

## DOCKETED

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# Planning for a Reliable Western Interconnection

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Western Interstate Energy Board

RETI 2.0 Planning Goals  
Workshop  
January 29, 2016

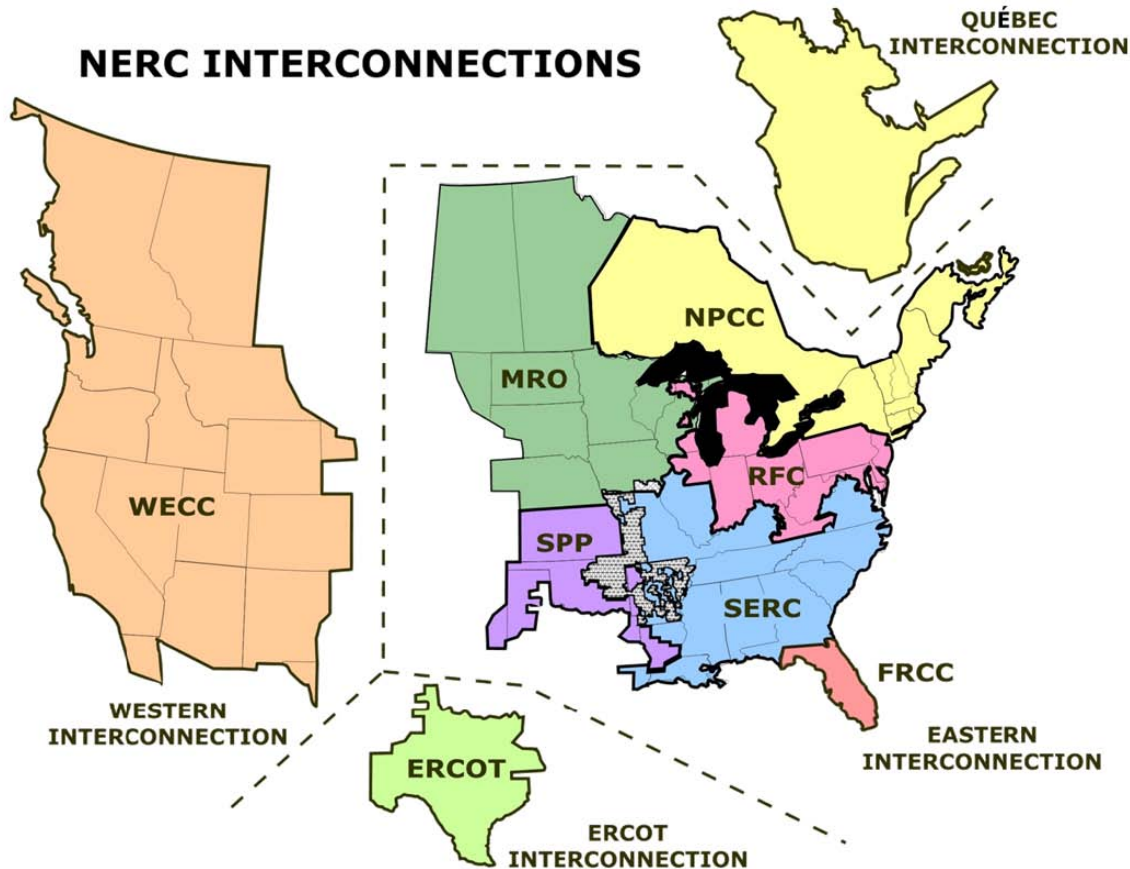


# Topics

- 1. WECC's Common Case**
- 2. RPS policies and renewable energy development**
- 3. Study case: Coal plant retirement future**



