At a glance

The Power Industry of Tomorrow Program is designed for senior managers, executives, developers and investors who need to understand the industry evolution in order to make key business decisions. Siemens’ deep technical expertise, international thought leadership and real-world experience in global environments bring unique knowledge and insights to participants.

Upon completion of the Power Industry of Tomorrow Program, participants will be able to conduct the following related tasks:

- Apply deep technical understanding of the evolving power system to business plans
- Develop sound business strategies with the knowledge gained around relevant power system industry trends, such as changing policies, rapidly evolving markets, decarbonization, business transformation and advanced technologies
- Incorporate risk considerations into business strategies
- Consider alternative business opportunities for growth

Program modules

The following provides a description of the Program Modules and topics covered. Each module will be broken out into one or more, one-hour, sessions.

**Module 1: An Overview of the Industry of Yesterday**

Duration: One session

Participants will learn how the power industry has evolved to where it is today. In this Module, the instructor will review the history of the industry developments while noting the drivers behind the changes, and the associated positive and sometimes negative impacts to investments.

The following topics will be covered in detail:

- Development of large holding companies
- Increased regulation
- Rural electrification
- Development of new bodies i.e., Independent System Operators (ISOs)
- Competition and the development of wholesale markets
- Energy policy legislation

**Module 2: An Overview of the Industry Today**

Duration: Two sessions

Session one: The instructor will provide an overview of today’s political and regulatory status and how the current markets operate.

The following topics will be covered at a high-level:

- State and Federal Policies: Renewable Portfolio Standards (RPS), Solar Renewable Energy Certificates (SRECs), Federal Energy Regulatory Commission (FERC) orders (i.e., 745, 1000), North American Electric Reliability Corporation (NERC) compliance, Environmental Protection Agency (EPA) rules and reliability focus, political drive to green energy and efficiency
- Rate cases, tariffs, flat rates, net metering, demand charges and time-varying rates
- Wholesale markets: capacity, energy, transmission lines, ancillary, scheduling, dispatch, Security Constrained Economic Dispatch (SCED), settlement, demand response (DR), wind and solar integration and duck curve
- Retail markets: Third-party and DR
Session two: Participants will learn how the generation fleet has changed and how players in the power industry make profits. An overview of the current technologies required to run the system will be discussed.

The following topics will be covered at a high-level:

- De-carbonization: Coal and nuclear retirements, stagnant oil, wind, gas increase (gas capacity limitations), planning and operations, carbon markets and generation mix
- Business models: Utility revenue requirements (transmission and distribution wire investments), non-wires alternatives (NWA), capital allocation, developers (Independent Power Producers [IPPs], transmission developers), 3rd parties (energy service companies [ESCOs] and DR), merchant generation and power purchase agreements (PPA)
- Technologies: Traditional equipment, substation automation, smart meters, distributed generation (DG) and DR, Flexible AC Transmission Systems (FACTS), high-voltage direct current (HVDC), IT and communications

Module 3: A look to the Industry of Tomorrow

Duration: One session

Participants will gain an insight into the future trends of the power industry, considering the various push-pull factors.

The following topics will be covered at a high-level:

- State and Federal Policies: Driving towards state level regulation and distributed energy focus
- Integrated markets: A future market where load follows generation with energy storage filling the gaps across the generation, transmission and distribution system
- Resource adequacy and Integrated Resource Plans (IRPs)
- De-carbonization: Impacts of a changing administration, fuel wars and reliability concerns
- Business models: A review of changes to incumbent business models, and new business opportunities and performance based ratemaking
- Technologies: An introduction to new and evolving technologies such as, energy storage, distributed generation and microgrids

Module 4: State and Federal Policies of Tomorrow

Duration: Three sessions

Session one: A detailed review of the latest Distributed Energy Resources (DER) related policies will be conducted. The following topics will be covered:

- FERC DER Proposal to allow DER
- Example state-led initiatives: California Public Utilities Commission (CPUC) and New York Reforming the Energy Vision (NY REV) DER policies
- Cyber security
- Distribution System Operators (DSOs) policy changes in planning, operations, expanded markets, DER ownership and independent DSO versa incumbent

Session two: The instructor will offer a deeper dive into some of the regulatory hurdles and a changing view on how technology is being considered for deployment, based on its performance versus type.

The following topics will be covered:

- Changing regulation barriers
- Move towards ‘technology agnostic’ views

Session three: The instructor will take a deep dive into the evolving financial structures of the power market and how energy independence is impacting federal and state policies.

The following topics will be covered:

- Financials: Time of Use (TOU) and other time-varying rates, Performance-based Ratemaking (PBR), revenue decoupling, Software as a Service (SaaS) and DER incentive mechanisms
- Energy independence: Market volatility, use of domestic resources and increased cost of fuel extraction

Module 5: Integrated Markets

Duration: Five sessions

Session one: Participants will learn how the traditional model of “generation follows load” is beginning to change. The instructor will offer an overview into the technologies and markets to fill in the gaps in this changing paradigm.

The following topics will be covered:

- Load follows generation with energy storage gap filling
- Capacity charges and methodologies
- Bi-lateral contracts
- Energy imbalance (California Independent System Operator [CAISO])
- Merchant generation
- Multi-state markets
- DER participation in wholesale markets

Session two: Participants will learn about expanding ancillary markets such as, frequency and reactive power, and how new companies are increasing participation in the market place. Changes to the granularity of the wholesale market pricing will be introduced.

