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Docket Number:	15-RETI-02
Project Title:	Renewable Energy Transmission Initiative 2.0
TN #:	211307
Document Title:	Presentation - Planning Goals Summary by Brian Turner - 5-2-16
Description:	N/A
Filer:	Misa Milliron
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	4/29/2016 2:44:06 PM
Docketed Date:	4/29/2016

Renewable Energy Transmission Initiative v2.0

Plenary Group Report

Planning Goals Summary

Brian Turner
RETI 2.0 Plenary Group

Joint Agency Workshop
2 May, 2016

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Background

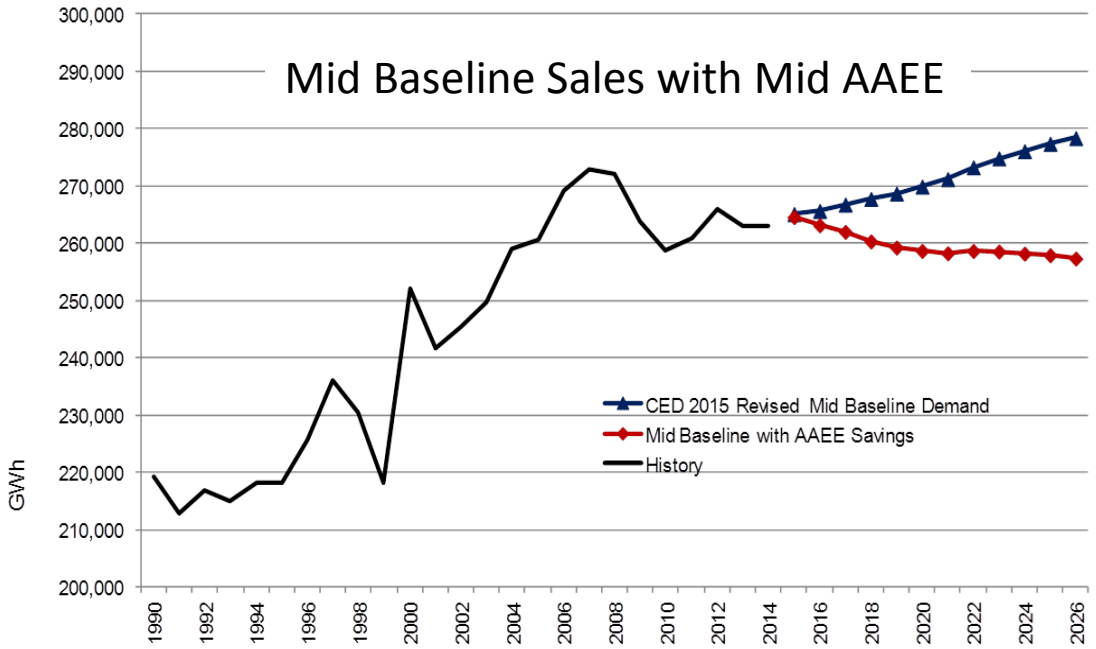
- Goal is to characterize (ballpark) the scale of renewable energy that may be needed to reach 2030 energy and GHG goals, in the context of Western renewables demand
- Used to guide the scale of demand for renewable resources from specific geographic areas

Data Sources

- California Energy Commission
  - California Energy Demand Forecast
- California Public Utilities Commission
  - Renewable Portfolio Standard proceedings
- L.A. Department of Water and Power
  - 2015 Integrated Resource Plan
- Energy and Environmental Economics (E3)
  - California PATHWAYS State Agencies' project
- Western Electricity Coordinating Council
  - 2026 Common Case

California Energy Demand

- Forecasted from 2016 to 2026; extrapolated to 2030
- High, Mid, and Low Demand Cases with High, Mid, and Low Additional Achievable Energy Efficiency (AAEE)
  - Mid-Mid case reaches 243,000 GWh by 2030
  - SB350-friendly AAEE estimate may reduce energy demand by additional 10,000 GWh



