

# Northwest Low Carbon Scenario Analysis

*Achieving Least-Cost Carbon Reduction in the Electric Sector*

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JULY 2018



# About PGP

- ❑ Public Generating Pool (PGP) is a trade association, representing 10 consumer-owned utilities in Oregon and Washington.



- ❑ PGP members own more than 6,000 MW of generation and purchase approximately 34% of BPA's preference power.
- ❑ PGP have diverse customer profiles, market positions, BPA relationships, and resource ownership.

# Project Purpose

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- ❑ If Western states are to further evolve carbon policies, it is important for efforts to be informed by which alternatives are least-cost and most effective in achieving emission reductions.
- ❑ Hired E3 to develop an analytical framework for the NW to address the following:
  - What policies best support a least-cost approach to carbon emissions,
  - What does that mean for the Northwest resource portfolio?
- ❑ This analysis focuses on the electric sector, but we are interested in collaboration to develop a multi-sector framework.



# About This Study

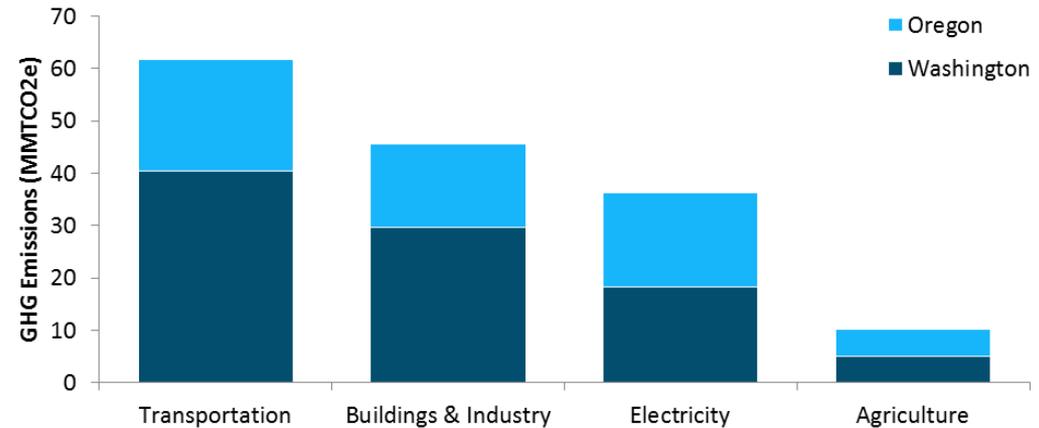
+ Oregon and Washington are currently exploring potential commitments to deep decarbonization in line with international goals:

- 80-91% below 1990 levels by 2050 (proposed)

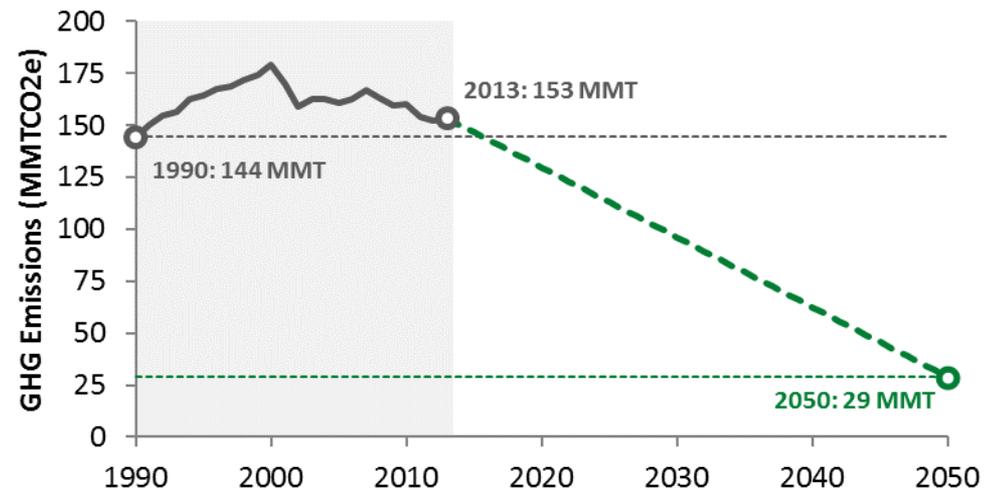
+ This study was conceived to inform policymakers on the effectiveness of various potential policies to reduce GHG emissions in the Northwest:

- What are the most cost-effective ways to reduce electricity sector emissions?
- What is the value of existing carbon-free resources?

