Comments to Supplement the Energy Storage Analysis ("ESA")
Request for Comments from NJ Board of Public Utilities Office of Clean Energy
Submitted by Tesla Inc.
March 20, 2019

I. Background

Tesla appreciates the opportunity to submit comments to the NJ Board of Public Utilities ("BPU") regarding the State's ongoing Energy Storage Analysis ("ESA"). Tesla commends BPU Staff for their efforts in implementing P.L.2018, c.17 the Clean Energy Act and we look forward to working with the BPU, electric utilities, and other stakeholders to see the Act's energy storage goals of 600MW by 2021 and 200MW by 2030 achieved to the benefit of New Jersey ratepayers.

At Tesla we design, develop, manufacture and sell high-performance fully electric vehicles ("EVs"), solar energy systems, and battery energy storage systems. We are the world's first vertically integrated sustainable energy company, offering end-to-end clean energy products, including generation, storage, and consumption.

Advances in battery architecture, thermal management and power electronics that were originally commercialized in our vehicles are now being leveraged in our energy storage products. Our energy storage systems are used for numerous applications including backup power, grid independence, peak demand reduction, demand response, reducing intermittency of renewable generation, replacement of fossil fuel generation, and wholesale electric market services.

In 2016, we began production and deliveries of our latest generation energy storage products, Powerwall 2 and Powerpack 2. Our energy product portfolio includes systems with a wide range of applications, from residential to large grid-scale projects. Powerwall 2 is a 14 kWh rechargeable lithium-ion battery designed to store energy at a home or small commercial facility and can be used to provide seamless backup power in a grid outage and to maximize self-consumption of solar generation.

In addition, we offer the Powerpack 2 system, a fully integrated energy storage solution comprised of up to 210kWh (AC) battery packs and up to 650 kVa (at 480V) inverters that can be grouped together to form megawatt hour ("MWh") and even gigawatt hour ("GWh") sized installations. The Powerpack 2 system can be used by commercial and industrial customers for peak shaving, load shifting, self-consumption of solar generation and demand response, as well as to provide backup power during grid outages. The system can be used by utilities and independent power producers to smooth and firm the output of renewable power generation sources, provide dynamic energy capacity to the grid, defer or eliminate the need to upgrade transmission or distribution infrastructure, and provide a variety of other grid services such as frequency regulation and voltage control. Powerpack 2 can also be combined with renewable energy generation sources to create microgrids that provide communities with clean, resilient and affordable power.

Similar to our electric vehicles, our energy storage products have been developed to receive over-the-air firmware and software updates that enable additional features over time. We manufacture our energy storage products at Gigafactory 1 in Sparks, Nevada. As of 2018, we deployed over one GWh of energy storage products, and expect a continued high rate of growth for Tesla and the energy storage industry at large. We also deployed 326 megawatts ("MW") of solar energy generation during 2018.

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II. <u>Responses to BPU Questions</u>

1. How might the implementation of renewable electric energy storage systems benefit ratepayers by providing emergency back-up power for essential services, offsetting peak loads, providing frequency regulation and stabilizing the electric distribution system;

For end-use electricity customers, energy storage can provide a range of benefits to control energy costs and increase resiliency including:

- Peak Shaving – The on-site energy storage system can discharge at times of peak demand to avoid or reduce demand charge,
- Load Shifting – Energy storage can help shift energy consumption from one point in time to another to avoid paying premium energy prices,
- Emergency Backup – Energy storage can provide intermediate backup power at almost any scale in the event of the grid interruption. This function can typically be standalone or paired with an on-site generating source, and
- Demand Response – Energy storage can discharge instantly in response to signals from a demand response administrator to alleviate peaks in system load.

Energy storage can also be a versatile grid resource that allows electric utilities to:

- Defer or avoid costly investments in generation, transmission and distribution,
- Enhance the integration of intermittent solar and wind renewable energy, of which NJ is one of the largest US market, and
- Increase the security, reliability, and resiliency, of the electric grid by:
  - Providing flexible ramping to support local and system ramping needs in a cost-effective manner,
  - Frequency Regulation, and
  - Voltage and Reactive Power Support at local and bulk power levels.

