



Ben Brownlee, PE
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Transmission Expansion Planning Department

WECC/TEPPC Update

8th ACC BTA Workshop

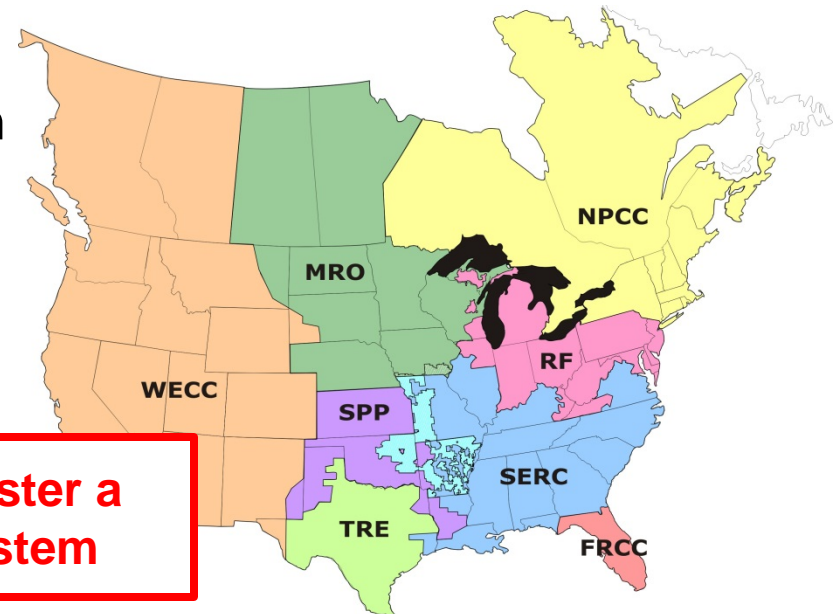
May 15, 2014

Overview

- WECC and TEPPC
- Planning Tools
- “2013 Plan”
 - Impacts to Arizona
- 2013/14 TEPPC Study Program Themes
- Questions & Answers

WECC Functions

- **What we do:**
 - Compliance Monitoring and Enforcement
 - Standards Development
 - WREGIS
 - **Reliability Planning and Performance Analysis**
- **What we do not do:**
 - Site, permit, or build transmission
 - Operate transmission
 - Cost allocation
 - “Pick winners”



WECC's mission is to promote and foster a reliable and efficient bulk electric system

