NORTHWEST PowerPool

AGENDA

Dynamics of Today's Energy System

A Resource Adequacy Symposium

October 2, 2019 | 8:00 am to 2:30 pm

MORNING SESSION

8:00

Why now?

Frank Afranji, NW Power Pool President; Comments from Larry Bekkedahl, Portland General Electric; Jason Thackston, Avista; Debra Smith, Seattle City Light

Attendees will hear directly from NWPP members as they engage in a dialogue around the need for a regional approach and possible mechanisms for assuring reliability with adequate supply, now and in the future.

8:30

Today's reality, what is the risk?

Scott Corwin, NWPPA

Stefan Bird, PacifiCorp; Mike Cashell, NorthWestern Energy; Gerry Froese, Avangrid; Frank Lawson, EWEB

These utility leaders will share how they are reshaping their business models to meet the goals of the future and provide insight into what they are doing to ensure regional reliability.

9:30

Accelerating the conversation

Kurt Miller, NWRP

Nicole Hughes, Renewable NW; Senator Lee Beyer, Oregon; Jim Collins, Microsoft

This panel's conversation will underscore the growing expectation for clean energy and achieving our environmental goals, while maintaining highly reliable electric services by working together and keeping an eye toward the future.

BREAK

10:45

What we know today

Shauna McReynolds, PNUCC

Scott Kinney, Avista; Dan Kirschner, NW Gas Assn; Ben Kujala, NW Power & Cons. Council; Arne Olson, E3

These experts will provide a comprehensive look at analysis from various perspectives of resource adequacy and integrated resource plans that compares and contrasts efforts, and provides insight into the art of what could be.

LUNCH

AFTERNOON SESSION

12:30

Where are we heading?

Therese Hampton, PGP

Mark Holman, Powerex; Gregg Carrington, Chelan PUD; Rick Link, PacifiCorp

These industry professionals will share findings of the analysis of regional resource adequacy assessments and provide insights on the design elements for a successful resource adequacy program to ensure continued reliability.

1:30

Owning the solution

Scott Simms, PPC

Steve Wright, Chelan PUD; Maria Pope, Portland General Electric; Elliot Mainzer, Bonneville Power Admin.

These leaders will reflect on the day and share thoughts on what it will take, along with possible next steps, to ensure continued reliability with resource adequacy under the new paradigm.

2:15

Next steps

Frank Afranji, NW Power Pool

To wrap it up, Afranji will highlight the key elements of the day's in-depth discussions that he sees informing the next body of work to ensure the region remains reliable while powering the customers of the future.

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DYNAMICS OF TODAY'S ENERGY SYSTEM

A Resource Adequacy Symposium

Frank Afranji
President
Northwest Power Pool

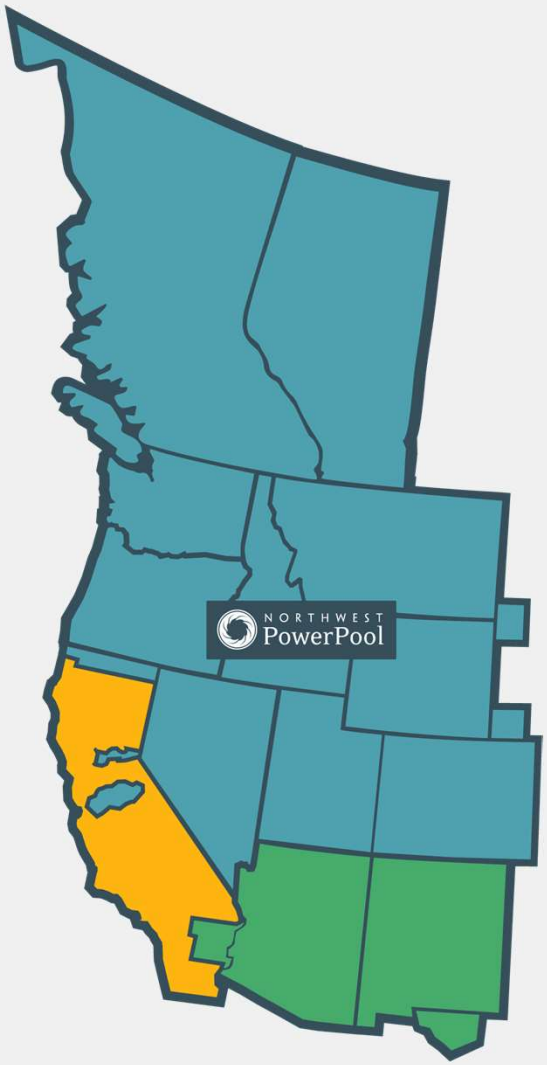
NORTHWEST PowerPool

October 2, 2019 – Portland, OR

NORTHWEST RESERVE SHARING GROUP

SOUTHWEST RESERVE SHARING GROUP

CALIFORNIA INDEPENDENT SYSTEM OPERATOR



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PNUCC


PGP
Public Generating Pool


BONNEVILLE
POWER ADMINISTRATION


P.U.D.
CHELAN COUNTY


AVISTA


Northwest Power and
Conservation Council


NORTHWEST
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Alberta Electric System Operator
Avangrid
Avista
Balancing Area of Northern California
BC Hydro
Bonneville Power Administration
Calpine
ColumbiaGrid
Cowlitz PUD
Douglas County PUD
Energy Keepers, Inc.
Eugene Water & Electric Board
Fortis BC
Grant County PUD
Gridforce
Idaho Power Company
NaturEner
Northwestern Energy
NVEnergy
PacifiCorp
Pend Oreille PUD
Perennial Power
Portland General Electric
Powerex
XcelEnergy
Puget Sound Energy
Seattle City Light
Snohomish County PUD
Tacoma Power
Turlock Irrigation District
US Army Corps of Engineers
US Bureau of Reclamation
Western Area Power Administration

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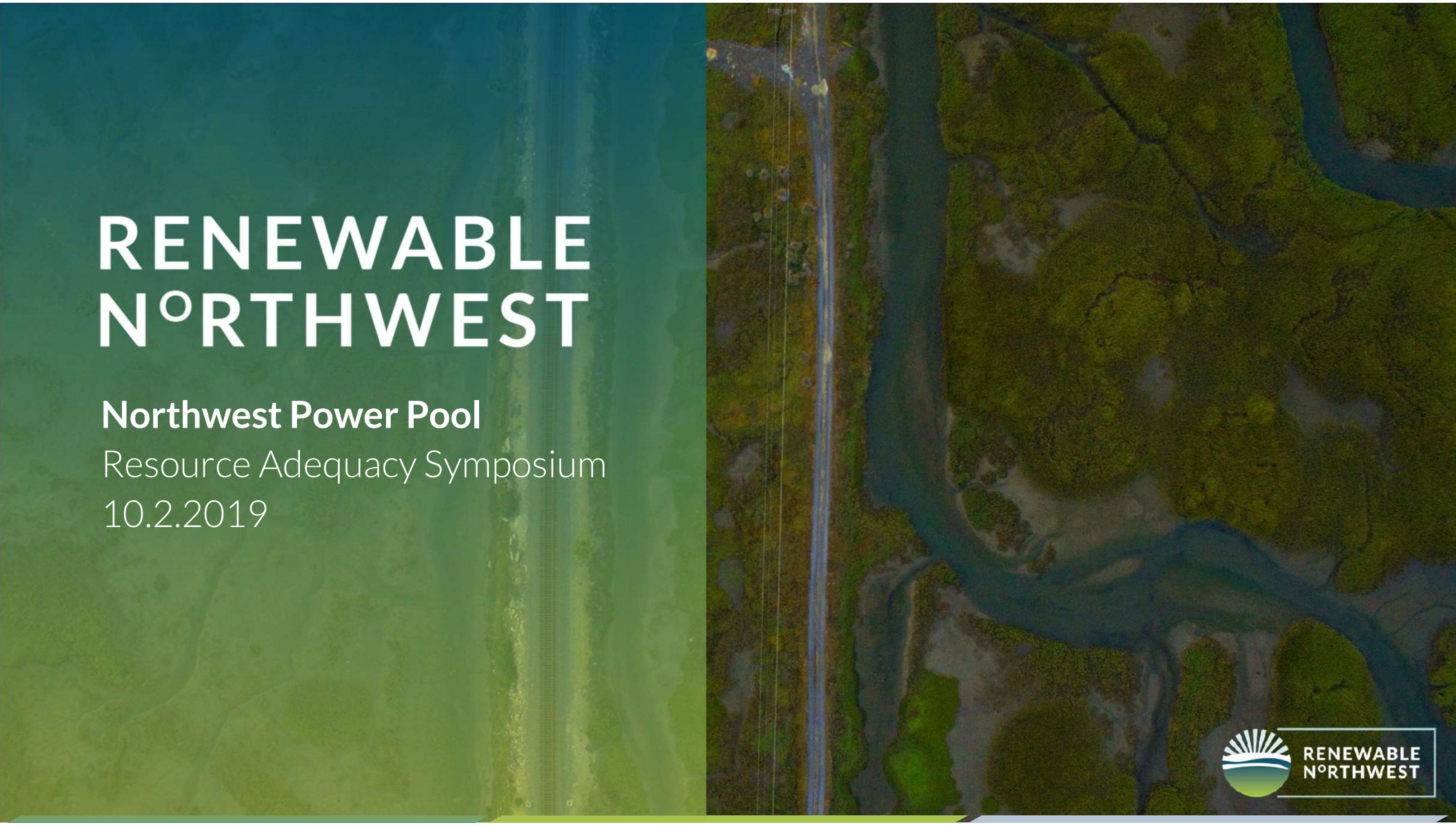


RENEWABLE NORTHWEST

Northwest Power Pool

Resource Adequacy Symposium

10.2.2019

Agenda

1. About Renewable NW
2. Introduction
3. Resource Trends
4. Cost of Energy
5. Principles for Regional Resource Adequacy Planning

> **We advocate for the expansion of environmentally responsible renewable energy resources in the Northwest through collaboration with government, industry, utilities, customers, and advocacy groups**

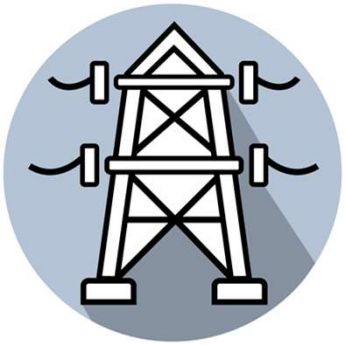
— Renewable NW Mission Statement

RENEWABLE NORTHWEST

Program Areas

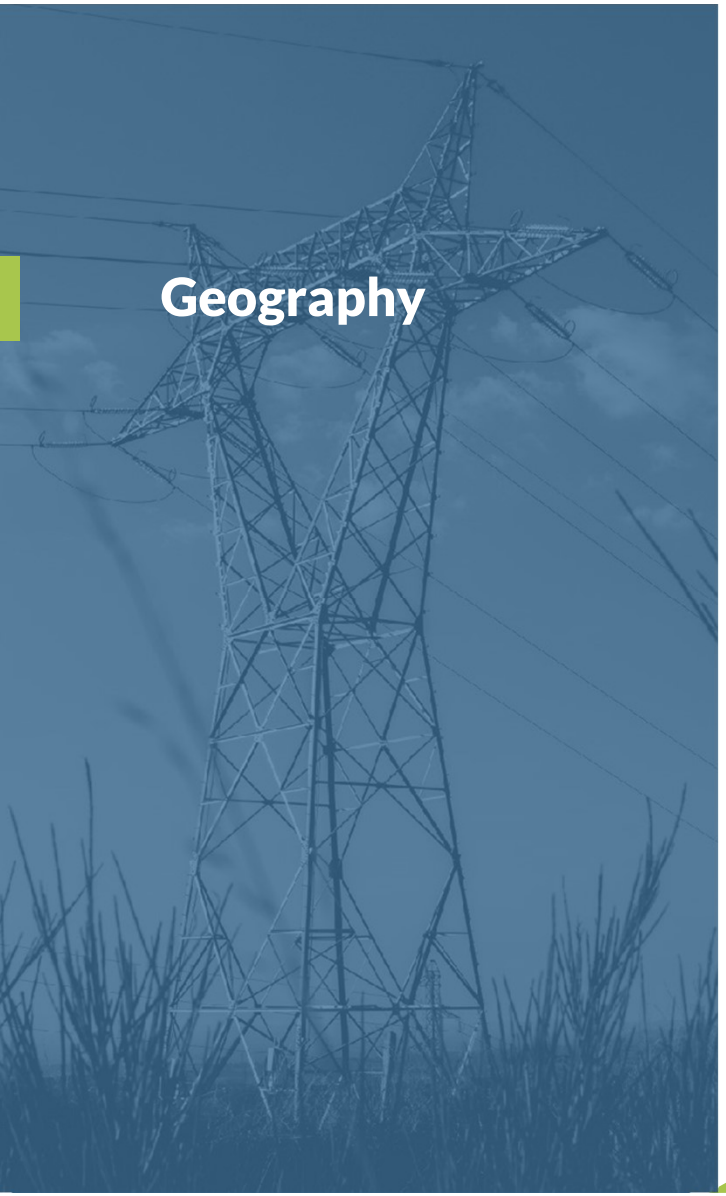
Planning

Policy

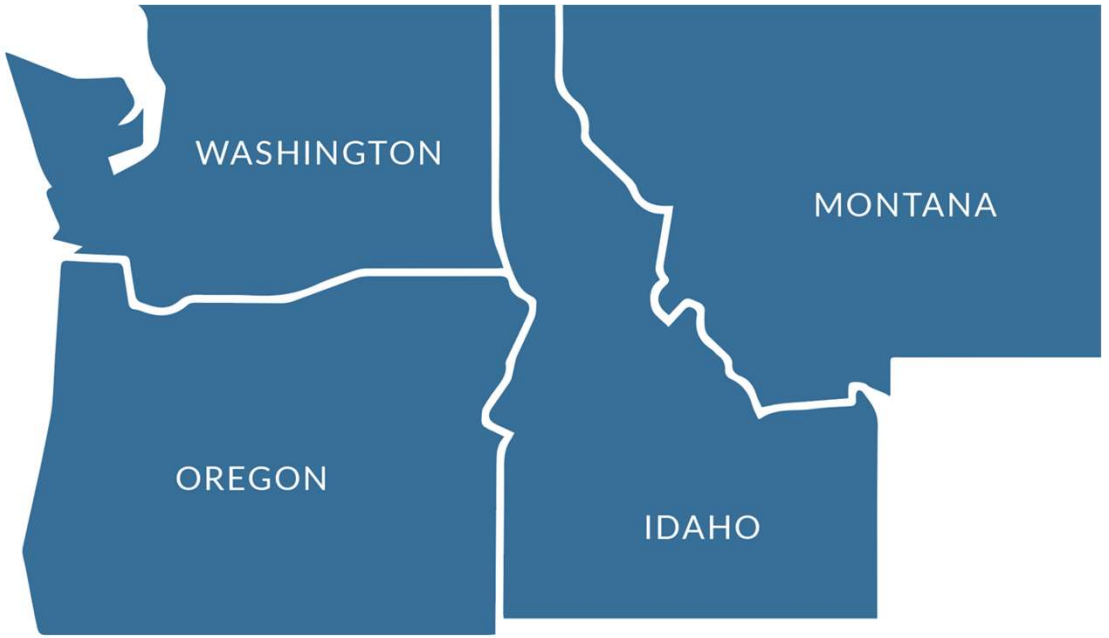


Markets & Transmission

RENEWABLE NORTHWEST



Geography



RENEWABLE NORTHWEST

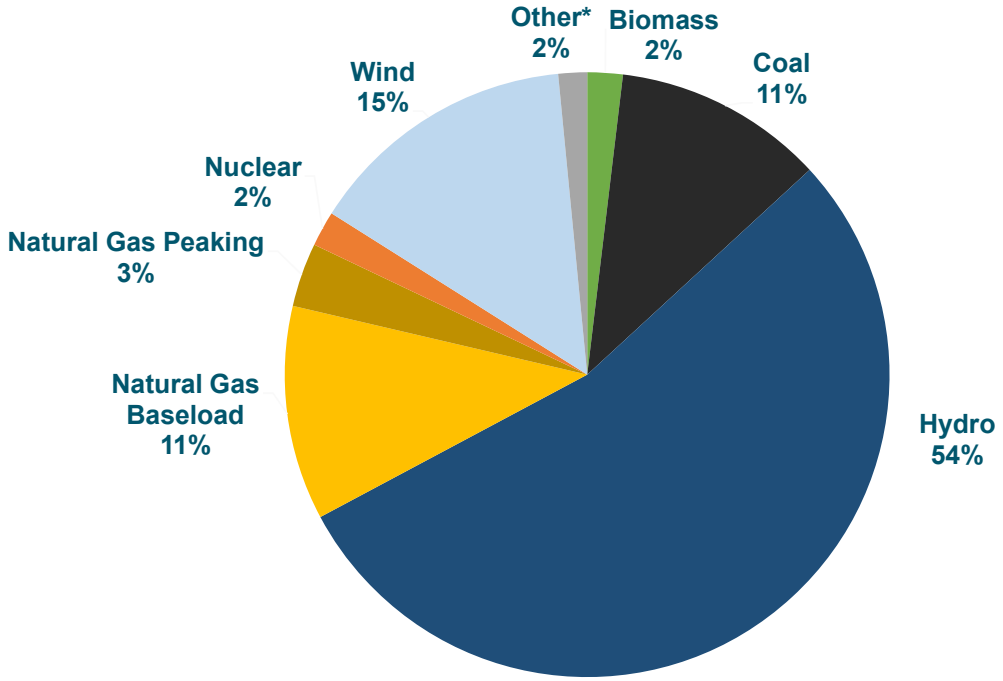
Introduction

- RNW values a coordinated and consistent process for determining our resource adequacy needs throughout the region.
- We support the development of market opportunities that facilitate integration of renewable energy and prioritizes decarbonization.
- There is an urgency to look at our system differently.
- We are encouraged by the action of some utilities in the NW to be creative and open-minded about meeting capacity needs with non-emitting resources.