4. What might be the optimal amount of energy storage to be added in New Jersey over the next five years in order to provide the maximum benefit to ratepayers;

The goals set forth in New Jersey's Clean Energy Act of 600 MW by 2021 and 2,000MW by 2030 are appropriately ambitious and achievable. 600 MW is equivalent to ~3% of NJ's peak load which is consistent with other regional targets. The New York State Public Service Commission recently issued an order establishing energy storage goals of 1,500 MW by 2025 and between 2,600 to 3,600 MW by 2030 with deployment mechanisms to achieve both the 2025 and 2030 targets. Among other things, the NY PSC Order focused on:

- Authorizing an energy storage bridge incentive program to include funding for solar-plus-storage projects participating in their NY-SUN solar incentive program,
- Directing the State's six investor owned utilities to hold competitive procurements for a minimum of 350 MW of bulk-sites energy storage, and

- Continued efforts to streamline permitting, interconnection, and siting challenges and ensuring straightforward access to market rules and opportunities.[1]

For New Jersey, Tesla recommends two primary policies support the deployment of energy storage systems:

1. Energy storage procurement targets; and
2. Customer-located energy storage incentive programs.

Storage procurement targets have been one of the primary drivers of storage procurement to date, largely because traditional utility planning, valulation, and procurement processes do not account for the unique attributes of energy storage. Storage procurement targets are set as an amount of installed energy storage capacity that can be measured as a percentage of peak load, in megawatts (MW), or in megawatt-hours (MWh). Generally, however, some consideration of both the power (MW) and energy (MWh) is appropriate given that both attributes factor into the value of the energy storage systems to the grid. Storage procurement targets should require deployment of some storage at every point of interconnection to the grid – transmission, distribution, and customer-located – to ensure sufficient learning with different applications of storage. The details surrounding what types of energy storage should be procured can be left relatively open-ended to allow (and require) the utilities to do the appropriate analysis to understand where energy storage can be most valuable to their unique grids.

Storage targets force learning by doing. For example, when Southern California Edison was given a 50 MW storage target in a 2014 solicitation for new generation capacity, it ended up procuring 264 MW of energy storage – 5 times what was required – because, to its surprise, it found that storage was a cost-effective alternative.[2] Further, gaining experience deploying energy storage provides optionality to states in emergency situations where they may need to deploy resources more quickly than traditionally occurs. For example, after a natural gas system leak threatened the electricity reliability of the Los Angeles Basin, the utilities were able to bring over 100 MW of storage projects online in less than a year.[3]

New Jersey should develop a new incentive program in the form of rebates for customer-located energy storage. Customer-located energy storage can provide all of the benefits of utility-scale storage plus it provides direct customer savings and increased resiliency in the form of back-up power. The NJ BPU's Renewable Electric Storage program, with $6M for projects in 2016, was a start but was not sufficiently funded or designed to launch a robust energy storage market. The most established model for energy storage incentives to date is California's Self-Generation Incentive Program, which provides an incentive of ~$0.40 per watt-hour of installed energy storage capacity for systems located at residential, commercial, or industrial sites. Accordingly, California makes up over 90% of the customer energy storage deployments in the US. In New York State, NYSERDA is providing a $0.35/Wh energy storage incentive eligible to small and large commercial businesses, industrial customers, and community solar project developers.

