EUCI COURSE

RENEWABLE ENERGY 101

May 18-19, 2017
EUCI Offices
4601 DTC Blvd.
Denver, CO

AUTHORIZED IACET PROVIDER

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

OVERVIEW

Renewable energy is growing at an astounding pace, and now accounts for more than half of all new electric generating capacity additions. Costs for renewables – notably solar photovoltaics (PV) – have dropped to the point where they can undercut coal and natural gas-fired generation. And further cost reductions are expected for wind and solar PV, meaning that these technologies will continue to see very rapid growth.

Renewables' growth is challenging many of the assumptions upon which traditional utility planning and operation relies. Renewables are creating countless new business opportunities, and disrupting many of the existing companies and institutions that make up the electricity grid.

This course will tell you what you need to know about renewables. We'll provide insight into the technologies themselves, focusing on real-world cost and performance. We'll untangle the complex issue of grid integration, detailing the technical and economic challenges that variable renewables impose on electricity grid operation. We'll look at case studies of businesses that have successfully ridden the renewables wave (and some that haven't), identifying lessons learned that determine success or failure in this vibrant new market. And we'll provide a pragmatic guide to the various state and federal policies that both help and hinder renewables.

LEARNING OUTCOMES

- Discuss the electric industry, its concepts, and the growing role of renewable generation in it
- Review statistics on renewable market growth and projected future
- Evaluate renewable energy technologies cost, performance, and technical characteristics
  - Wind
  - Solar: Photovoltaic (PV) – utility scale and distributed and Concentrating Solar
  - Hydro power
  - Geothermal Power
  - Burning wood and other biomass
  - Landfill gas
- Examine impacts of wind and solar generation on the electric grid
- Review processes and best practices for integrating renewable electricity on the grid
- Analyze the every-changing policy environment and its impacts to renewable business
- Assess key elements of renewable project finance and cost analysis
- Evaluate renewable energy market dynamics and tips for making a profitable business
- Identify opportunities, risks, and how to move forward for renewable business success

COURSE TIMING - DAY 1

THURSDAY, MAY 18, 2017

7:30 – 8:00 am	**Registration and Continental Breakfast**
8:00 am – 5:00 pm	**Course Timing**
12:00 – 1:00 pm	**Group Luncheon**

AGENDA

I. The Big Picture: Renewable Energy Technologies & Their Growing Role on the Electric Grid

- How the electricity utility industry began: early years and how it led to the current structure
- Dynamics of the traditional US electric power grid: generation, transmission and distribution
- Types of electric companies: IOUs, cooperatives, public power and government utilities
- The electric utility vertically integrated business model
- Drivers for change and the rise of renewables
  - o Generation and consumption statistics, cost of electricity
  - o How has the mix of electricity generation been changing over time?
- Big picture trends on renewable electricity
- Statistics on renewable market growth and projected future

II. Renewable Energy Technologies: Cost and Performance, Grid Impacts and Integration

Renewable Electricity Technologies

- Technical characteristics, costs, and market projections
- Understanding their potentials, limitations, and promising applications
  - o Wind
  - o Solar
    - Photovoltaic (PV) – utility scale and distributed
    - Concentrating Solar
  - o Hydro power
  - o Geothermal Power
  - o Burning wood and other biomass
  - o Landfill gas

Integrating Variable Renewable Electricity into the Power System

- Solar PV and wind variability
- How much variable renewable energy can power systems handle?
  - o Technological and economic limits
  - o Case studies of integrating high levels of variable renewable generation: Germany, Denmark, US
- Power system planning requirements for achieving successful integration of renewables
  - o Balancing and flexibility
  - o Reserves
  - o Transmission infrastructure and planning needs
  - o Grid services from wind/solar or other equipment

AGENDA

THURSDAY, MAY 18, 2017

Integrating Variable *(continued)*

- Options to increase flexibility to address grid integration challenges
  - o System operation
  - o Load Management/DSM
  - o Electricity pricing
  - o Flexible generation
  - o Storage
- Best planning practices to accommodate renewable integration for maintaining reliability and cost-effectiveness