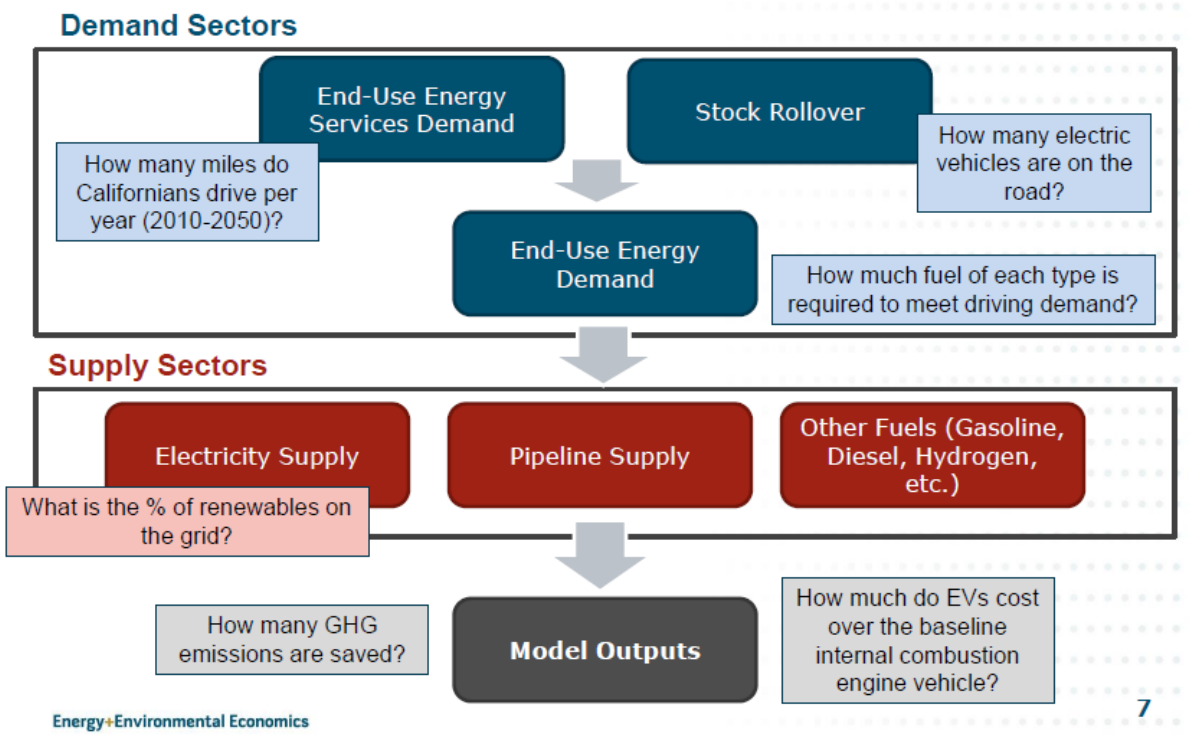
California Energy Demand-based 2030 RPS-eligible sales and 50% RPS estimates*

RPS Eligible Retail Sales w/AAEE (GWh)			
Year	**High Demand, Low AAEE**	**Mid Demand, Mid AAEE**	**Low Demand, High AAEE**
2020	257,061	**247,441**	236,893
2030	276,454	**243,081**	205,519
33% RPS 2020	84,830	**81,655**	78,175
50% RPS 2030	138,227	**121,541**	102,760
(2020)-(2030)	53,397	**39,866**	24,585

*Estimates only; no regulatory weight

E3's California PATHWAYS model

- Economy-wide, bottom-up, user-defined model tests energy and GHG-reduction scenarios
- Captures interactions between sectors
- Annual time steps for infrastructure and stock roll-over
- Hourly treatment of electric sector



California PATHWAYS

- 2014-2015 State Agencies' Project
  - Prior to development of Governor's 2030 Goals
  - Purpose to evaluate the feasibility and cost of a range of GHG reduction scenarios that reach 80% reduction (over 1990) by 2050
  - Project Sponsors included California Air Resources Board, Energy Commission, Public Utilities Commission, Independent System Operator, and the Governor's Office
- 2016 Scoping Plan
  - In response to Executive Order B-30-15 and SB 350, CARB is preparing an updated Scoping Plan outlining strategies to achieve 40% (below 1990) economy-wide GHG reduction by 2030
  - Using PATHWAYS model to assist in technology and economic assessment of strategies