5. What might be the optimum points of entry into the electric distribution system for distributed energy resources (DER);

[1] https://www.nyserda.ny.gov/All%20Programs/Programs/Energy%20Storage/Achieving%20NY%20Energy%20Goals/The%20New%20York%20State%20Energy%20Storage%20Roadmap

[2] https://www.greentechmedia.com/articles/read/breaking-sce-announces-winners-of-energy-storage-contracts#gs.1rlxpr

[3] https://www.greentechmedia.com/articles/read/aliso-canyon-emergency-batteries-officially-up-and-running-from-tesla-green

Please see below representative real-world examples of energy storage and distributed energy resources providing resilient electric service at different points in the electric system. Please find associated one-page descriptions of these projects in the Appendix:

South Australia Powerpack Battery System

Energy storage can be quickly deployed in order to provide services that can stabilize the bulk power system and prevent a bulk power system outage. In September 2016, a 50-year storm damaged critical infrastructure in the state of South Australia, causing a state-wide blackout that left 1.7 million residents without electricity. Further blackouts occurred in the heat of the Australian summer in early 2017. In response, the South Australian Government sought to deploy grid-scale energy storage to ensure energy security for its residents. Tesla was selected through a competitive bidding process, and on December 1, 2017, Tesla commissioned a 100 MW / 129 MWh Powerpack battery system at Neoen's Hornsdale Wind Farm near Jamestown, Australia. The battery system participates in Australia's National Energy Market, providing energy arbitrage; reserve energy capacity, as contracted by the South Australian government; frequency control ancillary services; and network loading control ancillary services, which detects high flows on a major interconnecting transmission line and triggers the 100 MW to start discharging as quickly as possible to prevent the South Australia power system from separating from the rest of the national energy market. The Australian Energy Market Operator ("AEMO") recently released a report[4] detailing the initial operation of the battery system, pointing out that data demonstrates that the regulation Frequency Control Ancillary Services provided by the system is "both rapid and precise, compared to the service typically provided by a conventional synchronous generation unit." The report highlights the battery system's rapid response to a frequency deviation caused by the trip of 689 MW of coal generation in New South Wales on December 18, 2017.

Southern California Edison (SCE) Storage Peaker Plant

In response to the Aliso Canyon natural gas storage facility leak and the associated potential for grid outages, Southern California Edison undertook an accelerated procurement for utility-scale storage solutions that could be operational by December 31, 2016. Through a competitive bidding process, Tesla was selected to provide a 20 MW / 80 MWh Powerpack system at Southern California Edison's Mira Loma substation. Tesla successfully installed the system in only three months, far quicker than traditional generation can be developed, even in emergency situations.

Southern California Edison owns and operates the Powerpack system, which offsets four hours of peak electricity demand thus reducing the need to rely on the region's now-fragile natural gas infrastructure during peak times. The Powerpack storage system also provides ancillary services, procured through competitive wholesale markets, to support reliability in the region. By taking advantage of the multiple value streams that energy storage systems provide, projects like the Southern California Edison's Mira Loma battery project can be cost-competitive with conventional generation.

Residential Customer-Sited Solar Plus Storage

Numerous Tesla Powerwall customers in Florida were able to maintain power at their homes throughout the grid outages that occurred during Hurricane Irma.[5] Customer-sited solar and

[4] See "AEMO – Initial Operation of the Hornsdale Power Reserve Battery Energy Storage System" http://energylive.aemo.com.au/Innovation-and-Tech/-/media/45ACDCBA73CE46A585ACBFFB132EF9B0.ashx

[5] *See* "During Irma's Power Outages, Some Houses Kept the Lights on with Solar and Batteries," Fast Company, September 13, 2017, https://www.fastcompany.com/40467003/during-irmas-power-outages-some-houses-kept-the-lights-on-with-solar-and-batteries.

storage, which Tesla is installing throughout in New Jersey and throughout the world at individual customers' homes, also offer customers resiliency in the form of back-up power when the grid is down. When there's a grid outage, Tesla's Powerwall battery systems paired with solar systems immediately react to safely maintain power at customers' homes so that they can operate important loads indefinitely, as the solar panels recharge the batteries daily.

Puerto Rico Microgrid and Customer-Sited Storage

Similar solar and storage microgrids can be installed at critical facilities, such as hospitals and community centers, to provide resilient electric infrastructure. Microgrids that rely on renewable energy sources and energy storage units support continued operations even when there is extreme damage to transmission, distribution, and central-station generation, as occurred recently in Puerto Rico due to Hurricane Maria. In response to the devastation to Puerto Rico's bulk electric power system due to Hurricane Maria, Tesla deployed over 600 battery systems at sites across the island to provide power. In Montones, Puerto Rico, Tesla's microgrid is providing power to a remote community, where the grid had not been restored for many months.