# Western Interconnection Footprint





# 1. WECC's Common Case

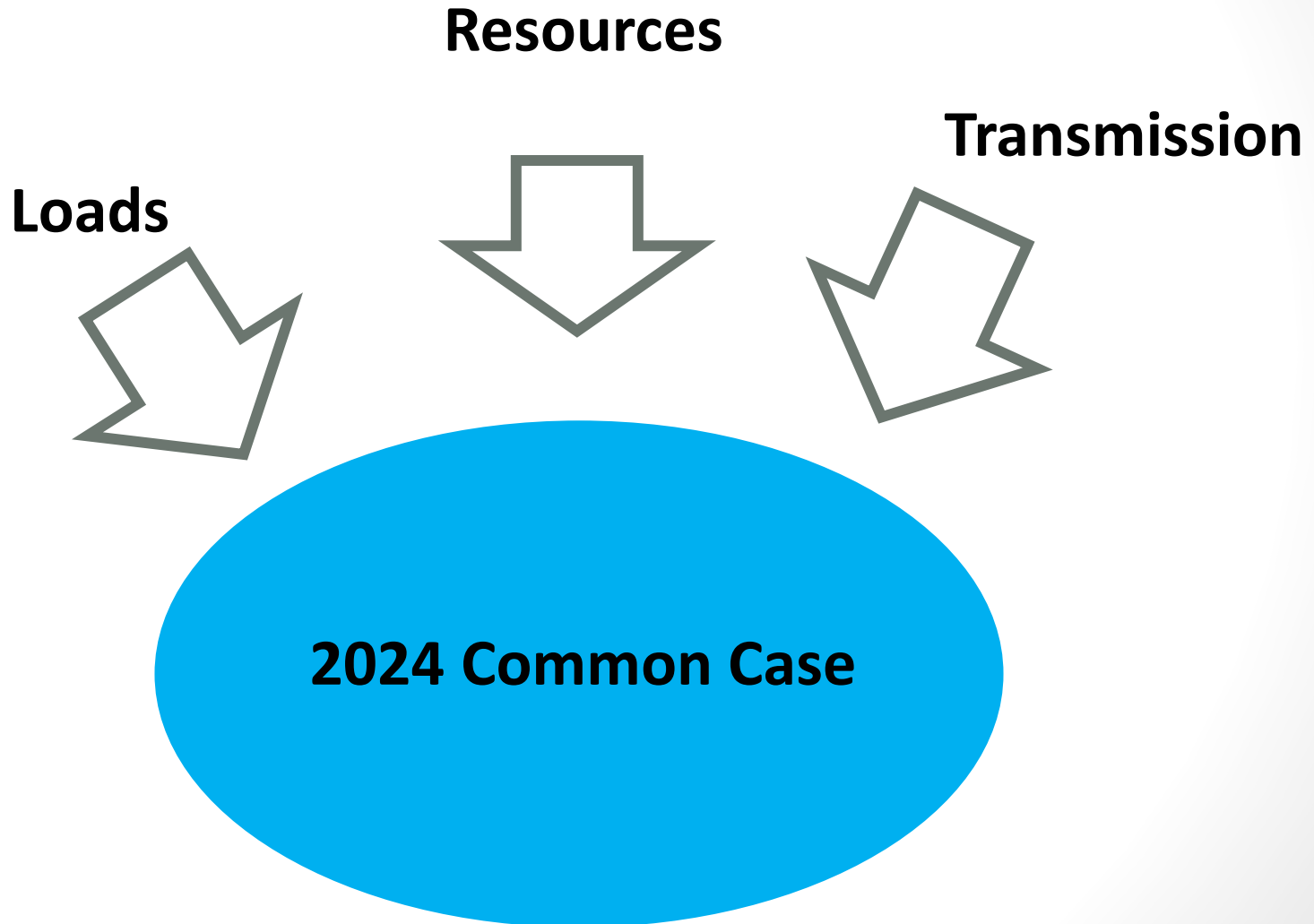


# WECC's 2024 Common Case

- Developed by WECC's Transmission Expansion Planning Policy Committee (TEPPC)
- Expected 10-year future
  - Production cost model for the year 2024 that simulates hourly power generation for the Western Interconnection
  - Critical assumptions:
    - Load forecasts for every Balancing Authority
    - Generation resources consistent with RPS policies and planned coal plant retirements (7200 MW)
    - Transmission system including projects expected to be online 2024
- New 2026 Common Case being developed, 2016 1<sup>st</sup> Qtr
  - Updated data
  - Modeling improvements
    - "Roundtrip" capability production cost model and power flow model



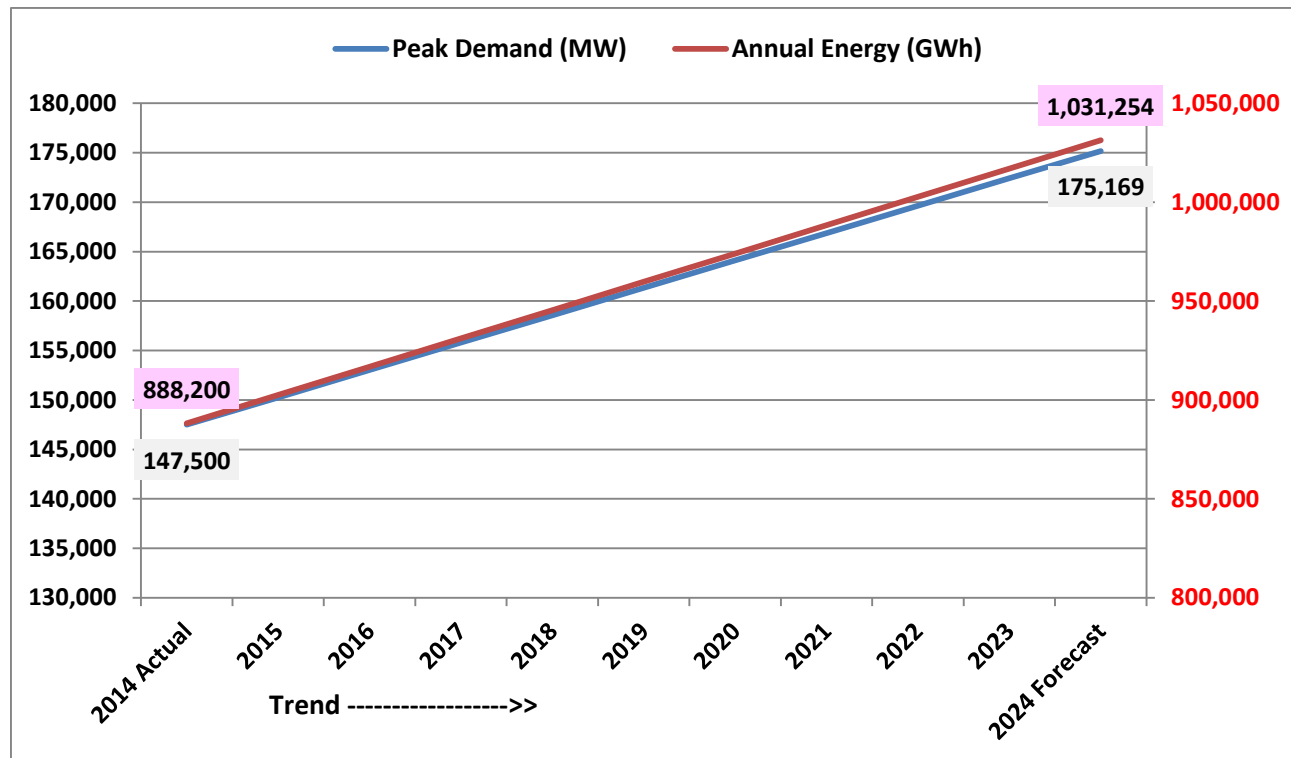
# Inputs to the Common Case





# Load forecast 2024

- Peak demand: compound annual growth rate 1.7%
- Energy demand: compound annual growth rate 1.5%
- 

