WECC QER Comments

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1. **Lay of the land in the West**
    a. WECC Overview
        i. Regional Entity responsible for assuring the near- and longer-term reliability of the Western Interconnection
        ii. 501(c)4 social welfare organization, funded through Load Serving Entity (LSE) assessments but with accountability to the general public
        iii. Do not own or operate any Bulk Electric System (BES) assets
        iv. Long-standing, central role in BES planning in the West—planning occupies a fair amount of our mindshare
    b. Western Interconnection characteristics
        i. Unique characteristics create challenges and separate the West from the Eastern and Texas Interconnections
        ii. Western Interconnection design results in a high degree of inter-state interdependence and requires regionally integrated planning
            - Load tends to be concentrated near the coast in large urban areas, particularly along the Pacific coast and Southwest
            - Resources have generally been co-located with fuel and power wheeled to load (e.g., northwest hydro, Rocky Mountain coal)
            - Multiple long-haul transmission lines make up our transmission paths, crossing hundreds of miles of terrain with high levels of environmental sensitivity
        iii. Planning, operational and market constructs overlap
            - Two organized markets in Alberta and California – the remainder are traditional IRP markets
            - 38 functional Balancing Authorities (BAs), of which 7 are generation-only BAs, creating multiple seams issues between BAs and Planning Coordinators
        iv. Water resources are scarce in the West, which further complicates resource planning
2. **Current Planning Challenges**
    a. The resource mix continues to undergo fundamental change, leading to very different characteristics than we have traditionally planned for
        i. Traditional base load resources are disappearing
            - Over the next 10 years we anticipate between 4,000 and 6,000 MW of coal to be retired; more if the Clean Power Plan proceeds
            - Recently closed one of the three large nuclear plants that serve the West
        ii. Most new additions over the past 20 years have been natural gas plants and variable energy resources such as wind and solar

- Current resource base ~40% natural gas and ~12% wind and solar; only 17% coal and nuclear
- Anticipate the amount of wind and solar to double over the next ten years

b. System topology presents new and different challenges for planners and operators
   i. Fuel security is declining. Nearly 40% of our resource mix is hydro, wind or solar which is susceptible to long- and shorter-term weather patterns. In addition another 40% of our capacity is natural gas (nearly all without a liquid fuel alternative), and gas is also susceptible to weather related interruptions.
   ii. "Behind the Meter" resources, which are growing to significant numbers, are invisible to system operators.
   iii. Challenges with balancing the significant amount of solar on the system are increasing.
      - These inverter-based resources do not provide reactive power to support transmission system stability
      - Mostly binary, all-on or all-off, resources with no inertia to support the system
      - Ramping capabilities and resource flexibility required to balance of the system needs to accommodate increasingly large amounts of power that turns on and off very quickly
   iv. Expansion of natural gas and the transition of natural gas from a "supplemental resource" to the "primary resource" is creating challenges.
      - Natural Gas infrastructure has proven to be enormously reliable, but not designed to meet the electric sector needs
      - Natural gas infrastructure is optimized for economics, not reliability. As a result, it tends to be based on large single elements. When problems occur with major elements, they can significantly disrupt the power system.
         a. For example, the operational challenges faced by the BES, and specifically the Los Angeles and greater Southern California area due to the loss of the Aliso Canyon gas storage facility
         b. A major disruption on a key pipeline could also interrupt fuel supply for thousands of megawatts of generation

3. Planning needs of the future

a. Better Planning tools adapted to the realities and needs of the emerging 21st century grid (e.g., high penetration of VERs and natural gas, reduced reliance on coal and existing nuclear)
   i. Flexibility assessments of the system like the one WECC conducted with E3 and NREL
   ii. Better models of weather patterns and wind/solar capacity values for serving peak load
   iii. More risk-informed tools for assessing resource adequacy
   iv. New thinking around resource adequacy requirements – our economy and resource mix is much different that 50 years ago when much of the approach to resource adequacy was developed.

b. Better analytics and computing power

   i. We have terabytes of syncrophasor data, it is not clear how we can use it in predictive analyses to help system operators
   ii. In our analyses, we need to examine balance the reliability benefits of diversity in the system (e.g., resource mix, geographic) with the risks associated with scale and complexity.

c. Better integration of gas and electric planning and operating protocols
   i. Large single-element risk
   ii. Physical security of pipeline infrastructure
   iii. Scheduling and nominating protocols
   iv. Etc.

d. Continue partnership between the private sector and DOE/national Labs