7. What might be the calculated cost to New Jersey's ratepayers of adding the optimal amount of energy storage;

If deployed correctly, adding the optimal amount of energy storage should provide a net benefit to New Jersey ratepayers. The cost of energy storage alone is not a relevant metric since there would also be a cost to the traditional generation, transmission, and distribution resources required if the energy storage was not deployed. Thus, Tesla recommends that the BPU focus on the net present value of storage resources, which is inclusive of both the costs and benefits of the systems.

A state-commissioned study found that Massachusetts could save $2.3 billion by installing 1,766 MW of storage over the next decade, and recommended 600 MW of near-term storage to save $800 million.[6]

Analysis performed by Acelerez to support *New York State's Energy Storage Roadmap* showed that deployment of the 2.8-3.6GW of energy storage by 2030 would result in ratepayer benefits exceeding $3 billion. [7] This analysis examined system needs that can be met by energy storage in a least-cost combination of resources to provide electric system services as the State reaches 50 percent renewable generation and 40 percent greenhouse gas reduction (compared to 1990 levels) by 2030.

In addition to the legislatively prescribed questions above, please also respond to the following questions:

11. What discharge time duration could be applied to the State goals of 600 MW of energy storage by 2021 and 2,000 MW of energy storage by 2030? Four hours? Ten hours? Other?

As a baseline, Tesla recommends that New Jersey apply a minimum four-hour duration to the State goal of 600 MW of energy storage by 2021. As discussed below, multiple studies have found storage with a four-hour duration to provide significant system benefits and receive a full 100% capacity value. The four-hour duration enables many potential use cases for energy

[6] Massachusetts Energy Storage Initiative, "State of Charge," September 2016, http://www.mass.gov/eea/docs/doer/state-of-charge-executive-summary.pdf.
[7] NYS Energy Storage Roadmap https://www.ethree.com/wp-content/uploads/2018/06/NYS-Energy-Storage-Roadmap-6.21.2018.pdf

storage including short-duration use cases such as frequency regulation that stabilizes the regional grid and longer-duration use cases such as peak shifting and capacity.

For its goal of 2,000 MW of energy storage by 2030, Tesla suggests that New Jersey evaluate its system needs to determine the most valuable mix of durations to its system based on learnings around successful models in New Jersey, projected peak demand, and projected renewable penetration levels. While a four-hour duration has proven to be optimal for many systems, it is likely that storage of varying durations would be appropriate, particularly as grid conditions change.

As mentioned above, recent rulings and studies have shown that electric storage resources with four-hour durations can provide significant capacity value in many systems. In 2014, the California Public Utilities Commission established that for energy storage, Qualifying Capacity values would be based on the resource's ability to generate power "for at least four consecutive hours at a maximum power output ($Pmax_{RA}$), and to do so over three consecutive days."[8] This determination continues to govern the participation of energy storage in California's Resource Adequacy construct.[9]

The National Renewable Energy Laboratory ("NREL") released a report in 2018 assessing California's four-hour requirement and determined that storage resources with a four-hour duration could receive 100% capacity credit. To arrive at this determination, NREL approximated the capacity credit of energy storage by evaluating its ability to reduce the peak net demand for electricity based on the day of peak demand in California. NREL determined that conservatively, up to 3,000 MW of energy storage in California could receive the 100% capacity credit. NREL determined the amount of four-hour energy storage resources that could receive 100% capacity credit, by analyzing the "shape" of the peak demand period and identifying the point at which the ability of an incremental unit of four-hour storage to reduce peak demand would drop to below 100%. NREL also noted that the amount of solar PV on the system affects that amount of storage that can provide 100% capacity, specifically that beyond 11% PV penetration, the potential of four-hour storage increases.[10]

