January 4, 2017

MEMORANDUM

TO: **Council members**

FROM: **Steven Simmons, Senior Economic Analyst**

SUBJECT: **Briefing on Load Forecasts Outside of the Northwest**

BACKGROUND:

Presenter: Steven Simmons

Summary: Periodically, Council staff updates a long term load forecast for the western regions outside of the Northwest. Load in this case is considered as demand for electricity at the bus bar, and is typically net of expected energy efficiency and self-generation such as rooftop solar. A new forecast was developed in the fall of 2016 which can be used as input for modeling work, and also provides a comparison to the previous forecast which was completed during work leading to the Seventh Plan. Changes in the forecast reflect changes in economic growth, end use characteristics, energy efficiency, and self-generation or distributed generation. For many of the regions in the Western Interconnect, the new forecast for energy and peak demand dropped from the previous forecast. In regions such as California and Arizona, the continued growth in self-generation solar capacity is expected to reduce demand for energy and peak, and may also begin to alter traditional utility load profiles and shift the timing of peaks to later evening.

Relevance: This long term load forecast provides input for modeling work at the Council, including electricity market modeling used for price forecasting and the upcoming marginal carbon study.

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Workplan: A.3 Forecasting and Economic Analysis

Background: The forecast is comprised of a twenty year look at energy, peak, and hourly load profiles for the regions included in the Western Interconnection. The primary source for data for the forecast was the WECC 2026 Common Case Study; however for this forecast cycle, additional data from the California Energy Commission (CEC) and the Lawrence Berkeley National Lab (LBNL) was incorporated.

Load Forecasts Outside of the Northwest

January 2017

Steven Simmons

Northwest Power and Conservation Council

Today's Discussion

1. Background on the forecast process for loads outside the Northwest, and how it fits into Power Council modeling and analysis
2. Review most recent load forecasts for the "Rest of the West"

   Is there a theme ? – Yes, forecasts have dropped
3. We'll look at some specific regions in detail including California

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Load Forecasts Outside of the Northwest

BACKGROUND

Load Forecast

What is it ?

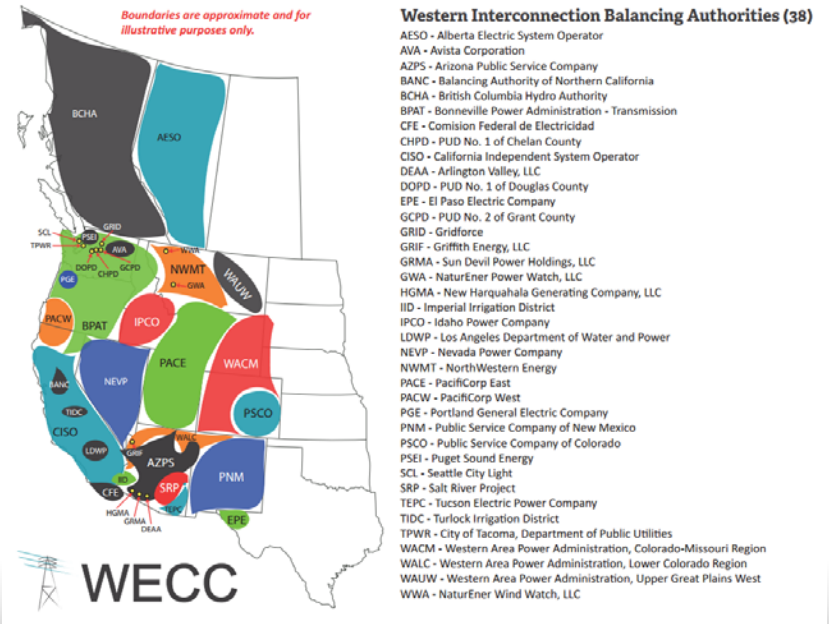
Twenty-plus year forecast of load for the Western Interconnection – mapped to our electric market model dispatch areas

Where is it used at the Council ?

Primarily as an input for electricity market modeling (such as Aurora$_{xmp}$) for electric price forecasting, marginal carbon studies, etc....

