2019 Fall Technical Workshop REVIEW

Tutorial: Future Directions for Market Design and System Planning

Co-chairs: Bethany Frew, NREL, and Mark Ahlstrom, President, ESIG Board of Directors

This tutorial covered a wide range of topics related to resource adequacy, including how market designs and various system planning approaches can help to ensure sufficient amounts of capacity and other capabilities that are needed for reliability. First, an overview of resource adequacy metrics, tools, and approaches was provided. This was followed by a high-level description of two structural philosophies for how resource adequacy could be pursued: (1) a decentralized approach that could rely heavily on contracts, and (2) a centralized approach that could rely on a more formal market process. Then, representatives from five systems/utilities in the United States and Australia provided examples of resource adequacy approaches, including energy-only markets, energy plus capacity markets, and areas with resource adequacy constructs or conventional IRP processes. These examples also included ways in which these entities are changing how they pursue resource adequacy to adapt to an evolving power system. Key themes from the speakers and discussion included the need for risk-based approaches to capture uncertainty, the importance of accounting for all hours of the year, the need to shift focus from resource potential to resource availability, and the importance of accounting for multiple timescales in resource adequacy and market design structures.

Opening Plenary: Considerations for the System of the Future

Chair: Bryan Hannegan, President & CEO, Holy Cross Energy

The opening plenary session presented a cross-section of considerations for planning and operating the future power system. Bruce Tsuchida of The Brattle Group gave an overview of past, current and future business models and how they've changed in response to decreasing costs of renewable energy. This was followed by a presentation on the impacts of high VRE futures on demand-side decisions by Joachim Seel of LBNL. Chris Clack of Vibrant Clean Energy followed with a discussion of the impact of increasingly competitive dispatchable VG on the changing generation mix. The evolving role of energy storage in power system planning and operations was discussed by Nick Miller, followed by a thought-provoking presentation on the application of lessons from edge computing to the distributed grid architecture, from Astrid Atkinson of Camus Energy. The final presentation was on the topic of high capacity energy storage from hydro power, by Patrick Balducci of PNNL.

Session 2A: PPA's and Corporate 100% Renewables Targets – What Comes Next

Chair: Derek Stenclik, Founding Partner, Telos Energy

This session covered the evolving trend of corporate renewable energy procurement. It started with an overview of the recent trends, highlighting how corporate procurement is driving renewable energy and enabling significant renewable procurement outside of traditional utility channels. The panel included first-hand experience of a leading RE100 corporate buyer - sharing lessons learned on their journey to 100%. It then covered evolving PPA structures, with increasing complexity but also additional optionality to de-risk projects and shorten contract windows, and share project benefits. It concluded by covering the next frontier of PPAs and 100% targets, including direct connect data centers and renewable projects and a surge in renewable procurement by cities, often inside of traditional utility footprints. This panel highlighted that the renewable industry is quickly moving beyond utility control and including a wide array of new actors.

Session 2B: Offshore Wind Development

Chair: Michael Derby, Program Manager, Wind Technology, U.S. Dept of Energy

This session covered a broad overview of the burgeoning offshore wind market. The need to plan for the integration of this rapidly growing generation source onto the grid was highlighted, with over 5GW of new generation expected to come online in the next few years, with the potential for up to 22GW off the east coast in the near future. Growth is being driven by favorable economic conditions driven by turbine scaling, supply chain development and state policy decisions. The European approach to integration consists of a high degree of coordination between long term planning and the interconnection process, updated frequently to mitigate potential issues with regional grid saturation. With longer distances from shore, HVDC connections are increasingly becoming an option, with steady advances in cost reduction.

Session 3A: System Planning for Energy Storage

Chair: Aaron Bloom, Director, New Product R&D, NextEra Analytics

With the advent of ever higher concentrations of variable generation and dramatic reductions in the prices of battery energy storage systems, batteries are assuming an ever increasing role in the planning and operation of power systems. Andrew Mills of LBNL covered the topic of resource adequacy and ramp control for hybrid PV battery power plants, while Andy Oliver of RES covered the topic of storage optimization for PV battery hybrids. Paul Denholm of NREL presented results of capacity value analysis for battery energy storage plants, and the session was concluded with a presentation from Taylor Kelly of Intertek on the relationships between battery duty cycle and life.

Session 3B: System Planning for High VRE Penetration
Chair: Russ Philbrick, Polaris Systems Optimization

The role of system planning is becoming increasingly complex for systems with high penetrations of VG due to the increasing variability and uncertainty presented by these resources. Amro Farid of Dartmouth University gave a presentation on a recent VG integration study for ISO-NE, while Jin Tan of NREL spoke on a new multiple timescale PV model for grid scheduling and dynamics. Tom Carr of the Western Interstate Energy Board described a flexibility assessment performed for the Western Interconnection, and the session concluded with Juliano Freitas of SPP speaking on their process for the integration of economic and reliability planning.

Session 4A: System Operations Considerations for High Penetration Scenarios
Chair: Aidan Tuohy, Principal Project Manager, EPRI

This session focused on issues related to system operations, covering both technologies to enable improved operations as well as operations during extreme weather events. Babak Badrzadeh from the Australian Energy Market Operator kicked off the session with an overview of challenges in operating with low system strength, with a particular focus on the use of synchronous condensers as a mitigating option currently being explored in Australia. Julia Matevosjana from ERCOT followed up with further discussion on system strength metrics for operations and how they are using synchronous condensers. Josh Novacheck from NREL then spoke about some ongoing work looking at simulating system operations during extreme weather events at high renewable penetrations, showing some of the latest results from very large scale simulations. Frank Kreikebaum from Smart Wires wrapped up the session talking about the use of power flow control to support renewable integration, sharing some of their latest experiences. The panel discussion focused on common themes around how new technologies can support system operations needs, and how reliability will drive many of the operational decisions in the future. Specific challenges around low short circuit ratio were discussed, as well as the need to monitor system conditions to ensure security, and how new metrics and techniques might be needed there.

Session 4B: Market Design Evolution for High Share of Renewables
Chair: Rob Gramlich, Founder and President, Grid Strategies

This session covered market design considerations for high renewable penetration. One presentation described a proposed cross-sector system model for the Australian grid, while another explained market design issues for hybrid resources. A third presentation covered renewable energy dispatch and scheduling issues in the Chinese grid.

Closing Plenary: Creating the Future - A Panel Discussion

Panel Moderator: Mark Ahlstrom, President, ESIG Board of Directors

To have lasting value, the efforts of engineers and researchers must fit into the future needs of society. In this panel, we heard from leaders on their vision of the future and their priorities for the engineering and research community. These leaders ranged broadly—from the chair of the CAISO board and director of NREL, to leaders at the Danish system operator and an innovative power co-operative, and beyond. Themes of the session supported ESIG's efforts around technical approaches for economic and reliable clean electricity solutions and sector coupling with other energy vectors, thereby supporting sustainable global carbon reductions, but acknowledging the regulatory, political and economic realities in the process of doing so.