### 2013 GHG Emissions for Oregon and Washington

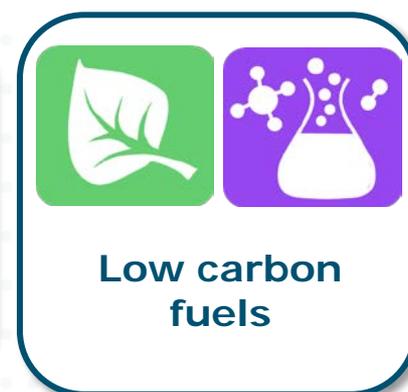
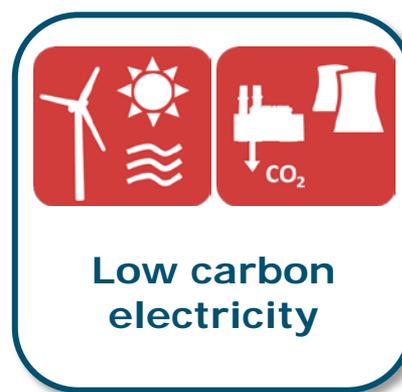


### Historical and Projected GHG Emissions





# Four “Pillars” of Decarbonization to Meet Long-Term Goals



- + Four foundational elements are consistently identified in studies of strategies to meet deep decarbonization goals
- + Across most decarbonization studies, electricity plays a key role in meeting goals
  - Through direct carbon reductions
  - Through electrification of loads to reduce emissions in other sectors

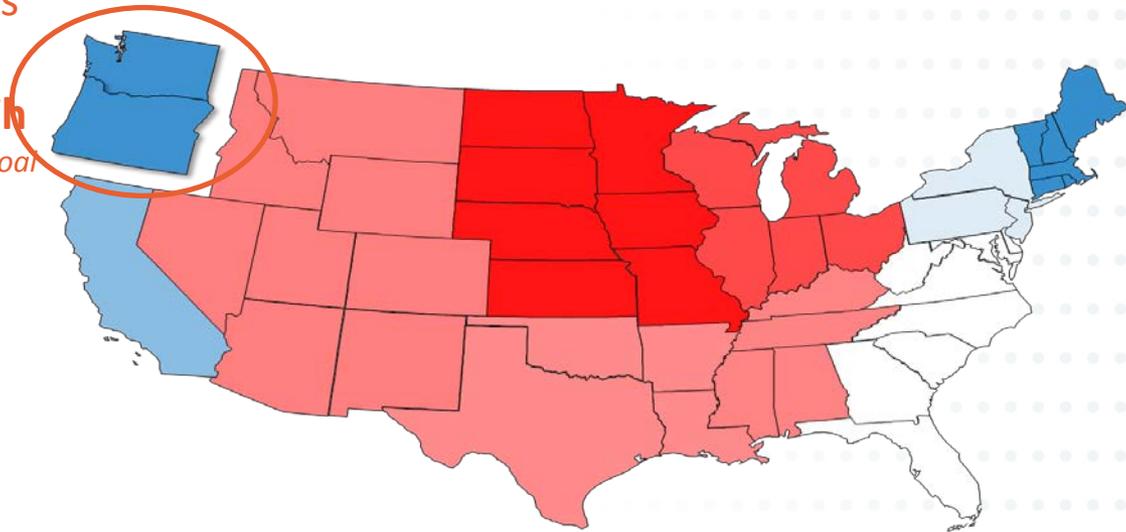


# Carbon Intensity of the Northwest's Electricity Sector is Relatively Low

- + Due to large fleet of existing zero-carbon resources, electric emissions intensity in the Pacific Northwest is already below other regions in the United States

## 2013 Regional GHG Intensity of Electricity Supply (tons/MWh)

2013 emissions intensity:  
**0.26 tons/MWh**  
(includes out-of-state coal resources)