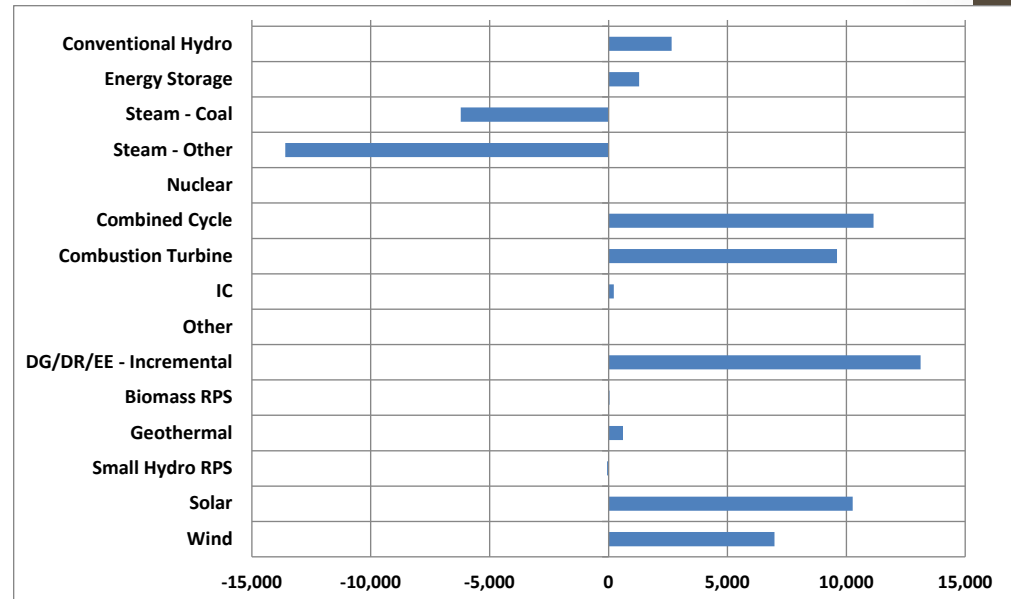
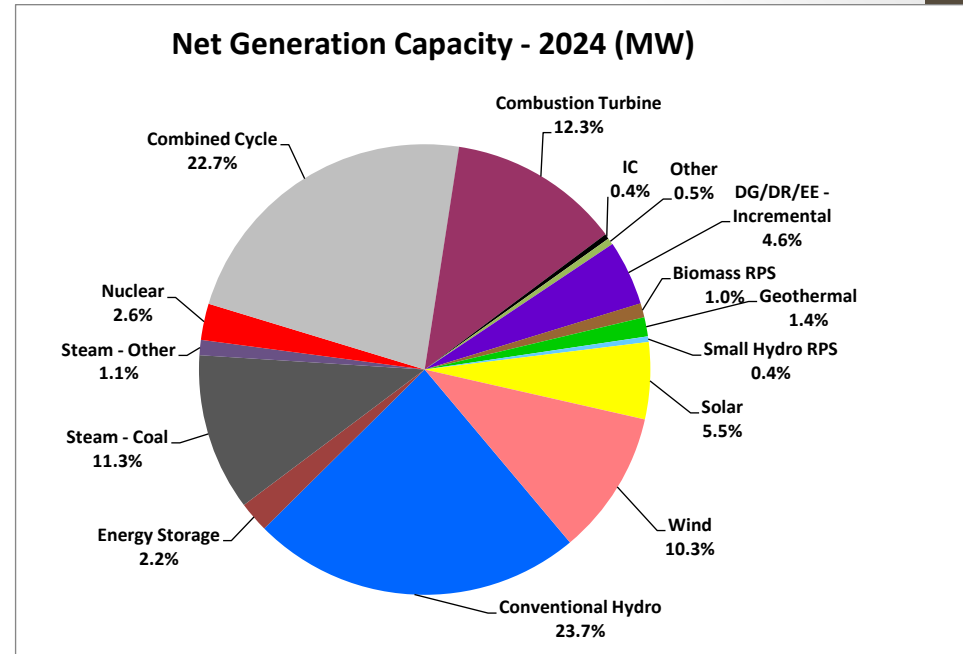






# Generation 2024

- Fossil Retirements:
  - Coal - 7 GW
  - OTC / Other steam -14 GW
- Fossil Additions
  - Gas generators +20 GW
- Renewable Additions
  - GW Solar +10 GW
  - Wind +7 GW
- Demand-side Additions:
  - DG-DR-EE +13 GW





# Transmission 2024

- Common Case Transmission Assumptions (CCTA)
  - Proposed transmission projects likely to be completed 2024
  - 22 projects and line additions for +2,500 miles