RENEWABLE NORTHWEST

Pacific NW Installed Nameplate Capacity

63,512 MW



*Other - Geothermal, Petroleum, Solar, Energy Storage (Pumped Hydro + Battery)
** Source: NWPCC January 2018

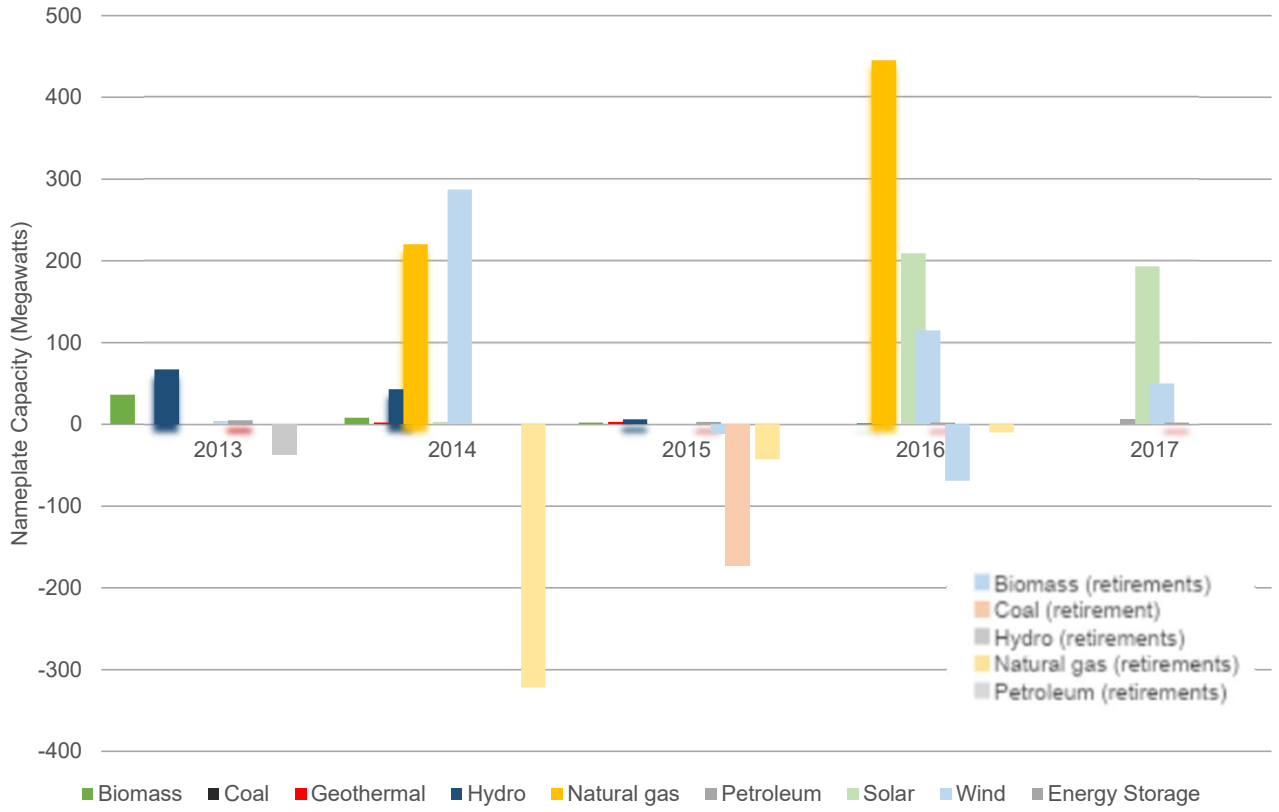
RENEWABLE NORTHWEST

Pacific NW Resource Additions & Retirements: 2013-1017

Net coal retirements:
-173 MW

Net renewable additions:
Wind: +452 MW
Solar: +402 MW

Storage:
+12 MW

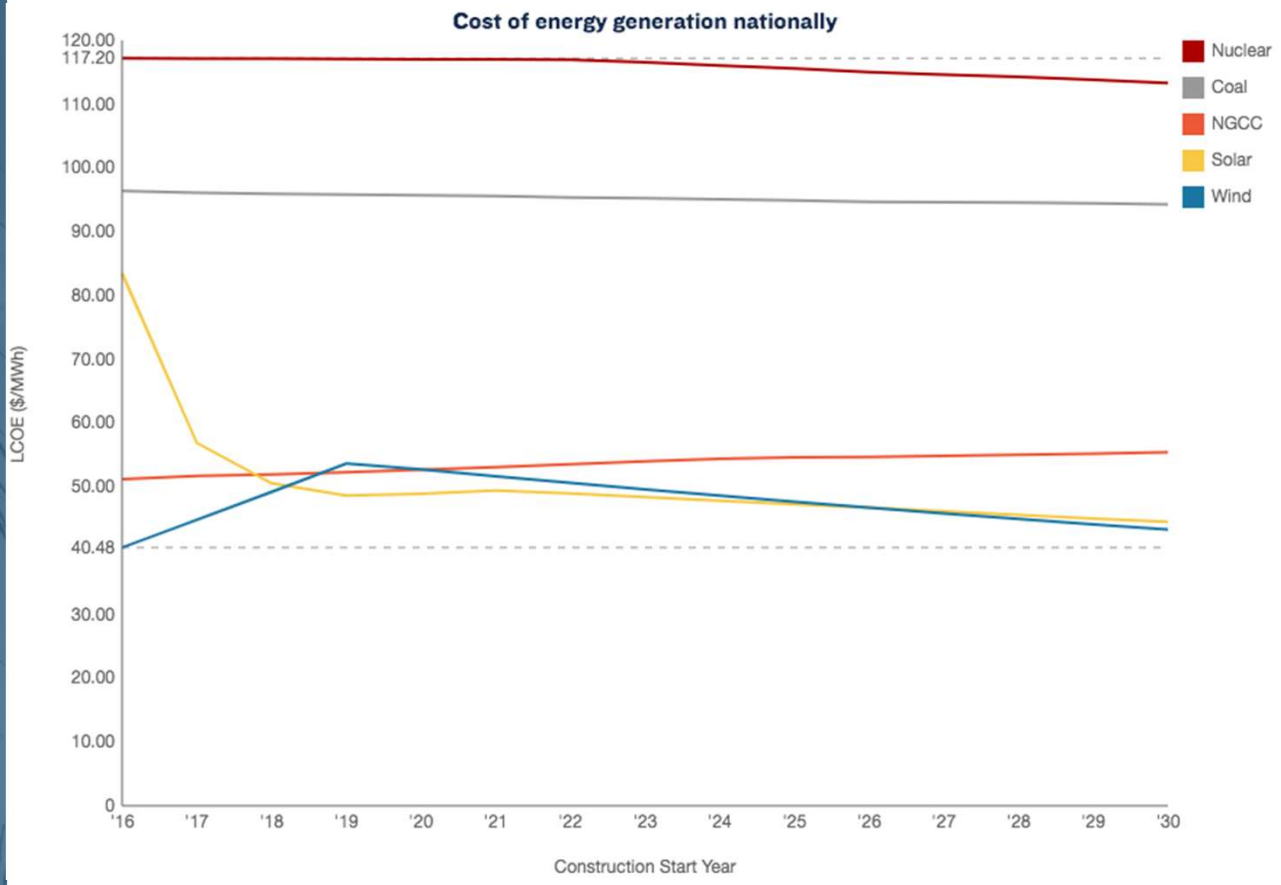


** Source: NWPCC January 2018

RENEWABLE NORTHWEST

What Is Driving Current Trends?

- LCOE Drop
- Policy
- Customer Demand
- Environmental Concerns
- Financial Risk



** Source: https://www.nrdc.org/cost-building-power-plants-your-state

RENEWABLE NORTHWEST

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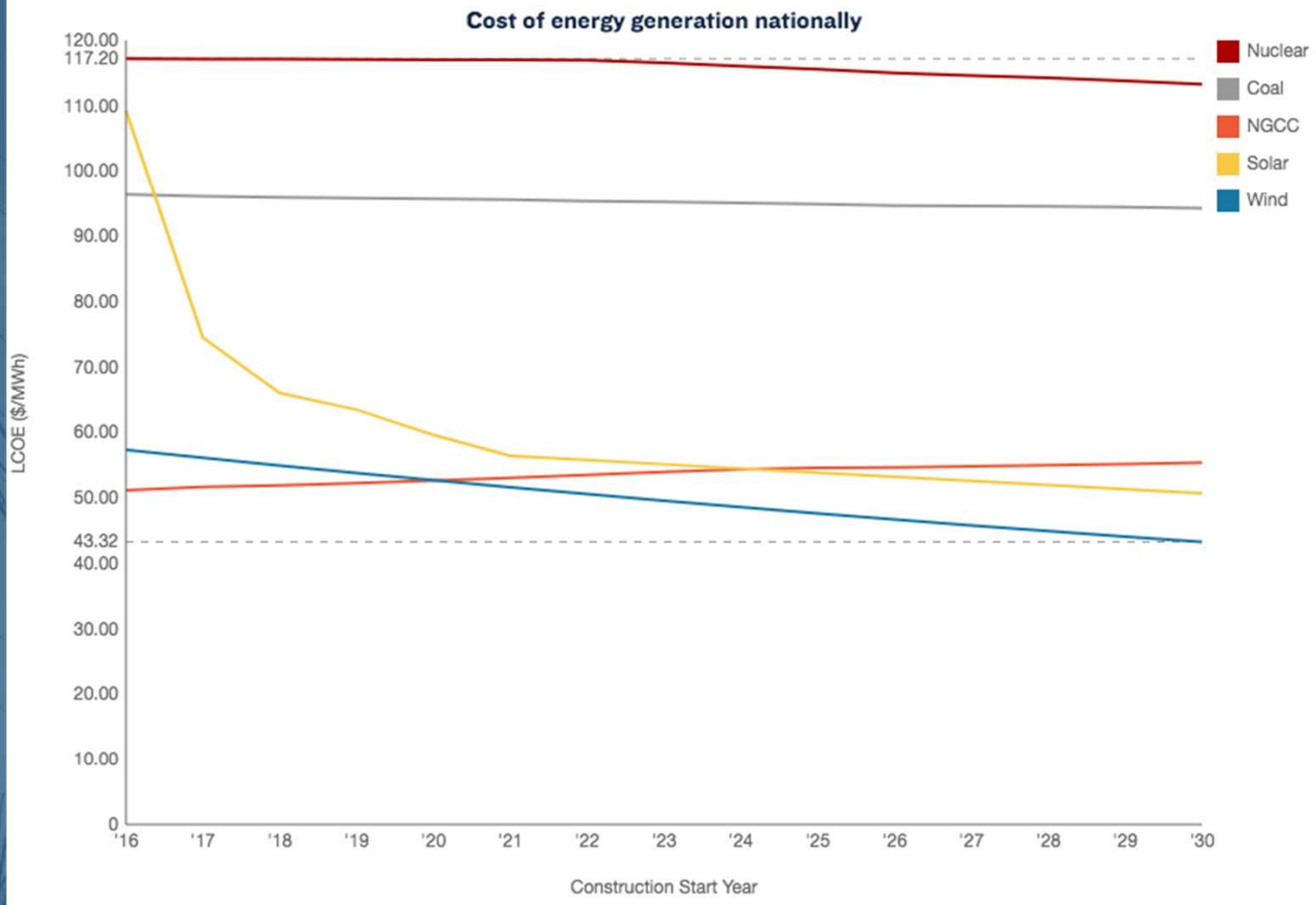

** Source: https://www.nrdc.org/cost-building-power-plants-your-state

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Next Steps For Meeting Clean Energy Requirements And Goals

- Closure and replacement of remaining coal plants
- Creation of market structures that value geographic diversity and non-energy attributes of all resources, including hydro
- Consider a regulatory structure which incentivizes investments in decarbonization
- Combination of Renewables, Storage and Demand-Side Resources (including EE)

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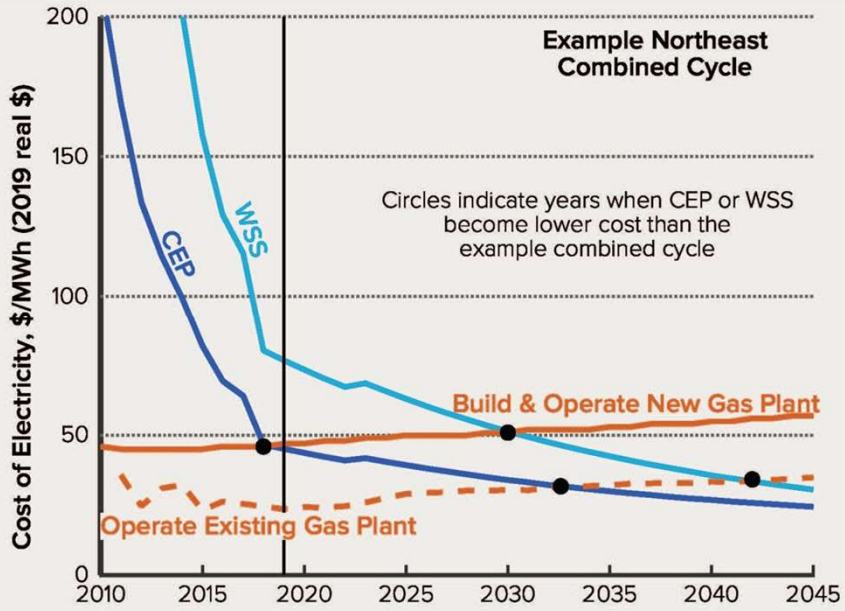
Clean Energy Portfolio v. New Gas



** Source: Rocky Mountain Institute

RENEWABLE NORTHWEST

Principles for a Robust RA Standard

Reliability
Need to maintain the reliability of our energy system in a way that is cost effective.

Consistency
Need consistency in the way we value capacity resources.
Consistency in the way we calculate resource adequacy.

Transparency
System-wide transparency to be able to evaluate where capacity resources are needed across the region, not on a utility by utility basis.

Responsibility/Accountability
- Need utilities to be open to considering unique ways to meet the opportunity.
- Need utility investors to own the risk of building new capacity resources which may become stranded assets in the near future.

