturer, how comfortable are lenders out there right now with that credit? Does it make sense to diversify or have a technology provider with a slightly stronger credit rating?

O'Brien, Siemens FS: Something to remember, too, is that Tesla's is a **Panasonic** battery. You can try to look at a backdoor to Panasonic, and then the way to work around it is just proper reserves and springing reserve... things like that.

Alers, Invenergy: Yes, and finding the right balance between initial overbuild and degradation and lower-priced equipment to replace five, six, seven years from now. There might be a sweet spot.

Raikar, Silverpeak: So the guarantee comes from Tesla, right, not Panasonic?

O'Brien, Siemens FS: I think so, but I only know LG at this point and I'm perfectly fine taking LG risks.

Poor, ENGIE Storage: Since we're sourcing batteries and we're using our own control and software, it may be better for us to provide an integrated warranty that leverages our balance sheet. ■