California PATHWAYS

State Agencies Project Key Findings

1. Efficiency and Conservation

By 2030:

- 8% reduction in vehicle miles traveled (smart growth)
- Continued vehicle fuel economy improvements
- Approximate doubling of current building efficiency savings goals

2. Fuel Switching

By 2030:

- 6-9 million light duty zero emission vehicles
- Trucking & freight strategy, i.e. CNG, hybrid, elec.
- 10% - 40% electric space heating & 5% - 70% electric water heating, depends on use of biogas

3. Decarbonize electricity

By 2030:

- 50 – 60% renewable electricity
- Renewable integration solutions

4. Decarbonize fuels (liquid & gas)

By 2030:

- 29 – 55% reduction in petroleum use in vehicles, relative to 2015
- Biofuels: Nearly all diesel use replaced with net-zero emissions biofuels, OR Nearly 50% biogas in the gas distribution pipeline

Energy+Environmental Economics

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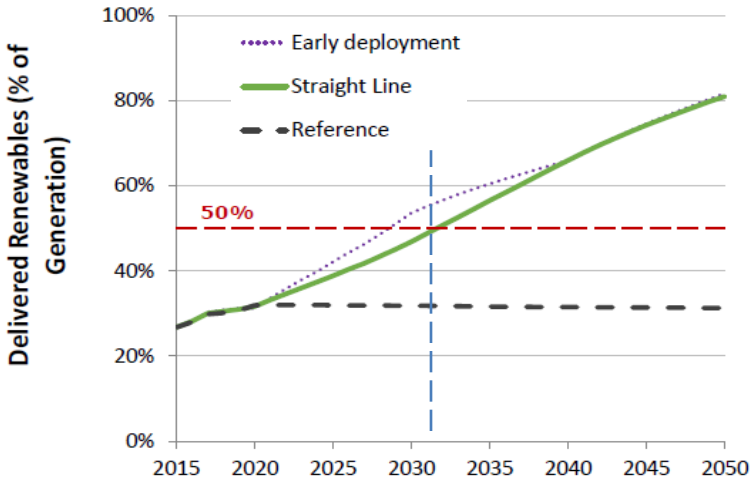
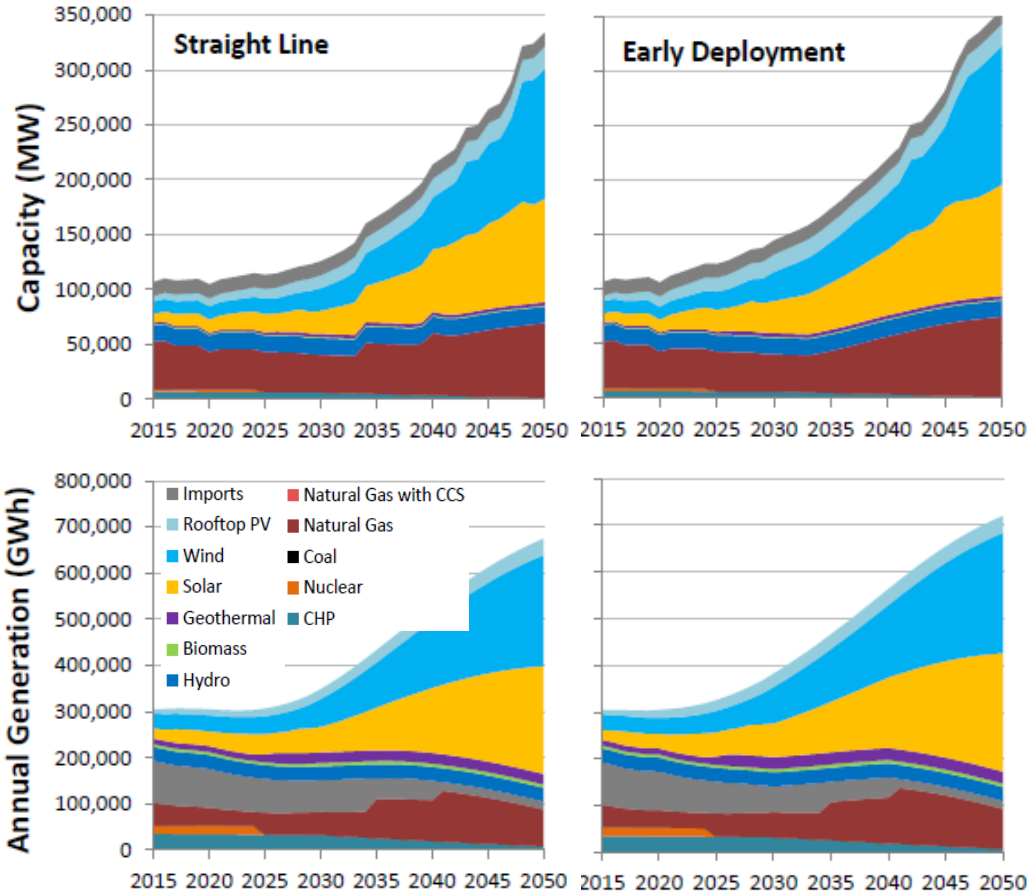
California PATHWAYS State Agencies' Project

