ANCILLARY SERVICES (A/S)  
FUNDAMENTALS & MARKET DESIGN

March 18 – 19, 2019
Charleston Marriott
Charleston, SC

“Always a great event with highly qualified speakers and very relevant topics and updates.”

Senior Tech Leader, EPRI
OVERVIEW

The emergence of renewable and variable energy resources has drawn attention to the supplemental services — beyond the basics of energy, generating capacity, and power delivery — that utilities, balancing areas and bulk-power systems require to ensure grid stability. Some of these ancillary services (A/S), such as regulation and reactive power, are required during normal operations to maintain the necessary balance between generation and load in real-time and voltages within the required ranges. Other ancillary services, such as contingency reserves, provide insurance to prevent minor problems from becoming full-scale catastrophes, or to restore the bulk-power system to normal operations after a major outage occurs.

This course will explain the functions performed by each ancillary service with a focus on the real-power services. It will also provide a comparison of A/S products across the various North American independent system operators (ISOs). Attendees will leave this program with a clear understanding of what functions these services provide, why they are important and their cost components. It will also prepare attendees to understand how these functions relate to available market participant bidding opportunities, with special emphasis on these three elements of market design:

- Co-optimization in the scheduling and dispatch of energy and ancillary services
- The theory and practice of reserve and regulation shortage pricing
- Market design approaches to scheduling and pricing ramp capability

LEARNING OUTCOMES

- Identify the different types of ancillary services (A/S) and their functions
- Assess the reliability performance requirements of specific A/S
- Examine and compare A/S services, nomenclature and functions across ISOs
- Analyze distinctions between normal and contingency conditions, and how they relate to other A/S
- Evaluate the different sources of A/S
- Discuss how the role and importance of A/S is likely to evolve as storage, renewable energy and other variable energy resources attain higher penetration
- Assess the reasons co-optimization of energy and ancillary services is becoming a standard feature of wholesale power markets and how co-optimization functions
- Examine the relationship between ramp constraints, regulation shortage prices, price variability, and the returns to being on dispatch
- Analyze and understand how the development of demand ancillary services is related to the level of price caps and the introduction of meaningful shortage pricing

WHO SHOULD ATTEND

- Integrated resource planning
- Resource adequacy planning
- Strategic and long-range planning
- Forecasting and analysis
- Energy efficiency planning
- Demand response planning
- Generation and load planning
- Transmission planning
- Reliability planning
- Intra-hour operations analysis and modeling
- Renewable energy planning
- Environmental and GHG planning
- State regulatory and commission staff
- Carbon/emissions management teams
- Carbon/emissions market consultants and advisors
- Environmental compliance groups
- Regulatory affairs
- Asset management
- Financial analysis
## AGENDA

**MONDAY, MARCH 18, 2019**

### Day 1: Fundamentals of Ancillary Services (A/S) Operations

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>7:45 – 8:15 am</td>
<td>Registration and Continental Breakfast</td>
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<tr>
<td>8:15 – 8:30 am</td>
<td>Overview and Introductions</td>
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<tr>
<td>8:30 am – 4:45 pm</td>
<td>Program Timing (includes 15 min mid-morning and mid-afternoon breaks)</td>
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<tr>
<td>12:00 – 1:00 pm</td>
<td>Group Luncheon</td>
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- Background / Who Is in Control?
- What Are Ancillary Services (AS)?
- Reliability Performance Requirements
- Comparison of AS Services and Functions Across All ISOs
- Normal Conditions
  - Frequency regulation
  - Load following
  - Energy imbalance
- Contingency Conditions
  - Frequency response
  - Supplemental reserves
- Other Ancillary Services
  - Voltage control and reactive supply
  - Black start
  - Scheduling, system control and dispatch
- Sources of Ancillary Services
  - Generation
  - Energy storage
  - Demand response
- Trends in Ancillary Services
  - Impact of FERC orders
  - Impact of state initiatives (New York, California)
  - Texas and ERCOT-specific AS conditions, initiative and outcome
  - Impact of variable energy resources (wind and solar)
  - Aggregated supply from distributed energy resources (DERs)
  - Shifts in resource ownership and offerings
- Multiple Services Possibilities and Practicalities
- Assess the reasons co-optimization of energy and ancillary services is becoming a standard feature of wholesale power markets and how co-optimization functions
- Examine the relationship between ramp constraints, regulation shortage prices, price variability, and the returns to being on dispatch
- Analyze and understand how the development of demand ancillary services is related to the level of price caps and the introduction of meaningful shortage pricing
- Identify how the need for system flexibility is resulting in the inclusion of fast and flexible ramping products and services in the markets
Day 2: A/S Market Design and Flexible Ramping Products

7:45 – 8:15 am  Continental Breakfast

8:15 am –12:30 pm  Program Timing (includes 15 min mid-morning break)

