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Understanding Impacts of Greater Renewable Development and Coal Plant Retirements on Neighboring Systems

RETI 2 Western Outreach Workshop

Las Vegas, Nevada
September 1, 2016

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Main Purpose for the Western Outreach

"…to better understand the transmission implications of accessing renewable energy from elsewhere in the West, as well as identifying potential markets for California's own excess renewable energy production that may help meet California's 2030 RPS and GHG goals most efficiently"

Key Concerns and Issues

- **Key Concerns**
  - An Integrated Regional Resource Plan that defines the necessary energy resources and transmission assets with a coordinated strategy to deploy them does not yet exist
  - Such an Integrated Regional Resource Plan is necessary to conduct comprehensive regionally coordinated reliability studies.
  - Short timeline for expected rate of renewable resource deployment and coal plant retirements
- **Key Issues:**
  - Coal Plant Retirements/Replacement Resources are uncertain
  - Changing California Imports/Exports driven by Nuclear and Gas OTC Retirements, Increasing Renewable Penetration and Wind Resources from New Mexico & Wyoming
  - Loss of “inertia” associated with coal plant shutdown, resulting in possible stability and/or frequency response impact
  - Change in generation pattern and resource mix will impact Path Ratings

Arizona Coal Reduction Study Results & Conclusions

Presented to TEPPC on August 13, 2014

- **Results**
  - High coal reduction with high renewable penetration significantly increases risk of system instability
- **Conclusions**
  - There is a limit to the amount of coal plants that may be shut down while maintaining reliable system operation
  - The limit to the amount of coal capacity that may be reduced is influenced by gas fired replacement capacity
  - The amount of renewable resources that may be integrated is dependent upon addition of gas fueled generation, or alternative technologies that compensate for loss of inertia and dynamic reactive capability

Coal Reduction Study Recommendations

Presented to TEPPC on August 13, 2014

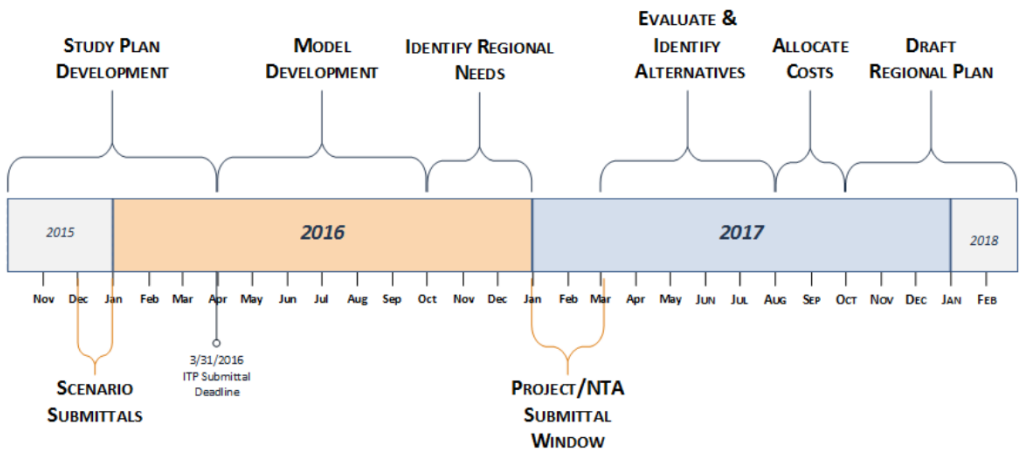
- Consider impacts of intra- and inter-regional power transfer
- Need for coordination among planning regions and with states
- States should consider grid reliability in their implementation plans
- Explore more scenarios to Identify specific transmission system needs by 2020 (e.g. reactive support, inertial resources, energy storage, dispatch patterns, etc.)
- Implement in coordination with the WestConnect 2016-17 Regional Planning Process

Arizona Coal Reduction Reliability Assessment
Presented to Arizona Corporation Commission on June 1, 2016

- **WestConnect data, base cases initial study results are expected to be available by mid-2017**
- **Arizona utilities may access credible cases and information to conduct a reliability study**
- **Propose to outline next steps and deliverables pending WestConnect evaluation of alternatives to identify transmission needs**