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RENEWABLE NORTHWEST

CONTACT

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Executive Director
c: 503-789-5741
e: nicole@renewablenw.org

RENEWABLE NORTHWEST

IRP OVERVIEW

Some Observations on Utility Resource Planning

Scott Kinney, Avista

October 2, 2019

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APPROACH TO IRP ASSESSMENT

Surveyed 16 utilities – methods and assumptions for IRPs

- Total non-coincident peak around 47,000 MW (includes summer and winter peaks)
- Traditional NWPP footprint, includes BC Hydro

Identified similarities and differences in needs assessments (resource adequacy) methods, metrics and analysis inputs

Identified similarities and difference in planning requirements and practices across the states (COUs, IOUs)

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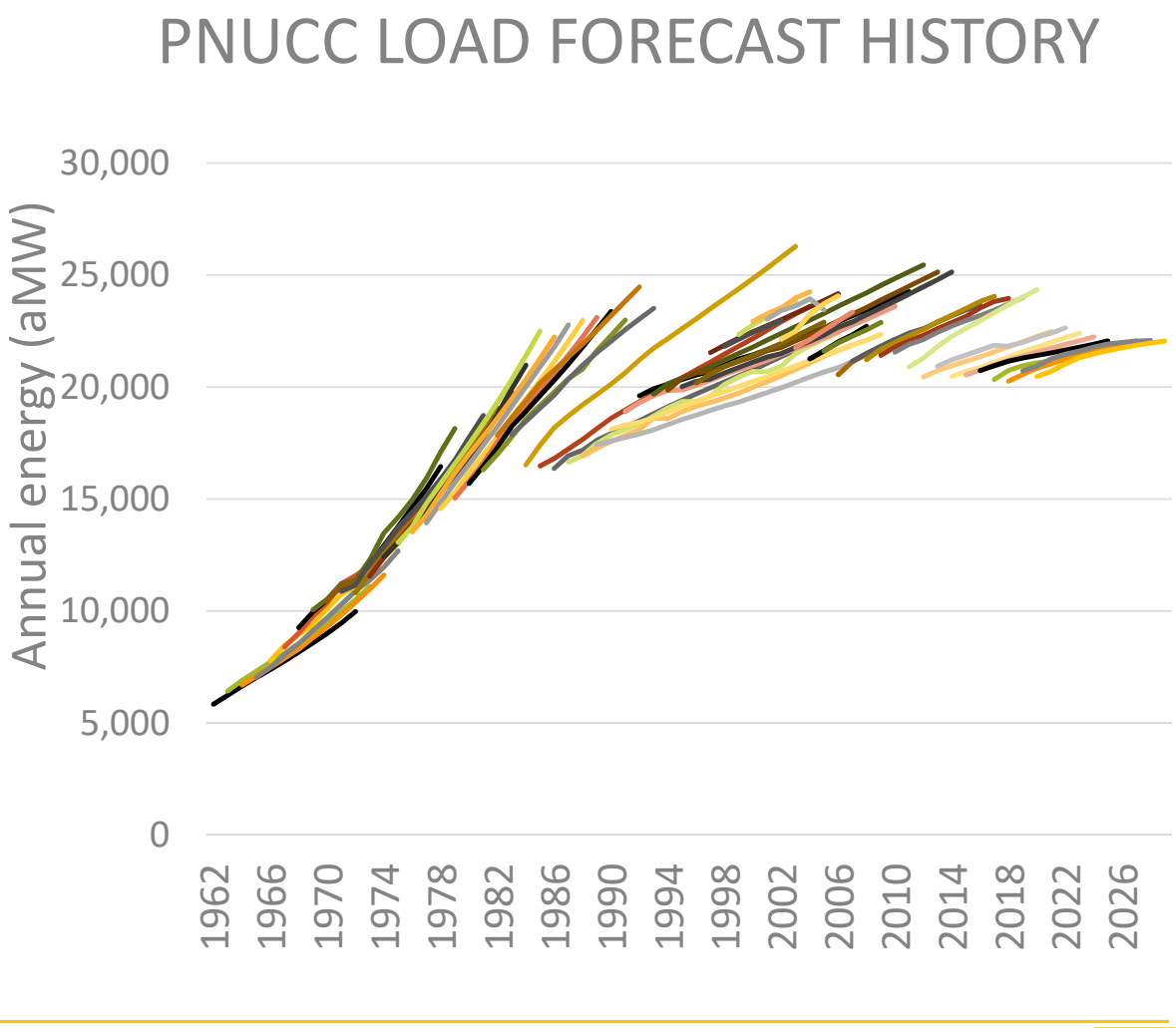

RESOURCE ADEQUACY METHODS AND ASSUMPTIONS

What method or metric do you plan to?

What level of load growth is your utility expecting?

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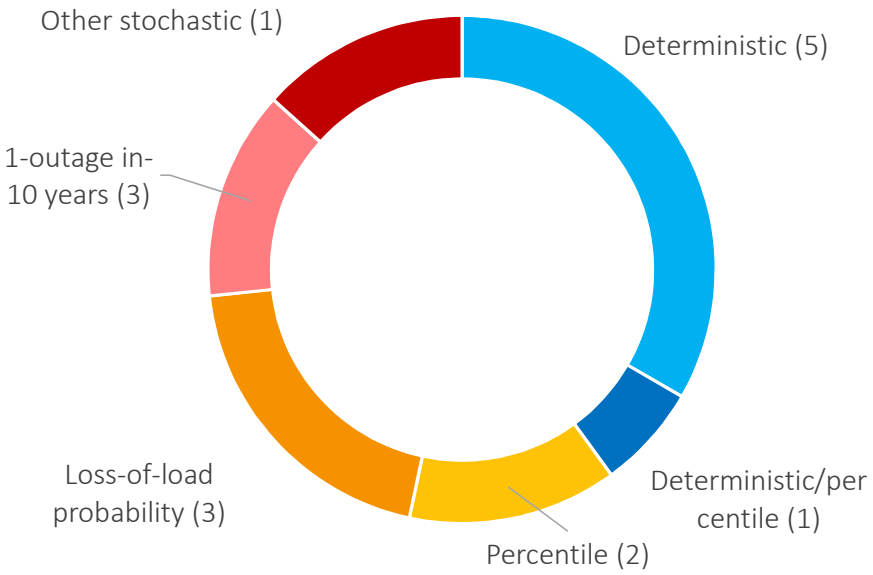
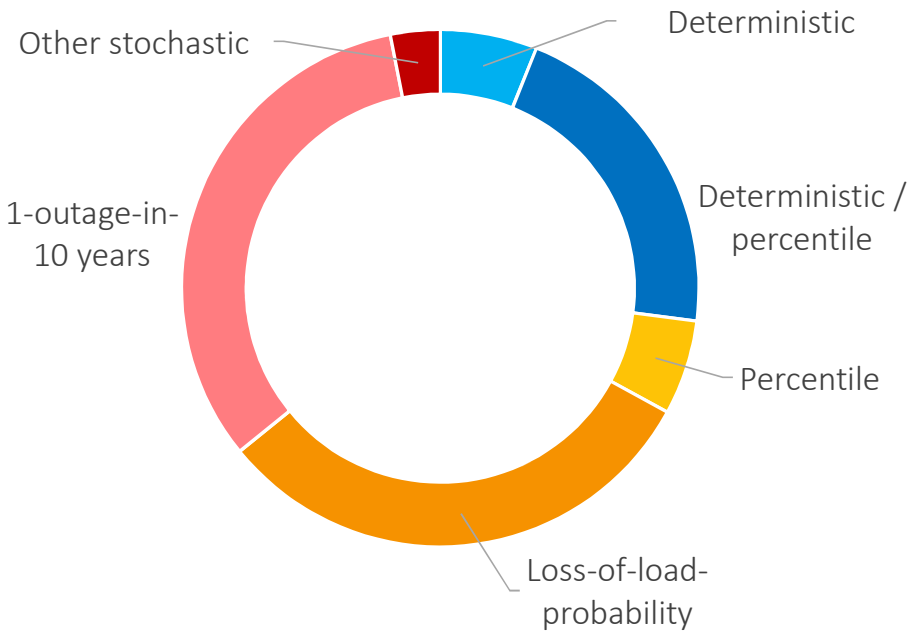
IRP NEEDS ASSESSMENT METHOD

Weighted by number of utilities



Weighted by peak load



Data from IRP survey. Missing data filled in when possible.

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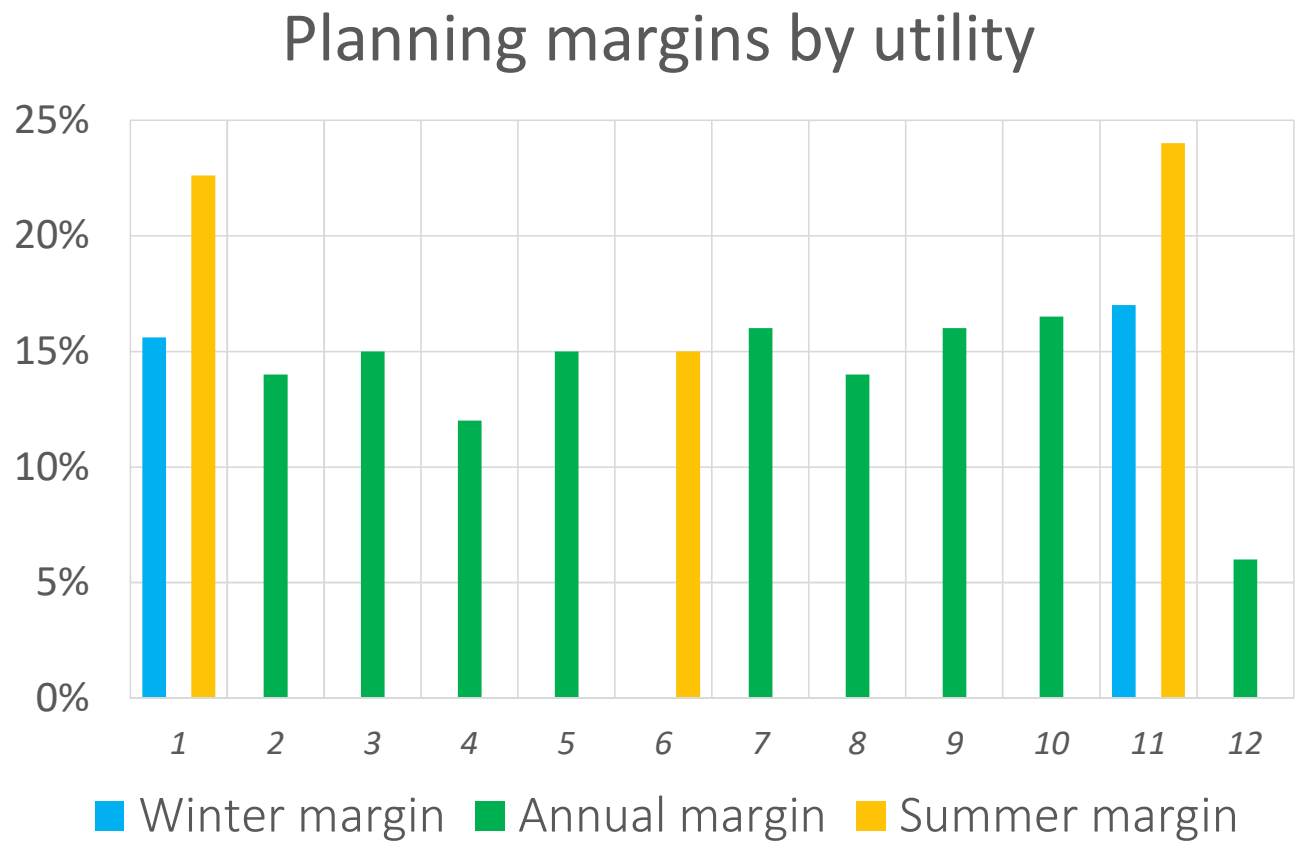
PLANNING MARGINS

Some margins are inputs, others are outputs

Most includes operating reserves



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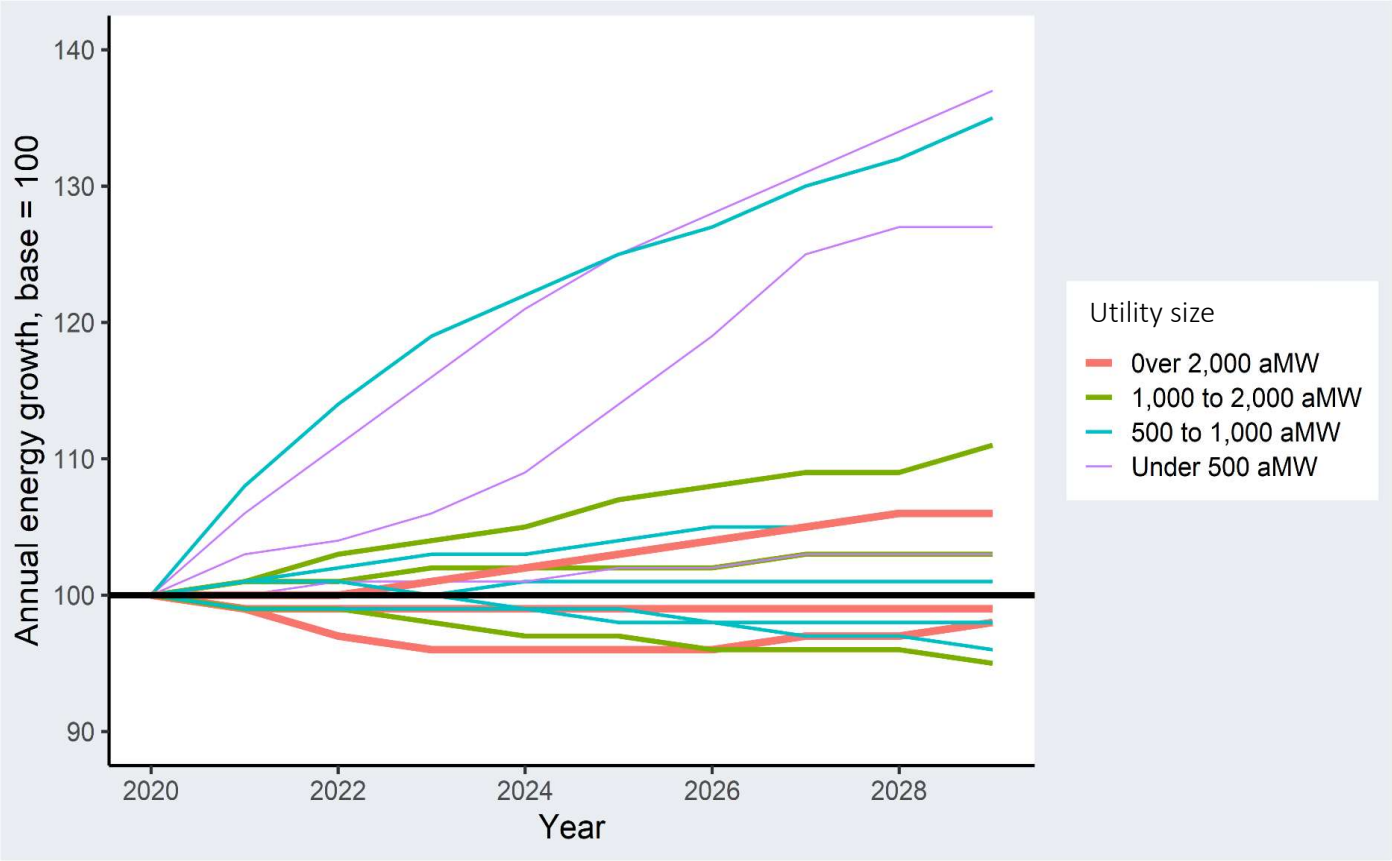
LOAD GROWTH VARIES



Smaller utilities seeing higher percent growth

Large new customer(s) more influential in smaller service areas

Data from PNUCC Forecast – does not include BC Hydro or BPA

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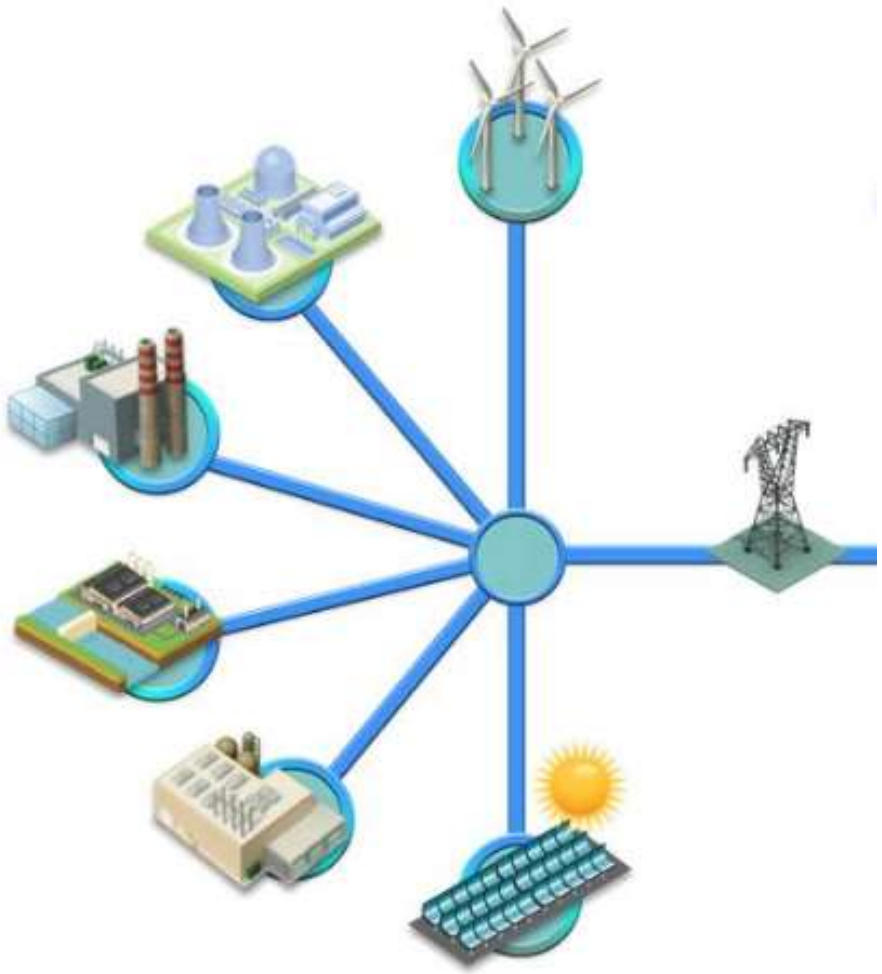

RESOURCE PEAK CONTRIBUTION

For each resource type, how much generation do you count on for meeting demand?

