# Panelist Comments
Technology Session 2: Operations and Planning
PSERC Future Grid Forum, June 27-28, 2012

George Angelidis, Principal, Power System Technology Development, California ISO

1. The future is almost here!
   - 33% Renewable Policy Standard in CA by 2020
   - Once-through cooling regulation
   - Greenhouse gas emission regulation
   - Carbon tax
   - Radical change in generation fleet characteristics
   - Higher requirements for regulation and operating reserves
   - Emerging need for new ancillary services: load following and flexible capacity

2. Planning Challenges
   - Reduced voltage support capability
     - Most wind turbines and solar plants cannot generate reactive power
     - No market for reactive power = no incentives
   - Reduced frequency response
     - No market for primary reserve = no incentives
   - Reduced system inertia
     - Stability limits must be reevaluated
   - Reduced fault current
   - Protection schemes must be redesigned

3. Operations Challenges
   - Renewable energy production forecast
   - Maintain generation fleet flexibility for load following
   - Reevaluate operating reserve requirements
     - What constitutes largest contingency?
   - Visibility, dispatch, and metering of distributed generation and demand response

4. Market Design Challenges
   - New models for new technology
     - Limited Energy Storage Resource model
     - Dispatchable Demand model
   - New market commodities and ancillary services
     - Regulation mileage
     - Dynamic transfers for renewable energy imports
     - Flexible ramp capacity
     - Primary reserve
     - Reactive power
     - Load following

George Gross, University of Illinois at Urbana-Champaign

1. The deepening penetration of variable/intermittent resources introduces wide and sudden changes during their operations creating the **need for flexibility** with adequate ramping capability over a wide range of time scales for essential services:
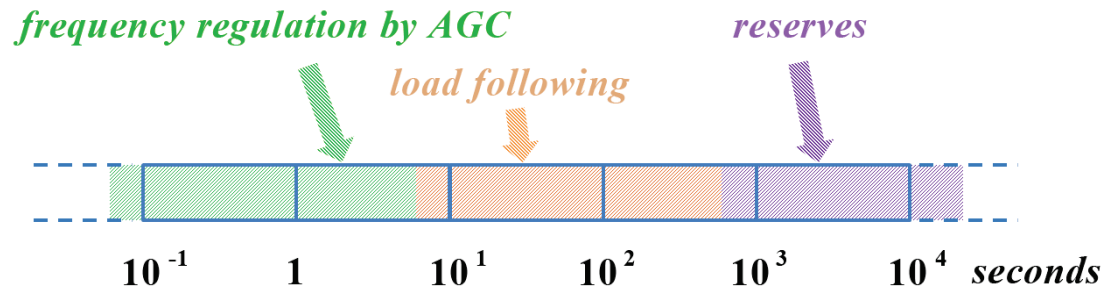
2. System planners and operators need **appropriate tools** to gain better understanding of, and ability to deal with, the intermittency and variability resource impacts in key areas
   - improved **forecasting tools** over shorter and longer-term periods to explicitly take into account the meteorological sources of uncertainty
   - models appropriate for the representation of the **dynamic behavior of renewable resources** and their interactions with conventional units and control elements and their incorporation into existing dynamic simulation tools
   - stochastic and robust methods for unit commitment/economic dispatch scheduling of large-scale systems with the ability to adaptively set reserves and adequate ramping capability requirements for the controllable resources, including storage and DRRs, to securely and economically meet the load at the various time scales
   - computationally efficient **probabilistic simulation tools** to quantify the economic, reliability and environmental impacts of the integration of renewable resources over longer-term periods for planning, investment, operations and analysis applications

3. Implementation of new power system components to provide:
   - additional flexibility in controllable resources with higher ramping capabilities, shorter start-up times and reduced down time requirements
   - judicious deployment of short-term and longer-term arbitrage-based energy storage devices
   - pervasive deployment of demand response resources
   - extensive deployment of smart-meters to automatically control loads
   - effective integration of battery vehicle aggregations.

4. Stand-alone operation of a microgrid over longer-term periods using community storage

Tim Ponseti, Vice President of Transmission Reliability, Tennessee Valley Authority

1. New Tools that:
   - help give early warnings and help defend against Cyber Attacks, EMP events, and Physical attacks.
   - can simultaneously optimize resources and transmission constraints (both in the real-time and planning horizons).
   - calculate and rank real-time operating risk based on amount of variable generation deployed, non-firm schedules in play, generation linked to single gas pipeline, loss of all lines in a common transmission corridor (e.g., plane crash, sabotage). Point being to consider multiple contingencies in real-time....making operators more aware of multi-contingency risks they face.
   - provide automatic optimized constraint management (transmission reconfiguration with redispatch and transmission load relief option)

2. Wish List of Technologies, System Characteristics and Operations Capabilities
   - pumped storage
   - dispatchable load
   - flexibility in controlling resources – especially those whose output varies widely
   - need market for reactive power and other ancillary services
   - built-in protection schemes for single phase induction motors (residential HVAC units) – FIDVR solution. Note: FIDVR is Fault-Induced Delayed Voltage Response (key root cause of brownouts/blackouts and near blackouts of cities with large blocks of residential HVAC units).
   - day-ahead predictability for variable generation
   - real-time visibility for bulk electric system operators regarding fuel supply for gas, wind, solar generation

3. Characteristics that any successful operations/planning technologies and tools must have:
   - accurate, flexible, and capable
   - durable and maintainable (with a ready supply of spare parts for when it breaks),
   - operator friendly - have good visualization - and good man-machine interface
   - recognizable value
   - should make it easier to comply with NERC reliability standards - not tougher
   - should not be overly complex – keep it simple

David Whiteley, Executive Director, Eastern Interconnection Planning Collaborative

Based on experience gained from DOE sponsored interconnection studies work

1. Study design (different potential futures vs. refining a singular future) dictates the type of modeling and tools that are required.

2. The history of system development matters.

3. Economics must continue to be considered as a (if not the) key driver.

4. Studies are needed of the best ways to interact with stakeholders in assessing potential changes in energy policies

5. The interaction of postulated additions to the system is difficult to analyze in unison particularly if they represent new or advanced technology.

6. New models and tools are needed to control and integrate significant HVDC transmission into the predominantly AC system.