In 2016, the management consulting company ICF International, Inc. ("ICF") evaluated the potential of energy storage to provide firm capacity in the Electric Reliability Council of Texas ("ERCOT") system. ICF found that energy storage systems with a duration of four hours or higher could capture a 100% capacity value on the ERCOT system. ICF performed its study by identifying the hour with the highest Loss of Load Expectation ("LOLE") and evaluating the improvement in LOLE from adding storage availability in that hour. ICF repeated the process for one-, two-, three-, four-, five-, and six-hour energy storage systems. ICF's study highlighted that energy storage with durations lower than four hours can also provide partial capacity benefits, finding that "100 MW energy storage system with 1-hour of stored energy can provide 46 MW of firm capacity, while a 100 MW storage resource with 4-hour of stored energy can provide 99 MW of firm capacity This study suggests that requiring extended runtimes beyond four hours for electric storage resources like energy storage is not required to provide firm capacity, and that the extended hours may provide little additional value.

13. How might Federal Energy Regulatory Commission's (FERC) Order 841 and the associated PJM compliance filing affect the foregoing?

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[8] Public Utilities Commission of the State of California, Decision Adopting Local Procurement and Flexible Capacity Obligations for 2015, and Further Refining the Resource Adequacy Program, *Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Refinements, and Establish Annual Local Procurement Obligations,* Decision 14-06-050 (2014), Appendix B, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M097/K619/97619935.PDF

[9] Public Utilities Commission of the State of California, *2018 Final RA Guide*, http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454920, *referring to CA PUC Decision 14-06-050.*

[10] Denholm, P. and Margolis, R. (March 2018), "The Potential for Energy Storage to Provide Peaking Capacity in California under Increased Penetration of Solar Photovoltaics," National Renewable Energy Laboratory.

FERC's Order 841 takes a step forward in removing many barriers to the participation of energy storage in wholesale markets. These changes will provide opportunities for the creation of new business models for energy storage and the potential for storage to provide additional benefits to the state.

However, PJM's compliance filing contains two significant barriers to the participation of energy storage in its capacity market, the Reliability Pricing Model (RPM), including: (1) a wholly unsupported ten-hour runtime requirement, and (2) potential financial penalties that extend beyond the physical capabilities of energy storage resources.

First, PJM has proposed a minimum runtime requirement of ten hours for electric storage resources.[13] This requirement is arbitrary and unduly discriminates against electric storage resources by not allowing them to provide all services of which they are technically capable. The proposed ten-hour runtime requirement represents a minimum requirement for electric storage resources that is more than double the requirements that are existing or proposed for other RTO/ISO regions or is shown by existing studies, discussed above, to be necessary to achieve full capacity value. California Independent System Operator Corporation ("CAISO") currently determines the Net Qualifying Capacity of Non-Generator Resources based on the resource's sustained output over a four-hour period,[14] in agreement with the California Public Utilities Commission's decision to base Qualifying Capacity values on an electric storage resource's ability to generate power for at least four consecutive hours at a maximum power output.[15]

PJM has not provided any rationale as to why system need in its territory would differ so greatly from other regions as to require such a significant increase in required minimum runtime for electric storage resources. More importantly, PJM has not conducted or submitted a study of systems needs that supports the requirement of a ten-hour minimum runtime for electric storage resources.

Tesla, as well has numerous other stakeholders have opposed this requirement in comments to FERC in the relevant proceeding, including Energy Storage Association, NextEra, Public Interest Organizations, Joint Consumer Advocates, EDF Renewables, Solar Energy Industry Association, Advanced Energy Economy, American Wind Energy Association, Solar Council, and Union of Concerned Scientists.

New Jersey should also insist that PJM develop a new proposal that allows four-hour energy storage to reasonably serve peak loads and reduce costs to consumers. Doing so would help maximize the ratepayer benefits provided by the energy storage developed to meet New Jersey's storage targets.