Load Forecast

1. Load at the bus bar, typically net of energy efficiency (EE) and self-generation (such as rooftop solar)
2. Source data is primarily from the WECC 2026 Common Case Study, the California Energy Commission (CEC) Electricity Demand Forecast, and Lawrence Berkeley National Lab (LBNL)
3. Source data is on a Balancing Authority (BA) or Load-Serving Entity of granularity out to 2026 – this is mapped to Council Load & Resource Areas (less granularity) and extended out past 2036

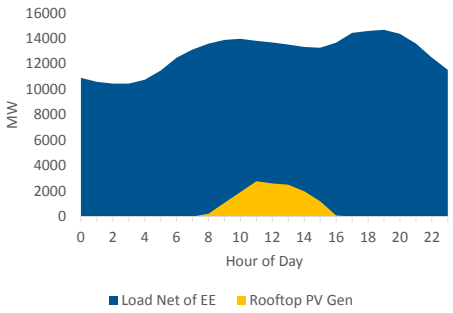


Western Interconnection Balancing Authorities (38)

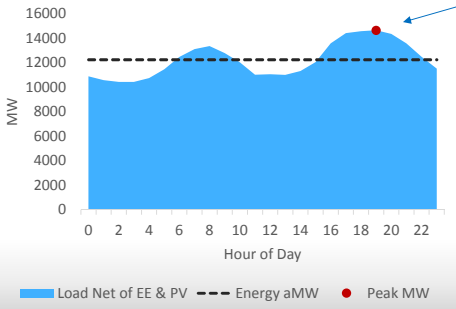
AESO - Alberta Electric System Operator
AVA - Avista Corporation
AZPS - Arizona Public Service Company
BANC - Balancing Authority of Northern California
BCHA - British Columbia Hydro Authority
BPAT - Bonneville Power Administration - Transmission
CFE - Comision Federal de Electricidad
CHPD - PUD No. 1 of Chelan County
CISO - California Independent System Operator
DEAA - Arlington Valley, LLC
DOPD - PUD No. 1 of Douglas County
EPE - El Paso Electric Company
GCPD - PUD No. 2 of Grant County
GRID - Gridforce
GRIF - Griffith Energy, LLC
GRMA - Sun Devil Power Holdings, LLC
GWA - NaturEner Power Watch, LLC
HGMA - New Harquahala Generating Company, LLC
IID - Imperial Irrigation District
IPCO - Idaho Power Company
LDWP - Los Angeles Department of Water and Power
NEVP - Nevada Power Company
NWMT - NorthWestern Energy
PACE - PacifiCorp East
PACW - PacifiCorp West
PGE - Portland General Electric Company
PNM - Public Service Company of New Mexico
PSCO - Public Service Company of Colorado
PSEI - Puget Sound Energy
SCL - Seattle City Light
SRP - Salt River Project
TEPC - Tucson Electric Power Company
TIDC - Turlock Irrigation District
TPWR - City of Tacoma, Department of Public Utilities
WACM - Western Area Power Administration, Colorado-Missouri Region
WALC - Western Area Power Administration, Lower Colorado Region
WAUW - Western Area Power Administration, Upper Great Plains West
WWA - NaturEner Wind Watch, LLC

Load Forecast

1. Previous forecast was done in preparation of the Seventh Plan
2. Current forecasting work took place from late summer through the fall of 2016
3. Final Product – load forecast from 2016 out to 2036
   a. Annual Energy Forecast (aMW)
   b. Annual Peak Forecast (MW)
   c. Hourly Profiles



1) Start with a forecast for load net of EE
2) Add a forecast of rooftop solar generation (behind the meter)
3) Net out the solar – now have a load forecast net of EE and solar



Peak – 14,463 MW

Energy – 12,256 aMW

Example
Northern California single day in January of 2026

Load Forecasts Outside of the Northwest

RESULTS

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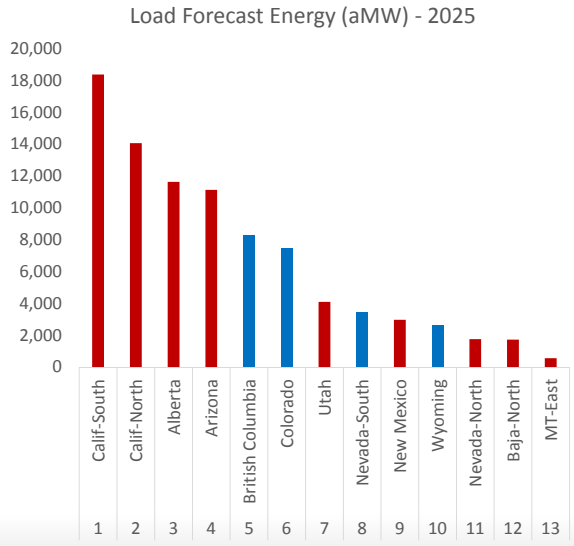
- Snapshot of energy forecast by area in 2025
- 9 of 13 areas see a drop (red) from the previous forecast
- Largest declines occur in the California, Alberta, Arizona areas