Expanding Arizona Study to WestConnect

Coordination with the WestConnect 2016-17 Regional Planning Process & Schedule



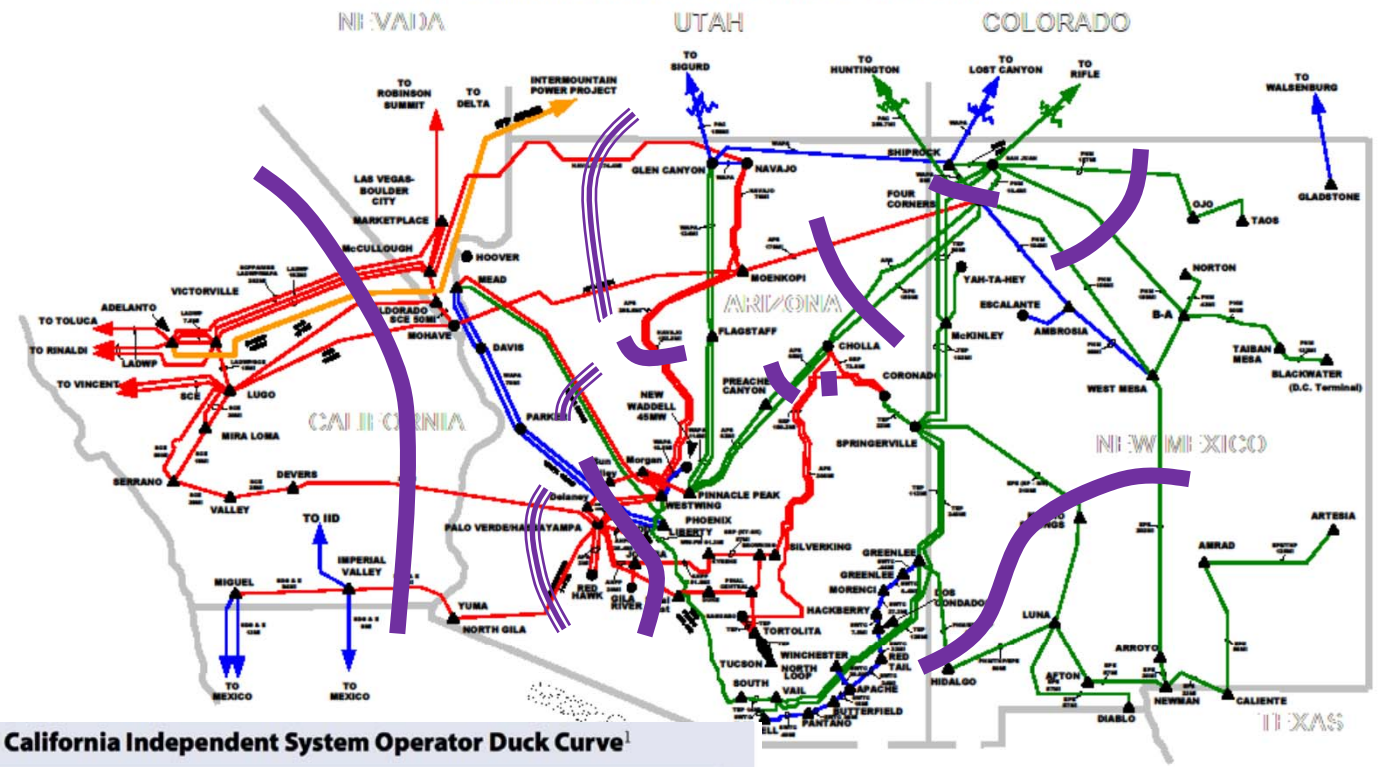
WestConnect Order 1000 models and preliminary scenario analysis is starting point for Arizona reliability assessment. Available by mid-2017.

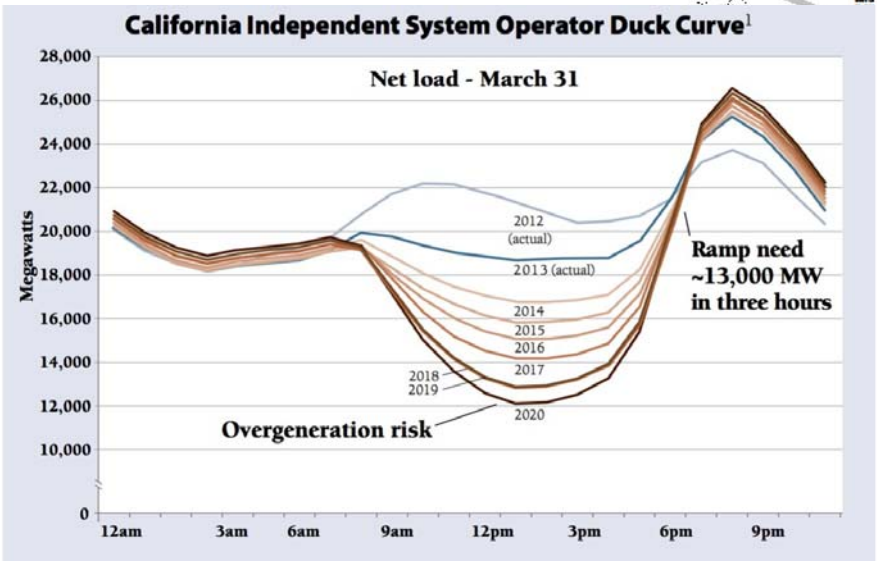
New requirements that include, but are not limited to, ramping, frequency response, voltage regulation and dynamic reactive capability will have to be determined through separate studies among the regions

WestConnect Scenarios in 2016-17 Study Plan

Scenario Name	Scenario Description
2026 Base Case	Business-as-usual case based on WECC 2026 Common Case with additional regional updates from WestConnect members.
2026 Heavy Summer Base Case	Summer peak load conditions during 15:00 to 17:00 MDT, with typical flows throughout the Western Interconnection
2026 Light Spring Base Case	Light load conditions with high wind generation
CPP – WestConnect Utility Plans	Reflect individual WestConnect member utility plans for CPP compliance
CPP – Heavy RE/EE Build Out	Additional coal retirements, additional RE/EE, minimal new natural gas generation
High Renewables	California 50% RPS with regional resources (Wyoming wind and New Mexico wind) *and* increase WestConnect state RPS requirement beyond enacted with other resources