### WA/OR Generation Mix

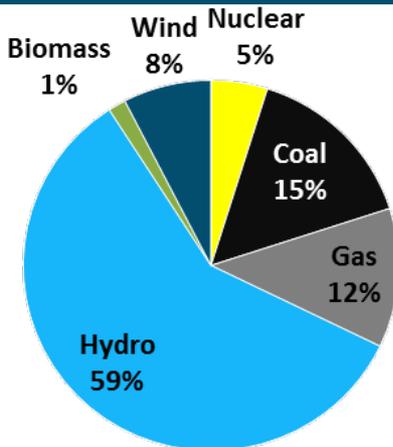
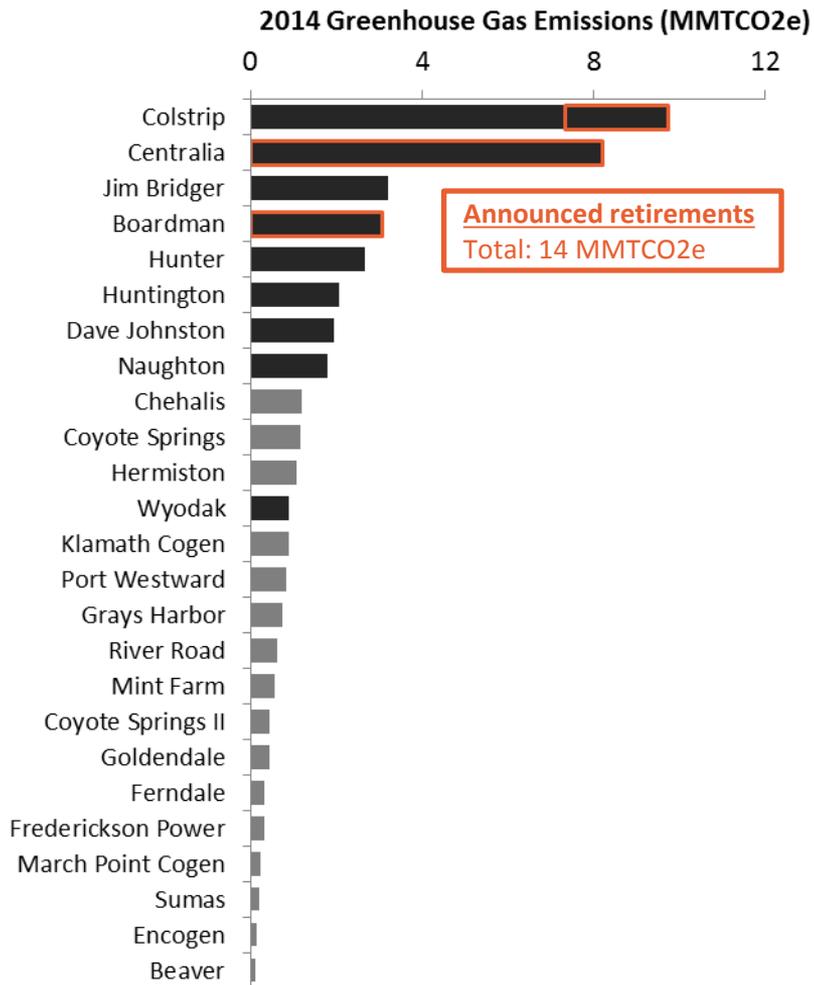


Figure developed using data gathered from state 2013 GHG inventories for Washington, Oregon, and California; supplemented with data from EIA Annual Energy Outlook 2016



# A Handful of Plants are Responsible for Most of the Electric Sector GHG Emissions in the Northwest



+ Existing coal plants (9 units) are responsible for 33 million metric tons of emissions—roughly 80% of all emissions attributed to Washington & Oregon

- Includes contracted generation in Montana, Wyoming

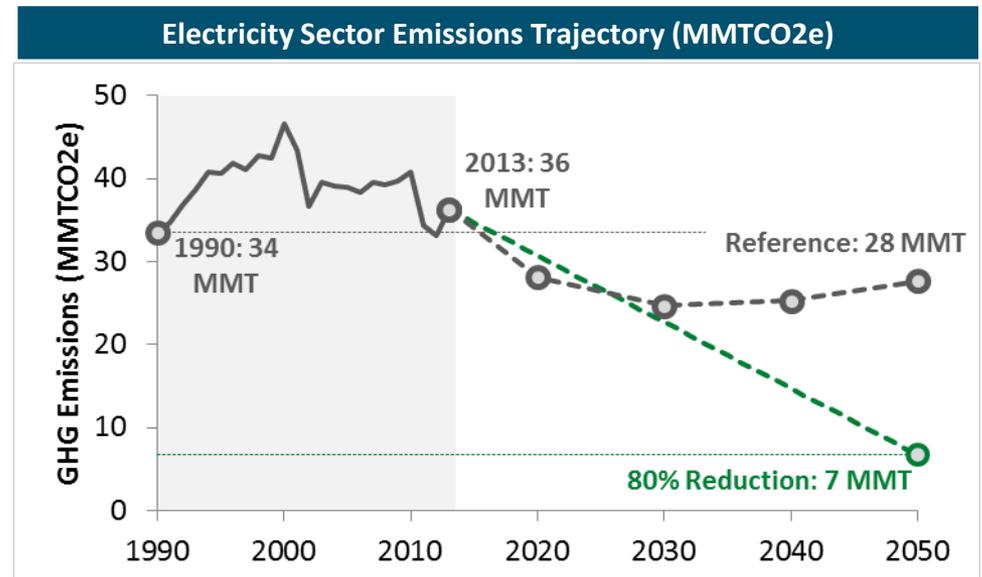
+ Existing gas generation accounts for roughly 9 million metric tons