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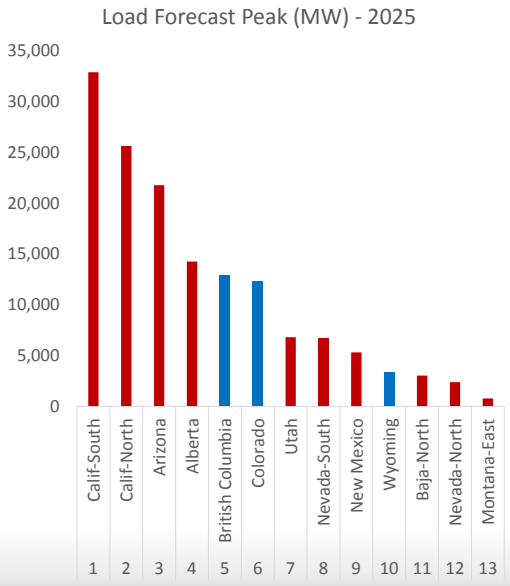
- Snapshot of peak forecast by area in 2025
- 10 of 13 areas see a drop (red) from the previous forecast
- Largest declines occur in California, Alberta, and Arizona



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Load Forecast Declines

Changes in forecast reflects changes in economic growth, energy efficiency, self-generation (like rooftop pv)

Will focus on the areas with the largest declines in forecast

1. Alberta
2. California North & South
3. Arizona

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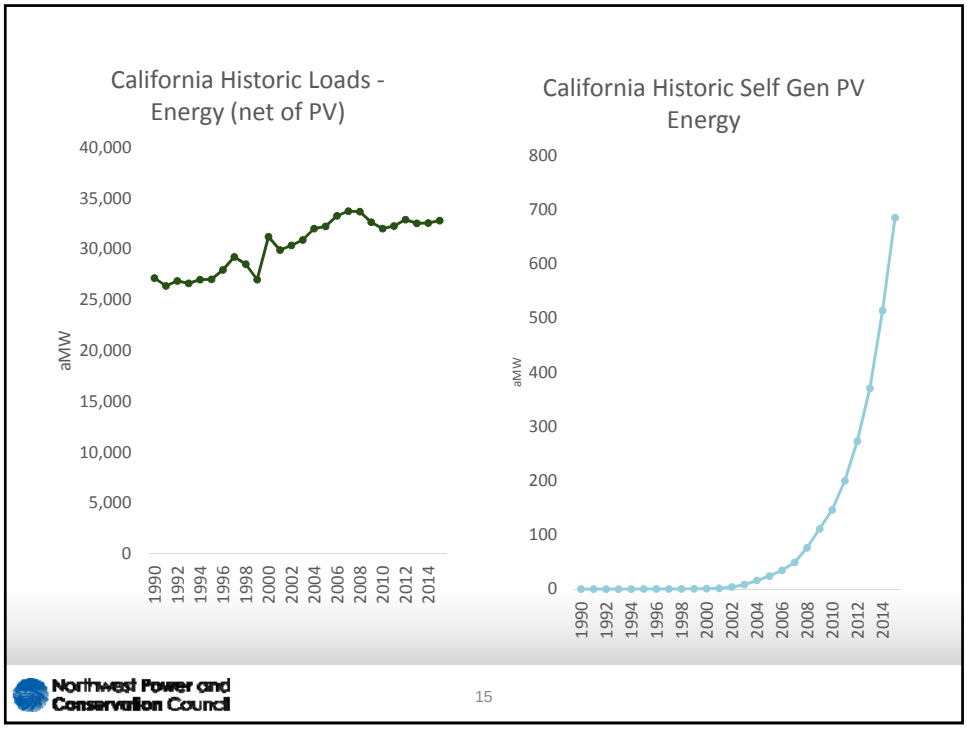
Load Forecasts Outside of the Northwest

INDIVIDUAL REGIONS

California

1. Historic loads have leveled off despite economic growth and forecasts for energy and peak have dropped – why?
2. Rooftop Photovoltaic (PV) & Energy Efficiency
3. Resulting in concern around the “Duck Curve” and flexible resources
4. Future changes
   a. Electric vehicle loads
   b. Peak shifting as more self-gen PV is installed
   c. Residential battery storage of electricity