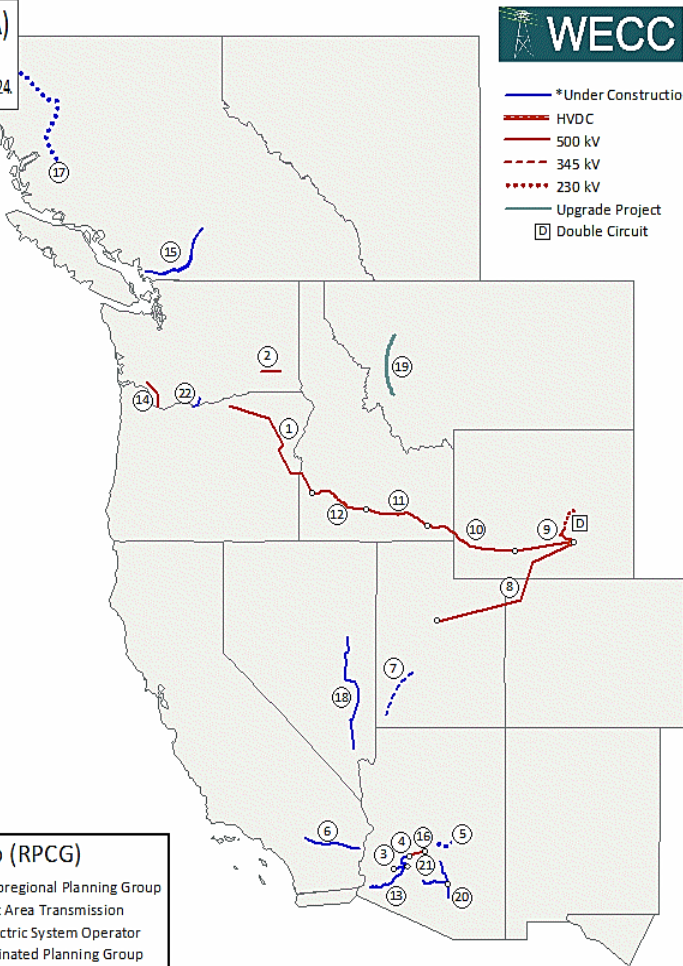
## 2024 Common Case Transmission Assumptions (CCTA)

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 are expected to be in service by 2024.

- 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

| Regional Planning Coordination Group (RPCG)    |  |
|--|--|
| CAISO - California Independent System Operator | SIERRA - Sierra Subregional Planning Group |
| CTPG - California Transmission Planning Group  | SWAT - 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        |  |



\* As of November 11, 2013



# Uses of the Common Case

## TEPPC Process

2024 Common Case



Study Cases  
(i.e. alternative future)



Expansion Cases  
(i.e. add transmission)



## Outside TEPPC

- Regional Planning Groups
- EIM Studies
- WIEB Gas-Electric Study
- NREL's Western Wind and Solar Integration Studies
- WECC-WIEB Flexibility Assessment Study
- Clean Power Plan analysis



## **2. RPS policies and renewable energy development**



# RPS and Renewable Energy

| State/<br>Province | RPS% for<br>IOUs in<br>2024 | 2024 RPS<br>Target | 2024<br>Common<br>Case<br>Renewable<br>Energy<br>(GWh) | 2024<br>Adjusted<br>Load<br>Forecast<br>(GWh) |
|--------------------|-----------------------------|--------------------|--|---|
| AB                 |                             |                    | 7,201  | 113,234                                       |
| AZ                 | 14.0%                       | 8,325              | 6,446  | 103,465                                       |
| BC                 |                             |                    | 3,441  | 68,154  |
| CA                 | 33.0%                       | 93,377             | 95,362   | 321,134                                       |
| CO                 | 30.0%                       | 11,453             | 10,283   | 61,476  |
| ID                 |                             |                    | 1,824  | 29,013  |
| MEX                |                             |                    | 6,259  | 14,985  |
| MT                 | 15.0%                       | 1,061              | 920  | 14,981  |
| NV                 | 24.5%                       | 8,410              | 10,231   | 44,241  |
| NM                 | 20.0%                       | 3,028              | 2,424  | 19,059  |
| OR                 | 24.0%                       | 11,593             | 9,603  | 58,056  |
| TX                 | 5.0%                        | 429                | 164  | 8,458   |
| UT                 | 18.7%                       | 5,498              | 2,205  | 31,396  |
| WA                 | 15.0%                       | 12,821             | 11,062   | 112,464                                       |
| WY                 |                             |                    | 2,727  | 20,022  |
| <b>Total</b>       |                             | <b>155,994</b>     | <b>170,151</b>   | <b>1,020,137</b>                              |

- 10 States with RPS
- State RPS policies are all unique
- Non-RPS states/provinces have significant RE
- 2024 Common Case estimates:
  - RPS RE = 15.3%
  - Total RE = 16.7%
  - Before SB 350 and CPP