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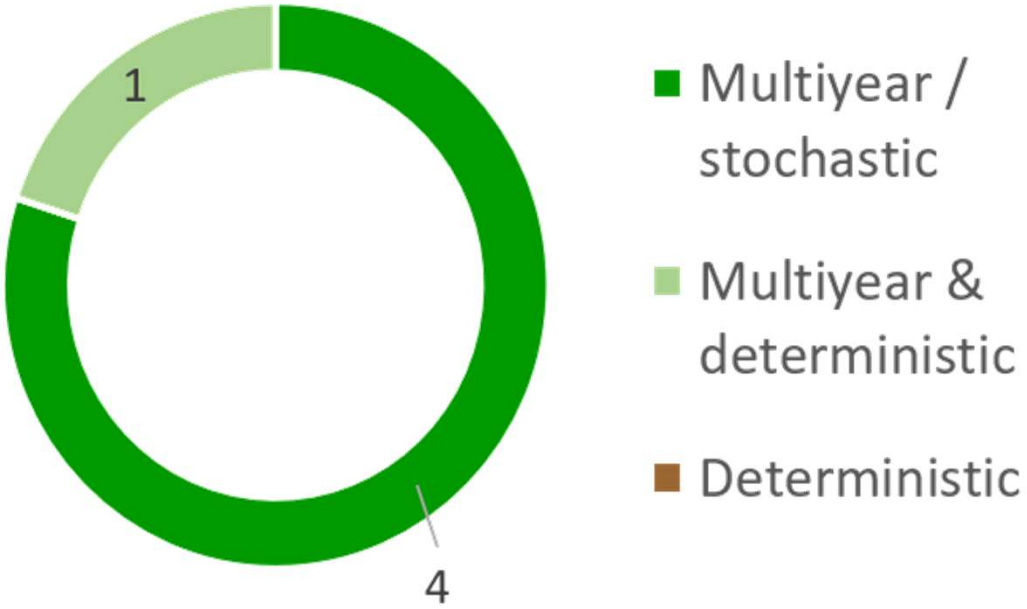
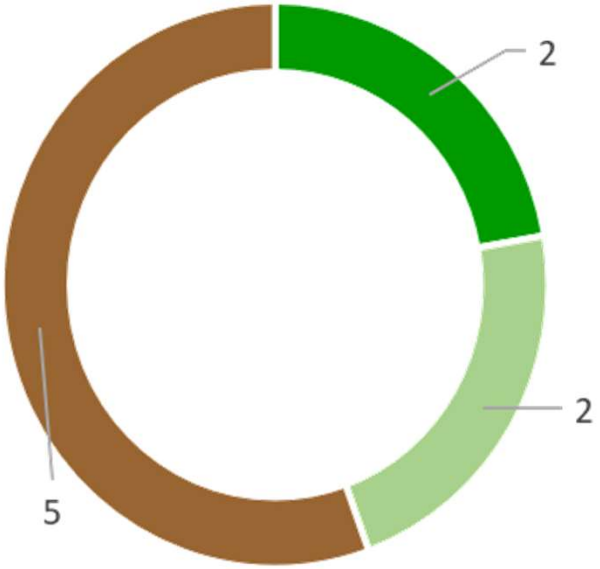
HYDROPOWER ASSESSMENT METHODS

Investor-owned utilities



Public-owned utilities



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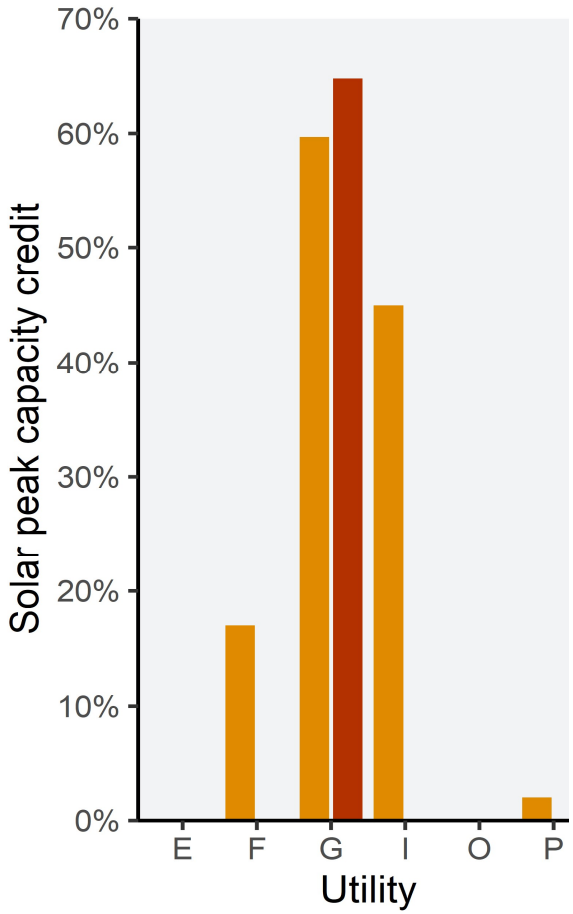
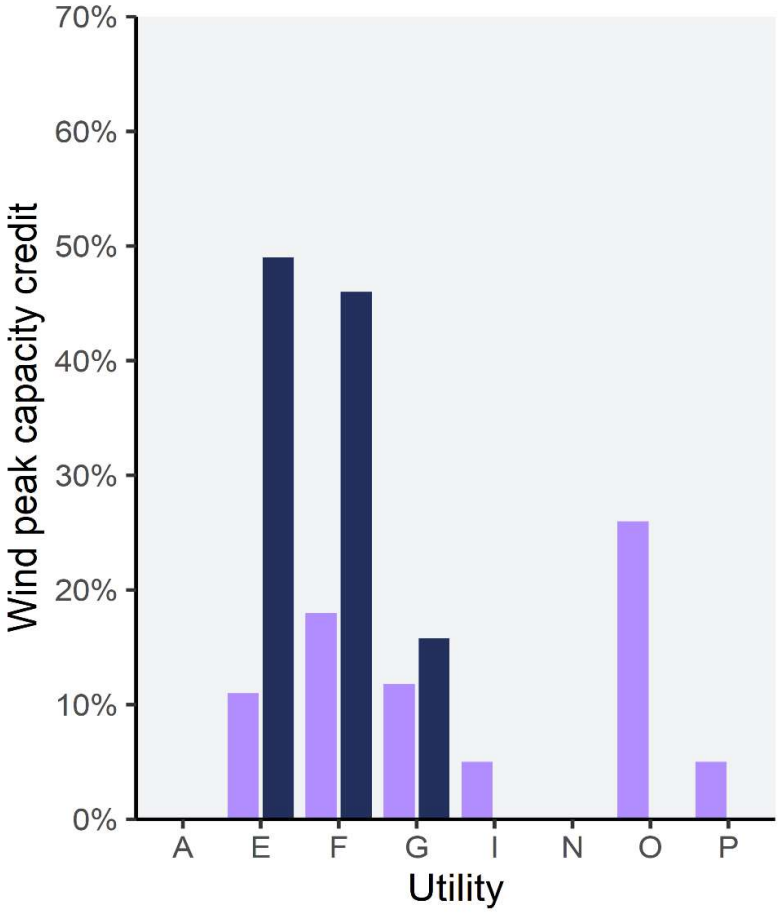
WIND & SOLAR PEAK CONTRIBUTION VARIES

Depends on:
- Location
- Season of stress
- Existing portfolio
- Analysis method





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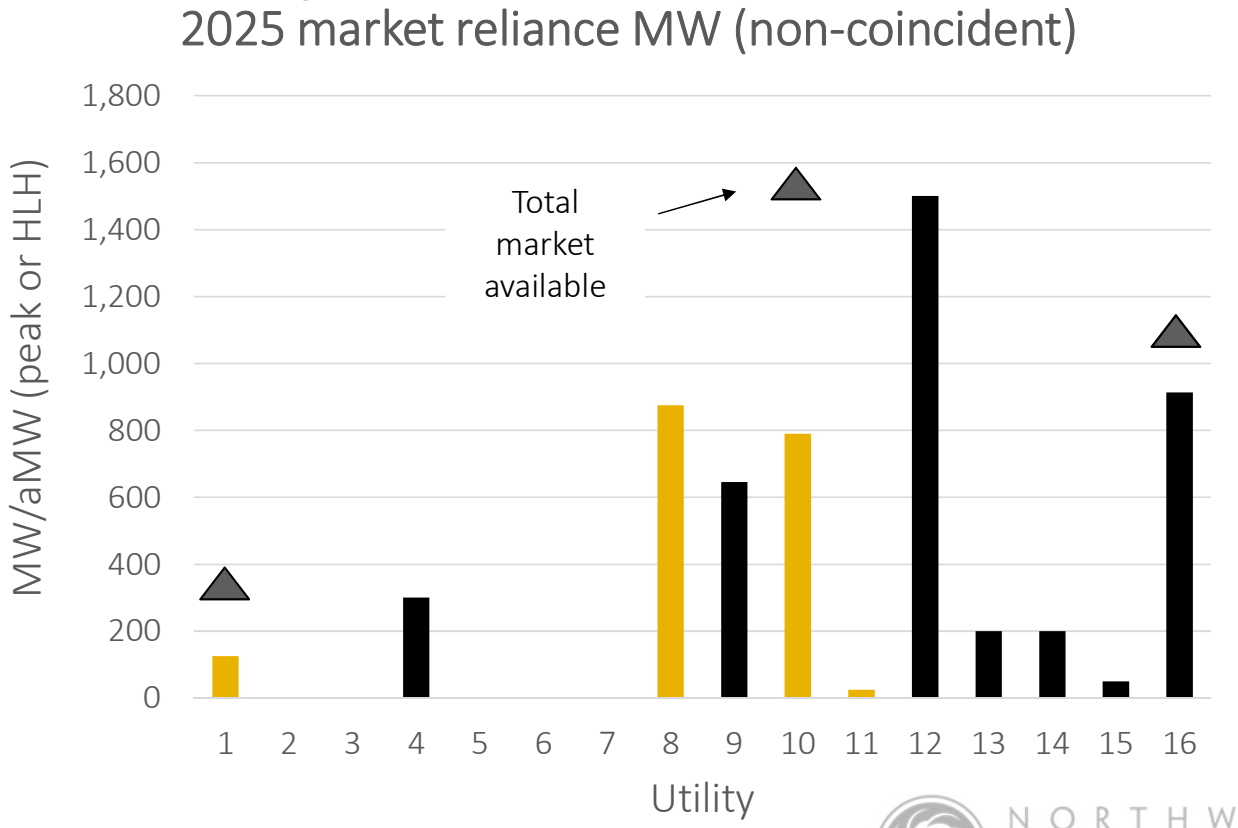
MARKET RELIANCE, YES!

Season of highest use
SUMMER
WINTER



Data from IRP survey. Missing data filled in when possible.

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STATE PLANNING REQUIREMENTS

- ✓ Common requirements include:
  - Open public process
  - Least cost planning
  - Regular filing intervals
  - Conservation potential and demand response evaluation
  - Scenario planning – market prices, load growth, early retirements
  - Assess environmental costs and impacts
- ✓ Other considerations
  - Inform or determine avoided costs
  - Include transmission assessments
  - Evaluate distributed generation resources and storage

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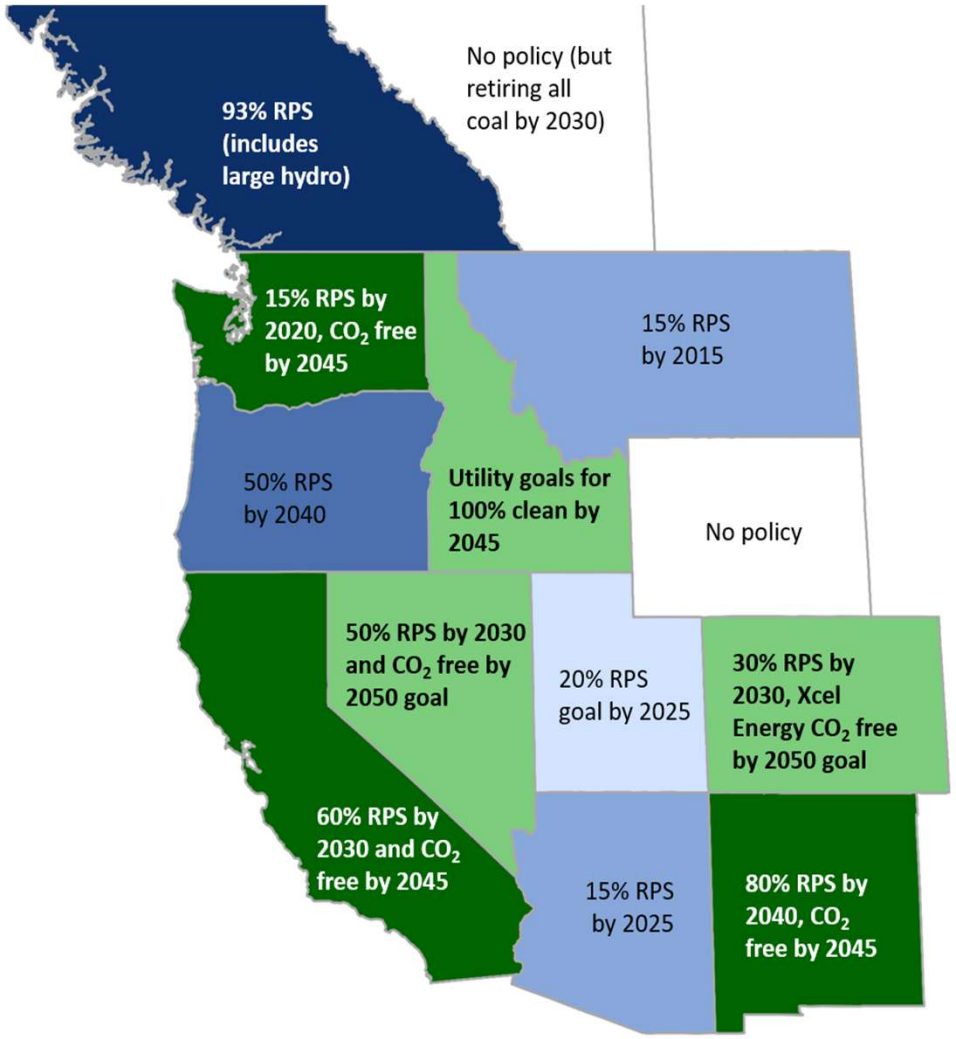

STATE RESOURCE PLANNING REQUIREMENTS

Emission policies are driving changes

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KEY SURVEY TAKEAWAYS

- ✓ Each utility approaches resource planning uniquely
  - IRPs are tailored for each utility and are changing with new policy
  - This makes it tricky to cross-compare
- ✓ Utilities rely on the market to maintain resource adequacy
  - Market depth is not measured or monitored
- ✓ The changing power system is driving the need to review and consider new approaches to resource adequacy
  - Thermal retirements are a key force driving resource adequacy review
- ✓ A Resource Adequacy Program doesn't replace the IRP process
  - They will supplement and inform each other

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THANK YOU!