The following topics will be covered:

- Expanding ancillary market
- Increasing non-utility participation (i.e. IPP, 3rd parties)
- Nodal versus zonal analysis

Session three: Participants will learn various proposed models to integrate DER into electricity markets.

The following topics will be covered:

- DER aggregation and Virtual Power Plant (VPP) (CAISO)
- DER integration into wholesale markets (i.e., recent FERC proposal)
- DSO integration (i.e., NY REV)
- Customer engagement

Session four: Participants will understand various methods to value DER, from both a planning and market perspective.

The following topics will be covered:

- Locational Marginal Price plus Distribution (LMP+D): Time and location based and Symmetrical pricing
- DER Cost Benefit Analysis: New York Benefit-Cost Analysis (BCA) handbook, California Locational Net Benefit Analysis (LNBA) and National Association of Regulatory Utility Commissioners (NARUC) manual

Session 5: Participants will understand how planning is becoming more granular and needs to account for complex optimal market dispatch across the entire system.

The following Integrated planning topics will be covered:

- Techno-economic analysis of generation, transmission, distribution and DER systems
• Model integration
• Maturity levels
• Accounting for opportunities and for uncertainly
• Scenario formulation
• Granularity (temporal and geographical)
• Model integration
• Process
• Business case impacts

**Module 6: Continued Trend towards De-carbonization**

Duration: Five sessions

**Session one:** Participants will learn expected outcomes from a changing federal administration with regards to clean energy.

The following topics will be covered:
• Impacts of a changing administration
• Clean Power Plan (CPP), state-driven versus federal

**Session two:** The instructor will present participants with likely outcomes from EPA regulations and their potential impacts on the existing generation fleet.

The following topics will be covered:
• EPA (reduced authority)
• Water regulations
• Coal retirements

**Session three:** Participants will see how changing regulation around de-carbonization is likely to the effect future generation mix and indirectly bulk system reliability.

The following topics will be covered:
• Generation mix predictions (coal versus gas versus green)
• Reliability concerns: Reduced reserve margins, reduction in rotating inertia and ramp rates

**Session 4:** Participants will understand how carbon markets are evolving and how volatility in fossil fuel prices will likely impact generation.

The following topics will be covered:
• Carbon markets
• Increasing fossil fuel extraction costs and market volatility

**Module 7: Changing Business Models**

Duration: Three sessions

**Session one:** Utility defection and other alternatives to utility supply will be discussed.

The following topics will be covered:
• Community energy
• Solar photovoltaic (PV) revenue impacts
• Off-grid systems
• Microgrids

**Session two:** The instructor will delve into new utility business models along with tools to help make informed decisions.

The following topics will be covered:
• Utility organizational: Process and workforce changes
• Utility business transformation: Tools (Siemens Compass™), outcomes and services (DSO, DER ownership and home services)

**Session three:** Participants will learn about evolving third-party business models from supply of energy through to the aggregation of services.

The following topics will be covered:
• ESCOs
• DR aggregation
• VPP

**Module 8: Advanced Technologies**

Duration: Four sessions

**Session one:** Participants will understand the three technologies that are expected to turn the industry upside down.

The following topics will be covered:
• Distributed generation: Various technologies, technical capabilities, technical impacts and IEEE P1547
• Demand response: Automatic versa manual, trends and DR versa energy storage
• Storage: Various technologies and technical capabilities

**Session two:** Participants will gain an insight into the benefits of integrating the technologies covered in the previous Module.

The following topics will be covered:
• VPP: Aggregation of DER and technologies to integrate 1000s of individual units
• Microgrids: Technologies, grid operation, island operation and transition states

**Session three:** Participants will see how customer connected equipment is likely to play a larger role in the future.

The following topics will be covered:
• Electric vehicles: Charging technologies, vehicle-to-grid (V2G) and vehicle-to-home transmission (V2H), and demand response participation
• Customer in-house technologies: Internet of things (IoT), smart meters, home area networks and home microgrids

**Session 4:** Participants will see how digitizing the grid is changing the power industry, covering hot topics such as cyber security.

The following topics will be covered:
• Monitoring and Control: DER, smart meters, transmission and distribution, and phasor measurement units (PMUs)
• Cyber security: Security layers, best practices, trends, vulnerability risks and threats, tracking security issues
• IT/OT: Sharing smart meter data with other applications and increased integration of applications (i.e., Service-Oriented Architecture [SOA])
Delivery
This expert training program can be delivered via several methods:

- **Onsite.** Training offered at any global location, i.e. a single company office, for employees only.

- **Hosted Onsite.** Training conducted at any global host location, i.e. company offices, for host employees and participants from external companies. Financial rebates are available in exchange for hosting.

- **Webcast.** Training conducted via an online training platform with live video and audio between the instructor and the participants.

- **On Demand.** Individual interested participants can contact Siemens Power Academy TD – NA to be on standby for an upcoming delivery based on their preferences.

Prerequisites
Participants should have a degree in electrical engineering, a minimum of five years industry experience and be familiar with stability topics.

Exercises, Mentoring and Testing
Participants will solidify learning through hands-on exercises conducted throughout the Program, mentoring sessions and an online test.

Certification
A certificate of completion will be issued to each participant upon meeting all attendance and examination requirements of the respective program. The certificate will document the associated Professional Development Hours (PDH) and Continuing Education Units (CEU) associated with the program.

Contact us
Siemens Power Academy TD – NA
Phone: (518) 395-5005
Fax: (518) 346-2777
Email: power-academy.us@siemens.com
Web: usa.siemens.com/pti-education

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