- Overview of Ancillary Services Pricing
- Co-optimization of Energy and Ancillary Services
  - Why is co-optimization needed for economic efficiency?
  - How does co-optimization work?
- Reserve and Regulation Shortage Pricing
  - Overview of alternative scarcity pricing mechanisms
  - The advantages of reserve shortage pricing
  - How does reserve shortage pricing work
  - Determining energy prices in markets with reserves shortage pricing and co-optimized energy and ancillary service markets
  - ERCOT’s operating reserve demand curve
  - Ramp constraints, price spikes and regulation shortage values
  - The role of scarcity pricing in markets with capacity requirements
- Ramping Products
  - Evolving need for ramping products
  - CAISO flexible ramping product
  - MISO ramp capability model

“Great group of presenters, timely topics and an incredible venue.”

Utility Specialist, City & County of San Francisco

“Thorough survey of practices and issues across the organized markets.”

Director – Regulatory Affairs, NRG Energy
NSTRUCTORS

Michael Coddington
Principal Engineer, National Renewable Energy Laboratory (NREL)

Engineer with the Integrated Devices and Systems Group at the National Renewable Energy Laboratory (NREL) - a Department of Energy owned laboratory in Colorado. Before coming to NREL nearly 10 years ago, he worked as a Distribution Planning and network Engineer, System Planning Engineer, Key Account Executive, and numerous other roles at two electric utility companies. His work at NREL focuses on the integration of photovoltaic systems (and other distributed generation systems) to the electric distribution system, with a focus on high penetration PV concerns and solutions. Mr. Coddington has authored and collaborated on dozens of technical reports and papers focusing on integrating distributed generation systems onto the grid in a safe, reliable and cost-effective manner. He is active in standards and codes development, is a Senior Member of the IEEE, was Secretary of IEEE 1547.6, and is a voting member of the UL1741 Standards Technical Panel (STP). He received his electrical engineering degree from Colorado State University, is a licensed Master Electrician and licensed Electrical Contractor in the State of Colorado, and is a licensed commercial electrical inspector.

Joseph Cavicchi
Executive Vice President, Compass Lexecon

Joseph Cavicchi is Executive Vice President with Compass Lexecon (Boston), an FTI Company. He provides wholesale and retail electricity market regulatory economic analyses in connection with the restructuring of the US electricity industry. In particular, he advises clients in a variety of Federal Energy Regulatory Commission (FERC) and state regulatory proceedings, and files testimony and affidavits supported by economic analyses. His work focuses extensively on analyzing the competitiveness of the U.S. wholesale electricity markets and developing an in-depth understanding of the operations of the wholesale markets. Mr. Cavicchi’s work also involves conducting wholesale market power screens, analyzing the competitive impact of mergers and acquisitions, and overseeing the development of complex analytical modeling to assess electricity system operations.
INSTRUCTIONAL METHODS

PowerPoint presentations and case studies will be used in program.

REQUIREMENTS FOR SUCCESSFUL COMPLETION

Participants must sign in/out each day and be in attendance for the entirety of the course to be eligible for continuing education credit.

IACET CREDITS

EUCI has been accredited as an Authorized Provider by the International Association for Continuing Education and Training (IACET). In obtaining this accreditation, EUCI has demonstrated that it complies with the ANSI/IACET Standard which is recognized internationally as a standard of good practice. As a result of their Authorized Provider status, EUCI is authorized to offer IACET CEUs for its programs that qualify under the ANSI/IACET Standard.

EUCI is authorized by IACET to offer 1.0 CEUs for the course.

REGISTER 3, SEND THE 4TH FREE

Any organization wishing to send multiple attendees to this event may send 1 FREE for every 3 delegates registered. Please note that all registrations must be made at the same time to qualify.

EVENT LOCATION

A room block has been reserved at the Charleston Marriott, 170 Lockwood Dr., Charleston, SC 29403, for the nights of March 17 – 20, 2019. Room rates are US $229 plus applicable tax. Call 1-843-723-3000 or click here for reservations and mention the EUCI event to get the group rate. The cutoff date to receive the group rate is February 18, 2019 but as there are a limited number of rooms available at this rate, the room block may close sooner. Please make your reservations.
Substitutions & Cancellations

Your registration may be transferred to a member of your organization up to 24 hours in advance of the event. Cancellations must be received on or before February 22, 2019 in order to be refunded and will be subject to a US $195.00 processing fee per registrant. No refunds will be made after this date. Cancellations received after this date will create a credit of the tuition (less processing fee) good toward any other EUCI event. This credit will be good for six months from the cancellation date. In the event of non-attendance, all registration fees will be forfeited. In case of course cancellation, EUCI’s liability is limited to refund of the event registration fee only. For more information regarding administrative policies, such as complaints and refunds, please contact our offices at 303-770-8800.

EUCI reserves the right to alter this program without prior notice.