# 3. Coal Retirement Study

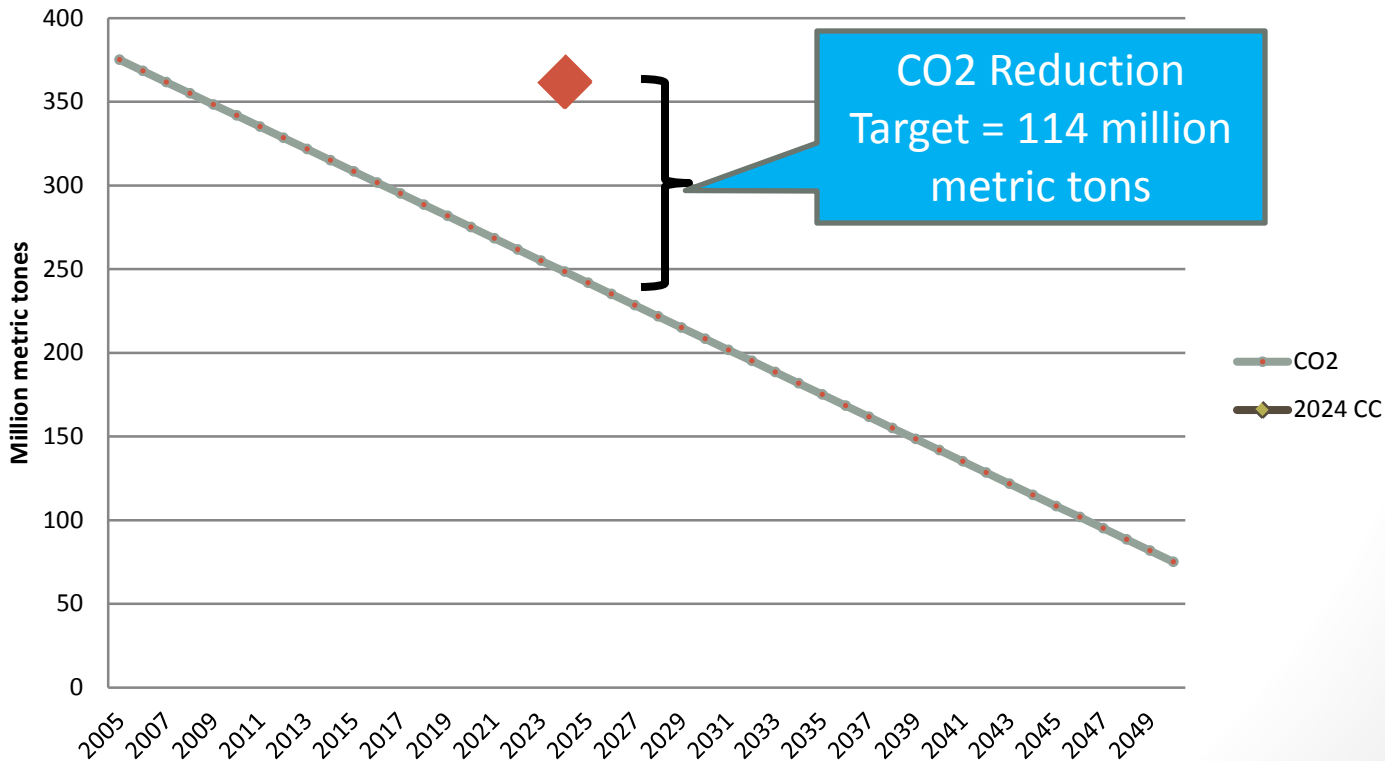


# Study Objective

- Target coal plant retirements to reduce emissions in 2024 to a trajectory moving to an 80% reduction in emissions by 2050 relative to the 2005 level.

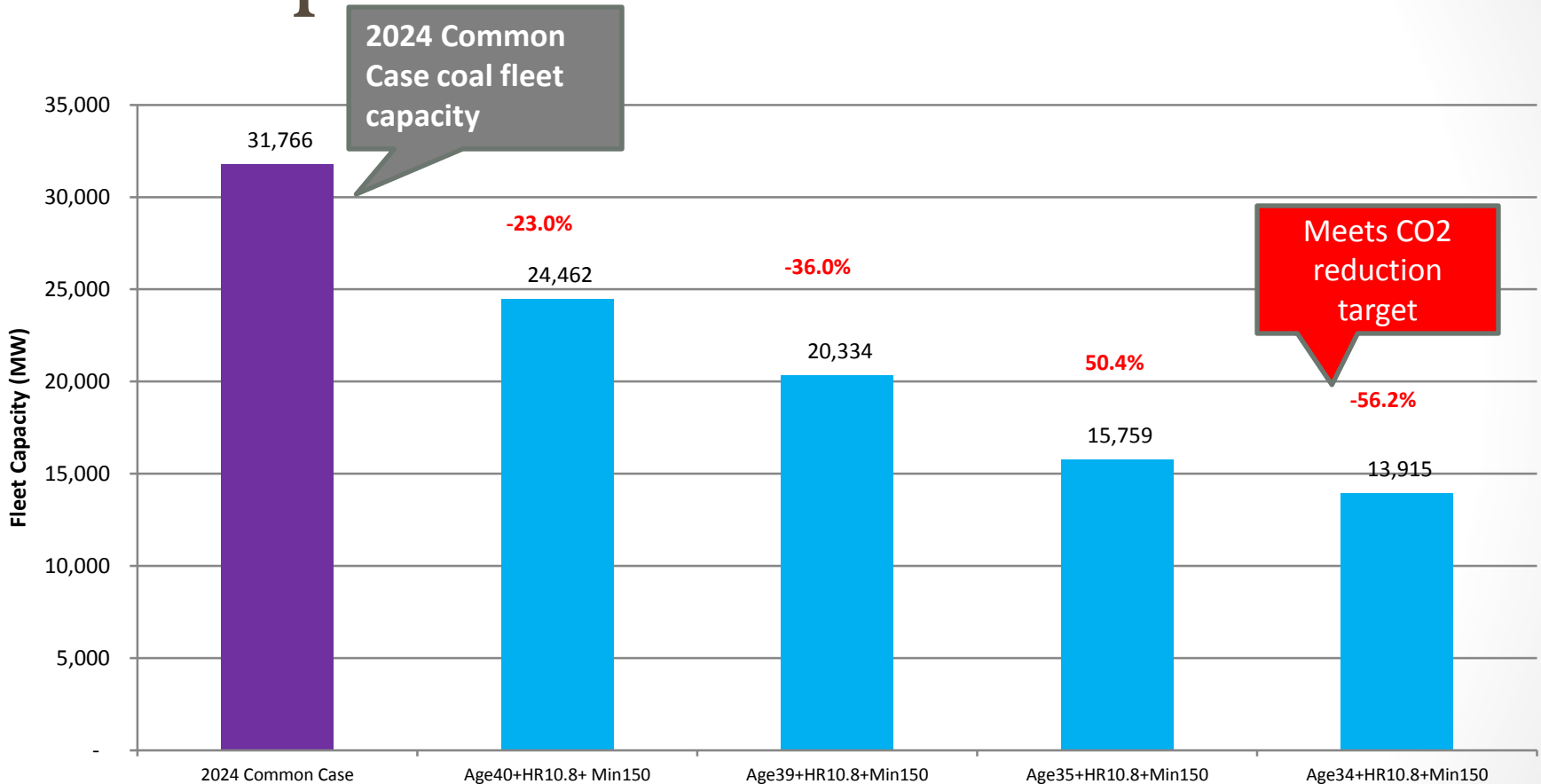
| Yr                  | CO2 | % change |
|---------------------|-----|----------|
| 2005                | 375 |          |
| 2024                | 248 | 33.8%    |
| 2034                | 182 | 51.6%    |
| 2050                | 75  | 80.0%    |
| 2024 Common Case    |     | 362      |
| 2024 Target         |     | 248      |
| Reduction from 2024 |     | 114      |