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ROLE OF NATURAL GAS

Interdependence with Electric Power Generation

Dan Kirschner

Northwest Gas Association

October 2, 2019

NORTHWEST PowerPool

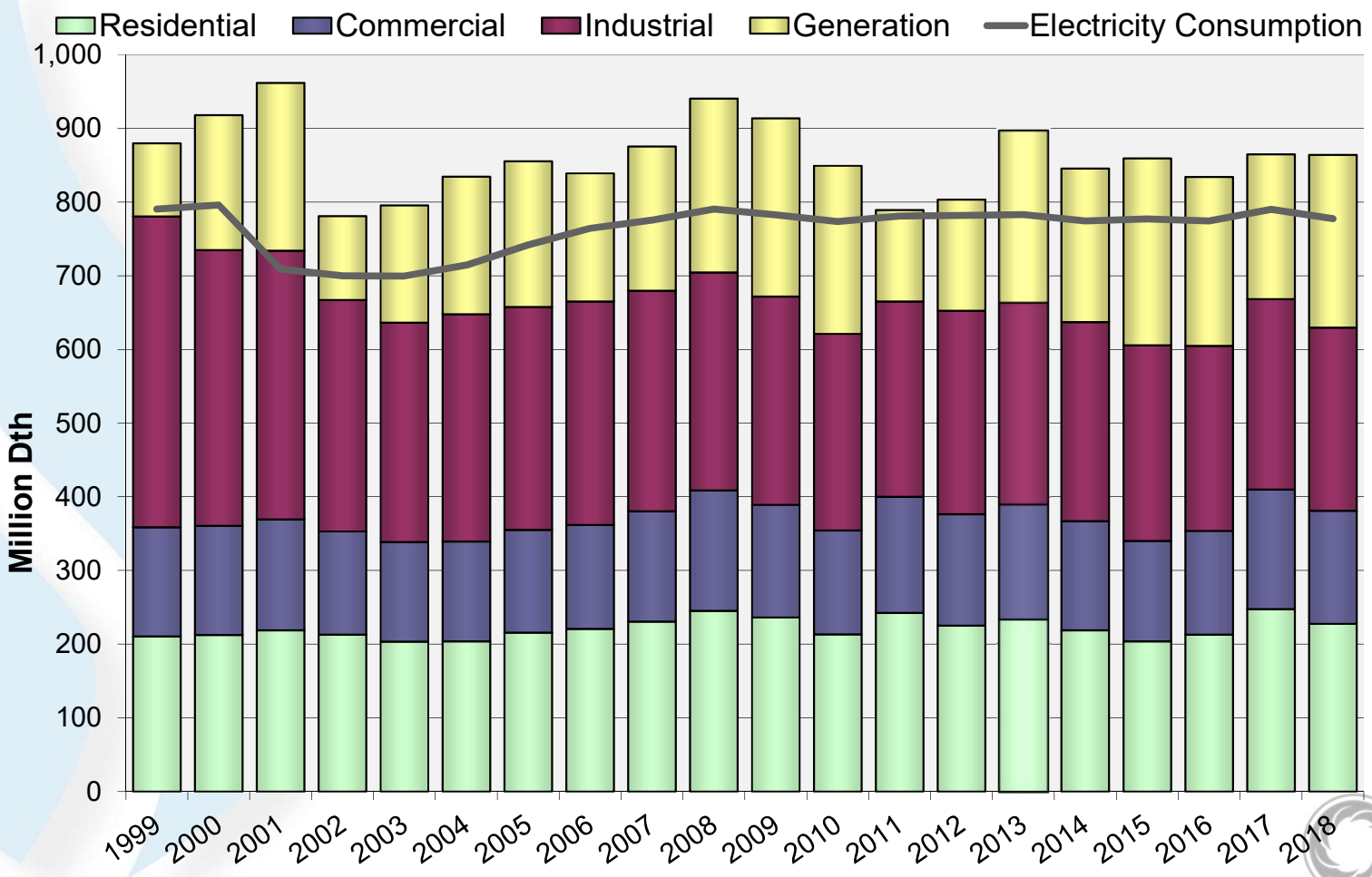
NORTHWEST GAS ASSOCIATION

1914 Willamette Falls Dr., #255
West Linn, OR 97068
(503) 344-6637
www.nwga.org

Members

Avista Utilities
Cascade Natural Gas Corp.
FortisBC Energy
Intermountain Gas Co.
NW Natural
Puget Sound Energy
Enbridge BC Pipeline
TC Energy GTN System
Williams NW Pipeline

RECENT GAS DEMAND



NWGA
NORTHWEST GAS ASSOCIATION

Gas Customers (2018)

Res:	3,287,578
Com:	326,492
Ind:	6,047
Total:	**3,620,117**

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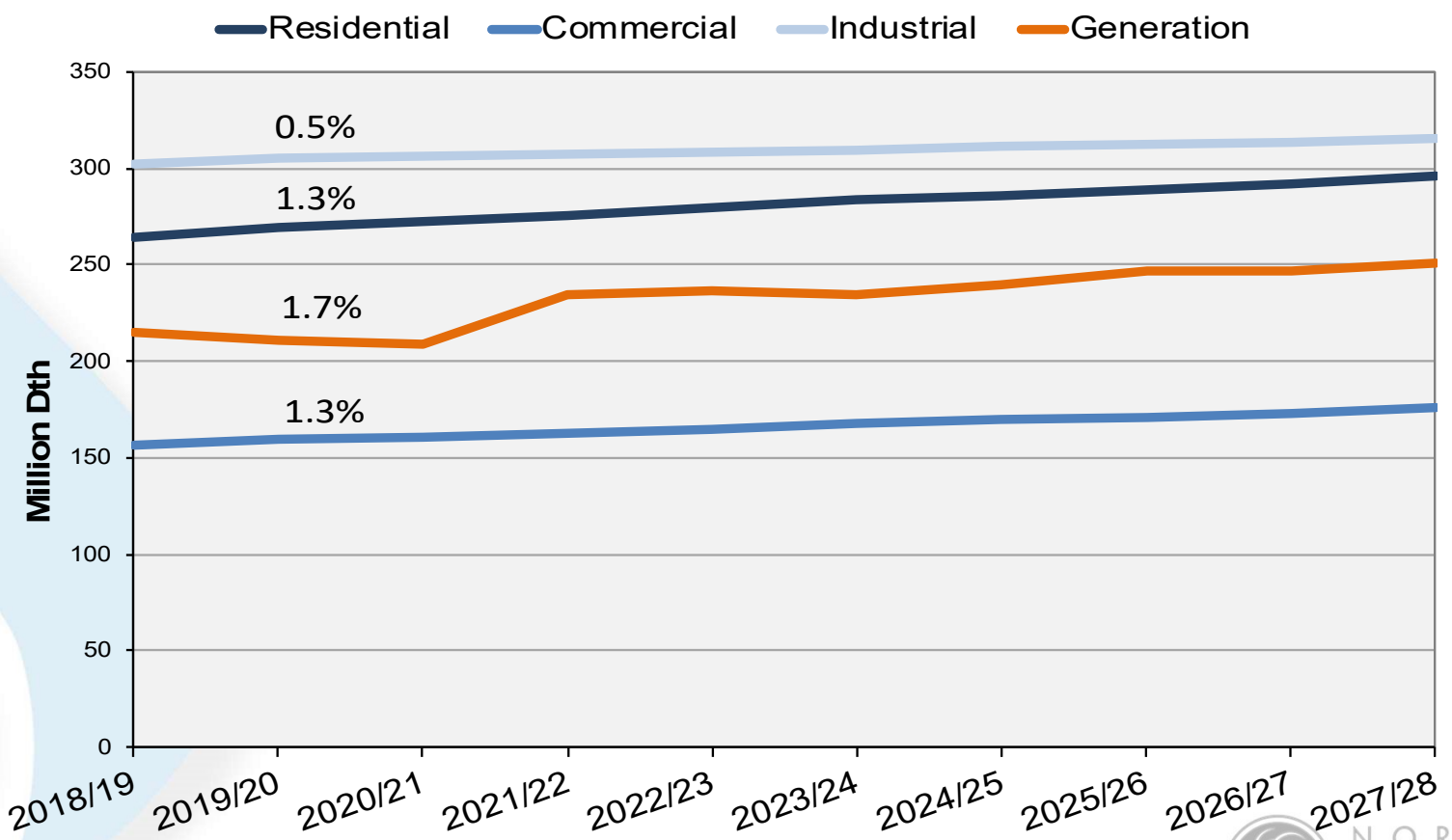
2018 OUTLOOK FORECAST (1.1% CAGR)



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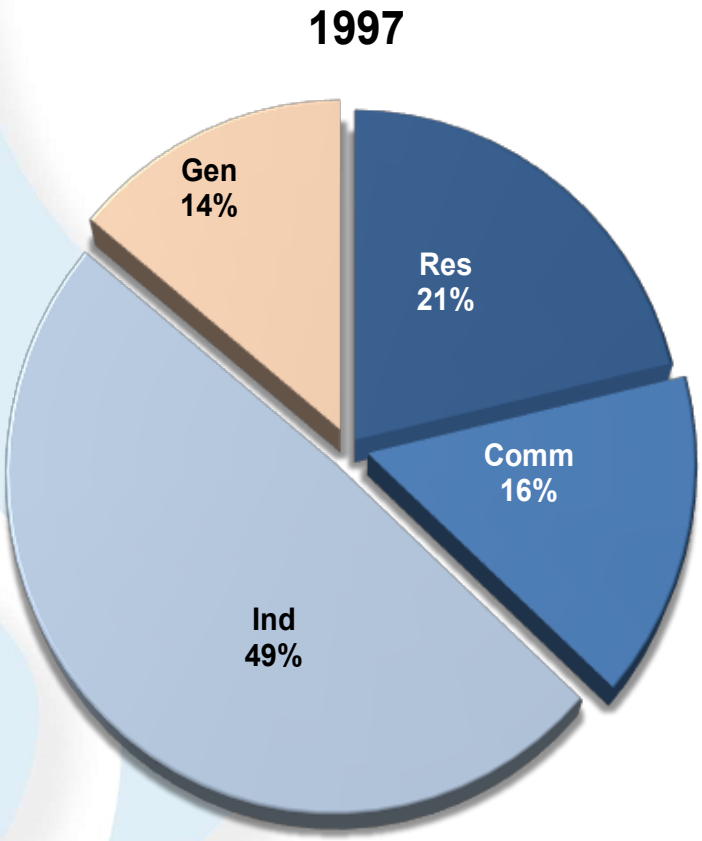
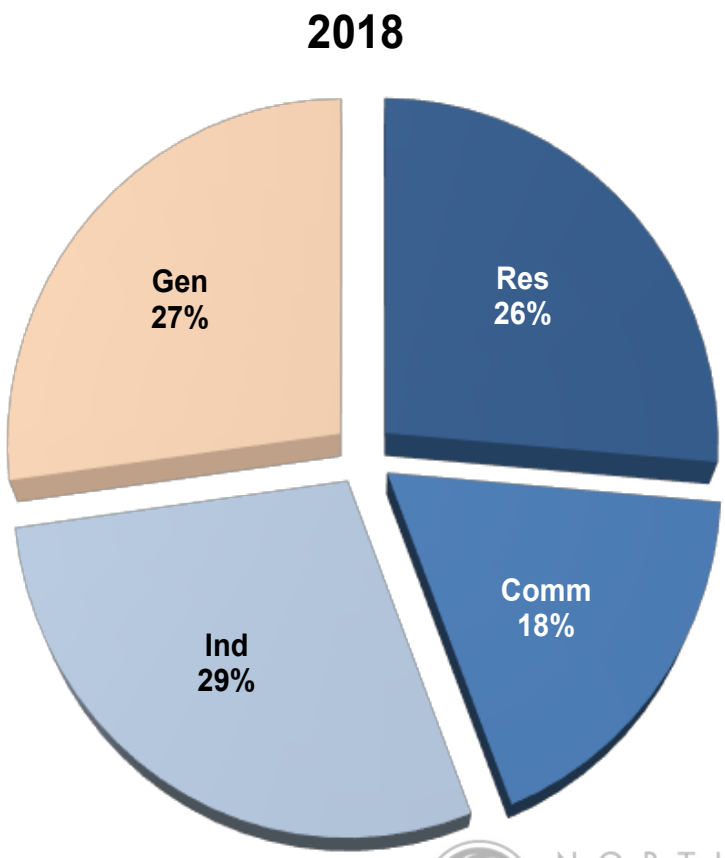
LOAD COMPOSITION





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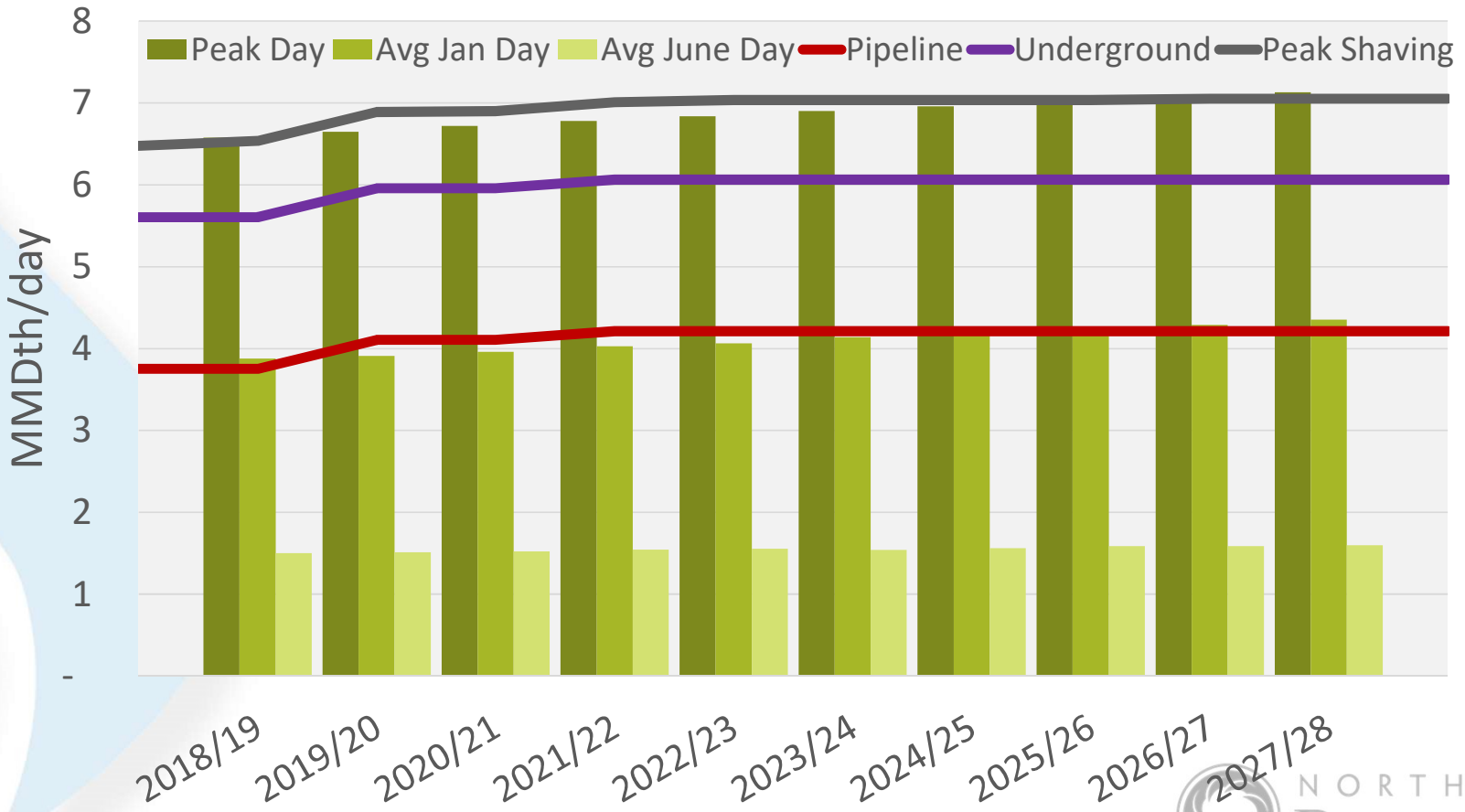
SUPPLY DEMAND BALANCE



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GAS, ELECTRIC PEAKS CONCURRENT

January 5, 2017, 7am-8am:

- ~30 GWh delivered via electric system
- ~1,500,000 therms delivered via gas system

1.5 million therms = 44 GWh

6.5 x

THANK YOU!

