METEOROLOGY FOR RENEWABLE ENERGY SYSTEMS

September 25-26, 2019
EUCI Office Building Conference Center
Denver, CO

“I really learned a lot about Meteorology fundamentals and how it affects renewable energy projects. I intend to implement most of what I learned in my day to day work with renewables. Also, I have a lot of reference materials for future use.”

Senior Electrical Engineer, AWS
OVERVIEW

Renewable energy is growing at an astounding pace at the global level, with rapidly declining prices now making it the most cost-effective option for new generation on many energy grids today. This increasing growth of renewable energy is impacting the electric grid in multiple ways, challenging many of the assumptions upon which traditional utility planning and operation relies. As this trend continues, it becomes increasingly important to evaluate best practices of renewable integration and to identify techniques and resources that simultaneously improve the power quality of the grid in systems with escalating levels of renewable penetration.

A crucial – and often overlooked – component to ensuring a functioning grid for a clean energy future is understanding the relationship between atmospheric science and renewable energy systems. This course will evaluate how meteorology fits in the big picture in the future of the utility system, discussing how and where it is important, and presenting a 'soup to nuts' approach to studying, planning, and applying meteorology data for renewable project development and grid operations.

LEARNING OUTCOMES

• Evaluate the significance of atmospheric science in the transition to a renewable energy future
  o How the weather impacts renewable integration and operations
• Discuss meteorology impacts to the system — transmission and generation
• Identify strategic and technical meteorology needs in renewable energy systems
  o Fundamental best practices
  o Using meteorology to build a better system from front to back
  o Forecasting and data analytics
  o Asset management in renewable systems
• Review wind and solar resource assessment and forecasting
• Discuss processes to move away from deterministic forecasting to probabilistic forecasting
• Assess best practices to bridge the gap between atmospheric science and utility industries

INSTRUCTOR

Justin Sharp
Principal and Owner, Sharply Focused LLC

Justin Sharp is principal and founder of Sharply Focused Forecasting, consultants in all aspects of wind forecasting. He has 15+ years of experience as a meteorologist, and 7½ years of energy sector experience gained at Iberdrola Renewables and Bonneville Power Administration. He founded and directed the operational meteorology division at Iberdrola, where tasks included reconciling commercial and operational data with meteorological data, and providing real-time 24/7 trading and operations support from a renewable energy forecasting desk. He has played an active role in advocacy and policy discussions, presenting at numerous workshops and informing policy discussions in a diverse range of areas including FERC, NOAA leadership, DOE, and the President’s Office of Science and Technology Policy.

“Knowing renewable energy is knowing your fuel source!”
Engineer, WEB Aruba NV

“Great course. Very informative.”
Renewable Energy Group Manager, Campbell Scientific
AGENDA

WEDNESDAY, SEPTEMBER 25, 2019

8:00 – 8:30 am  Continental Breakfast & Registration

8:30 – 8:50 am  I. Introduction

8:50 – 9:30 am  II. Setting the Context: Power Systems and Weather Dependency
  • Weather Dependency in Utility Power Systems
    o Overview of weather impact on traditional systems
      - How do variables like wind, temperature, and humidity impact load, distribution, transmission and traditional generation
      - How do these variables interact?
      - What impact do extreme events have
    o An overview of weather impacts on renewable generation (wind, solar and hydro)
      - Similarities and differences in weather impacts of each
      - Comparison with weather impacts on traditional systems
      - Resource interactions and why they matter
    o The current siloed approach to meteorology in the project life cycle
      - An overview of three chief ways that meteorology is typically utilized: Resource assessment, generation forecasting and asset management
      - The consequences of the silos in the renewable energy transition
        * Project siting drivers
        * Current real and perceived challenges for each type of renewable

