



Solar PV plus Energy Storage (Hybrid Systems)

In recent years, the integration of energy storage systems (ESS) into existing or new solar PV systems has become highly popular due to its attractive return on investment and large positive impact of combined system performance. Hybrid solar plus storage facilities can offer new applications for increasing the hosting capacity of the grid, improving clipped energy capture and enhancing the firming capacity services in the energy market. To become eligible for the Investment Tax Credit (ITC) associated with renewable energy resources, a BESS (Battery Energy Storage System) must be charged solely from a PV system. The charging requirement will be influenced by a selected topology and control scheme to ensure that the BESS will not use grid-sourced power for charging only use energy from a PV system for charging. In addition, the interconnection requirements may vary based on a connecting PV system and the BESS either in parallel to AC side or become a DC connection.

Topology Size and Applications

Combining solar and energy storage introduces additional complexity as well as opportunities for topology optimization in the design and engineering of these projects that may not be initially noticed if a proper design and sizing approach is not applied. There are multiple AC / DC topologies available for integrating ESS into a solar facility, where DC connection is the more attractive choice from an efficiency and control perspective.

Most existing design approaches utilize Rule of Thumb methods that are very rudimentary. At Quanta Technology, we have developed a sizing and topology selection methodology for hybrid systems including solar plus storage systems that incorporates annual solar radiation (or production) profiles in evaluating the applications with the use of an 8760 dispatch and application analysis model. Renewable firming applications or use of the facility for microgrid purposes are also key contributors in calculating the size of ESS. In addition, the approach provides a set of key performance indices (KPI) to track performance and ensures that the actual performance meets or exceeds design requirements.

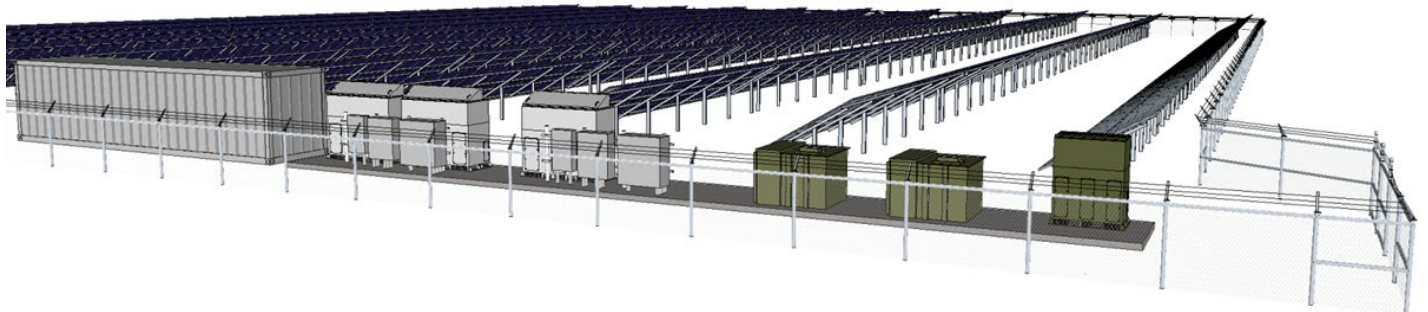
Why Quanta Technology

Quanta Technology experts have extensive knowledge of design, sizing and engineering of both solar PV systems and ESS. This is a major value proposition for our customers which ensures proper topology, sizing and technology is utilized to achieve the highest performance and internal rate of return on investment. Our hands-on experience and direct involvement in all steps of selecting the technology, designing and integrating into utility environment has been extremely valuable and helped our customers save time, budget, and maximum success in their projects.

Industry Best Practices and Standards:

Our experts are actively participating and leading development of industry standards and recommended practices for energy storage systems with IEEE, Cigre, IEC, and local jurisdictions (NERC/FERC/NFPA, etc.).

These activities give us extensive knowledge of industry best practices and lessons learned from a multitude of projects to offer the best advice and practical solutions to customers.