Second, storage resources cannot meaningfully participate in the RPM due to the significant penalties that Capacity Performance rules apply to a resource if it is not available during a Capacity Performance interval, even if the electric storage resource has provided its entire energy capacity through PJM dispatch. This structure unduly discriminates against electric storage resources and fails to account for their physical attributes.

Under Capacity Performance rules, the performance of a resource is assessed during all Capacity Performance intervals, which are unlimited and determined by PJM. For all Capacity

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[13] PJM (December 3, 2018), "Transmittal Letter," Docket No. ER-19-469-000, p20.

[14] California ISO, Fifth Replacement Electronic Tariff, Section 40.8.1.16(b), http://www.caiso.com/Documents/Section40-ResourceAdequacyDemonstration-SCs-CAISOBAA-asof-Nov30-2018.pdf

[15] Public Utilities Commission of the State of California, Decision Adopting Local Procurement and Flexible Capacity Obligations for 2015, and Further Refining the Resource Adequacy Program, *Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Refinements, and Establish Annual Local Procurement Obligations,* Decision 14-06-050 (2014), Appendix B, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M097/K619/97619935.PDF

Performance intervals during which a resource underperforms, PJM assesses a Non-Performance Charge. While Non-Performance Charges for capacity resources were developed to ensure that capacity resources performed when called, their final implementation has also led to an effective requirement that resources be able to respond to calls 24 hours a day, 365 days a year, for an unlimited number of consecutive hours. This requirement may promote performance for traditional generators that can continuously provide energy without having to recharge, but it unduly discriminates and effectively blocks participation of use-limited resources like electric storage resources, despite their proven ability to provide significant capacity value. For example, if a 100MW / 400MWh (-hour) energy storage resource is dispatched by PJM to provide 100MW of energy during a Capacity Performance event, it could comply with that dispatch for four hours. However, if the Capacity Performance event exceeds four hours, the energy storage resource will have no remaining charge and perform at zero during the subsequent Capacity Performance Intervals. It also does not make sense for the energy storage resource to place additional strain on the system by charging during Capacity Performance events, so it should not charge in preparation for later Capacity Performance intervals. Thus, for each Capacity Performance interval after the energy storage resource has been depleted -- including due to PJM dispatch -- it will receive a Non-Performance charge. The Non-Performance Charge Rate depends on the Net Cost of New Entry ("Net CONE") of the auction for that Delivery Year. At a Net CONE of $300/MW-day, the Non-Performance Charge Rate would be $3,650/MW-hour, with the maximum annual Non-Performance charge being $16,425,000— significantly more than the $6,049,145 that the resource would have earned in capacity revenue.[16]

So, because Capacity Performance rules potentially subject electric storage resources to penalties for not performing beyond the resource's physical capability, electric storage resources cannot effectively manage this financial risk, creating a barrier to participation for electric storage resources in PJM's capacity market. Tesla and SolarCity highlighted this issue in comments in 2017 comments to FERC regarding the now-approved rules for energy storage.[17]

Options for electric storage resources to pair with other resources or de-rate their capacity in order to mitigate the financial risks significantly dilute the economics of electric storage resources participation in the capacity market. This methodology also fails to accurately reflect the value that electric storage resources provide to the system.

Behind-the-meter energy storage systems also cannot effectively participate in PJM's capacity market through the Demand Response Capacity Performance rules because those rules do not currently allow behind-the-meter resources to inject energy onto the grid. This would significantly restrict the functionality of behind-the-meter energy storage resources.
These barriers to participation in PJM's RPM will reduce the ability of New Jersey's energy storage resources to earn revenue and provide value to the state's ratepayers. Tesla urges New Jersey to engage with PJM and FERC to ensure that these barriers are removed to ensure that the state can realize the full benefits of its energy storage resources.

III. Conclusion

Tesla appreciates this opportunity to provide feedback to the BPU on its Energy Storage Analysis and looks forward to further collaboration to ensure that New Jersey can reap the benefits of new energy storage technologies.

Please reach out if Tesla can be of assistance.