CO2 Emission Path to 80% Reduction in 2050





# Coal Fleet with Retirement Options





# PC21 Additional Coal Retirements

| AB                     | AZ                 | CA                    | CO                  | MT                      | UT                       | WY                       |
|------------------------|--------------------|-----------------------|---------------------|-------------------------|--------------------------|--------------------------|
| Battle River 4,5 [537] | Apache 2,3 [350]   | ACE Cogen [103]       | Comanche 1,2 [660]  | Colstrip 1,2,3 [1354]   | Huntington 1,2 [909]     | Dave Johnston 1-4 [762]  |
| Genesse 2 [390]        | Cholla 1,3 [387]   | Argus 8,9 [50]        | Craig 1,2 [863]     |                         | Intermountain 1,2 [1800] | Jim Bridger 1,2,3 [1581] |
| Sheerness 1,2 [780]    | Coronado 1 [380]   | Casterville [1]       | Hayden 1,2 [446]    | NM                      | KUCC 1-4 [175]           | Naughton 1,2 [357]       |
| Sundance 3 [362]       | H.W. Sundt 4 [156] | Fellow [1]            | M Drake 5,6,7 [254] | Four Corners 4,5 [1540] | Sunnyside [53]           | Neil Simpson 2 [80]      |
|                        | Navajo 2,3 [1500]  | Jackson Valley [21]   | Nucla 1-4 [100]     |                         |                          | Wygen 1,2 [180]          |
|                        |                    | Lassen [22]           | R D Nixon 1 [208]   | NV                      | WA                       | Wyodak [340]             |
|                        |                    | Mt Poso [35]          |                     | N Valmy 2 [268]         | Centralia 2 [688]        |                          |
|                        |                    | Phillips Carbon [16]  |                     | TS Power 1 [227]        |                          |                          |
|                        |                    | Portland Cement [28]  |                     |                         |                          |                          |
|                        |                    | Port of Stockton [44] |                     |                         |                          |                          |