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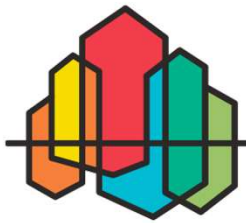
The Northwest Power and Conservation Council

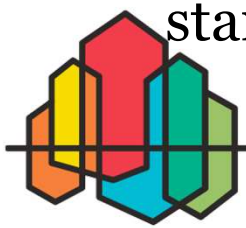
The 1980 Northwest Power Act authorized Idaho, Montana, Oregon, and Washington to develop a regional power plan and fish and wildlife program to balance the Northwest's environment and energy needs.

- Each state legislature passed laws to form the NWPCC
- The governors of each state appoints two Council Members
- Predominantly funded by rates collected by Bonneville



Why the Council established a standard

- Historically, L/R Bal was used to measure adequacy
- During the 1990s, it was assumed that "the market" would incentivize resource development
- Few resources were built – by 1998 L/R deficit grew to 4,000 aMW
- Region did not know if the power supply was adequate
- In 1999, Council took a probabilistic approach, built the GENESYS model and set the initial standard to 5% LOLP
- First adequacy assessment done in 1999 indicated an LOLP of 24%
- West Coast energy crisis of 2001 validated need for new standard



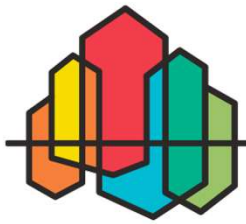
Council's Adequacy Standard[1]

- *The Council deems the regional power supply to be adequate if the likelihood of having one or more shortfalls in a future operating year is less than or equal to 5 percent (i.e. annual LOLP ≤ 5%).*

- Monte-Carlo program (GENESYS) simulates hourly operation thousands of times with each simulation drawing different manifestations of future unknowns:
  - River flow volume (based on historic record from 1929-2008)
  - Temperature-sensitive load (based on historic temperatures from 1949-2017)
  - Wind generation
  - Solar generation
  - Thermal resource forced outages

- Annual LOLP = $\frac{\text{Simulations with shortfalls}}{\text{Total number of simulations}}$

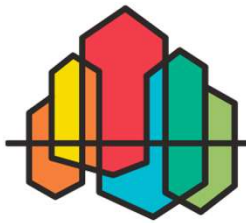
[1]Officially adopted by the Council in 2011.

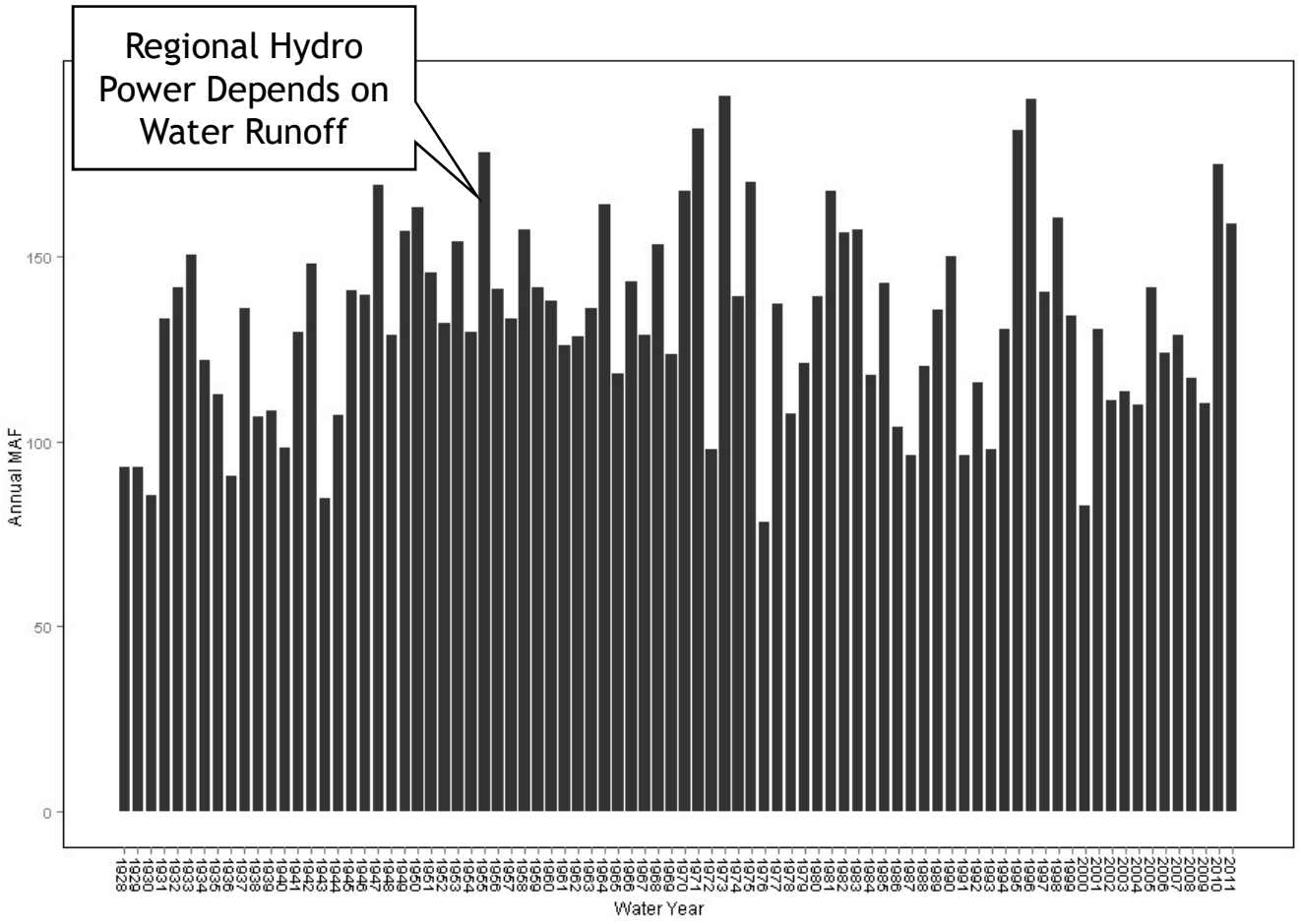


2021-24 Resource Adequacy Assessments

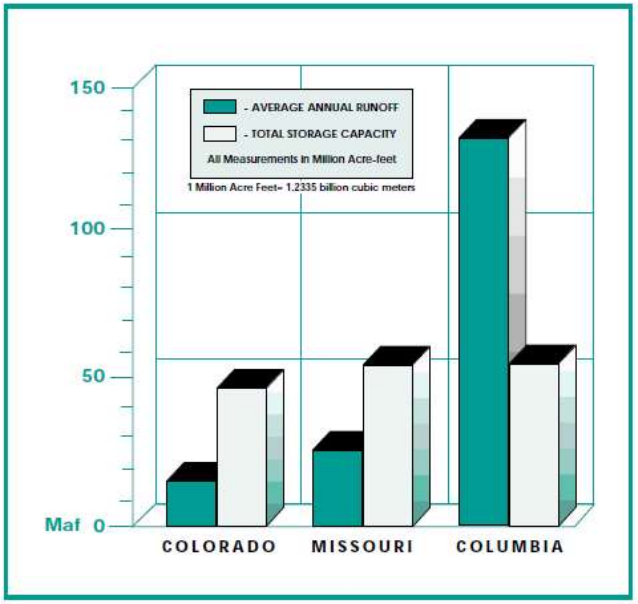
- 2021 LOLP = 7 to 8%
  1,619 MW Retired Capacity (Hardin, Colstrip 1 and 2, Boardman, Centralia 1)
- 2022 LOLP = 7 to 8%
  127 MW Retired Capacity (N Valmy 1)
- 2023 LOLP = 7 to 8%
  No coal retirements

- 2024 LOLP = 8.2% - with mostly winter shortfalls
  No coal retirements in reference case
- 2024 LOLP = 33% - with both winter and summer shortfalls
  1,853 MW Early retirement case (Centralia 2, Bridger 1 and 2, N Valmy 2)

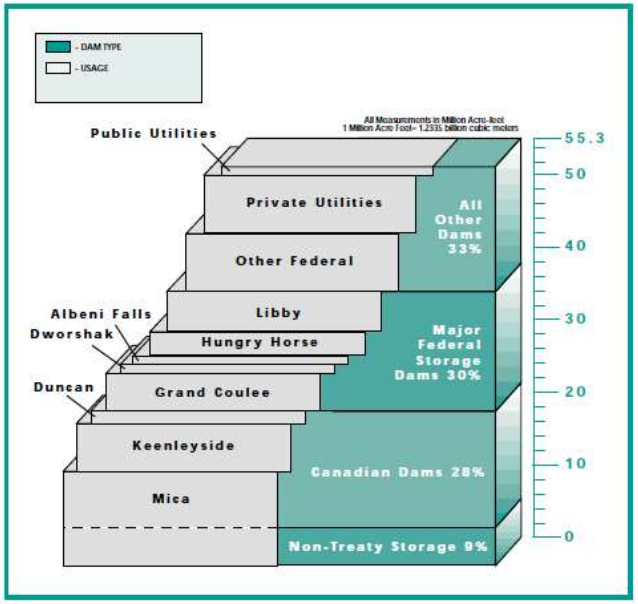



Regional Hydro Power Depends on Water Runoff
Annual MAF
0
50
100
150
Water Year

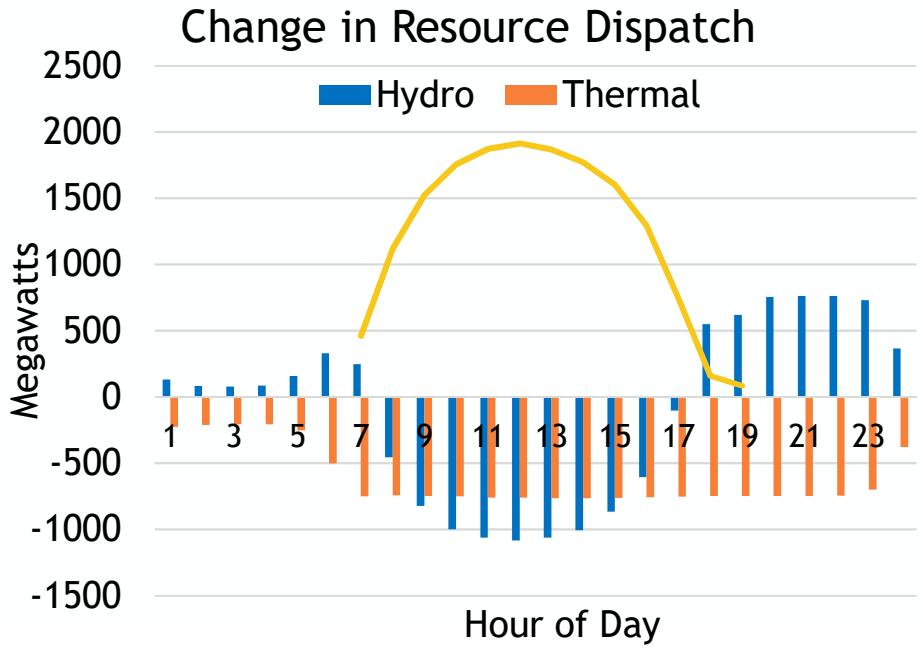
Columbia River Runoff and Storage Compared to the Colorado and Missouri Rivers



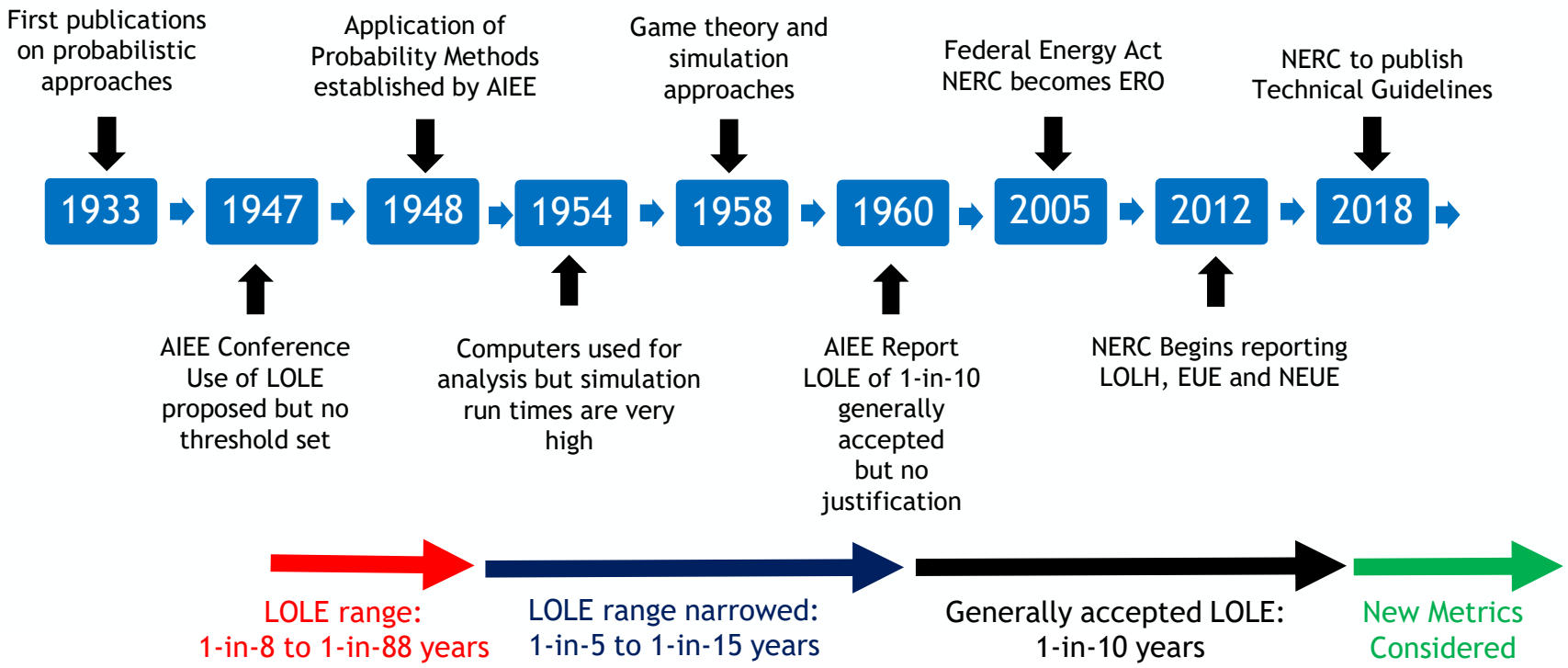
Columbia River System Storage Space



Integrated Solar affects both Hydro and Thermal Resources

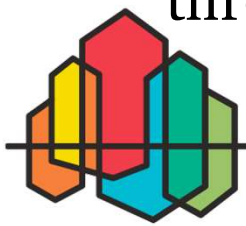


Milestones in Adequacy Assessments

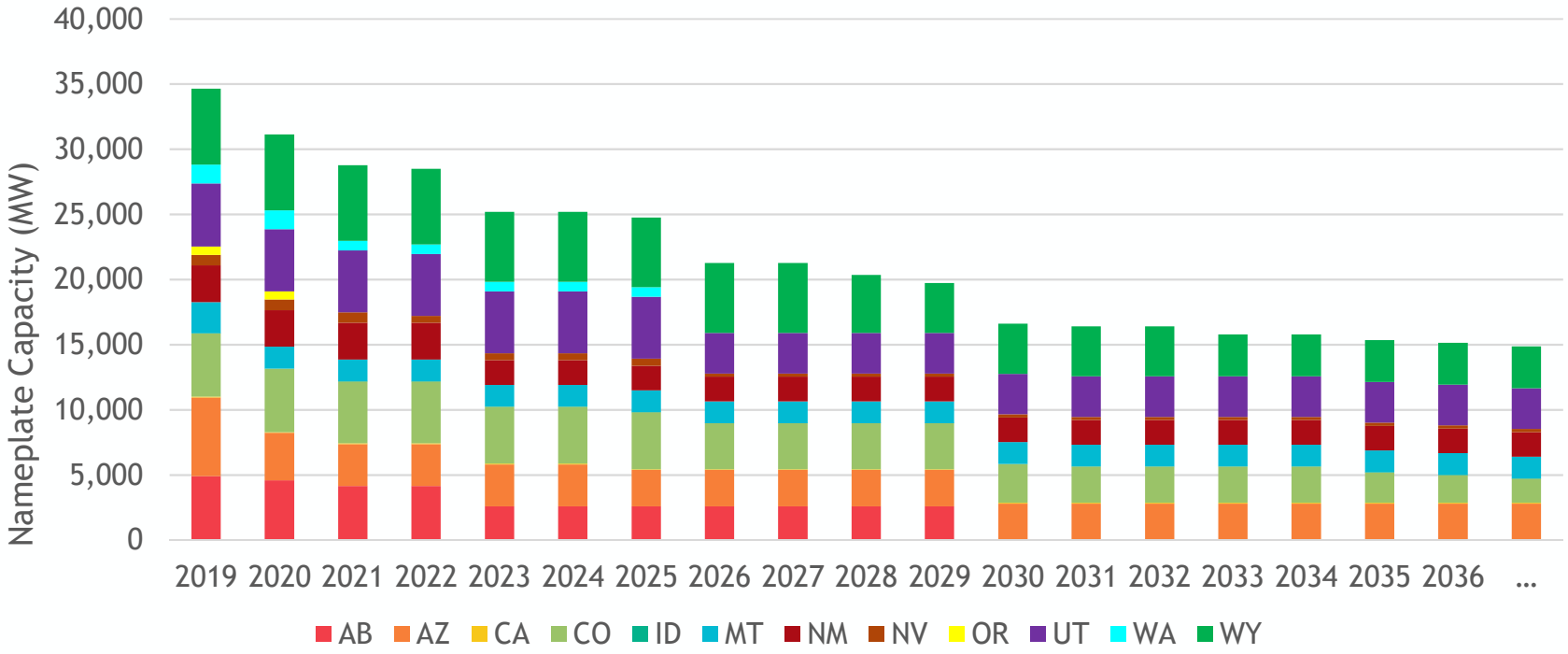


2005 Energy Policy Act

- FERC designated NERC as the Electricity Reliability Organization for North America
- NERC mandates
  - Standardize definitions for all viable resource adequacy metrics
  - Establish a set of preferred metrics
    - LOLH – Loss of load hours
    - EUE – Expected unserved energy
    - NEUE – Normalized EUE
    - LOLEV – Loss of load events
  - Collect and report adequacy assessments for all NERC sub regions
- NERC was not mandated to set standards (i.e. set metric thresholds)