# Emissions Trajectory

## Reference Case

- + **Through 2030, current policies and trends result in emissions reductions that are generally consistent with long-term goals**
  - Load growth limited by cost-effective energy efficiency
  - 2,500 MW of renewable generation added to meet RPS policy goals by 2030
  - 2,300 MW of coal capacity retired
- + **Additional measures are needed to meet long-term goals beyond 2030**
  - Coal generation remains the largest source of emissions beyond 2030
  - Additional gas generation & imports are needed to meet load growth
  - Emissions start to trend back up after 2030 without new policy

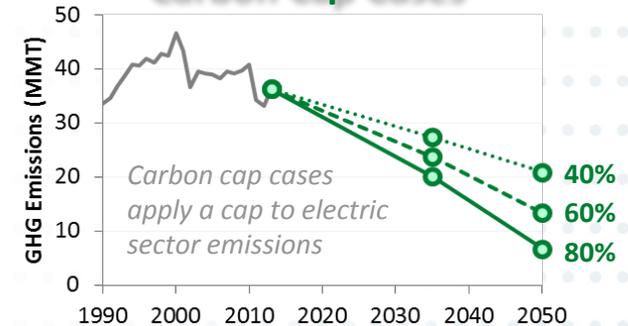




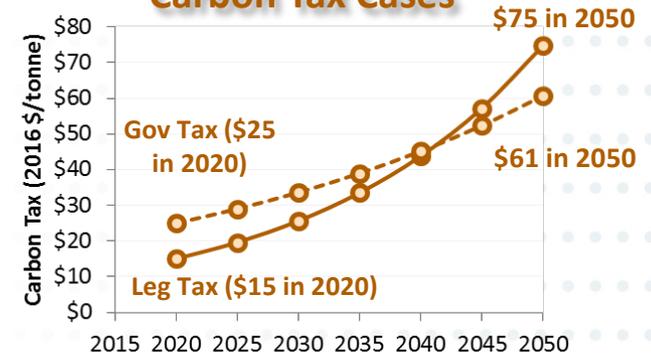
# Overview of Core Policy Scenarios

- 1. Reference Case:** reflects current state policy and industry trends,
  - Achieves regionwide average 20% RPS by 2040
  - Reflects announced coal retirements: Boardman, Colstrip 1 & 2, Centralia
- 2. Carbon Cap Cases:** 40%, 60%, and 80% reduction below 1990 levels by 2050
- 3. Carbon Tax Cases:** Two specific Washington proposals
  - **Gov.:** \$25/ton in 2020, 3.0% real escalation
  - **Leg.:** \$15/ton in 2020, 5.5% real escalation
- 4. High RPS Cases:** 30%, 40%, and 50% regionwide average RPS by 2050
- 5. 'No New Gas' Case:** prohibits construction of new gas generation

