Exhibit to Agenda Item #1

Board Strategic Development Committee and Special SMUD Board of Directors Meeting
Tuesday, January 7, 2020, scheduled to begin at 5:30 p.m.
Customer Service Center, Rubicon Room
Post 2020 Grid Operational Outlook

Mark Rothleder
VP, Market Quality and California Regulatory Affairs

SMUD Board
January 7, 2019
The CAISO supports California’s clean energy goals while maintaining reliability

33% RPS achieved ahead of 2020 target  
78% highest load level served by renewable energy  
98.7% highest load level served by carbon-free resources

32% Reduction in GHG Emission associated with serving ISO since 2014 (as of November 2019)
Challenges

• Challenge 1: Capacity shortfall in 2020 and meeting summer evening peak load

• Challenge 2: Increased ramping needs

• Challenge 3: Low renewable energy production from multi-day weather events
Challenge 1: Capacity shortfall in 2020 and meeting summer evening peak load

• The peak demand the ISO serves is shifting from the afternoon to the early evening

• Solar production is significantly reduced or not available during these new, later peak demand hours

• Instead, we now rely on energy from natural gas resources and imports

• However, energy capacity is decreasing due to:
  – Net retirement of 4,000 MW of once-through cooling steam generation
  – Reduced imports due to increasing load, thermal resource retirement, and increasing renewable integration needs outside of California
  – Potential changes in hydro conditions and availability in CA and west
Gas and imports support high loads after sun sets

July 25, 2018 peak load:
46,424 MW at 5:27 p.m.
Potential resource shortage\(^1\) starting in 2020

Projected shortfalls at 7 p.m.:

\[
\begin{align*}
2020 &= 2,300 \text{ MW} \\
2021 &= 4,400 \text{ MW} \\
2022 &= 4,700 \text{ MW}
\end{align*}
\]

\(^1\) Assumes no transmission outages or other significant events affecting availability of generation
Challenge 1: Capacity shortfall in 2020 and meeting summer evening peak load – **Recommended actions**

- **Address 2020 capacity concerns**
  - Increase resource adequacy contracting from operational, mothballed and new resources
  - Secure available import capacity
  - Consider extension of once-through cooling compliance date on critical units until CPUC identifies alternatives

- **After 2021**
  - Diversify fleet for evening peaks, include preferred resources that align with needs; e.g. geothermal and wind
  - Add both short- and long-duration storage focused on evening peak
  - Strategically maintain gas fleet

**Other actions to consider:**
- Add automated demand response
- Increase energy efficiency
Battery use patterns

Challenge 2: Increased ramping needs

• Rapid increases in demand or “ramps” are being met by natural gas resources and imported energy
  – Relying on natural gas resources is counter to low-carbon power grid (SB 100)
  – Availability of imports are uncertain

• Curtailment of solar resources may be increased to flatten the ramp and avoid operational issues
Gas and imports respond to meet maximum ramp rate after the sun sets.

Jan 1, 2019 peak load:
26,997 MW at 6:22 p.m.

Max 3-hour ramp: 15,639 MW
Starting at 2:25 p.m.

- Solar down 2,342 MW
- Imports up 3,659 MW
- Natural gas up 2,805 MW

California ISO
For use by all authorized ISO personnel. Do not release or disclose outside the ISO without a signed confidentiality or non-disclosure agreement.
By 2030, solar is expected to contribute to increasing ramping needs.
Challenge 2: Increased ramping needs – *ISO actions*

• Completed
  – Expand the ISO’s western markets to maximize solar production with greater geographic diversity
  – Ensure inverter-based resources ride-through fault events

• In progress
  – Ensure resources are following dispatch instructions
  – Incent all resources, including renewable resources, to provide dispatch bids, ancillary and other services

• Future
  – Consider ramp constraints on variable resources to ensure they are not ramping up faster than can be accommodated
Challenge 2: Increased ramping needs – *other actions needed*