WECC Coal Units in Operation, Decreasing over Next 20 Years



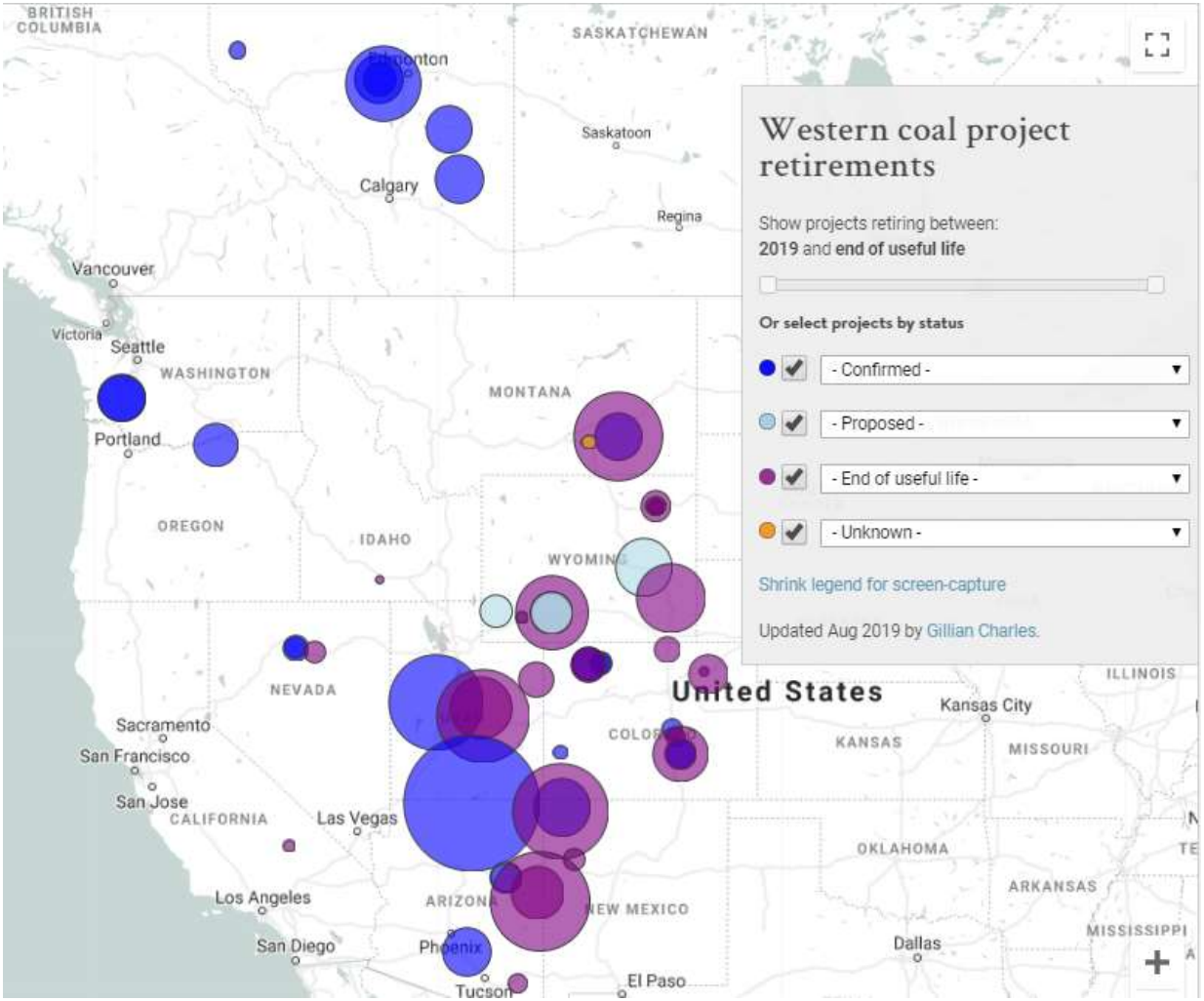
Overall, coal operating in the WECC in falls from about ~34GW in 2019, to ~15GW in 2036

Coal Unit Retirements in WECC – Interactive map on Council's website

- Visual representation of coal unit retirements
- Filter on status, retirement dates
- Markers based on nameplate capacity (MW)
- Ability to screen-capture and copy image

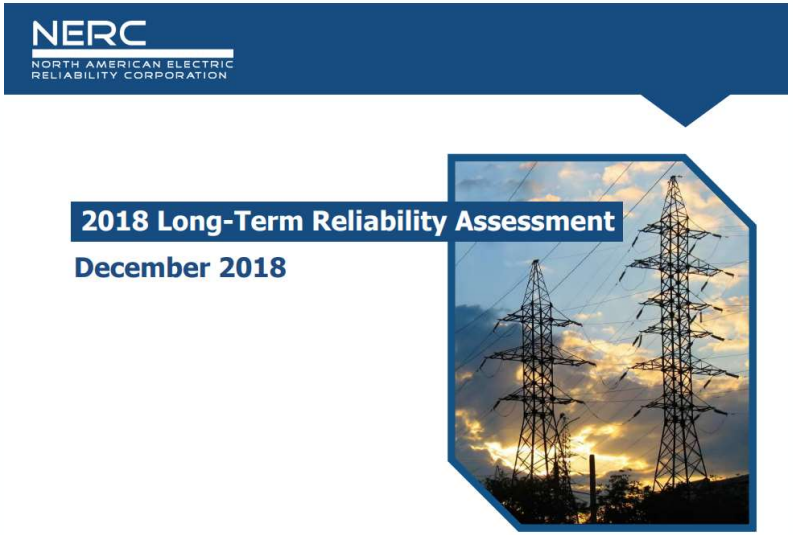
➢ Check out map here!

➢ Also, see blog post

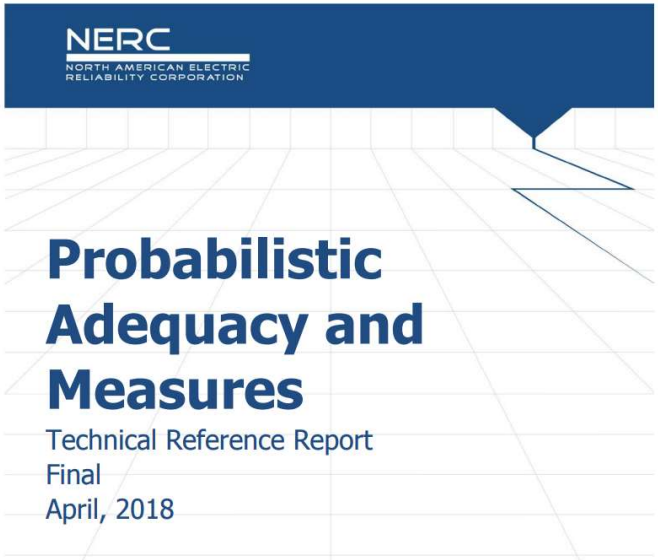


NERC Planning Subcommittees

- Reliability Assessment Subcommittee (RAS)
- Probabilistic Assessment Working Group (PAWG)



https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2018_12202018.pdf



https://www.nerc.com/comm/PC/Documents/2.d_Probabilistic_Adequacy_and_Measures_Report_Final.pdf

RESOURCE ADEQUACY IN THE PACIFIC NORTHWEST

Summary of existing studies and benefits of a regional program

Arne Olson, Senior Partner

Energy and Environmental Economics, Inc.

October 2, 2019

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RESOURCE ADEQUACY RECENT HISTORY

- Utilities were concerned about resource adequacy in the 1990s due to growing loads, lack of resource development and threat of electricity market restructuring
  - NW Power & Conservation Council established Resource Adequacy Committee
  - Voluntary group to look at RA issues but without authority to act on them
- Supply situation eased after the energy crisis
  - Permanent loss of most of the aluminum smelting industry
  - Over 5,000 MW of new natural gas generation constructed during the 2000s
- Significant wind development in the 2010s but gas development slowed

RESOURCE ADEQUACY RECENT HISTORY (CONT.)

- New state policies demand a shift to a cleaner electricity supply portfolio
  - Oregon Senate Bill 1547 increased the state's RPS to 50% in 2016
  - Washington Senate Bill 5116 established goals of carbon neutrality in 2030 and carbon-free by 2045
- Utilities acting on their own – combination of policy and economics
  - Avista and Idaho Power have pledged 100% clean electricity by 2045
  - PacifiCorp, PSE, Idaho Power proposing early retirements of coal
- Coal retirements – losing firm resources when the region already has relatively tight load-resource balance
  - 3,000 MW of coal resources will come offline in the next two years

E3 STUDY: *RESOURCE ADEQUACY IN THE PACIFIC NORTHWEST*

Completed in February 2019 for a coalition of 13 Northwest utilities

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STUDY INCORPORATED DETAILED LOSS-OF-LOAD PROBABILITY MODELING

- Resource adequacy is a critical concern under high renewable and decarbonized systems
  - Renewable energy availability depends on the weather
  - Storage and Demand Response availability depends on many factors
- E3's RECAP Model evaluates adequacy through time-sequential simulations over thousands of years of plausible load, renewable, hydro, and stochastic forced outage conditions
  - Captures thermal resource and transmission forced outages
  - Captures variable availability of renewables & correlations to load
  - Tracks hydro and storage state of charge

Information about E3's RECAP model can be found here:
https://www.ethree.com/tools/recap-renewable-energy-capacity-planning-model/

RECAP calculates reliability metrics for high renewable systems:

- **LOLP: Loss of Load Probability**
- **LOLE: Loss of Load Expectation**
- **EUE: Expected Unserved Energy**
- **ELCC: Effective Load-Carrying Capability for hydro, wind, solar, storage and DR**
- **PRM: Planning Reserve Margin needed to meet specified LOLE**

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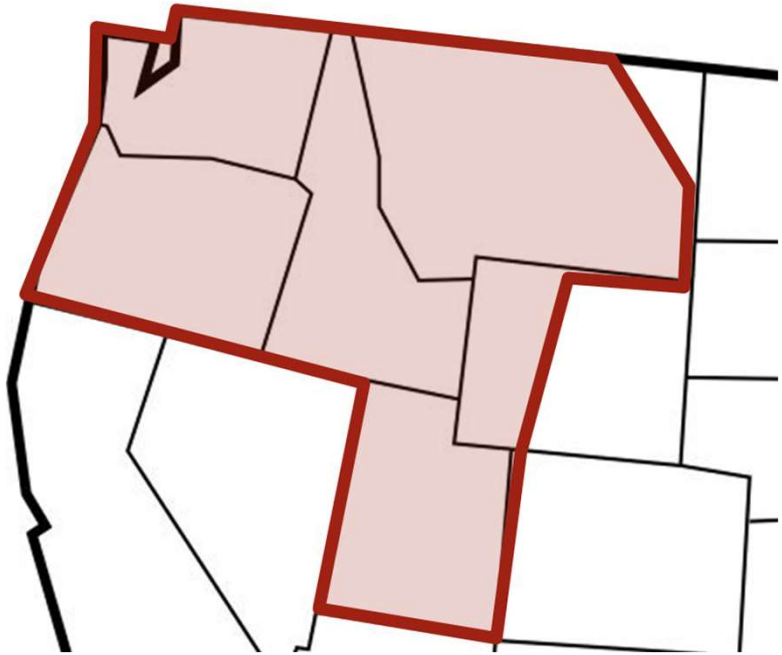
STUDY REGION – THE GREATER NW

- The study region consists of the U.S. portion of the Northwest Power Pool (excluding Nevada)
- It is assumed that any resource in any area can serve any need throughout the Greater NW region
  - Study assumes no transmission constraints or transactional friction
  - Study assumes full benefits from regional load and resource diversity
  - The system as modeled is more efficient and seamless than the actual Greater NW system
- Individual utility impacts will differ from the regional impacts



Balancing Authority Areas include: Avista, Bonneville Power Administration, Chelan County PUD, Douglas County PUD, Grant County PUD, Idaho Power, NorthWestern Energy, PacifiCorp (East & West), Portland General Electric, Puget Sound Energy, Seattle City Light, Tacoma Power, Western Area Power Administration

2018 RESULTS: THE REGION IS ALREADY IN TIGHT LOAD-RESOURCE BALANCE

- A planning reserve margin of 12% is required to meet 1-in-10 reliability standard
- The 2018 system does not meet 1-in-10 reliability standard (2.4 hrs./yr.)
- The 2018 system does meet Northwest Power and Conservation Council standard for Annual LOLP (5%)

	Reliability Metrics
Annual LOLP	3.7%
LOLE (hrs./year)	**6.5**
EUE (MWh/year)	5,777
EUE norm (EUE/Load)	0.003%
1-in-2 Peak Load (GW)	43
Required PRM to meet 2.4 LOLE	12%
Required Firm Capacity (GW)	48

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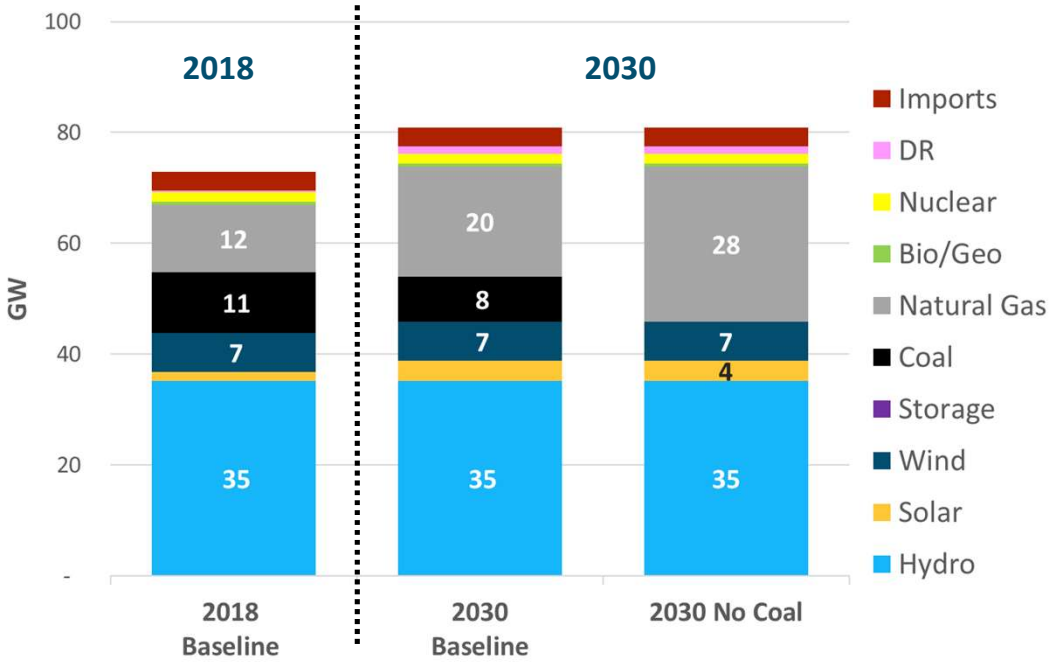
SIGNIFICANT NEW CAPACITY NEEDED BY 2030



GHG Free Generation (%)	**61%**	**61%**
Carbon (MMT CO2)	**67**	**42**
% GHG Reduction from 1990 Level	**-12%***	**31%**

With 3 GW of planned coal retirements, 8 GW of new capacity is needed by 2030 (730 MW/yr.)

