Operational Survey EPRI PS39D: Operations Planning & Engineering Support Studies

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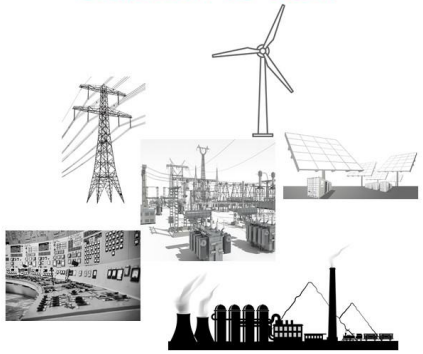

The future challenges in Operations

Why Operations can’t sleep at night!

High Level Concerns

- The power system transformation happening faster than tools, personnel, procedures, standards, etc. can adapt
- Industry is more reactive than proactive, that must change
- Operating margins in the system are shrinking, over time the system is pushed closer to the edge
- Industry is moving from a very complicated system with distinct subsets, i.e., generation, transmission, distribution, etc. to a more complex system where boundaries are blurred (This system more difficult to understand, study and manage)

High Level Concerns

- With the ever-increasing number of variables and moving parts challenging operations, better data analytics, data management, and tools will be needed.
- Complicated does not necessarily equal higher reliability, need to adopt the K.I.S.S. principle
- Governmental policy from the federal to state levels is creating operational challenges. A constant stream of mandates and one size fits all mentality is potentially negatively impacting resiliency and reliability

High Level Concerns

- Like governmental policy impacts, ever changing stakeholder driven market changes also can impact resiliency and reliability
- Many problems are region specific (data centers, gas electric coordination, BTM/DER resources, etc.) This directly dictates what each region sees as challenges
- Many challenges are tied to the ability to accurately forecast weather, i.e. load forecasting, resource availability, facility ratings, storage, etc. Forecasting improvements will be critical going forward.

High Level Concerns

- Studying adequacy based solely on the system resource capacity and peak load is fading. Much of the industry moving toward 24X7 energy evaluations
- In some areas load growth is outpacing new resources coming online. This has been highlighted in NERC resource adequacy work. Getting ahead of the resource adequacy curve is critical to resiliency and reliability

Some Specific Challenges

Operational engineer & operator staffing

- Retiring SMEs and hiring replacements
- Training and mentoring issues
- Dozens of organizations needing support
- Salaries

Some Specific Challenges

Grid Enhancing Technologies (GETs)

- Dynamic Line Ratings (DLR) problematic
  - Implementation is complicated (some have filed for extensions)
  - DLR in only real-time, short-term or long-term
  - Collateral impacts
  - Weather forecasting critical

Some Specific Challenges

- Advance conductors
  - Higher transfers change the dispatch
    - Higher transfers may increase system power ∠
    - Impacts on-line inertia and primary ƒ response
    - Shifts voltage and reactive capability
    - Losses
    - Protection system risks
    - Impact on other transmission facilities

Some Specific Challenges

- Dynamic flow control and topology optimization
  - Need models in off-line and EMS tools
  - What to optimize: avoid overloads, increase transfers, reduce N-1 or N-1-1 response, accommodate more outage requests, etc.
  - How to incorporate and coordinate with Security Constrained Dispatch to avoid conflicts

Some Specific Challenges

IBRs / BESS

- Inconsistent/inoperable stability models, the dreaded “black box” mystery
- Weather forecast critical to IBR operation
- Ride through and momentary cessation per IEEE 1547 and NERC recommendations not always followed
- Maintaining Area Control Error (ACE) becoming difficult
- No one knows where use of GFM will go
- System short circuit strength an issue especially during high maintenance periods

Some Specific Challenges

- How to dispatch BESS, markets or operators
- Need EMS tools to track BESS charge/discharge state
- Lack of historical BESS data to use in studies
- As large-scale transfers increase, systems now prone to new stability and voltage problems, need tools to identify these and suggest corrective actions
- Some entities seeing localized oscillations with heavy penetration of IBR/BESS, need tools to identify these and suggest corrective actions

Some Specific Challenges

Loads and Data centers

- Load model more complex with penetration of Behind the Meter (BTM) resources, what stability/PSCAD model should be used and where does it come from
- How to factor in weather related BTM changes
- What are Data Center load characteristics
- How to handle BTM and Data Center dispatchability when the system resources are tight or there is congestion

Some Specific Challenges

Gaps

- Need to bridge gap between planning and operations
- Gap between how distribution and transmission view DER
  - Poorly coordination
  - Impacts to load shed effectiveness
  - IEEE 1547 and NERC recommendations
- How to handle “firmness” of internal resources and external purchases
- Capacity resource additions not keeping pace with load growth and retirements, NERC spiked this out

Some Specific Challenges

Modeling

- Need protection and Remedial Action Systems (RAS) data, acquiring data in usable formats problematic and data must be synchronized across multiple real-time & off-line study tools
- How to address growing concerns with short circuit strength and proper protection operation as IBR penetration increases especially during high maintenance

Some Specific Challenges

- Historically studied peak hour with resource capacity or capacity obligations, now transitioning to energy analysis
- 24x7 energy analysis requires new tools & data
- Variable output resources such as (IBR/DER/BTM/BESS/etc.) complicate hourly analysis
- Forecasting accuracy and updatability critical and must improve across all operational tools
- Need to ensure forecast data consistency with sanity checks

Some Specific Challenges

Study Practices

- Operations pushed toward probabilistic assessments that require baseline goals, who determines them, how will it be determined, does it apply across all types of studies
- Probabilistic analysis will exponentially increase the number of variables to consider
- Operations also moving toward PSCAD studies

Some Specific Challenges

- PSCAD a demanding tool to use, Engineers need to understand:
  - The tool, data requirements, creating study models, deal with black box models, creating adequate equivalent systems, perform equipment model validation, evaluating results, etc.

Some Specific Challenges

Real-Time Operations

- Operations needs off-line and EMS tools to deal with new technologies along with enhanced simulator that incorporates new bells & whistles to train staff
- Push for AI in Operations to solve many highlighted issues, how should AI be used in decision making
- Push for increased use of RAS, should this be encouraged
- Challenge incorporating Markets changes into Operations
- Gas/electric coordination will continue to be challenging

Some Specific Challenges

- Elliot, Uri, and Helene have shown need for more flexibility in decision making, load management and generation resources, how can we get there
- How to model & handle extreme events, (weather, wildfires, EMP, etc.), need tools
- Considering world events, what about cyber security
- Ever-increasing number of alarms in the control room problematic, can they be “optimized” in the new world
- How will Blackstart and system restoration change

Questions?