TEPPC = Transmission Expansion Planning and Policy Committee

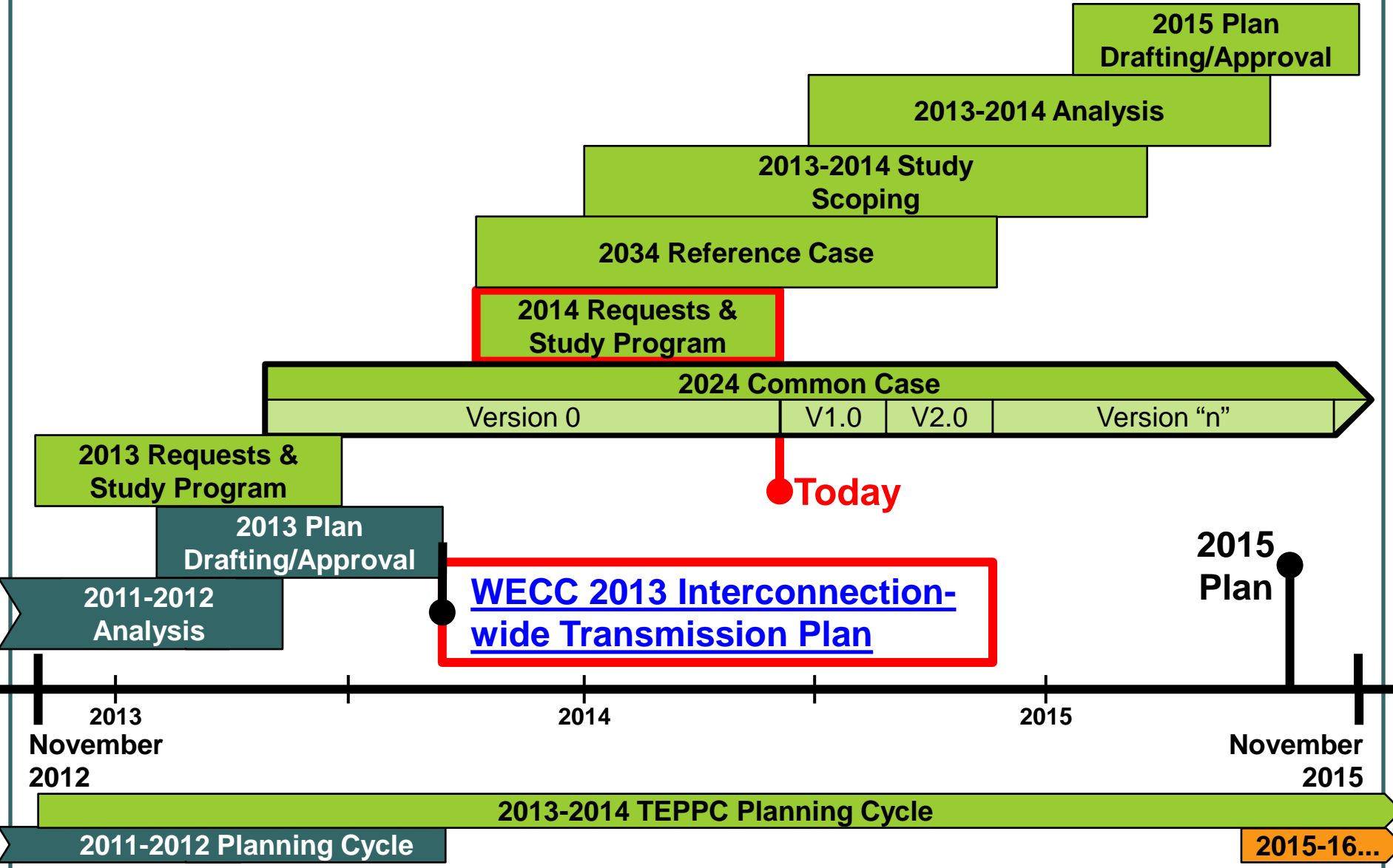
Purpose

1. Oversee and maintain public planning databases and models
2. Facilitate and coordinate Interconnection-wide planning processes
3. Guide, improve and conduct economic planning analyses for the Western Interconnection
4. Prepare Interconnection-wide Transmission Plans

Stakeholders

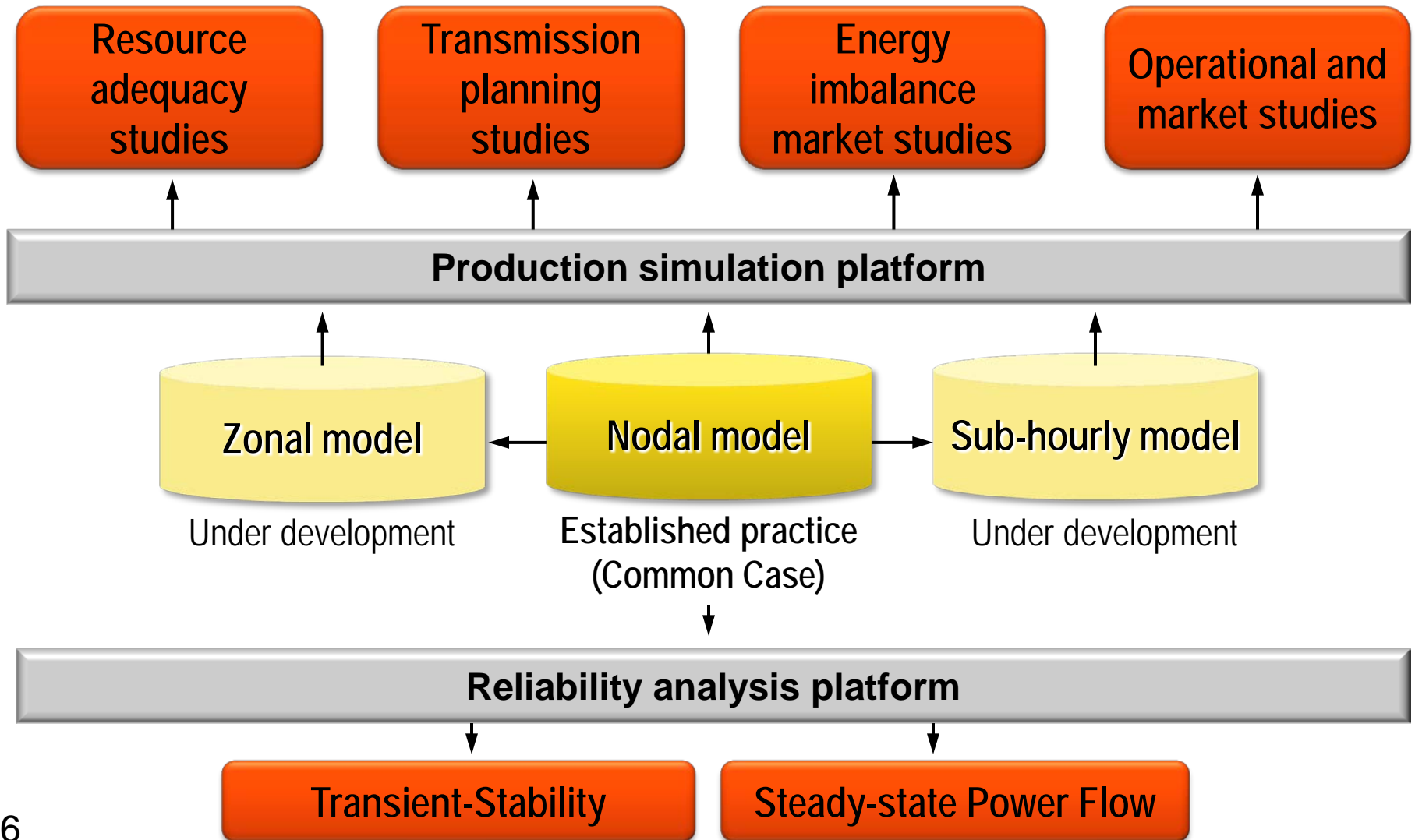
- Consumer Advocates
- State and Provincial Officials
- Transmission Owners, Operators, and Developers
- Generator Owners, Operators, and Developers
- Load-Serving Entities
- Subregional Planning Groups
- Environmental Advocates
- Technology Advocates
- Tribal Representatives
- Federal Agencies

TEPPC Biennial Planning Cycle



Production simulation study platform

Our vision and our new developments



2013 Plan 10-Year Assumptions & Studies impacting Arizona

- 2022 Common Case Transmission Assumptions (CCTA)
- Arizona Stress Test
- Southwest Resource Option under High WECC Load
- Bureau of Land Management (BLM) Outside California Study

2022 Common Case Transmission Assumptions (CCTA)

2022 Common Case Transmission Assumptions (CCTA)

The purpose of the CCTA is to provide a basic set of transmission facilities that TEPPC can use as a starting point for their own studies. The CCTA is a list of facilities that have a high probability of being in service by 2022.