9:30 – 10:00 am  III. Renewable Energy Meteorology 101
  • Renewable Energy Meteorology Introduction
    o What causes the weather? How does it relate to wind, solar and hydro
  • Terminology Primer – Commonly Used Terms and Definitions
    o Climate and weather
    o Variability and uncertainty
    o Renewable resource drivers for wind, solar and hydro
    o Variability, uncertainty and their nuances
    o Prediction types and their time horizons
      - Time horizons
      - Prediction types

10:00 – 10:30 am  IV. Renewable Energy Systems 101
  • Renewable Electricity Technologies
  • Understanding their Potentials, Limitations, and Promising Applications
  • Power Systems Integration
    o What are integration costs? What drives them?
    o Is renewables integration different? If so how?
    o Integration myths
    o Integration solutions (footprint, market speed/liquidity, dispatch interval/horizon, forecasting)
  • Getting Out of the Silos and Understanding the Need for a Systems Approach
    o Why is meteorology and climatology a key driver?
    o Where should it fit?

10:30 – 11:00 am  Networking Break
AGENDA

WEDNESDAY, SEPTEMBER 25, 2019 (CONTINUED)

11:00 am – 12:00 pm  V. Resource Assessment Part 1
- Assessment Purpose and End-users through the Project Timeline:
  - Engineering vs. Atmospheric Science Role: “Oil and Water” or “Peas and Carrots”?
  - Upfront: Prospecting winning sites and optimization of gross energy
  - Refinement: Only three things matter net energy, net energy and net energy
  - Win the PPA/find the off-take
  - Finance (P-Values), production performance, operations, repowering
- Traditional Approach vs. Current Approach: Know Your Fuel, Know Your Output
  - Every site is different and has unique meteorological features
  - Shortcomings of the traditional approach: What have we learned in the last 10 years?
  - Measurement campaign instruments and strategies
  - Historical context (“MCP”): Why? How? Dangers?
  - Validation and uncertainty
  - Wind speed frequency distribution: Critical and unique site characteristic
  - Haircut time: Gross to net energy considerations
  - Special subject: Wake loss modeling
  - How’s your mileage? Power curve performance
  - Evaluating sources of uncertainty: What about climate change?
  - P-Values: What they mean and what they do not mean?
  - Site suitability, extreme condition assessment and the “MLA”
  - Reckoning: How good are we?
  - Permanent Met Towers: An overlooked source of verification
  - Operational backcasting and repowering assessment
  - Key differences between wind and solar
- Future Resource Assessment
  - The advancing modern turbine era: Risks
  - Instrumentation above tip height: Sodars, lidars, scanning lidars and their benefits
  - Very high-resolution wind flow modeling: Mesoscale, LES, CFD
  - Advanced and more site-specific wake loss modeling
  - Stability impacts and the “reservoir above”
  - Advanced power performance testing
- Available Resources for People to Access from Both Vendors and Government Sources. (IRENA, NREL, etc.)

12:00 – 1:00 pm  Group Luncheon

“**A very good training course for a wide range of users and stakeholders within the Renewable Energy community**”

Market Sales Engineer, Campbell Scientific

“**This was an excellent course, a lot of great topics and also expert speakers. Congratulations.**”

Engineer, Multienergia
AGENDA

WEDNESDAY, SEPTEMBER 25, 2019 (CONTINUED)

1:00 – 2:00 pm  VI. Resource Assessment Part 2 (Continued)

2:00 – 3:00 pm  VII. Meteorology Impacts on Renewable Energy
• A Deeper Dive into the way Different Meteorological Phenomena Impact Wind, Solar and Hydro
  o Scales of motion
  o Drivers of change
  o Large scale weather systems
  o Terrain induced flows: mountain/valley and sea-breeze
  o Transient features like fronts and troughs
  o Mountain waves
  o Mountain wakes
  o Gapflows
  o Convection (Thunderstorms)
  o Stability
  o Micro-climates
  o Extreme conditions: High winds, high/low temperatures, snow and ice
  o Cold waves including impacts on traditional energy
  o Hurricanes

