

INTRODUCTION TO WHOLESALE ELECTRICITY MARKETS: RTOs AND ISOs

September 2-3, 2020
Online | Central Time

EUCI ONLINE COURSE

EUCI is pleased to offer this virtual course on its online interactive platform. Enjoy a valuable learning experience with a smaller impact on your time and budget. You will gain new knowledge, skills, and hands-on experience in from the comfort of your remote location.



“The most comprehensive discussion on markets!”

Principal Electrical Engineer,
Salt River Project



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



EUCI is authorized by CPE to offer 10 credits for the course

OVERVIEW

This course is designed to introduce basics of wholesale electricity markets operating in the U.S., Canada, and Mexico. The purpose is to enhance attendees' understanding of types of wholesale electricity markets and the platforms that offer such markets. The focus will be on the functions of RTOs / ISOs and their role in providing platforms for real-time and day-ahead energy markets, ancillary service markets, and in some cases capacity markets. Participants will also gain a high-level understanding of current issues affecting electricity markets and will receive detailed explanation of how the electricity markets operate.

Major topics covered in this course include:

1. Basics of Electric Power Systems
 - Fundamentals of electricity, definitions, and measuring units
 - Generation, transmission, distribution, and loads
 - Types of generation resources including intermittent resources, costs, and capabilities
 - Load duration curves, system load factors, load growth, and customer classes
 - Ancillary services
 - Power system losses
 - Power system load flow simulation
2. Regulatory Oversight – Role of FERC and State Regulatory Agencies
3. Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs)
 - RTOs/ISOs in U.S. and Canada
 - Regulatory structure of RTOs/ISOs
 - RTO functions and characteristics
 - Advantages and disadvantages of RTO participation
 - Role of FERC, state regulatory agencies, and market monitor
4. Regional Wholesale Electricity Markets Fundamentals – Part 1
 - Wholesale electricity prices trend and volatility
 - Locational marginal price (LMP) and its components
 - Review of supply and demand relationship; spot vs. bilateral electricity markets
 - Economic merit order selection and unit commitment including responsibilities and obligations
 - Security constrained economic dispatch and scheduling
 - Two settlement system: Day ahead and real-time settlement
 - Cost of transmission congestion
 - Financial transmission rights (FTRs) for hedging against transmission congestion
 - Wholesale demand response
 - Capacity market
 - Ancillary services market
 - Virtual trading
 - Comparison of energy, capacity, and ancillary service markets offered by RTOs/ISOs in the U.S.
 - LMP simulation
5. Regional Wholesale Electricity Markets Fundamentals – Part 2
 - Forward pricing curve
 - Generator bidding strategies and constraints
 - o Variable cost and its components, marginal cost, and incremental cost
 - o Cost-based vs. market-based rate
 - Scarcity pricing and load pockets
 - Energy price forecasting overview
 - Brief overview of risk management
 - RTO/ISO financial settlement



“This class was a great interactive and in-depth opportunity to learn industry knowledge from actual industry leaders.”

Registration Specialist II, MISO

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LEARNING OUTCOMES

Participants with little or no prior electric utility industry background or experience will be able to benefit from this course. At the adjournment of the course participants will be able to:

- Describe major components of a power system and types of wholesale electricity markets
- Describe platforms for real-time and forward wholesale electricity markets
- Explain locational marginal price (LMP) and its components
- Describe, at high level, types of risks inherent in the wholesale energy markets and financial tools to manage such risks
- Describe the role of generators, transmission, and load in a power system
- Define and provide examples of ancillary services
- State the role of FERC and state regulatory agencies
- Describe ISO/RTO functions
- Describe role of transmission in the regional wholesale electricity markets
- Explain bilateral and real-time energy markets
- Discuss RTO/ISO financial settlement and credit issues

WHO SHOULD ATTEND

- Employees new to the industry or with limited industry experience
- Energy attorneys and regulatory personnel new to the industry
- Energy traders and power marketers new to their job
- Customer service representatives
- Support staff of electric utilities and RTOs/ISOs - accounting, IT personnel, and support personnel
- Power generator and transmission project owners/developers
- Energy finance professionals

“This course helped me understand the relationships between generation, transmission, distribution, and load with respect to the different types of energy markets.”