Electricity and renewables findings

- Large-scale electrification could entail more than doubling total generation and more than tripling total capacity by 2050
- Renewables capacity could quintuple
- By 2030, scenarios suggest 50-60% RPS





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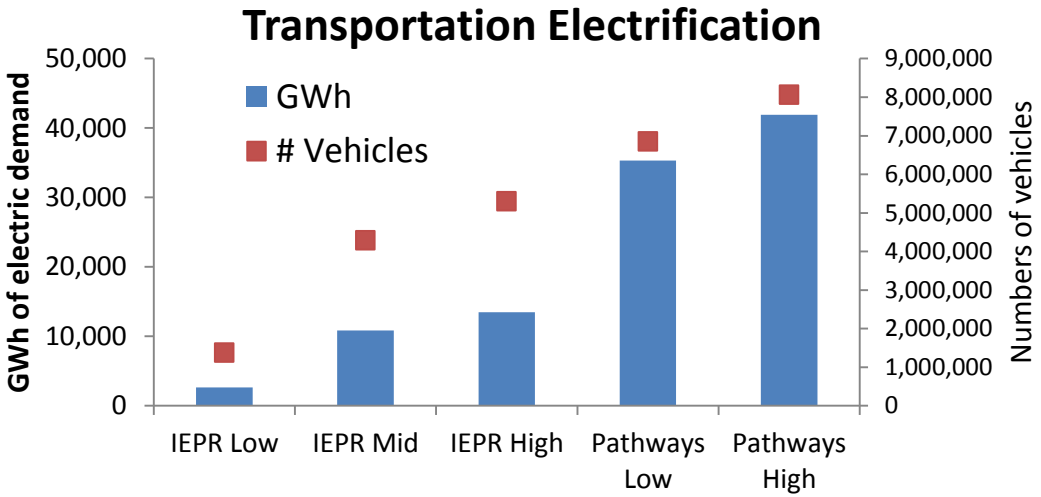
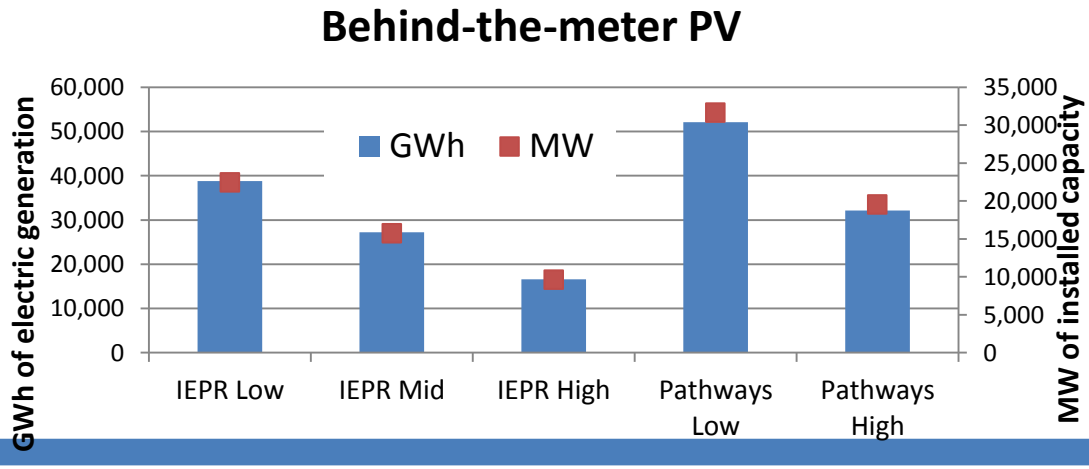
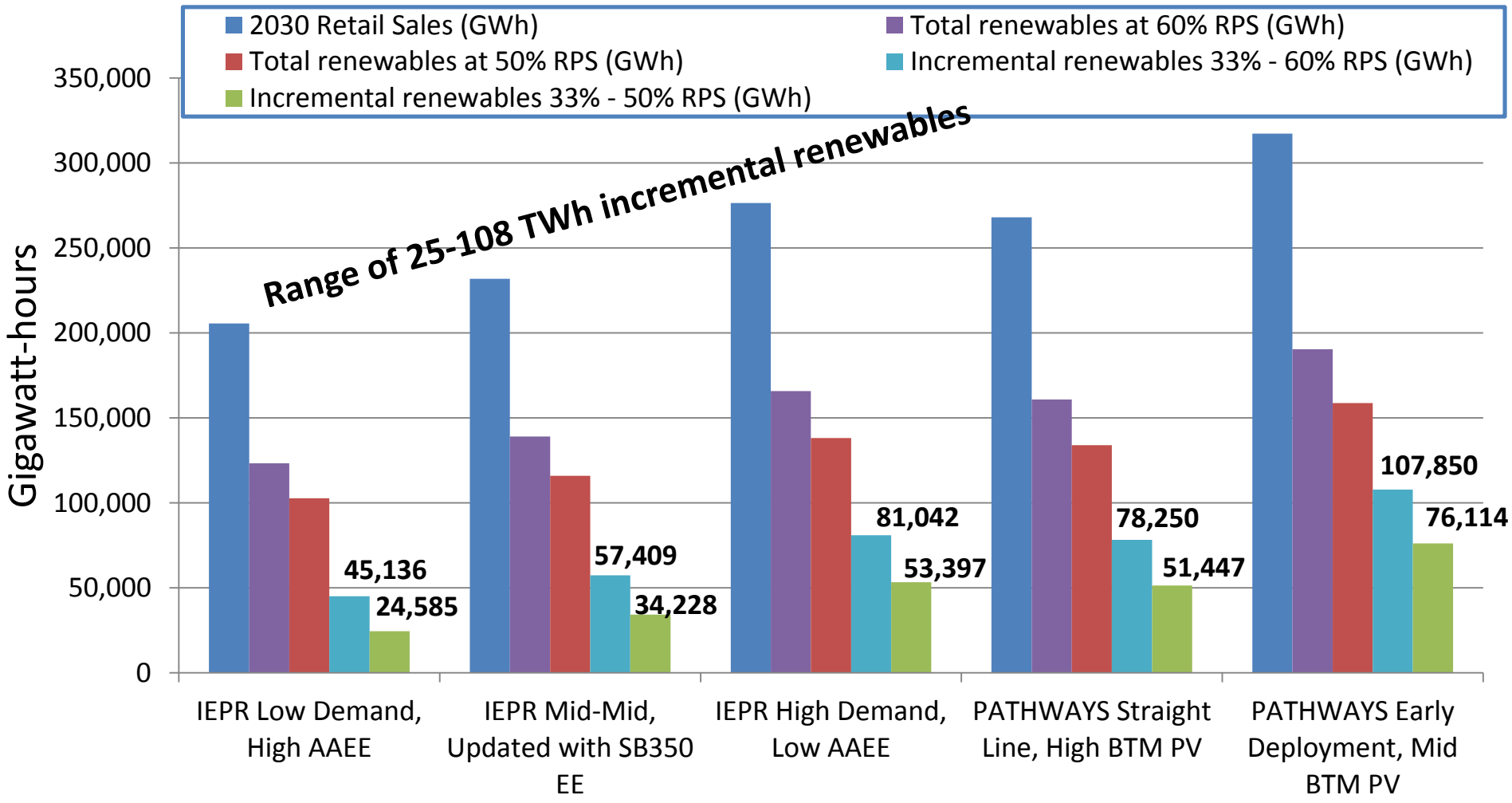
Drivers of demand