3:00 – 3:30 pm  Networking Break

3:30 – 4:15 pm  VIII. Renewable Energy Generation Forecasting Part 1
• Load, Wind and Solar Forecasting 101
  o The basic building blocks
  o The similarities and differences between wind, solar and load forecasting
  o Why load forecasting will allows be more accurate the wind and solar
• Foundational Numerical Weather Prediction
  o How do we forecast the planet’s weather
  o Initial conditions and boundary conditions. What are they? Where do they come from? What is data assimilation
  o The impact of resolution
  o Modeling processes occurring at higher resolution than the model operates at
• Creating a Power Forecast
  o How is a power forecast derived? What inputs are needed?
  o Methodologies utilized at different time horizons
  o Differences between wind and solar
  o Coupling of other earth system models
    - Land surface model and land use
    - Ocean models
    - Hydro models

4:15 – 5:00 pm  IX. Renewable Energy Generation Forecasting Part 1
• Probabilistic Forecasts, Prediction Intervals and the use of Ensembles – What? Why?
• Ramp Forecast Tools and Situational Awareness
• Data….What Matters and What Doesn’t?
AGENDA

THURSDAY, SEPTEMBER 26, 2019

8:00 – 8:30 am  Continental Breakfast

8:30 – 9:15 am  X. Implementing a Renewable Energy Forecasting Solution
• What Determines Variable Energy Resources and Load Forecast Value?
• The Weather Forecast Value Chain
• Best Practices for Developing a Robust Forecasting Solution and Integrating it into Operations
• The Importance of Quality Data
• Evaluating Forecast System Performance
  o Why verify? What to verify
  o Typical verification metrics
  o Advanced verification metrics
• Renewable Energy Forecasting Trials – Do’s and Don’ts

9:15 – 9:45 am  XI. Applications of Meteorology to Asset Management
• Know Your Fuel and Make Sure Your Fuel Gauge Works
  o Data, data, data
• How to Access Real Plant Performance Against Budget
  o Just because you’re met your budget doesn’t mean you operated the plant optimally
  o Potential generation
• Operations and Maintenance Planning
  o Lightning information and other services supporting life and property
• Planning for Non-Renewable Units
• Building a Lower Risk Portfolio

9:45 – 10:00 am  Networking Break

10:00 – 10:45 am  XII. Transmission and Generation Planning for High Penetration Renewables
• Why Meteorology/Climatology are Critical Here
  o Resource attributes and diversity
• Revisit the Hydro Analogy
• Grid Co-Optimization Studies
  o What is the motivation? How do they work?
  o Insights into how much RE can be integrated and at what cost
  o Advantages of planning versus ad-hoc build out
  o Limitations of grid co-optimization methods

10:45 – 11:15 am  XIII. Renewable Energy is About Systems - Pulling it All Together
• A Short Case Study Example of Meteorology Adding Millions of Dollars of Value
• Demand Side Pricing Transparency, Aggregators and Demand Response
• Forecasting is NOT a Magic Bullet
• The Old and New Paradigms
  o Baseload, curtailment, reliability
  o Load and generation are not independent
• Incorporating Meteorology into System Design

11:15 – 11:45 am  IXV. Final Q&A and Wrap Up
INSTRUCTIONAL METHODS

Case studies and PowerPoint presentations will be used in this 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.

REGISTER 3, SEND THE 4TH FREE

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

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 this course.

EVENT LOCATION

EUCI Conference Center
4601 DTC Blvd., B-100
Denver, CO 80237

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REGISTRATION INFORMATION

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EVENT LOCATION

EUCI Conference Center
4601 DTC Blvd., B-100
Denver, CO 80237

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METEOROLOGY FOR RENEWABLE ENERGY SYSTEMS COURSE
SEPTEMBER 25-26, 2019: US $1395
Early bird on or before September 6, 2019: US $1195

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

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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 August 23, 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.