



About the Course:

This course is specifically focused on the definitions and modeling of nanogrids. This subset of a microgrid has six specific benefits:

- **An Individual DER can define a Nanogrid.**
- **The nanogrid in this context serves as a building block for a portion or section of a facility or building (virtual UPS).**
- **The nanogrid is NOT dependent on data communications to operate.**
- **The nanogrid primary mission is resilience.**
- **The nanogrid can use common, off-the-shelf hardware and engineering**
- **The nanogrid can be “clustered” (using secure data communications) for advanced functions including market participation.**

There are many different configurations and options that meet the definition of a microgrid that are NOT included in the course. Power Analytics offers other training courses for those microgrids separately.

Why You Should Attend:

Microgrids and Distributed Energy Resources have moved from concept and testing to part of our energy future. The course was created from our years of experience and a specific approach with an architecture for a nanogrid. The nanogrid strategy is a specific approach that provides the lowest cost, vendor agnostic architecture using off-the-shelf hardware. Each nanogrid primary mission is resilience. The power engineering is based on existing technology generally associated with an uninterruptable power supply (UPS). Using concepts well understood in UPS technology this “virtual UPS” has all the functional components of a UPS but loosely coupled and does not require data communications. A “cluster” of nanogrid form Tier 1 microgrid incorporating higher order functions and situational awareness. Each nanogrid can meet the prime function of resilience without data communications, reducing the complexity and cost. Each nanogrid can be modelled and simulated as Power Digital Twin (PDT), or in real time including Asset Optimization of the PDT. Training will include specific examples and review advanced functions (Tier 2, Tier 3, etc.) for the higher order functions including market participation.

Since 2008, Power Analytics has led or worked with thought and system leaders in the evolution of microgrids. In 2019, those efforts have taken on a sense of urgency as resiliency, energy cost and innovation are rapidly changing. This course reviews the most current trends in microgrid power and energy standards and as well as specific examples.





Topics:

1-Nanogrids and Distributed Energy Resources (DERs)

- Modeling, simulation and configuration
- Power Digital Twin Data driven modeling of resources and estimation of potential
- Nanogrid/microgrids operating in grid-connected and islanded mode
- Mitigation of the variability of renewable supplies in the grid
- Resilience is location specific, and involves public safety
- Provision of frequency regulation and ancillary services

2- Inverter based DERs, nanogrids (virtual UPS) to microgrids and distribution systems

- Operation, control and protection systems
- Power converters modeling with special functionalities
- Active power filtering, load-sharing, islanding operation
- DC microgrid networks and DC distribution systems

3- Protection and faults in nanogrid/microgrids and distribution systems

- Fault analysis, location and isolation
- Protection coordination and adaptive communication-based protection
- Nanogrid/microgrids during emergency, islanding, and black start



4- Renewable generation, Energy storage, and load resources in a nanogrid

- Large scale integration in low-voltage grids
- Effects on the management of low-voltage networks
- Forecasting demand and generation in the context of microgrids
- Integration of microturbines, (small) wind turbines, photovoltaic, fuel cells, CCHP
- Virtual UPS and batteries: hydrogen and fuel cells, compressed air, flywheel
- Electric vehicles integration and operation

5- Control and management of nanogrids, clustering nanogrid (Tier 2 microgrid) and distribution systems

- Nanogrids and the Power Digital Twin
- Nanogrids and Asset Optimization
- Supervision, management, security, and hierarchical control
- Communication-based resilient and robust control
- Power management strategies and the effect of business models
- Distributed control and/or decentralized decision making
- Transient and stability analysis of microgrid systems

6- The role of microgrids/nanogrids in the power grids of the future

- The challenges of the transition to a distributed fully decarbonized power system
- Overview of current and future grid reliability services
- Overview of US wholesale electricity markets and market products
- Overview of utility programs
- Symbiotic relationships between the microgrids and the power grids
- Microgrid Operators

7- The economics of microgrids/nanogrids

- The Agile Fractal Grid approach
- Microgrids as Virtual Generators
- Microgrids economic optimization, constrained and unconstrained
- Case studies





Course Fees and Registration:

Please Contact Training@PowerAnalytics.com to reserve your spot!
(Accommodation information will be provided at time of registration) 2621 Spring Forest Road, Suite 101
Raleigh, NC 27616
919-848-6625

Training rates: \$TBD