- Increase visibility and control of commercial and consumer solar resources
- Implement dynamic pricing policies that shift load to periods of high solar
- Diversify the mix of renewable resources to increase output at the right times to match system needs; e.g. offshore wind
- Ensure resources have low minimum operating points or shut down mid-day
- Increase regional collaboration to improve flexibility and geographic diversity

Other actions to consider:

- Long & short duration storage
- Time of Use rates
- Electric vehicle integration
Challenge 3: Low renewable energy production from multi-day weather events

• During multi-day cloudy or low wind events, energy from other sources will be needed to meet demand

• Storage resources with short durations (~4 hours) might not have an opportunity to recharge during a multi-day event

• Multi-day events are hard to forecast in both operational and planning horizon
Multiple days of low solar production hinders ability of storage to recharge

Multiple day low solar production
Jan 13 – 18, 2019

Solar production as a percentage of total installed capacity

- **12,697 MW** Installed solar capacity
- **90%** Solar peak output record (7/2/19)

Multiple days of low solar production hinders ability of storage to recharge.
Low solar production across multi-day event – high reliance on natural gas and imports

**Typical solar days**

Max solar: 8,900 MW

**Multi-days of low solar**

Max solar: 2,100 MW

Multi-day low solar will hinder short-duration storage ability to recharge
The Kauai experience – July 21, 2019

- Kauai Island Utility Cooperative – approx. 70MW of load
- Loss of gas generation – 27.5 MW
- All hydro resources on maintenance outage – 16 MW
- Major storm caused low solar production for multiple days
- Solar – Battery storage unable to serve load each day
  - A. 28MW solar with 100MW-hr storage (4hr)
  - B. 13MW solar with 52MW-hr storage (4hr)
- Result: initial outage of 2 hrs, 2 days rotating outage of 30 min for 3-4 hrs in early morning hours
- Restored regular service after offline generation was put into service and solar production was increased
Challenge 3: Multi-day low renewable production events – *other actions needed*

- Diversify resource mix both technologically and geographically

- Develop resource strategy that supports multi-day events:
  - Develop significant amounts of storage with varying duration
  - Assess availability of imports
  - Develop cost-effective alternatives for multi-day and seasonal events; including, demand response, etc.
  - Reduce use of natural gas resource while strategically maintaining sufficient capacity for reliability

- Consider multi-day low production events in resource planning studies
Resource Adequacy in the Pacific Northwest

Assessment phase 1: summary of current integrated planning methods, existing adequacy studies. Phase 2A: Plans, program requirements and potential benefits of a regional program

Frank Afranji
SMUD BOD
January 7, 2020
Reliability is the NWPP focus
A REGION IN TRANSITION

• Coal retirements – losing firm resources when the region already has relatively tight load-resource balance
  • 3,000 MW of coal resources will come offline in the next two years
• New state policies demand a shift to a cleaner electricity supply portfolio
  • Oregon Senate Bill 1547 increased the state’s RPS to 50% in 2016
  • Washington Senate Bill 5116 established goals of carbon neutrality in 2030 and carbon-free by 2045
• Utilities acting on their own – combination of policy and economics
  • Avista and Idaho Power have pledged 100% clean electricity by 2045
  • PacifiCorp, PSE, Idaho Power proposing early retirements of coal
MULTIPLE STUDIES AGREE THAT THE NW IS APPROACHING A PERIOD OF CAPACITY SHORTFALLS

Note: WECC also publishes a resource adequacy assessment, but it focuses only on summer, whereas resource adequacy is primarily a winter issue for the Northwest

Note: Coal retirement scenarios developed by NWPP IRP Team. From research of announced and potential retirements from across the US WECC.
CURRENT PRACTICES MAY NOT BE SUFFICIENT TO MAINTAIN RELIABILITY IN THE PACIFIC NORTHWEST