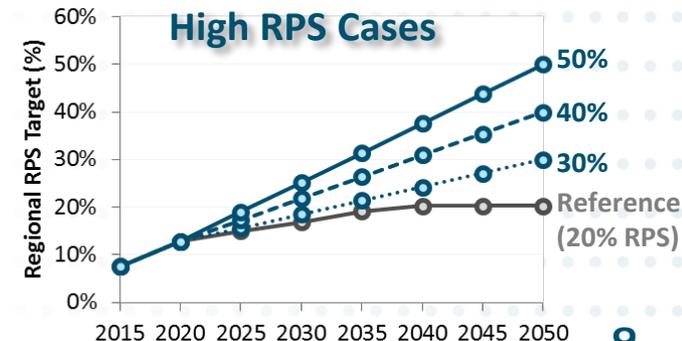
## Carbon Cap Cases



## Carbon Tax Cases



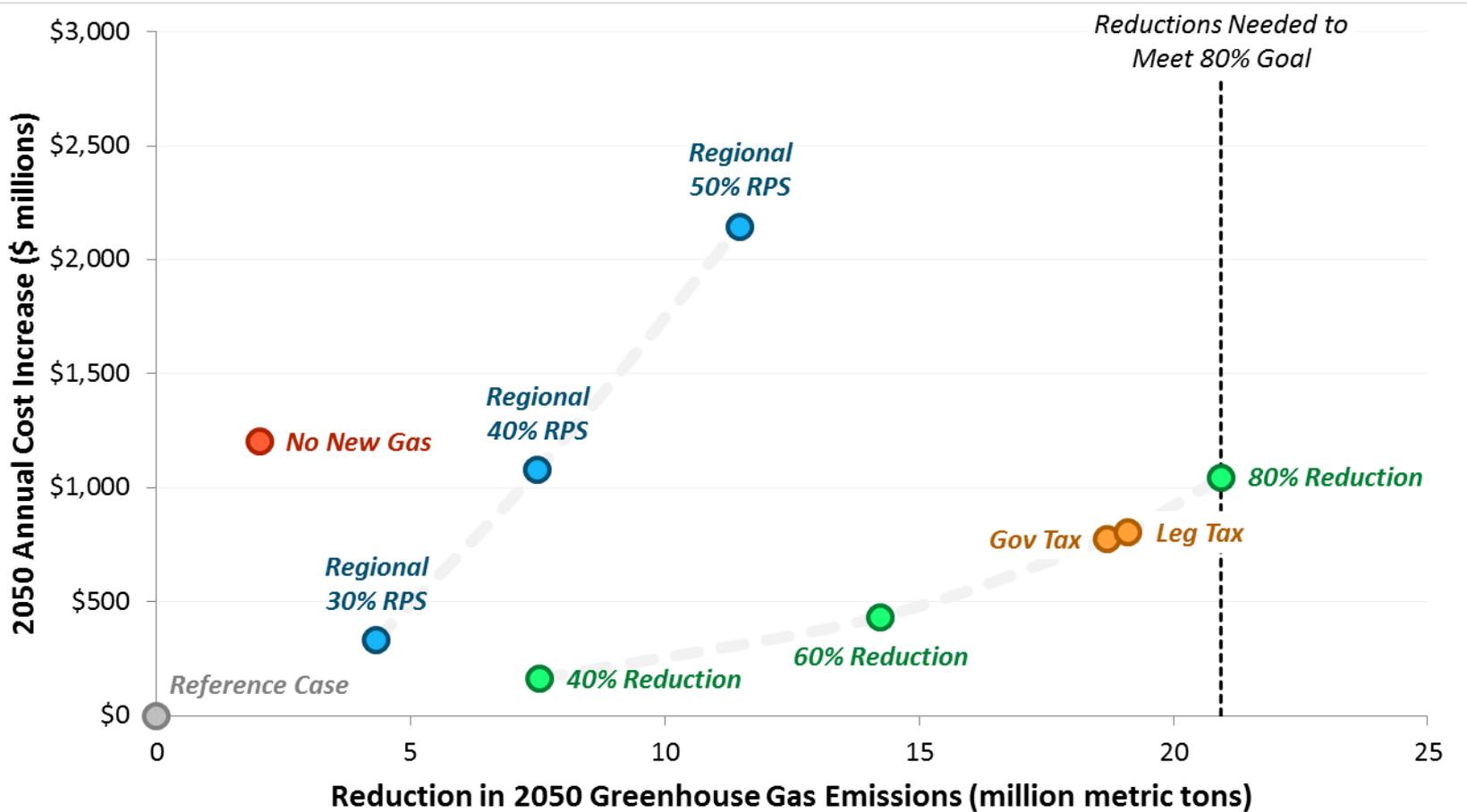
## High RPS Cases





# Cost & Emissions Impacts

## All Cases



Note: Reference Case reflects current industry trends and state policies, including Oregon's 50% RPS goal for IOUs and Washington's 15% RPS for large utilities