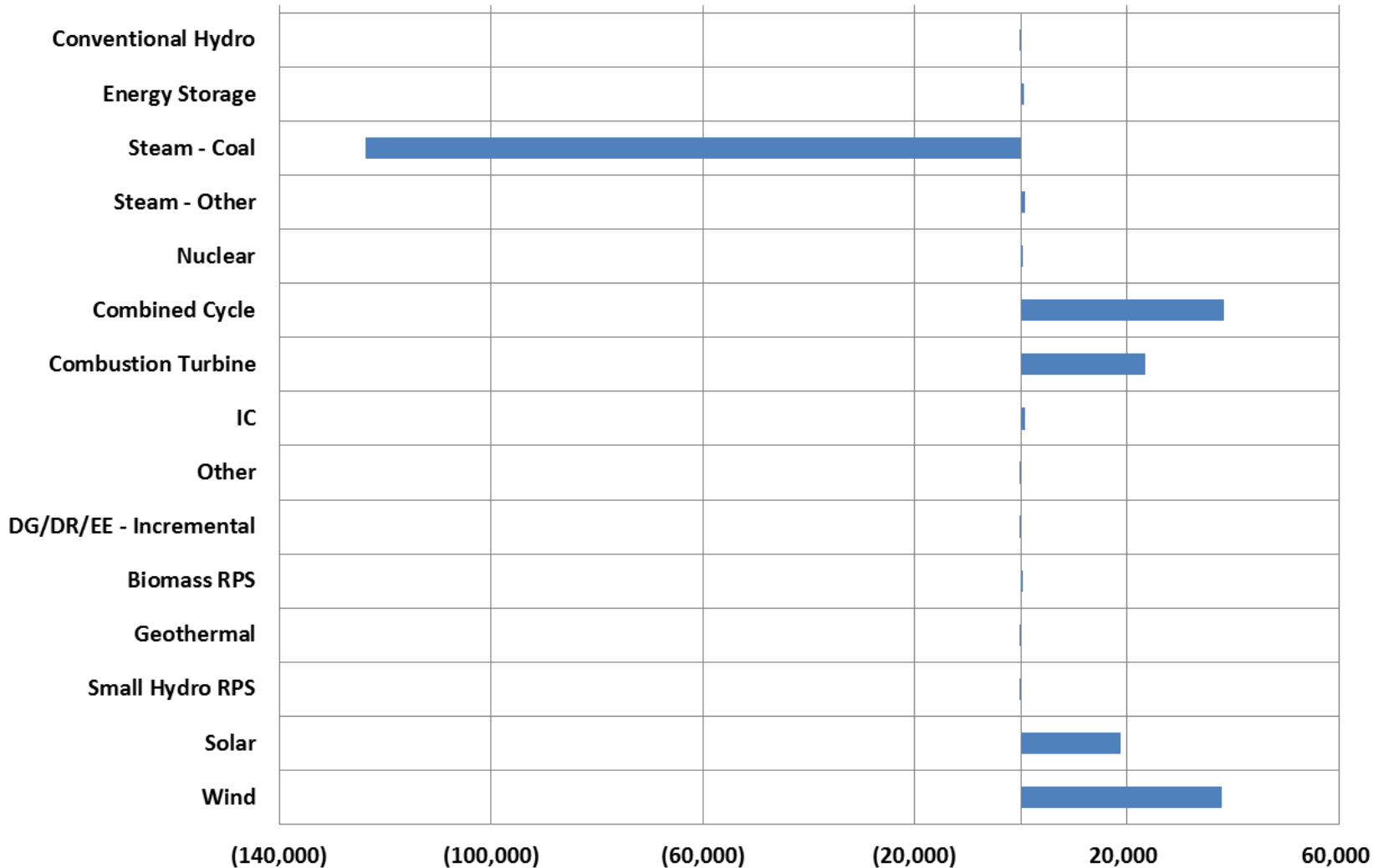
# Replacement Sources

| Repl. Type       | AB         | AZ                       | CA        | CO         | MT         | NM         | NV        | UT         | WA        | WY         | Total       | Est. Energy | %     |
|------------------|------------|--------------------------|-----------|------------|------------|------------|-----------|------------|-----------|------------|-------------|-------------|-------|
| CC (MW)          | 150        | 150                      | 0         | 150        | 0          | 0          | 0         | 150        | 0         | 0          | 600         | 3,162,240   | 4.7%  |
| CT (MW)          | 100        | 100                      | 0         | 100        | 100        | 100        | 0         | 100        | 100       | 100        | 800         | 2,108,160   | 3.1%  |
| ES (MW)          | 100        | 200                      | 200       | 300        | 100        | 200        | 200       | 200        | 100       | 100        | 1,700       | 2,986,560   | 4.5%  |
| Wind (MWh)       | 8,100,000  | 500,000                  | 90,000    | 7,100,000  | 5,360,000  | 1,100,000  | 300,000   | 2,400,000  | 900,000   | 12,800,000 | 38,650,000  | 38,650,000  | 57.7% |
| Solar (MWh)      | 0          | 8,350,000                | 1,020,000 | 1,050,000  | 0          | 3,800,000  | 1,200,000 | 3,800,000  | 200,000   | 0          | 19,420,000  | 19,420,000  | 29.0% |
| EE (MWh)         | 0          | 200,000                  | 0         | 0          | 0          | 180,000    | 100,000   | 100,000    | 100,000   | 0          | 680,000     | 680,000     | 1.0%  |
| DR (MWh)         | 0          | 0                        | 0         | 0          | 0          | 0          | 0         | 0          | 0         | 0          | 0           | 0           | 0.0%  |
| Est. Total (MWh) | 9,329,760  | 10,455,440               | 1,461,360 | 9,731,120  | 5,799,200  | 5,694,880  | 1,951,360 | 7,705,440  | 1,639,200 | 13,239,200 | 67,006,960  | 67,006,960  |       |
| Retired MWh      | 16,553,012 | 19,682,519               | 1,862,735 | 18,045,821 | 10,605,822 | 10,666,663 | 2,630,431 | 15,667,241 | 4,079,949 | 25,356,690 | 125,150,883 |             |       |
| Difference       | 7,223,252  | 9,227,079                | 401,375   | 8,314,701  | 4,806,622  | 4,971,783  | 679,071   | 7,961,801  | 2,440,749 | 12,117,490 | 58,143,923  |             |       |
| % Replaced       | 56.4%      | 53.1%                    | 78.5%     | 53.9%      | 54.7%      | 53.4%      | 74.2%     | 49.2%      | 40.2%     | 52.2%      | 53.5%       |             |       |
|                  |            |                          |           |            |            |            |           |            |           |            |             |             |       |
|                  |            | Assumed Capacity Factors |           |            |            |            |           |            |           |            |             |             |       |
|                  |            | CC                       | CT        | ES         |            |            |           |            |           |            |             |             |       |
|                  |            | 60%                      | 30%       | 20%        |            |            |           |            |           |            |             |             |       |