CRITICAL PATHS ON THE DESERT SOUTHWEST TRANSMISSION NETWORK





Observations on the Duck Curve

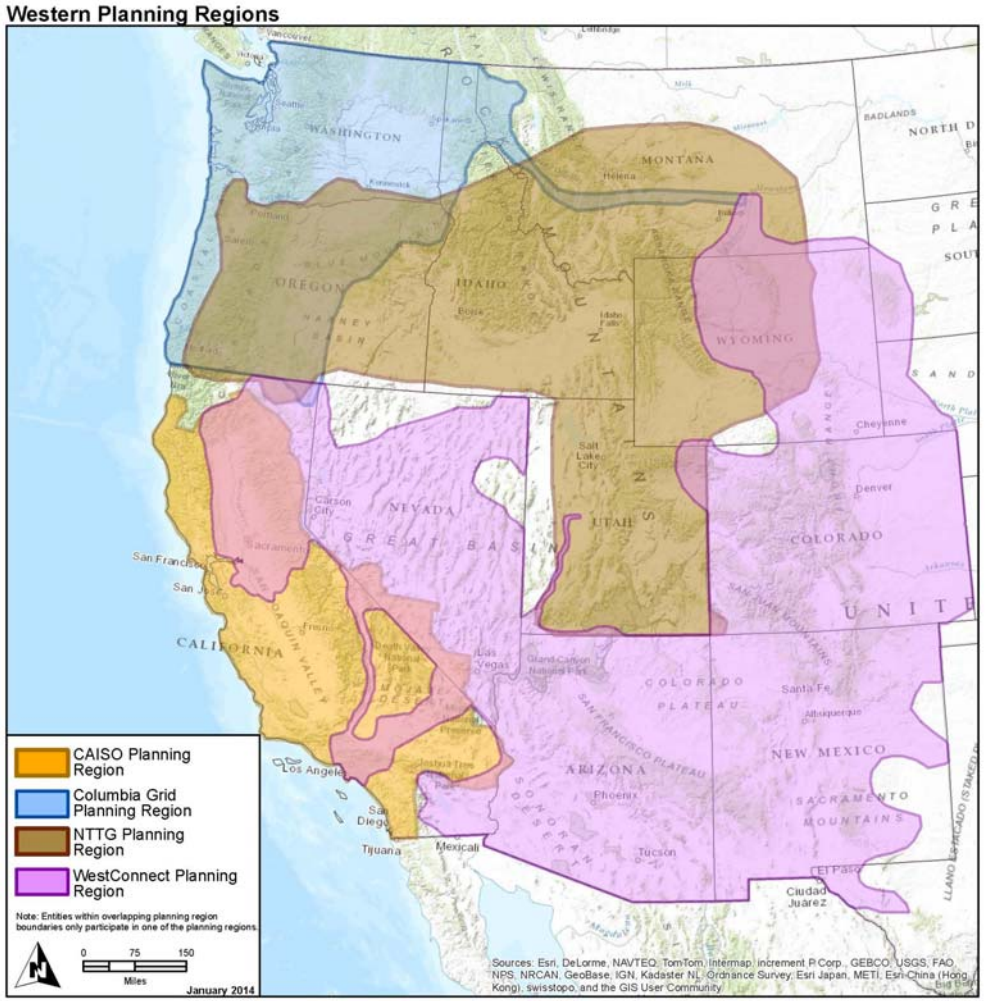
- Vertical axis starts at 10,000 MW
- Actual peaks may have dropped since 2013, possibly due to EE and strategic load management
- Wind resources produce energy during the late afternoon peak period

Coordination Among the Western Planning Regions

Coordination among regions to help meet California's 2030 RPS and GHG goals is in addition to the scope of FERC Order 1000.

Key Question: What can be done to help the other regions gain a more detailed understanding of California's system needs?

- **Each scenario requires a complimentary California model**



Anticipated Transmission Operating Challenges

- **Changing Magnitude and Direction of Power Flow on East of River (EOR) & West of River (WOR)**
- **Significant Ramping Events straining flexibility of dispatchable generation**
- **Resources needed to replace lost inertia, dynamic reactive and ramping response are unknown at this time.**
- **Possible need for mitigation of issues such as loop flow through application of remedial action, islanding schemes and other measures**

It Can Be Done

- **Time is of the essence**
- **Need for added flexibility**
  - Flexible generation, energy storage, reactive and/or voltage control devices
  - More efficiency, time-load management and other customer end-use measures
  - Flexible transmission planning strategies (May not be able to implement some transmission projects in time)
- **Technologies needed to ensure system reliability are commercially available or emerging**
- **Decisions and commitments to deploy must be made based on properly coordinated regional system studies**
- **Robust coordination among the Western Planning Regions to help engage consideration of west wide opportunities**

Questions ?

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