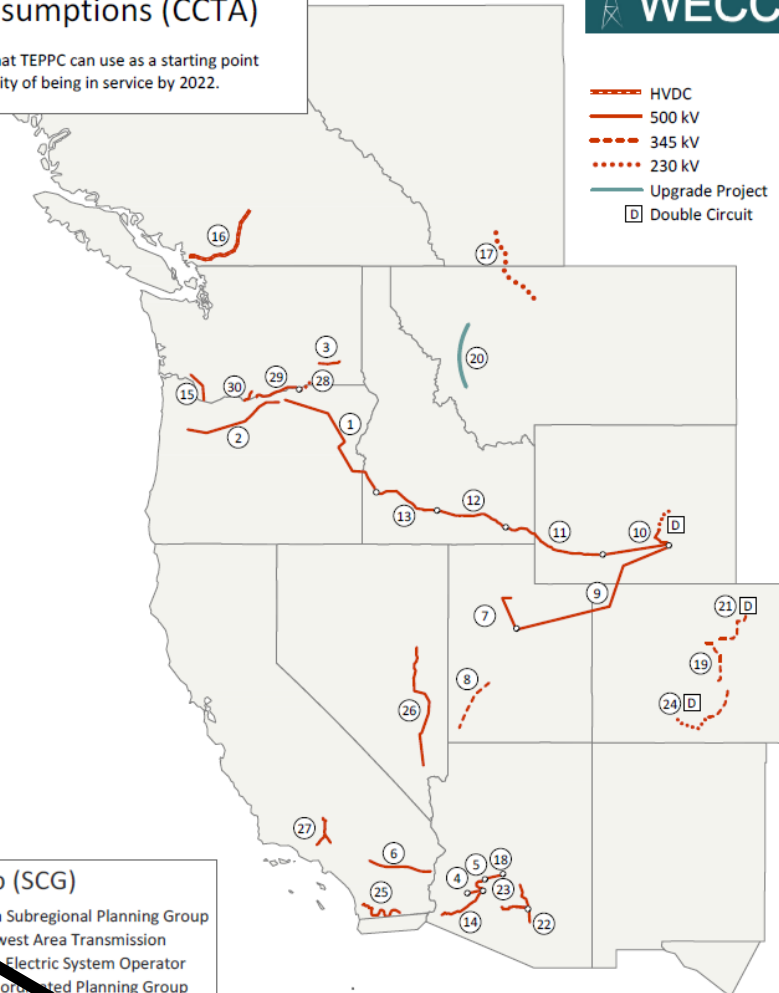
- 1 Boardman-Hemingway (B2H)
- 2 Cascade Crossing
- 3 Central Ferry - Lower Monumental (Little Goose Area Reinforcement)
- 4 Delaney - Palo Verde Line
- 5 Delaney - Sun Valley Line
- 6 Devers - Colorado River (DCR) Project
- 7 Gateway Central Project: Mona to Oquirrh (Segment C)
- 8 Gateway Central Project: Sigurd - Red Butte
- 9 Gateway South Project: Segment 2 (Aeolus - Mona)
- 10 Gateway West Project: Segment 1A (Windstar to Jim Bridger)
- 11 Gateway West Project: Segment 1B (Bridger - Populus single circuit)
- 12 Gateway West Project: Segment 1C (Populus - Midpoint)
- 13 Gateway West Project: Segment E (Midpoint - Hemingway)
- 14 Hassayampa - North Gila #2 Line
- 15 I-5 Corridor Reinforcement Project (Castle Rock - Troutdale)
- 16 Interior to Lower Mainland Transmission (ILM) Project
- 17 Montana Alberta Tie Project (MATL)
- 18 Morgan - Sun Valley Line
- 19 Midway-Waterton
- 20 Path 8 Upgrade/Colstrip Transmission Upgrade (western portion only)
- 21 Pawnee-Smoky Hill
- 22 Pinal Central-Tortolita
- 23 Pinal West-Pinal Central-Browning (SEV)
- 24 San Luis Valley-Calumet-Comanche
- 25 Sunrise Powerlink
- 26 SWIP South
- 27 Tehachapi Renewable Transmission Project
- 28 Walla Walla to McNary (Energy Gateway Segment A)
- 29 West of McNary Reinforcement Project Group 1 (McNary - John Day)
- 30 West of McNary Reinforcement Project Group 2 (Big Eddy - Knight)

Subregional Coordination Group (SCG)

- | | |
|--|---|
| CAISO - California Independent System Operator | SWAPA - Sierra Subregional Planning Group |
| CTPG - California Transmission Planning Group | SWATA - Southwest Area Transmission |
| CG - ColumbiaGrid | AESO - Alberta Electric System Operator |
| CCPG - Colorado Coordinated Planning Group | BCCPG - BC Coordinated Planning Group |
| NTTG - Northern Tier Transmission Group | |