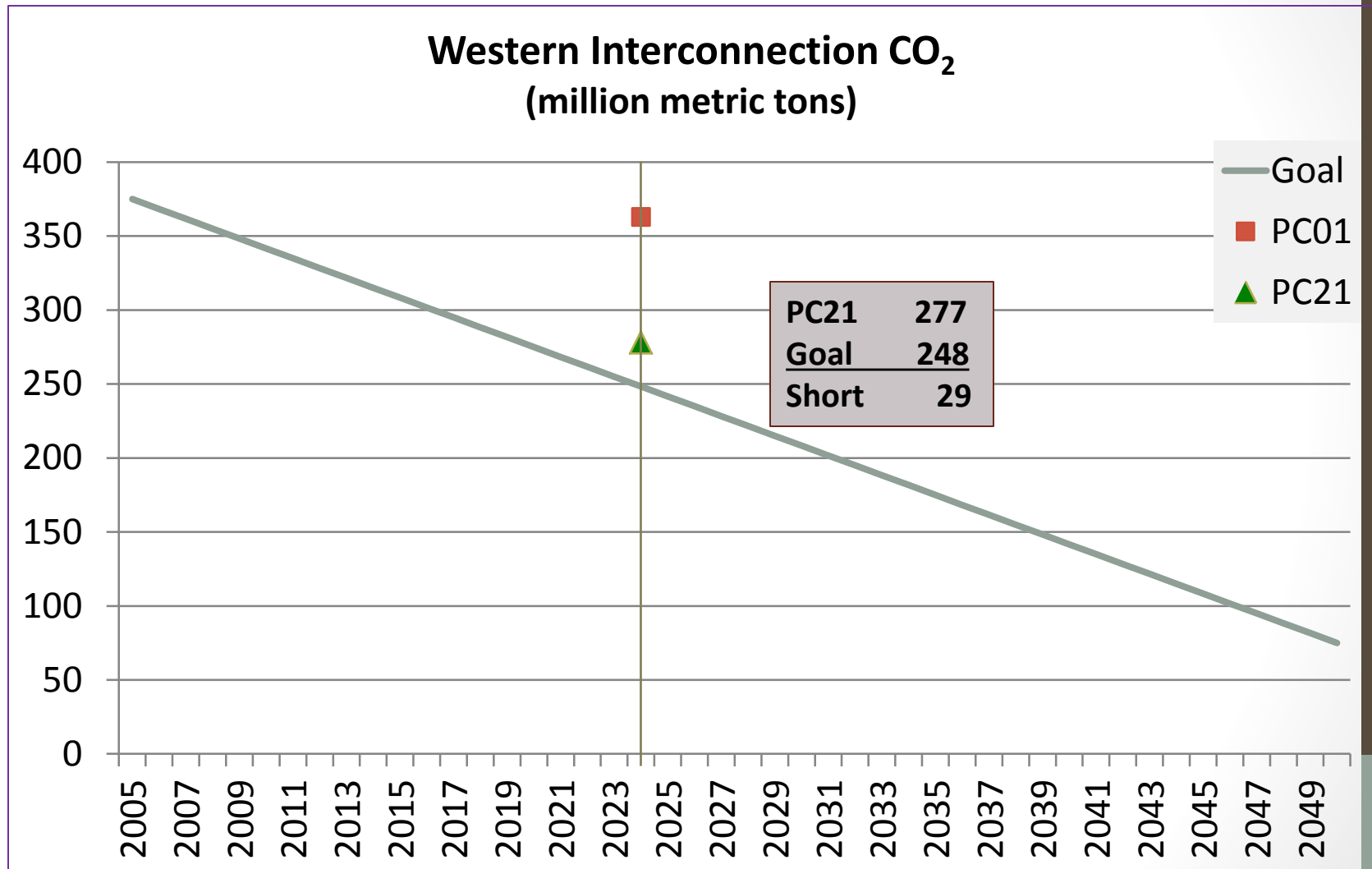
The Retired MWh represents the energy produced by the PC21 retired coal resources in the 2024 v1.5 common case. The EE energy was modeled as a load reduction and resulted in a total reduction of about 1700 GWh. Note that the replacement assumptions only replace 53% of the energy that was retired.

# Difference in Annual Energy - WECC

Annual Energy Difference (MWh): 2024 PC1 v1.5 vs 2024 PC21 Coal Retirement

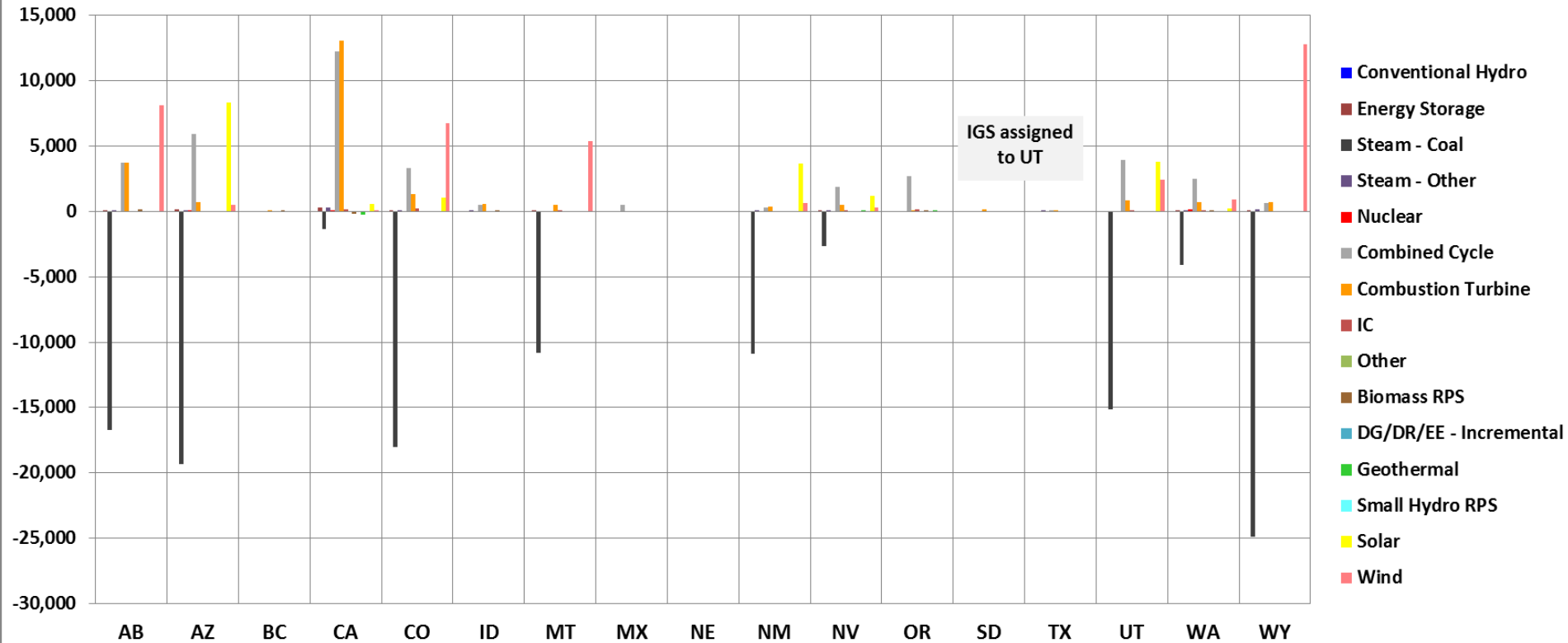


# 2024 CO<sub>2</sub> PC21 Coal Retirement Case



# Generation Change by State and Fuel

Annual Gen Change (GWh) 2024 PC1 v1.5 vs 2024 PC21 Coal Retirement



# Questions?

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