• Current practices do not take full advantage of regional load and resource diversity
• There is no uniform method for measuring resource adequacy and no standard for how much reliability is enough
• Significant reliance on front office transactions can save costs for consumers during a time of capacity surplus, but risks insufficient investment in a time of shortfall
• Attributing capacity values to a portfolio of variable and dispatch-limited resources will become increasingly complex due to interactive effects (e.g., solar and wind plus energy storage)
IRP needs assessment method

Weighted by number of utilities

- Other...
- Deterministic...
- 1-outage in-10 years (3)
- Loss-of-load probability (3)
- Deterministic (2)
- Percentile c/percentile

Weighted by peak load

- Other...
- Deterministic
- 1-outage in-10 years
- Percentile
- Loss-of-load probability

Data from IRP survey. Missing data filled in when possible.
Market reliance, yes!

Season of highest use

SUMMER

WINTER

2025 market reliance MW (non-coincident)

MW/aMW (peak or HLH)

Utility

Data from IRP survey. Missing data filled in when possible.
Wind & solar peak contribution varies

Depends on:
- Location
- Season of stress
- Existing portfolio
- Analysis method

Missing data excluded. Blanks are zeros.
North America overview

Energy Only Market
- AESO
- ERCOT

Bilateral Resource Adequacy Program
- CAISO
- SPP

Voluntary Central Capacity Market
- MISO

Central Capacity Market
- PJM
- NYISO
- ISO-NE
Key program design elements

- Adequacy/Reliability metric
- Governance
- Program operation and monitoring
- Supply/demand forecast metrics
- Resource eligibility
- Deliverability requirements
- Capacity determinations
- Outage rates
- Import qualifications
WORK GROUP RECOMMENDATIONS

1. The region should take further steps to develop a regional resource adequacy program to achieve the following benefits:
   • To maintain reliability during a period of significant transition for the region’s electricity system;
   • To promote increased transparency and uniformity that will provide utilities, regulators, and stakeholders alike with a clear understanding of the region’s resource adequacy position;
   • To allow utilities and their customers to safely realize the full benefits of the load and resource diversity that exists across the region while maintaining reliability;
   • To provide a platform for utilities to share planning reserves and make optimal use of existing resources.
WORK GROUP RECOMMENDATIONS

2. The design of a resource adequacy program for the NW should be tailored to reflect the unique qualities & characteristics of the region
   • Significant role of hydroelectricity & public power
   • Transmission and fuel delivery constraints in the region

3. A resource adequacy program should not usurp authority that is vested with the utilities and their governing bodies to determine the best way to meet resource adequacy requirements
   • RA program must include binding commitments for each member to do its share to maintain regional reliability and must have exclusive authority over resource capacity accreditation
   • However, decisions about which resources to procure to satisfy the regional obligation would continue to rest with member utilities
DEVELOP RESOURCE ADEQUACY PROGRAM

- Collect data
- Symposium
  - Complete: Oct. 2

- Prelim. design & proposal
  - Spring 2020

- Detail program & commit
  - Spring 2021

- Launch
  - Spring 2022
EXECUTIVE COMMITTEE
Set mission/vision; approve policy decisions

EXECUTIVE ADVISORY COMMITTEE
Sounding board / program champions
FRANK AFRANJI

STEERING COMMITTEE
Execute the mission/vision; recommend policy

COMMUNICATIONS AND STAKEHOLDER ENGAGEMENT TEAM (CSET)
Clearinghouse for external communications

PROJECT MANAGEMENT ORGANIZATION (PMO)
Manage and report on the scope, schedule, and budget to execute the mission/vision (including external contracts)

SAC
Stakeholder Advisory Committee

REG
Regulatory Engagement Group

LEWG
LSE Engagement Working Group (focus on external communications)

SCWG
SPP & CAISO Working Group

BLWG
BA and LSE Working Group (point of compliance/design)

HWG
Hydro Working Group

MWG
Modeling Working Group

Modeling Advisory Group
Thank you!

https://www.nwpp.org/resources/