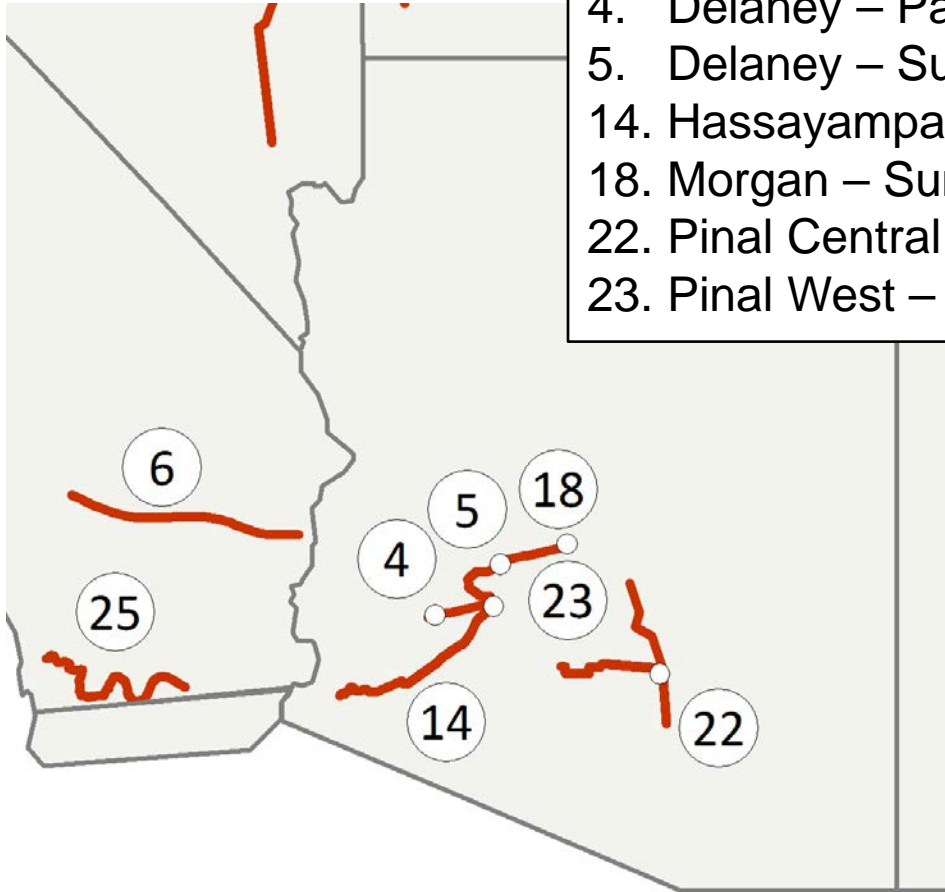
- HVDC
- 500 kV
- 345 kV
- 230 kV
- Upgrade Project
- Double Circuit



Now the Regional Planning Coordination Group (RPCG)

2022 CCTA in Arizona

- 4. Delaney – Palo Verde 500kV Line
- 5. Delaney – Sun Valley 500kV Line
- 14. Hassayampa – North Gila #2 500kV Line
- 18. Morgan – Sun Valley 500kV Line
- 22. Pinal Central Tortolita 500kV Line
- 23. Pinal West – Pinal Central – Browning (SEV) 500kV

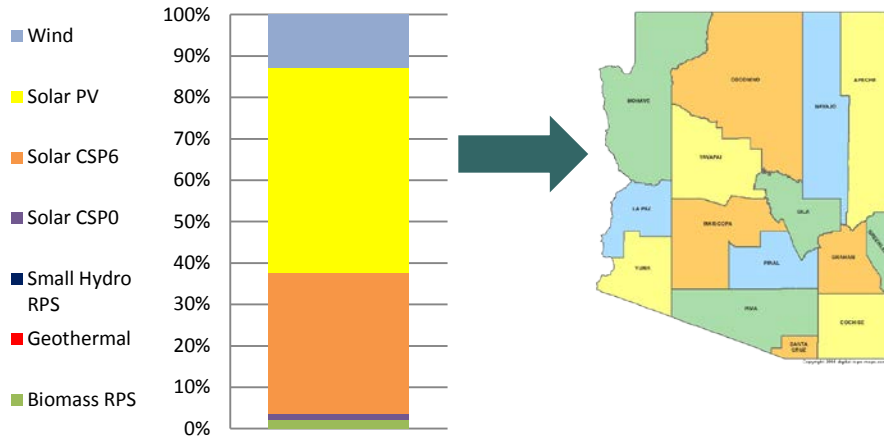


Developed by the
Regional Planning Coordination
Group (RPCG),
*formerly the
Subregional Coordination Group (SCG)*