- Differences in vehicle electrification and BTM PV explain some, but not majority, of differences
- Pathways assumes high hydrogen fuel production for vehicles, partially as a renewables integration strategy
- Other drivers include: economic assumptions, energy efficiency, and building electrification (e.g. Pathways assumes widespread heat pumps)



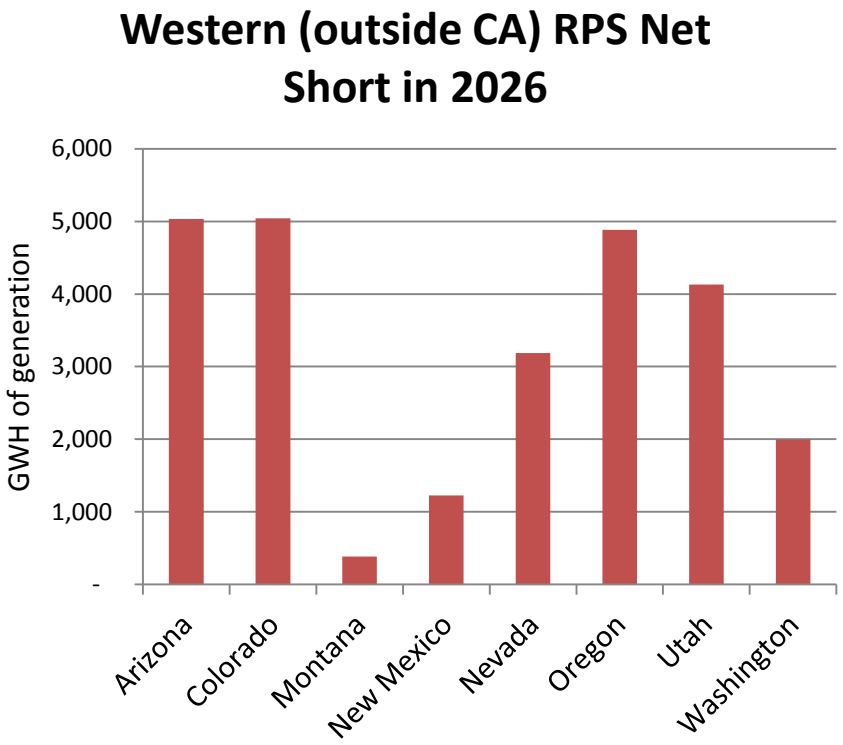


Potential 2030 Renewables under different scenarios



West-wide renewables demand

- Western Electricity Coordinating Council prepares 10-year forecasts (the "Common Case") of west-wide demand and generation, including RPS, based on bottom-up balancing authorities' data
- Preliminary 2026 Common Case RPS projections estimate a "net short" of ~25,000 GWh in other RPS states
  - However roughly 24,000 GWh is expected to be available from non-RPS states
- WECC projects total Western RPS renewables at 168,000 GWH in 2026
  - This projected level of total western electric sales and renewables would be equivalent to an 18% west-wide RPS



Conclusions

- Reaching 50% RPS under low demand conditions could entail modest renewables expansion by 2030
- However, reaching 2030 GHG goals, on track to 2050 goals, raises important cross-sector effects that could increase both total electricity sector demand and de-carbonization needs substantially
- The range of renewable need by 2030 could range from 25,000 GWh (for low load and 50% RPS) to over 100,000 GWh (for high load and 60% renewables).
- In capacity terms, this equates to a range of:
  - 7 to 31 GW of capacity if assuming an average 40% capacity factor
  - 9.4 to 41 GW of capacity at a 30% average capacity factor
- Western RPS renewables demand and supply appears roughly in balance, but market forces, new RPS targets, Clean Power Plan, and other forces may increase demand substantially