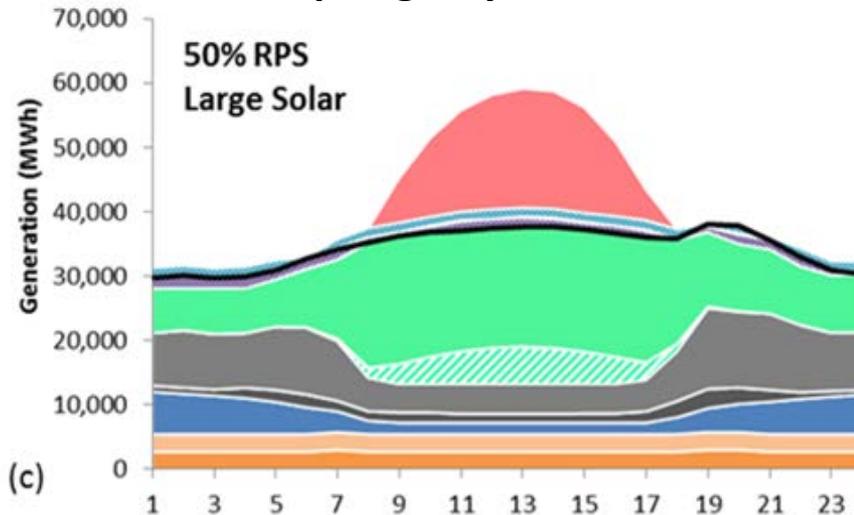


# Battery storage is less effective in the Northwest than in solar-dominated systems like California

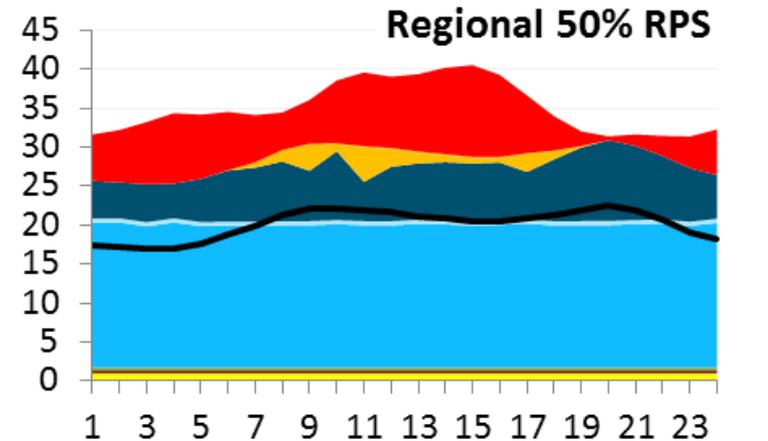
California can store surplus solar power with 4-6 hour grid batteries

Northwest has surplus of wind and hydro generation that occurs day after day during high hydro years

Spring Day In California



Spring Day in the Northwest

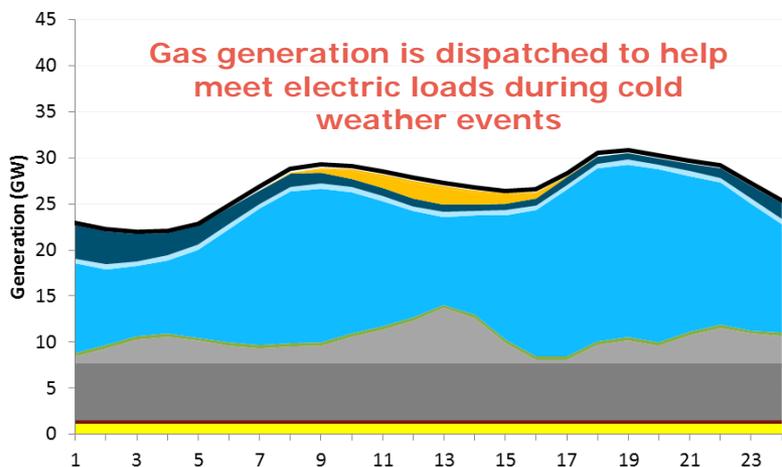


*Current storage technologies can be helpful but cannot solve all renewable integration challenges in the Northwest!*