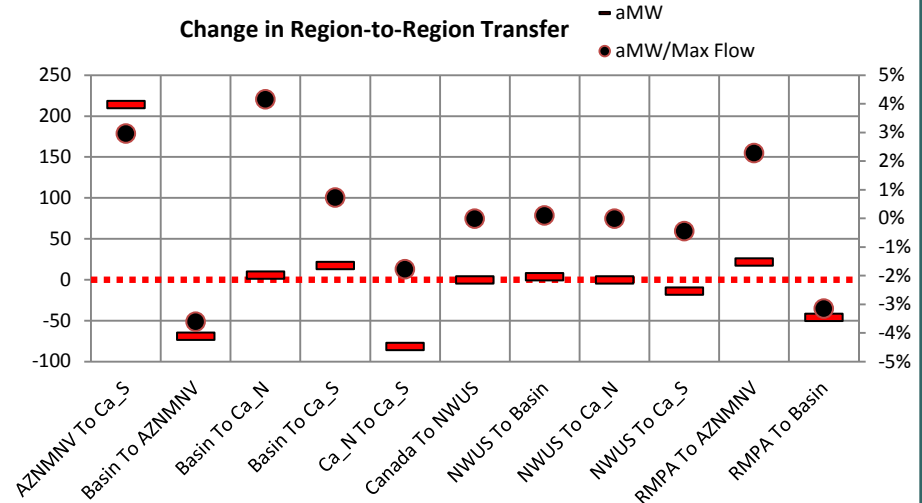
Arizona Stress Test

Assumptions

Resource Additions - 6,000 GWh

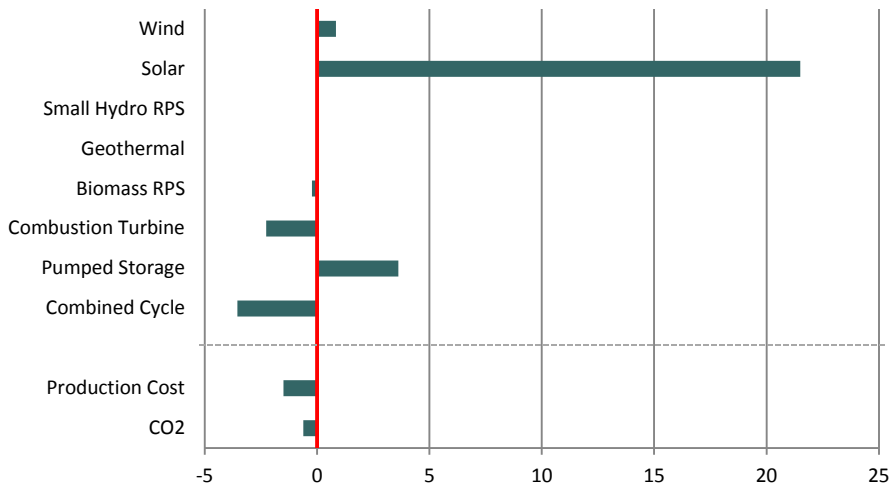


Transmission Results



Generation Impacts

Percent Change: Generation, CO2, Production Cost



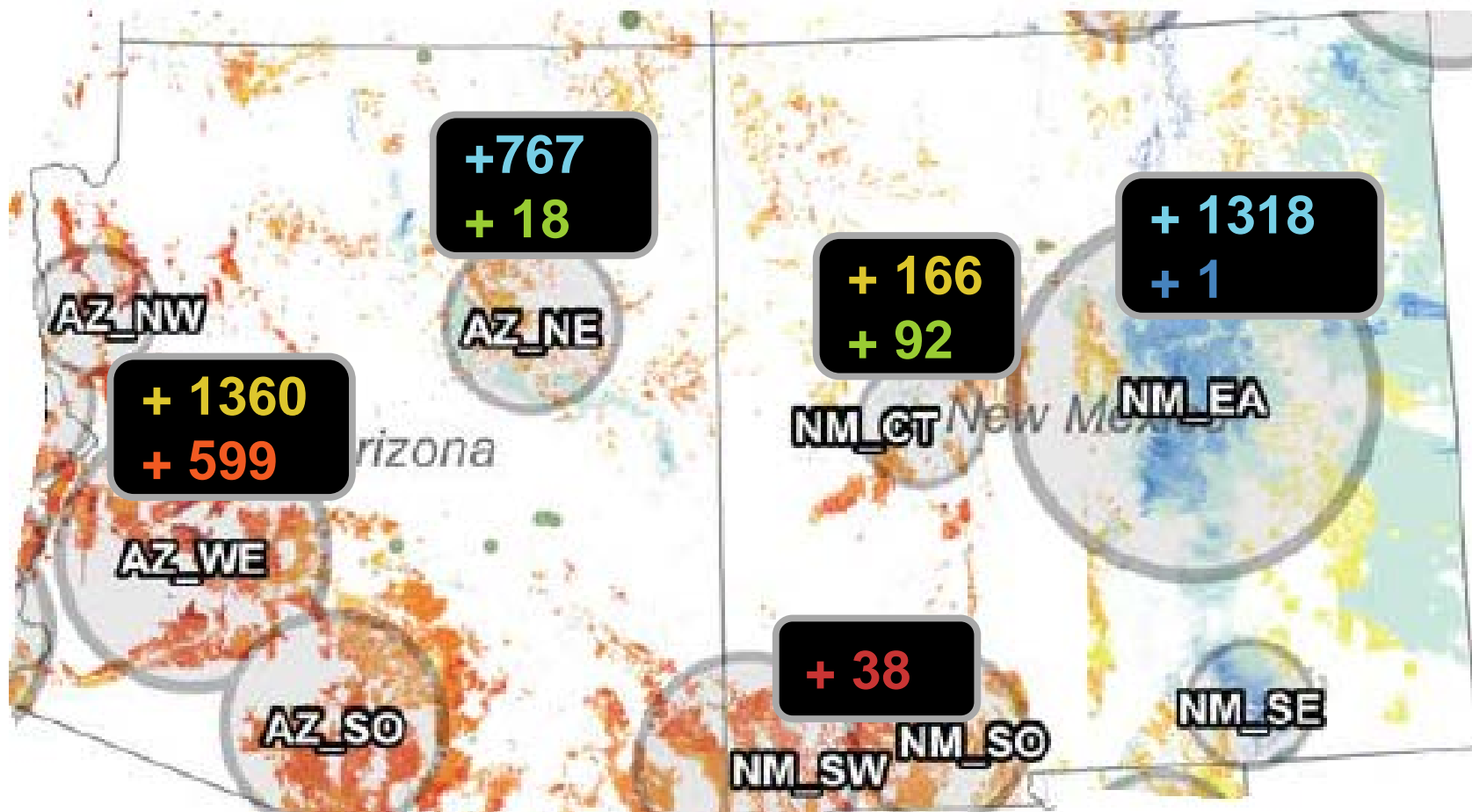
Key Finding

Increase in AZ to CA imports. Congestion on P29. More detailed analysis required.