Solar Plus Storage design and implementation process:

Although many aspects of the design and engineering of a solar plus storage follows the common engineering practices, there are key considerations that will highly impact the operation and success of the projects. The Quanta Technology team has developed an evaluation methodology that uses an 8760 dispatch model to incorporate various design factors such as topology considerations, controls, and application specific requirements in the final selection of size and topology.

Several aspects of the DC integrated BESS technology is still evolving and requires further testing and evaluation of the technology readiness. Quanta Technology provides interoperability testing and verifications of control and communications systems for hybrid solar plus storage, as well as microgrid performance for behind the meter systems.

Design and Engineering

- Facility layout and topology design
- Interconnection requirements and studies
- Use case development
- Protection and control scheme development
- Transient and dynamic analysis of interactions with the utility grid
- Engineering design package review and assessment

Sizing and Topology

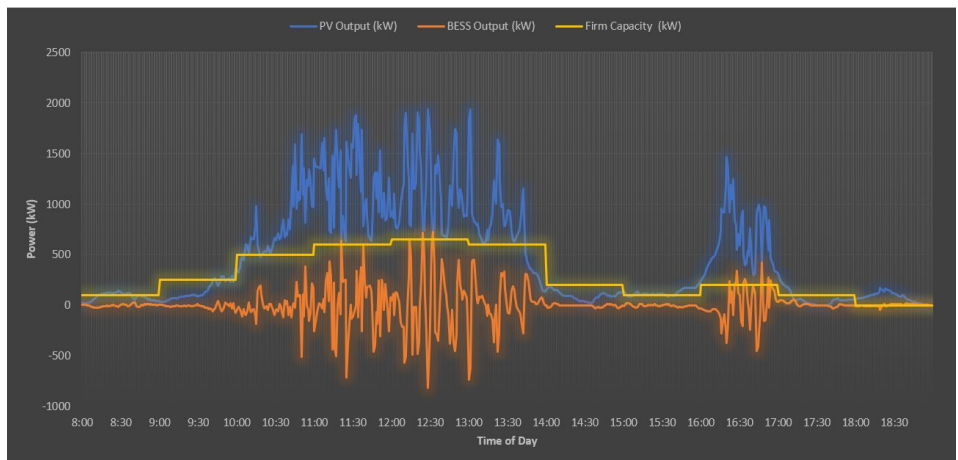
- DC to AC ratio optimization to achieve highest PV production
- Topology selection based on mature technologies for: AC/AC, or DC-DC, or DC/AC connected
- Sizing of DC and AC connected sections of ESS
- Hybrid control requirements for charging and various applications

Behind the Meter (BTM) for Microgrids

- Evaluation of the level of power export and renewable firming requirements for solar plus storage to serve loads
- Aggregate nameplate rating for various studies
- Interconnection studies

Hybrid System Commissioning and Testing

- Development of test plans and performance evaluation procedures
- Third party testing support during the factory acceptance testing and witness
- System inspection and commissioning test support
- Providing third party functional and application testing for site acceptance and performance verifications



About Quanta Technology

Quanta Technology is an independent technology, consulting, and testing company providing business and technical expertise, along with advanced methodologies and processes, to utilities and others in the power and energy industries. Our mission is to provide unparalleled value to our clients in every engagement across the value chain by using advanced software and hardware, laboratories, and custom tools for a holistic approach to practical service and the most insightful thought leadership in the industry.

For Additional Information Contact:

Northeast (USA) and Québec

Mike Longrie: MLongrie@Quanta-Technology.com

South/Southeast (USA) and Ontario

Diana Prkacin: DPrkacin@Quanta-Technology.com

Central (USA and Canada)

Evan Estes: EEstes@Quanta-Technology.com

West (USA and Canada)

Reza Nasri: RNasri@Quanta-Technology.com

International (outside USA and Canada)

David Elizondo: DElizondo@Quanta-Technology.com

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