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[16] *See* PJM, Manual 18, Section 8.4A Non-Performance Assessment.
[17] Tesla and SolarCity, Comments of Tesla and SolarCity, *Electric Storage Participation in in Markets Operated by Regional Transmission Organizations and Independent System Operators,* Docket Nos. RM16-23-000 and AD16-20-000 (February 13, 2017).

Sincerely,

Ryan Barnett, Tesla Policy

Appendix

POWERPACK 2

ENHANCES SOUTHERN CALIFORNIA ELECTRIC GRID RELIABILITY

"Southern California faces a number of energy reliability challenges — for electricity and for residential heating —all related to the loss of gas storage at Aliso Canyon. Now we're doing what we can to expedite the next generation of energy solutions." **President Michael Picker, CA Public Utilities Commission**

OPPORTUNITY

In response to the Aliso Canyon gas storage leak, the California Public Utilities Commission mandated an accelerated procurement for utility-scale storage solution that could be operational by December 31st, 2016. Through a competitive bidding process, Tesla was selected to provide a 20 MW/80 MWh Powerpack system at the Southern California Edison (SCE) Mira Loma substation. Tesla successfully installed the system in 3 months.

SOLUTION

Powerpack 2 is Tesla's next generation storage solution, which includes an integrated Tesla inverter. The system has been designed and engineered by Tesla to maximize safety, efficiency and energy density and has been rigorously tested to ensure it will perform reliably and provide critical energy to Southern California residents. In addition, Tesla provides a performance guarantee or a Capacity Maintenance Agreement (CMA) that ensures SCE will be able to utilize a certain amount of system energy each year.

RESULTS

SCE owns and operates the Powerpack system, which acts as a peaker plant when needed by providing multiple grid services. The primary application is to provide capacity and fast ramping capability when the natural gas system is contained, which results in greater grid reliability and smoother integration of renewable resources. SCE will also be able to bid the Powerpack system into the CA energy markets, which include ancillary services such as frequency regulation and spinning reserves. SCE's SCADA system sends commands to the Powerpack Controller via the Modbus/DNP3 communication protocol. By stacking up multiple applications, a multi-hour Powerpack system becomes cost-competitive with a peaker plant.

Customer
Southern California Edison (SCE)

Location
Ontario, CA

System size
20MW / 80MWh

Applications
Grid Reliability Enhancement

Commissioned
2016
3 months from deployment to operation

"Battery storage is the future of our national energy market and the eyes of the world will be following our leadership in this space."
South Australian Premier Jay Weatherill

OPPORTUNITY

In September of 2016, a once in 50-year storm damaged critical infrastructure in the state of South Australia, causing a state-wide blackout and leaving 1.7 million residents without electricity. Further blackouts occurred in the heat of the Australian summer in early 2017. In response, the South Australian Government as a leader in renewable energy, looked for a sustainable solution to ensure energy security for all residents, now and into the future, calling for expressions of interest to deploy grid-scale energy storage options with at least 100 megawatts (MW) of capacity.

SOLUTION

Tesla was selected to provide a 100 MW / 129 MWh Powerpack system to be paired with global renewable energy provider Neoen's Hornsdale Wind Farm near Jamestown, South Australia. Powerpack will charge using renewable energy from the wind farm and then deliver electricity during peak hours to help maintain the reliable operation of South Australia's electrical infrastructure. The Powerpack system will further transform the state's movement towards renewable energy and see an advancement of a resilient and modern grid.

RESULTS

Upon completion, this system will be the largest lithium-ion battery storage project in the world and will provide enough power for more than 30,000 homes. This grid scale energy storage project is not only sustainable, but will help solve power shortages, reduce intermittencies, and manage summertime peak load to improve the reliability of South Australia's electrical infrastructure. Additional stored energy could be dispatched into the grid and traded on the electricity market to meet demand and prevent problems with voltage or frequency.

Customer
Neoen Hornsdale Wind Farm and South Australia Government

Location
North of Jamestown, South Australia

Powerpack System
100 MW | 129 MWh

Applications
Renewable integration
Frequency control
Grid support

Commissioned
December 2017