Southwest Resource Option

+8% WECC load and +12,000GWh of Renewable Resources:



Wind Solar PV Solar Thermal Small Hydro Geothermal Biomass RPS

Southwest Resource Option (cont'd)

How SW stacked up:

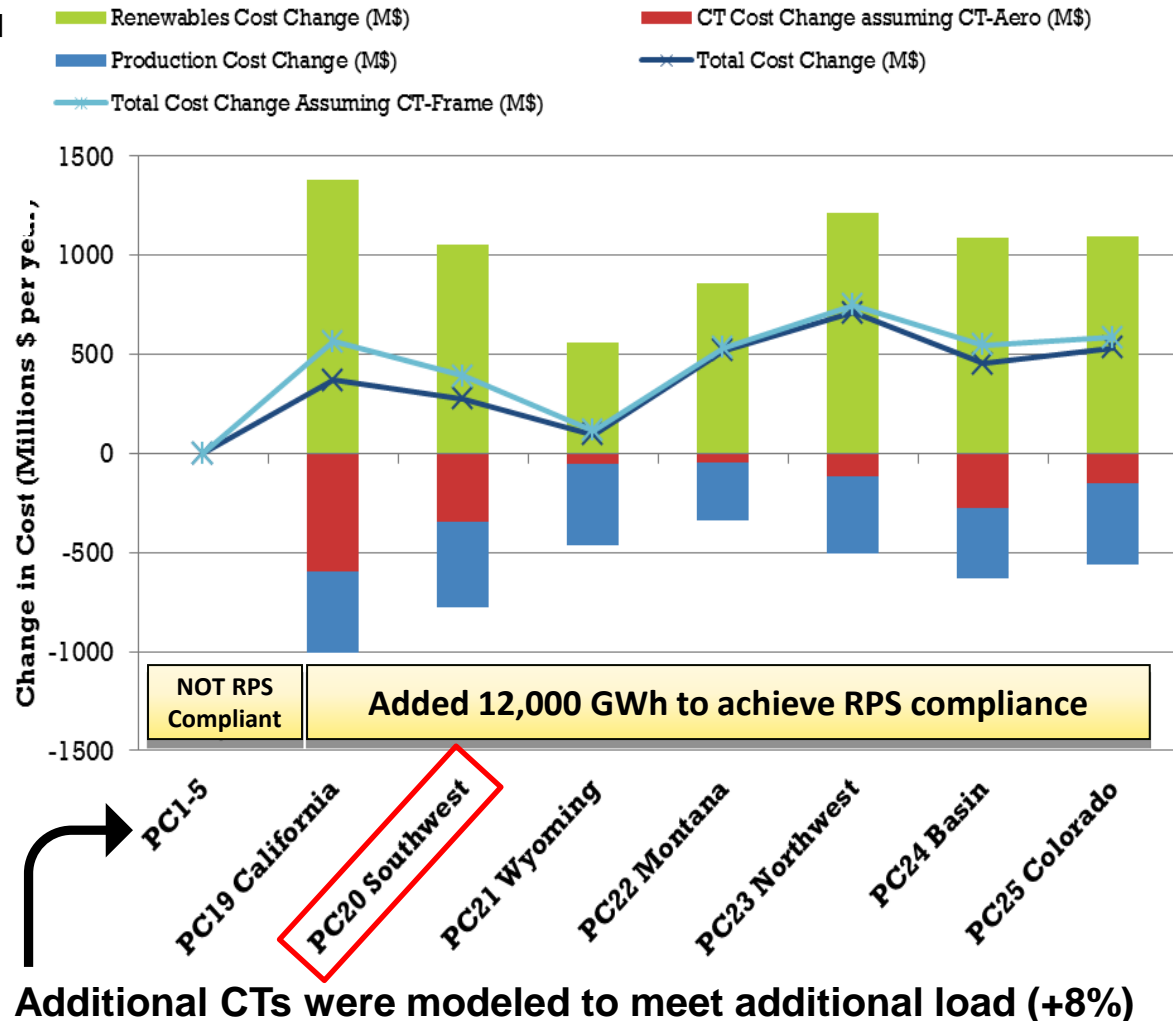
- **Low Cost Renewables: 3rd**
- **Low Total Cost: 2nd/3rd**
(depending on CT tech/cost assumption)

New thinking in Resource Adequacy (RA) since study:

- Improved assumptions:
 - Solar ↓
 - Wind ↑
- Utilizing Energy Load Carry Capability (ELCC) Analyses is planned

Change in Cost (\$M) to Achieve RPS-Compliance under High Loads

(no transmission, comparison with PC1-5 High Load non-RPS compliant case)