III. The Ever-Changing Policy Environment

- Understanding the policy landscape to leverage renewable business
- How policy helps (and hinders) new renewables
- Federal policy drivers
  - o Tax Credits – ITC and PTC
  - o Air quality and CO2 rules and regulations
  - o Expected changes under the new Administration
- State and local policy drivers
  - o Renewable portfolio standards (RPSs)
  - o Utility programs and policies
  - o Local tax and other incentives
- Policy change and uncertainties: How to hedge those risks

COURSE TIMING - DAY 2

FRIDAY, MAY 19, 2017

7:30 – 8:00 am **Continental Breakfast**

8:00 am – 12:00 pm **Course Timing**

AGENDA

IV. Renewable Energy – Business Opportunities and Impacts

Understanding the Market Demand for Renewables

- Renewables-related products and services – where, what, and how much
- Short-term forecasts for market growth and change
- Risks and uncertainties – market, policy, technology

Key Elements for Renewable Projects

- Levelized cost of electricity (LCOE) and other metrics for cost analysis
- Technology selection considerations – quality, equipment warranties, and performance guarantees
- Balance of system costs
- "Soft" costs
- Acquisition and siting elements
- O&M costs
- Project financing costs

AGENDA

FRIDAY, MAY 19, 2017

Renewable Project Finance and Renewable Energy Markets
- How deals are structured and financed
- Power purchase agreements (PPAs) and contracts
- Buyers and sellers — utilities, REC markets, and others
- Understanding Renewable Energy Credits (RECs), both voluntary and RPS-driven

Putting It All Together: Tips for Renewable Business Success
- How to make a profitable business in regulated utility environment
- Emerging (and fading) market niches
- Opportunities and risks: How to move forward

COURSE INSTRUCTOR

Paul Komor

Lecturer at University of Colorado at Boulder

Paul Komor is the founder of the Energy Education programs at the Renewable and Sustainable Energy Institute (RASEI) and a lecturer in the Environmental Studies Program at the University of Colorado-Boulder. As RASEI's first Education Director, Dr. Komor worked to establish CU-Boulder as a leader in energy education. He currently teaches graduate courses in energy technology and policy at CU-Boulder, and is an Advisor to the UNFCCC, IRENA, and UTP (Malaysia). Prior to joining the University of Colorado faculty, Paul was a Project Director at the U.S. Congress' Office of Technology Assessment (OTA), where he worked with House and Senate Congressional Committees in preparing and evaluating energy legislation. Prior to joining OTA, he taught at Princeton University. He has published numerous refereed articles, reports, and other papers on renewable energy. His book, Renewable Energy Policy, was required or recommended reading for courses at University of California, Santa Barbara (UCSB), University of Denver (DU), University of Utah, Robert Gordon University (UK), and elsewhere. In 2005, Paul was selected as the 2006 MAP/Ming Visiting Professor of Energy and the Environment by Stanford University, where he spent a sabbatical year researching and teaching on renewable energy policy and technology. In 2007, Paul shared in the Nobel Peace Prize awarded to Al Gore and the Intergovernmental Panel on Climate Change (IPCC) "for their efforts to build up and disseminate greater knowledge about man-made climate change". For his work with the IPCC, Paul was named a contributor to the Nobel Peace Prize. Paul holds a BS in Engineering from Cornell University, and MS and PhD degrees in Engineering from Stanford University.

REQUIREMENTS FOR SUCCESSFUL COMPLETION OF PROGRAM

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

INSTRUCTIONAL METHODS

Case studies and PowerPoint presentations will be used in this program

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.

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EVENT LOCATION

EUCI Offices
4601 DTC Blvd.
Denver, CO 80237

NEARBY HOTELS

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7800 E. Tufts Ave
Denver, CO 80237
Phone: 303-779-1234
0.3 miles away

Hilton Garden Inn Denver Tech Center
7675 E. Union Ave
Denver, CO 80237
Phone: 303-770-4200
0.6 miles away

Denver Marriott Tech Center
4900 S. Syracuse St
Denver, CO 80237
Phone: 303-779-1100
0.7 miles away

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PLEASE REGISTER

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May 18-19, 2017 | Denver, CO: US $1395,
Early bird on or before April 28, 2017: US $1195

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

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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 April 14, 2017 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, contact our offices at (201) 871-0474.