California Historic Loads - Energy (net of PV)
aMW
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
California Historic Self Gen PV Energy
aMW
800
700
600
500
400
300
200
100
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
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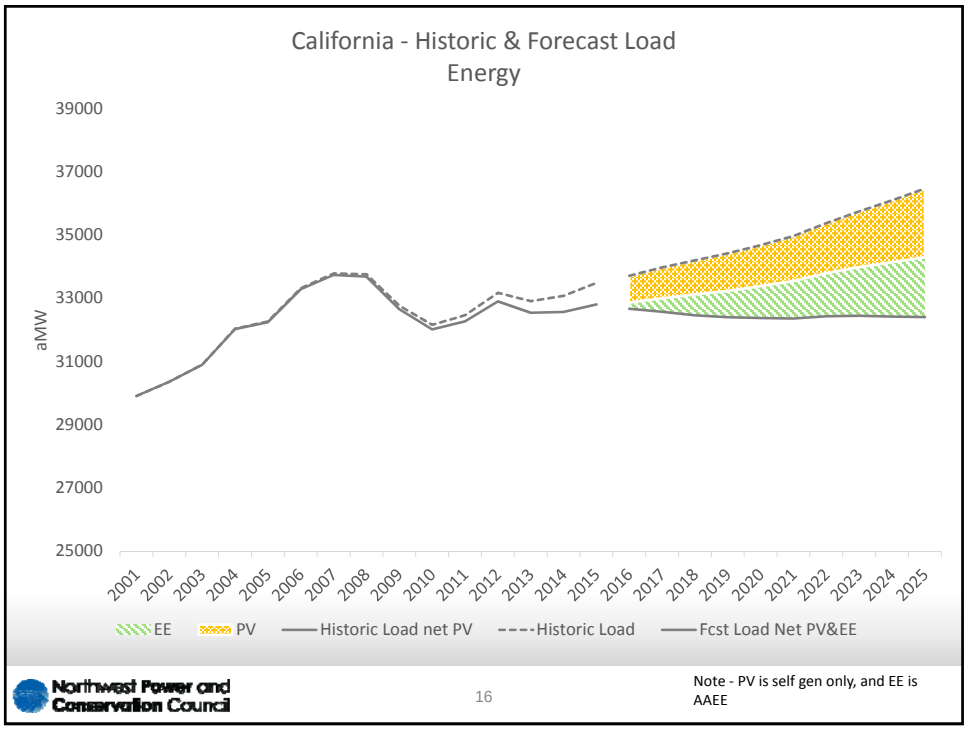
California - Historic & Forecast Load Energy
aMW
39000
37000
35000
33000
31000
29000
27000
25000
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
EE
PV
Historic Load net PV
Historic Load
Fcst Load Net PV&EE
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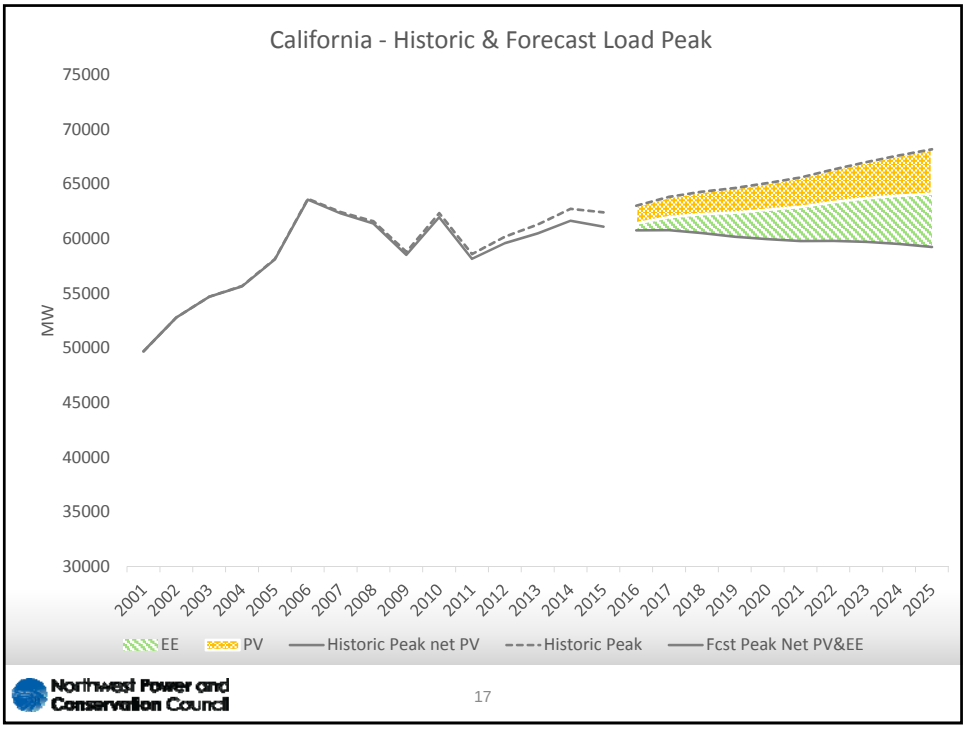
Note - PV is self gen only, and EE is AAEE