BLM Outside California Study Initial Assumptions

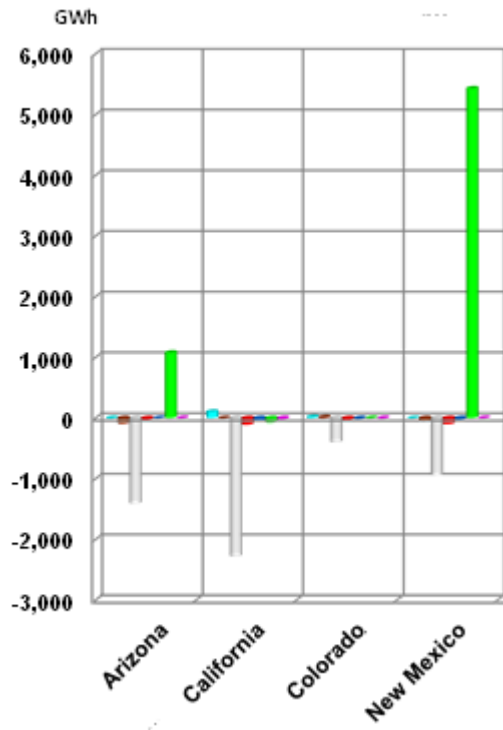


BLM Outside California Study

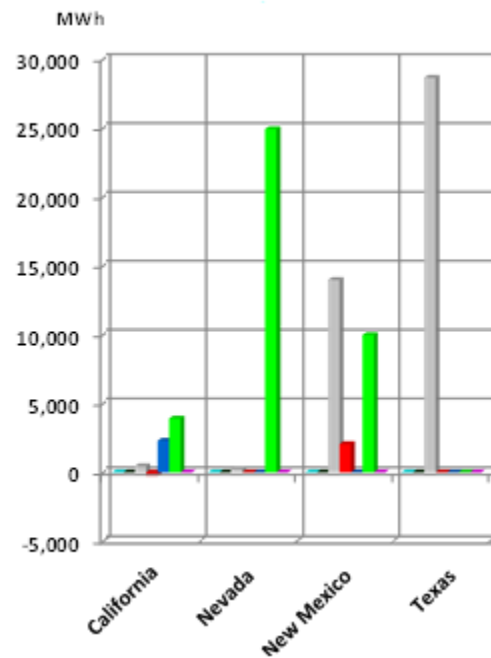
Initial Results

■ Hydro+PS
 ■ Steam - Boiler
 ■ Combined Cycle
 ■ Combustion Turbine
 ■ Cogeneration
 ■ Renewable
 ■ Other

Change in Annual Energy



Change in Dump Energy



BLM Outside California Study Transmission Expansion Assumptions



BLM Outside California Study Transmission Expansion Results

Addition of Armargosa-Northwest 500kV Line
+
SunZia Project double-circuit 500kV Line



- +1,500 GWh of NV renewable offset NV & CA combined cycle generation
- Negated all dump energy in initial results
- -\$80 Million (-0.5%) change in variable production cost

2013/14 Study Programs'

Study Themes

- Unified, foundational datasets & tools
- Mitigation of future issues via resources and transmission
- Integration of renewables & distributed generation (impact on transmission)
- Base load resource retirements
- Electric grid vs. other systems (e.g., water-energy nexus)

“Expected” Transmission Through 2024

2024 Common Case Transmission Assumptions (CCTA)

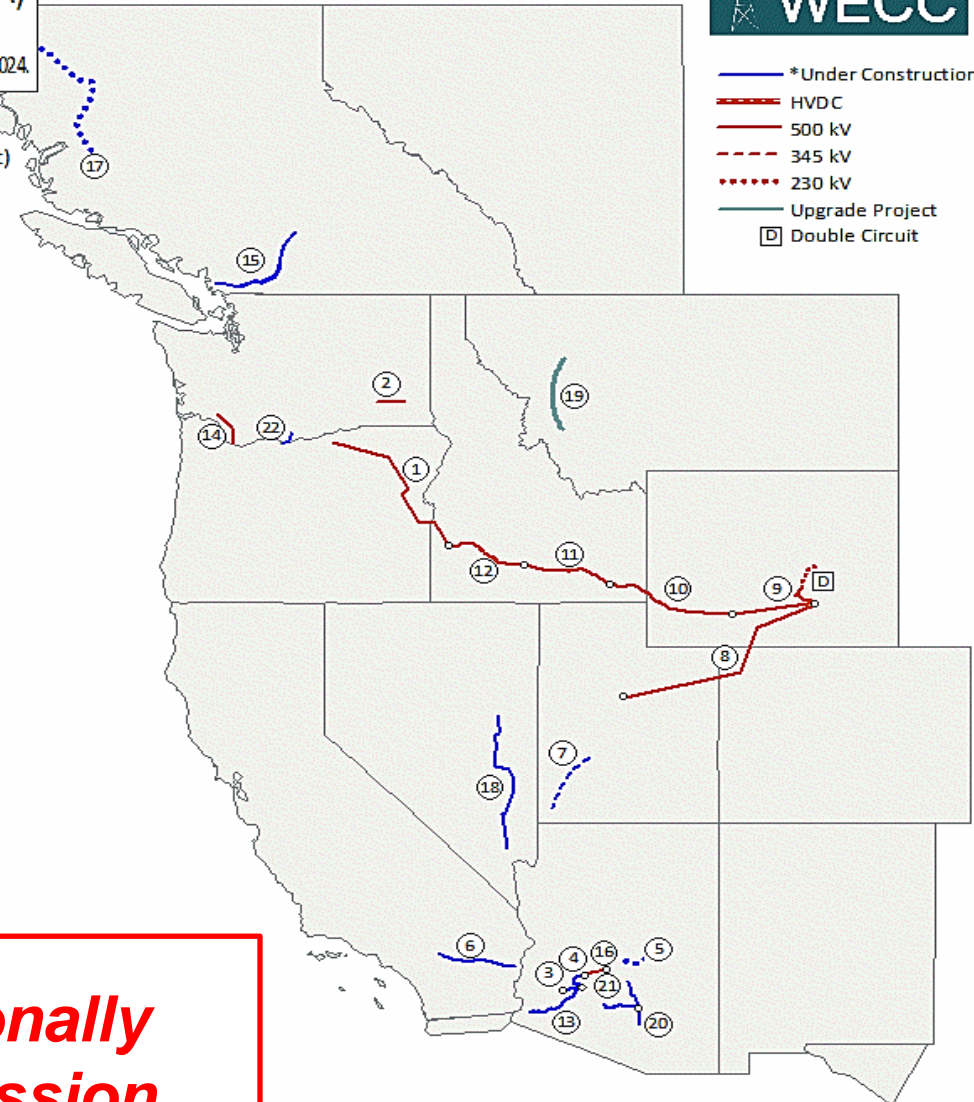
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- ① Boardman-Hemingway (B2H)
- ② Central Ferry - Lower Monumental (Little Goose Area Reinforcement)
- ③ Delaney - Palo Verde Line
- ④ Delaney - Sun Valley Line
- ⑤ Desert Basin - Pinal Central
- ⑥ Devers - Colorado River (DCR) Project
- ⑦ Gateway Central Project: Sigurd - Red Butte
- ⑧ Gateway South Project: Segment 2 (Aeolus - Mona)
- ⑨ Gateway West Project: Segment 1A (Windstar to Jim Bridger)
- ⑩ Gateway West Project: Segment 1B (Bridger - Populus single circuit)
- ⑪ Gateway West Project: Segment 1C (Populus - Midpoint)
- ⑫ Gateway West Project: Segment E (Midpoint - Hemingway)
- ⑬ Hassayampa - North Gila #2 Line
- ⑭ I-5 Corridor Reinforcement Project (Castle Rock - Troutdale)
- ⑮ Interior to Lower Mainland Transmission (ILM) Project
- ⑯ Morgan - Sun Valley Line
- ⑰ Northwest Transmission Line
- ⑱ One Nevada Line (ON Line)
- ⑲ Path 8 Upgrade/Colstrip Transmission Upgrade
- ⑳ Pinal Central-Tortolita
- ㉑ Pinal West-Pinal Central-Browning (SEV)
- ㉒ West of McNary Reinforcement Project Group 2 (Big Eddy - Knight)