Client Representative, MISO

“Topics multiple colleagues have struggled to explain to me finally make sense.”

Senior Regulatory Analyst,
Oklahoma Corporate Commission

“I am more confident answering operational questions now that I have a better understanding of how things work.”

Client Relations Sr. Analyst, MISO

“Definitely helped put all the terms and information I heard and knew about and put it together in a more structured and organized way.”

Manager of Organized Markets,
Policy and Support,
Arizona Public Service

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AGENDA

WEDNESDAY, SEPTEMBER 2, 2020 - CENTRAL TIME

8:45 – 9:00 am	Log In
9:00 am – 4:30 pm	Course Timing
12:30 – 1:15 pm	Lunch Break

Power System Basics, Types of Generation Resources and Loads, and Regulatory Oversight

- Fundamentals of electricity, definitions, and units
- Overview of source to socket components - generation, transmission, distribution, and loads
- Power flow demonstration
- Types of generation resources, heat rate, capacity factor, and installation costs
- Load characteristics, load duration curves, load factor, and customer classes
- Demand response
- Power system losses
- Regulatory oversight – role of FERC, state regulatory agencies, and market monitor
- Review questions

Types of Energy Markets and Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs)

- Wholesale electricity prices and volatility
- Review of supply and demand relationship
- Types of electricity markets – real-time (spot) versus bilateral markets
- RTOs/ISOs in U.S. and Canada
- RTO functions and characteristics
- RTO drivers
- Advantages and disadvantages of RTO /ISO participation
- Regulatory framework and role of FERC and state regulatory agencies
- RTO stakeholders
- Review questions

Locational Marginal Price (LMP)

- LMP concept
- Components of LMP and examples
- Nodal, Hub, and Zonal LMP
- LMP demonstration, review questions, and class exercise

RTO/ISO Wholesale Electricity Markets

- Economic merit order and unit commitment
- Security constrained economic dispatch
- Cost of transmission congestion and losses
- Financial transmission rights (FTRs) for transmission congestion hedging
- Day ahead and real-time market, scheduling and dispatch
- Capacity market
- Ancillary services – whose responsibilities?
- Ancillary services market
- Comparison of markets offered by RTOs/ISOs in the U.S.
- Review questions

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AGENDA

THURSDAY, SEPTEMBER 3, 2020 - CENTRAL TIME

8:45 – 9:00 am **Log In**

9:00 am – 12:00 pm **Course Timing**

Review of Previous Day; Opportunities for Questions and Discussion on Previous Day's Material

Regional Wholesale Electricity Market Basics - Continued

- Overview of generator/load offer/bidding considerations, bid and offer curves, three-part bid
- Generator capacity dispatch range, variable cost components, start-up cost, no load cost, ramp rate concepts
- Overview of RTO/ISO financial settlement
- Review questions

Risk Management and Credit Requirements

- Potential risks
- Overview of risk hedging tools for real-time and bilateral markets: FTRs, virtual trading, options, futures, and SWAPs
- Credit requirements
- Review questions



“Raj was great with explaining the industry at every level. I was happy with the knowledge I was able to gain from the course.”

Office Manager,
Key Capture Energy



“A great opportunity for starters in the Whole Electricity Markets; an opportunity for intermediates to reinforce knowledge.”