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California Load - Peak

- Growth in rooftop PV has reduced the demand for peak for power from utility generators
- However as PV installations continue to grow, the impact on peak reduction may not be as large as self-gen solar generation shifts the peak to later evening
- More analysis to come from CA on this topic

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California Load Profiles with Rooftop Solar

- Staff generated hourly load & rooftop solar profiles for Northern California – in year 2016
- Graphs of single-day load, pv, and load net of pv
- Can see beginnings of the "duck" (the full "duck" includes utility solar) and peak shift
- Additional impacts of electric vehicle home charging and home storage to come

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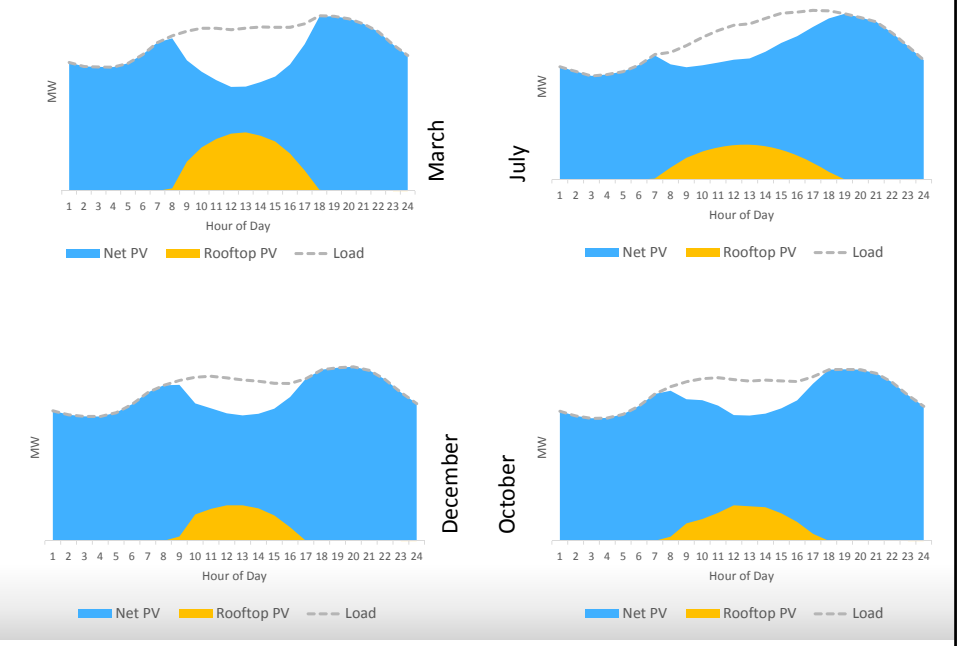

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Alberta (AESO)

1. Oil sands
   a. Oil sands projects are the primary economic driver for Alberta and accounts for nearly 20% of the demand for electricity
   b. Previous forecast included strong growth forecasts for oil sands
   c. World-wide oil glut has resulted in delays and cancelation of new projects
2. Current forecast based on AESO 2016 Long Term Outlook – which has a more moderate forecast for oil sands expansion – but much uncertainty
3. Alberta's Climate Leadership Plan is calling for all coal units to be retired by 2030 (replaced by gas and wind) and Energy Efficiency

Arizona

1. Similar to California – decline in energy and peak demands from previous forecast
2. High levels of distributed generation – rooftop PV
3. Also expecting "duck curve" issues during non summer months – robust solar generation in mid-day during periods of low demand – shifting peak to later evening
4. Looking at EV charging, battery storage and natural gas recips/combustion turbines