Blue text - Indicates Under Construction



- *Under Construction
- HVDC
- 500 kV
- - - 345 kV
- ⋯ 230 kV
- Upgrade Project
- Double Circuit



* As of November 11, 2013

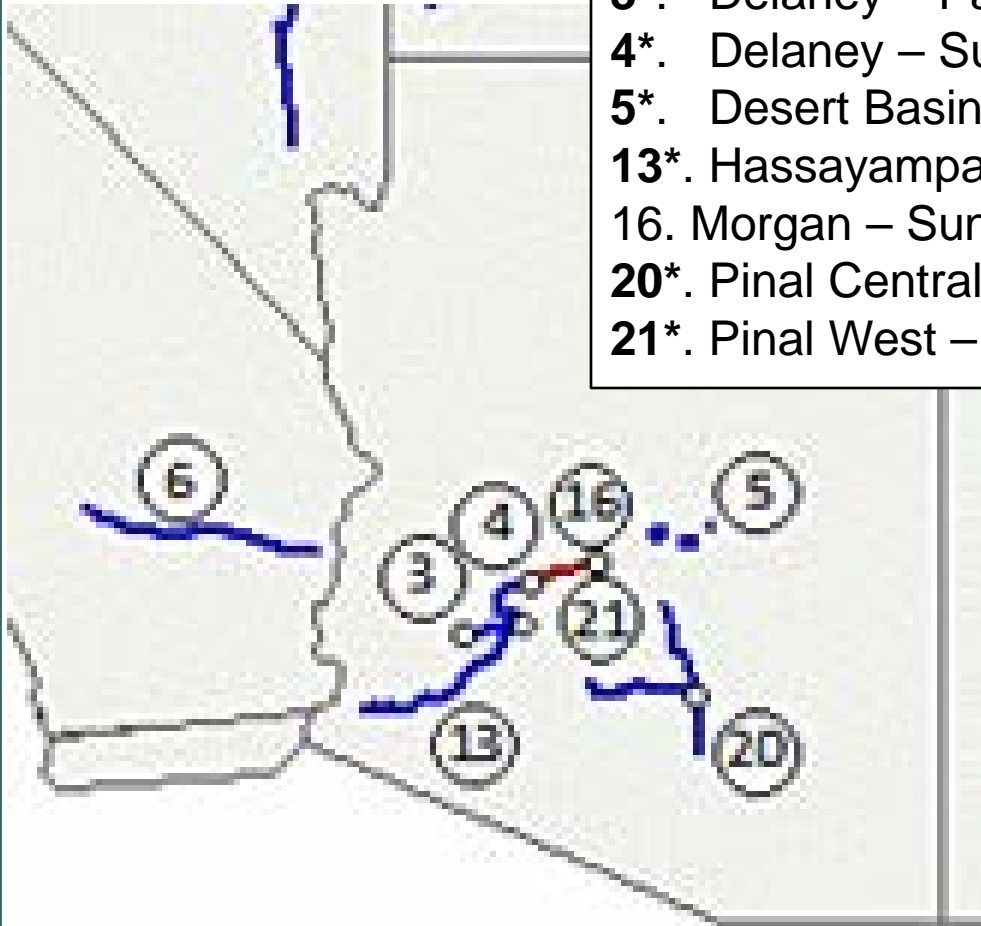
2400 miles of regionally significant transmission

Source: RPCG CCTA Report for 2024

2024 CCTA in Arizona

- 3*. Delaney – Palo Verde 500kV Line
- 4*. Delaney – Sun Valley 500kV Line
- 5*. Desert Basin – Pinal Central 230kV Line
- 13*. Hassayampa – North Gila #2 500kV Line
- 16. Morgan – Sun Valley Line 500kV Line
- 20*. Pinal Central – Tortolita 500kV Line
- 21*. Pinal West – Pinal Central – Browning (SEV) 500kV

* Under Construction



Questions?



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