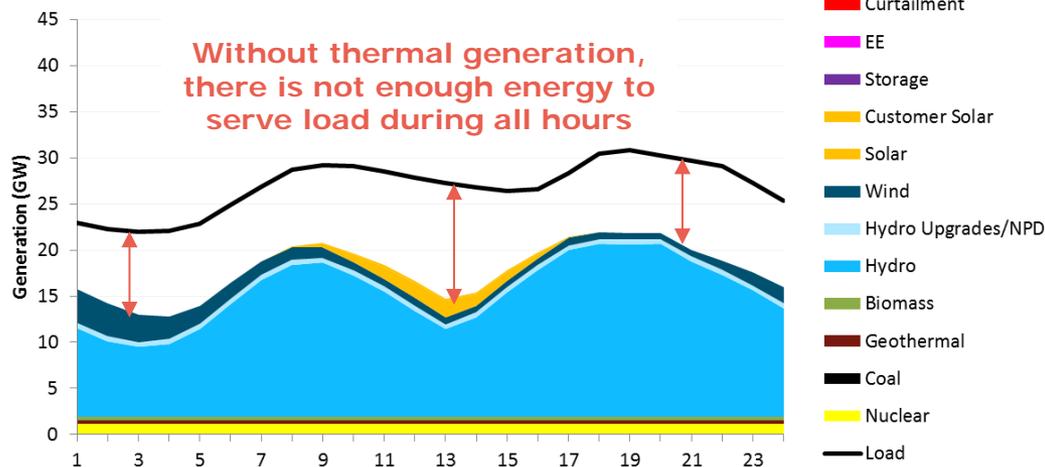


# A system without enough gas generation may not meet our expectations for reliable electric service

## Cold Winter Day under 80% Reduction

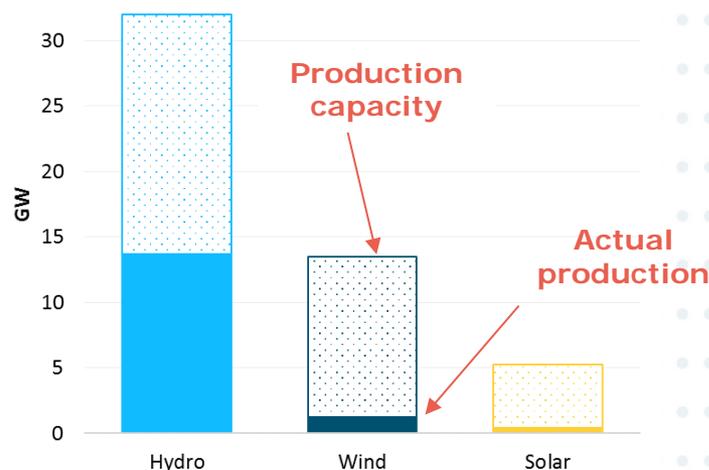


## Cold Winter Day Without Gas



- + Most challenging conditions for the Northwest power system are multi-day cold snaps that occur during drought years
- + Wind and solar production tends to be very low during these conditions
- + Absent a technology breakthrough, gas generation appears to be needed for reliability

## Energy from Zero-Carbon Resources





# Key Findings

- 1. The most cost-effective opportunity for reducing carbon in the Northwest is to displace coal generation with a combination of energy efficiency, renewables and natural gas**
  - Coal generation produces approximately 80% of the Northwest's electricity-sector GHG emissions today
  - A technology-neutral policy that focuses on carbon provides incentives for leveraging the lowest-cost GHG emissions reductions
- 2. Renewable generation is an important component of a low-carbon future, however a Renewables Portfolio Standard results in higher costs and higher carbon emissions than a policy that focuses directly on carbon**
  - RPS policy has been successful at driving investment in renewables but ignores other measures such as energy efficiency and coal displacement
  - RPS policy has unintended consequences such as oversupply and negative wholesale electricity prices that create challenges for reinvestment in existing zero-carbon resources



# Key Findings

## **3. Prohibiting the construction of new natural gas generation adds significant cost but does little to save GHG emissions**

- Older gas plants run at a higher capacity factor and generate more carbon emissions
- More study is needed to determine whether the system modeled has sufficient energy and capacity to meet resource adequacy requirements
- Building new gas resources for capacity is part of a least-cost portfolio even under carbon-constrained scenarios

## **4. Meeting decarbonization goals becomes significantly more challenging and costly should existing zero-carbon resources retire**

- Replacing 2,000 aMW of existing hydro or nuclear generation would require nearly 6,000 MW of new wind and solar generation and 2,000 MW of natural gas generation at an annual cost of \$1.6 billion by 2050
- A policy that encourages the retention of existing zero-carbon generation resources will help contain costs of meeting carbon goals