Energy Settlement Analyst,
Ente Operator Regional

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INSTRUCTOR



Raj Rana, PE, MBA, CEM, PMP
President, Rana Energy Consulting

While serving as the director of RTO Policy and NERC Compliance at American Electrical Power, Raj was responsible for coordination of energy, transmission, market structure, finance, and governance-related RTO policy issues among the AEP business units, development of corporate positions/policies, and advocacy of such positions at regulatory agencies and stakeholder forums in PJM, SPP, and ERCOT RTOs. He was also responsible for the development and coordination of strategic direction of AEP's power system reliability compliance program among all business units, as well as coordination and facilitation of compliance plans, policies, and procedures within the company to ensure timely and successful compliance of NERC and regional reliability standards.

Previously, Mr. Rana worked in AEP's System Planning department in various positions. His experience at AEP includes planning and operation of the bulk transmission network, generation interconnections, tariff and regulatory/legislative issues, system integration, asset management, mergers and acquisitions, as well as planning and engineering studies for international transmission and generation projects.

Mr. Rana holds a BSEE degree from M. S. University (India), an MSEE degree from West Virginia University, and an MBA degree from University of Dayton. Mr. Rana also completed the AEP Management Development Program at the Fisher Business College of the Ohio State University. He is a life-senior member of IEEE and holds the Ohio State PE license. Mr. Rana is also a certified energy manager and project management professional.



"Raj is an excellent instructor. I'm thankful he converted his presentation into an online format that was easy to understand, included effective visuals and analogies, and was paced appropriately for an online course."

Program Examiner, Office of Management and Budget



"Raj did a great job. He didn't go too far off course and was able to answer questions easily."

Analyst, MISO



"Raj was an excellent. He simplified and explained the concepts in terms, and with examples, that were easy to follow and understand. Overall, Raj is one of the best instructors I've had on utility topics."

Rates and Regulatory Strategy Director, Duke Energy Florida



"Raj was excellent. Very good content, good explanations in response to questions."

Attorney Advisor, Dept. of Energy

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ONLINE COURSE DELIVERY & PARTICIPATION DETAILS

We will be using Microsoft Teams to facilitate your participation in the upcoming event. You do not need to have an existing Teams account in order to participate in the broadcast – the course will play in your browser and you will have the option of using a microphone to speak with the room and ask questions, or type any questions in via the chat window and our online administrator will relay your question to the instructor.

- You will receive a meeting invitation which will include a link to join the meeting.
- Separate meeting invitations will be sent for the morning and afternoon sessions of the course.
 - o You will need to join the appropriate meeting at the appropriate time.
- If you are using a microphone, please ensure that it is muted until such time as you need to ask a question.
- The remote meeting connection will be open approximately 30 minutes before the start of the course. We encourage you to connect as early as possible in case you experience any unforeseen problems.

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.

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Upon successful completion of this event, program participants interested in receiving CPE credits will receive a certificate of completion. **EUCI is authorized by CPE to offer 10 credits for this course.** There is no prerequisite for this course.

Program Level 1: Intermediate, **Delivery Method:** Group-Live, **Advanced Preparation:** None

REQUIREMENTS FOR SUCCESSFUL COMPLETION

Participants must login for the entirety of the course to be eligible for continuing education credit.

INSTRUCTIONAL METHODS

This course will use slide presentation, group discussions, as well as active participation. Attendees will have ample opportunities to actively participate in review questions/answers sessions, and simulations/demonstrations offered as part of this course.

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INTRODUCTION TO REGIONAL WHOLESALE ELECTRICITY MARKETS—RTOS AND ISOS ONLINE COURSE:

SEPTEMBER 2-3, 2020: US \$1,195 (Single Connection)

PACK OF 5 CONNECTIONS: US \$5,375

PACK OF 10 CONNECTIONS: US \$8,965

For volume discounts call +1.303.770.8800 for quote

**all other discounts do not apply to license packs*

Online Course Delivery & Participation Details

See page 7 for information

How did you hear about this event? (direct e-mail, colleague, speaker(s), etc.)

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CREDIT CARD INFORMATION

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OR Enclosed is a check for \$ _____ to cover _____ registrations.

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 July 31, 2020 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.