If all coal is retired, then 16 GW of new capacity is needed by 2030 (1450 MW/yr.)

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CONCLUSIONS

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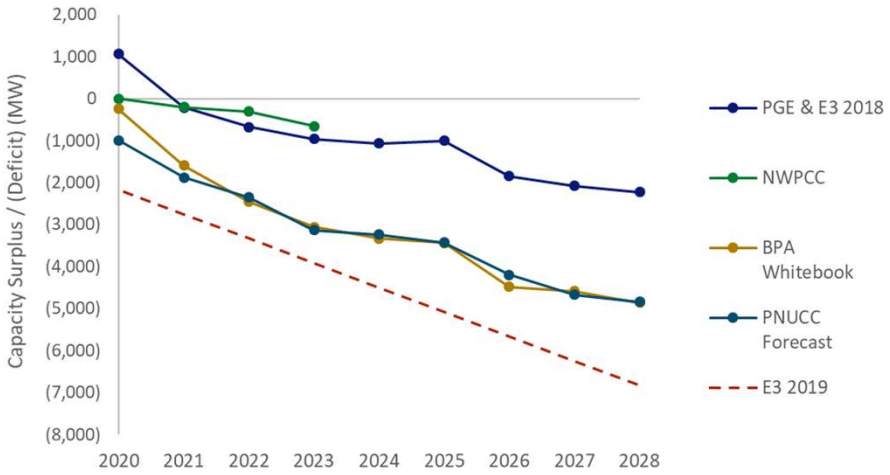
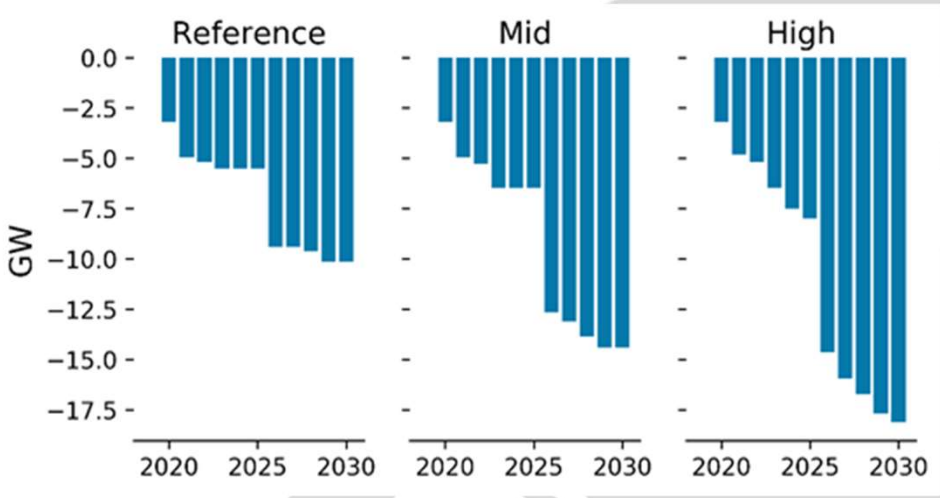
MULTIPLE STUDIES AGREE THAT THE NW IS APPROACHING A PERIOD OF CAPACITY SHORTFALLS

NW Capacity Surplus / Deficit in Recent Studies



Note: WECC also publishes a resource adequacy assessment, but it focuses only on summer, whereas resource adequacy is primarily a winter issue for the Northwest

US WECC Coal Retirement Scenarios



Note: Coal retirement scenarios developed by NWPP IRP Team. From research of announced and potential retirements from across the US WECC.

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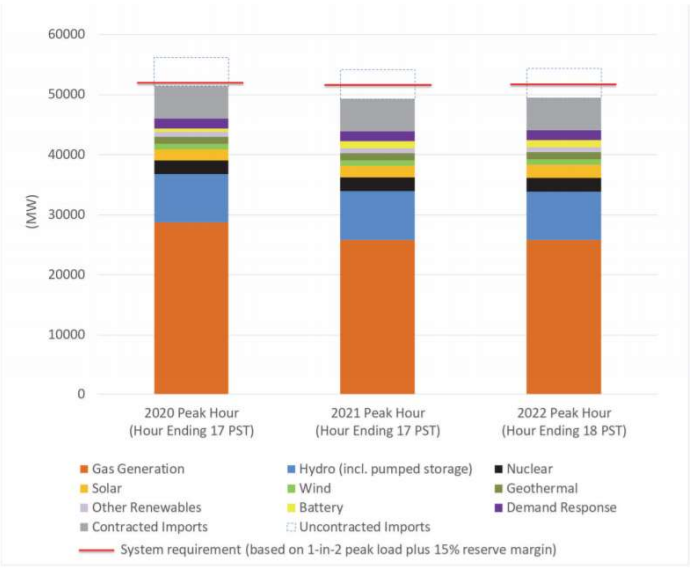
NOT JUST A NW ISSUE – CALIFORNIA IS ALSO CONCERNED ABOUT RESOURCE ADEQUACY IN THE NEAR TERM

- 3-4 GW of scheduled gas retirements in 2019-2020 will leave the CAISO system significantly tighter in resource adequacy
- CPUC recently reduced its assumption about the availability of imports in its IRP proceeding
- CPUC and CAISO project 2500-4500 MW of shortfalls
- CPUC proposed decision to open a procurement track in IRP for near-term RA resources
  - Potential outcomes: delayed OTC retirements and/or accelerated energy storage procurement

CAISO Resource Adequacy Forecast: 2020, 2021, 2022



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CURRENT PRACTICES MAY NOT BE SUFFICIENT TO MAINTAIN RELIABILITY IN THE PACIFIC NORTHWEST

- There is no uniform method for measuring resource adequacy and no standard for how much reliability is enough
- Significant reliance on front office transactions can save costs for consumers during a time of capacity surplus, but risks insufficient investment in a time of shortfall
- Attributing capacity values to a portfolio of variable and dispatch-limited resources will become increasingly complex due to interactive effects (e.g., solar and wind plus energy storage)
- Current practices do not take full advantage of regional load and resource diversity

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REGIONAL PLANNING RESERVE SHARING HAS THE POTENTIAL TO RESULT IN SIGNIFICANT BENEFITS

- Provides an independent means for determining the quantity of capacity that is needed for regional resource adequacy
- Takes advantage of load and resource diversity that exists across regions
  - Planning to meet regional coincident peak loads requires less capacity than meeting each individual utility's peak loads
  - Resources that are surplus in one area could be utilized to meet a deficit in a neighboring area
- May enable a lower reserve margin because large systems are less vulnerable to individual, large contingencies

	Potential Benefits	
	BPA+ Area	**NWPP (US)**
Individual Utility Peak + 15% PRM	33,574	46,398
Regional Peak + 15%	32,833	42,896
Reduction (MW)	***741***	***3,502***
Regional Peak + 12%	31,977	41,777
Reduction (MW)	***1,597***	***4,621***

Note: Capacity reductions calculated as the difference between the sum of non-coincident peaks for all Northwest Balancing Areas and the coincident peak for the US portion of the Northwest Power Pool footprint

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RECOMMENDATIONS OF THE WORKING GROUPS

1. The region should take further steps to develop a regional resource adequacy program to achieve the following benefits:
   - To maintain reliability during a period of significant transition for the region's electricity system;
   - To promote increased transparency and uniformity that will provide utilities, regulators, and stakeholders alike with a clear understanding of the region's resource adequacy position;
   - To allow utilities and their customers to safely realize the full benefits of the load and resource diversity that exists across the region while maintaining reliability;
   - To provide a platform for utilities to share planning reserves and make optimal use of existing resources; and
   - To encourage timely identification and development of new investments when and where they are needed to meet regional requirements.

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RECOMMENDATIONS OF THE WORKING GROUPS

2. The design of a resource adequacy program for the NW should be tailored to reflect the unique qualities & characteristics of the region
   - Significant role of hydroelectricity & public power
   - Transmission and fuel delivery constraints in the region
3. The resource adequacy program should not usurp authority that is currently vested with the utilities and their governing bodies to determine the best way to meet resource adequacy requirements
   - RA program must include binding commitments for each member to do its share to maintain regional reliability and must have exclusive authority over resource capacity accreditation
   - However, decisions about which resources to procure to satisfy the regional obligation would continue to rest with member utilities

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THANK YOU!

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RESOURCE ADEQUACY

Mark Holman, Managing Director – Power

Powerex

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DEFINITIONS

Day-Ahead and Real-Time

Resource Sufficiency

Does each entity have sufficient resources **committed** to serve demand **next day** and **next hour**?

Forward (1-3 years)

Resource Adequacy

Does each entity have sufficient **installed** resources to serve demand **next season**, or **next year**?

DEFINITIONS

Day-Ahead and Real-Time

Operating Reserves

Energy to meet demand

- Balancing reserves to respond to supply and demand variations
- Contingency reserves to respond to forced outages

Forward (1-3 years)

Planning Reserves

Energy to meet demand

- Peak demand exceeds P50 peak demand
- Forced outages
- Operating reserves

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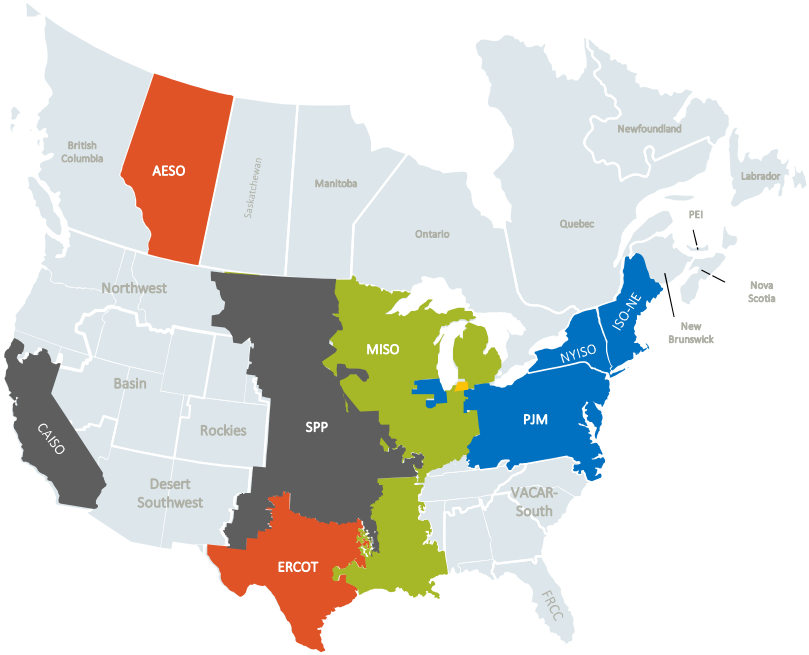
NORTH AMERICA OVERVIEW



Energy Only Market
- AESO
- ERCOT

Bilateral Resource Adequacy Program
- CAISO
- SPP

Voluntary Central Capacity Market
- MISO

Central Capacity Market
- PJM
- NYISO
- ISO-NE

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RESOURCE ADEQUACY PROGRAM BENEFITS

Reliability

- Ensure sufficient resources are installed and committed to reliably serve demand, during stressed grid and market conditions, with a high degree of confidence

Cost Savings

- Unlock the benefits of diversity in supply and demand in a safe and equitable way

Improved Visibility, and Coordination

- Enable members to make fully informed RA planning decisions, using best-practice approaches

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RESOURCE ADEQUACY DESIGN ELEMENTS

Gregg Carrington, Managing Director of Energy Resources
Chelan County PUD

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INTRODUCTION AND DISCLAIMERS…

Where are we at now and what has been done?

- The final report of findings will be issued by the NWPP in November
- NWPP members with the NWPP President will decide if a Resource Adequacy Program should be developed (phased approach with decision points)
- Design has not started yet – we have only reviewed what others have done
- No decisions have been made yet

DESIGN ELEMENT EXAMPLES

Over 20 design elements were identified, what are some of the most important ones?

Element / Issue	Description
1. Program Design	Decision making process, support, rules and regulations and modeling for the resource adequacy program design
2. Adequacy Objective/Metric	The adequacy metric the program is designed to achieve
3. Governance	The governance structure of the resource adequacy program
4. Other Design Elements	The details….

PROGRAM DESIGN

What we will do next?

- NWPP President and NWPP members need to approve funding and initiation of the next phase
- Major elements of project
  - Support – funding and subject matter experts
  - Rules and regulations
    - Governance
    - Resource Adequacy Sharing Mechanism?
  - Modeling
  - Stakeholder input

Important considerations along the way:

- Deliverability (within and into the footprint)
- Fuel supply (gas, hydro, VERs)

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ADEQUACY OBJECTIVE/METRIC

How do we measure success?

- Resource adequacy metric establishes the required amount of committed capacity to serve the forecasted load at a targeted level of reliability
- Common metric in other RA programs is 1 day in 10 year loss of load expectation (LOLE)
- Other approaches include Loss of Load Event (LOLEv), Loss of Load Probability (LOLP), Expected Unserved Energy (EUE)
- **Loss of Load** study – usually considers load and resource balance under different conditions
- How much of a buffer above the peak load is necessary (Planning Reserve Margin)?

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GOVERNANCE

What structure will be needed to govern a RA program?

- Board Structure
- Membership – participating and funding NWPP members
- Funding
- Decision making process
- Committee structure
- Role of stakeholders
  - Stakeholder Engagement Committee

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OTHER DESIGN ELEMENTS

What else may we talk about in the first phase?

- Program operation and monitoring
- Supply/demand forecast metrics
- Lead time and duration requirements for supply
- Resource eligibility
- Deliverability requirements
- Capacity determinations
- Outage rates
- Import qualifications

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RESOURCE ADEQUACY

Rick Link, Vice President of Resource Planning and Acquisitions

PacifiCorp

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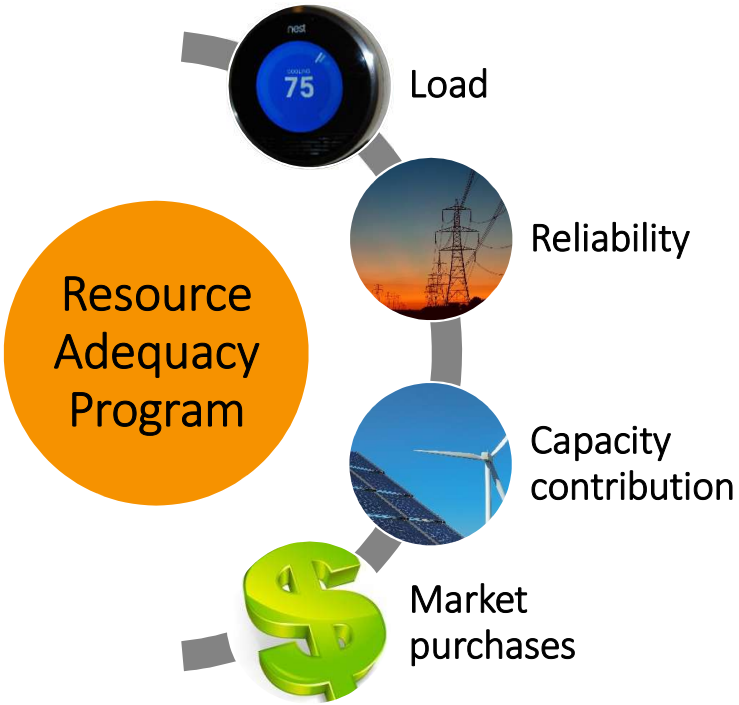
LONG-TERM RESOURCE PLANNING IMPLICATIONS



A resource adequacy program will facilitate improved planning:

- Cost savings
- Consistency
- Transparency
- Data & information
- Market opportunities

NEXT STEPS

Resource Adequacy Program

- Approval and funding from NWPP members to initiate next phase
- Program design
- Modeling
- More discussion in next panels

Stakeholder Engagement

- Share resource adequacy options under consideration by NWPP members
- Input from regional stakeholders
- Stakeholder advisory committee
- Regular public webinars

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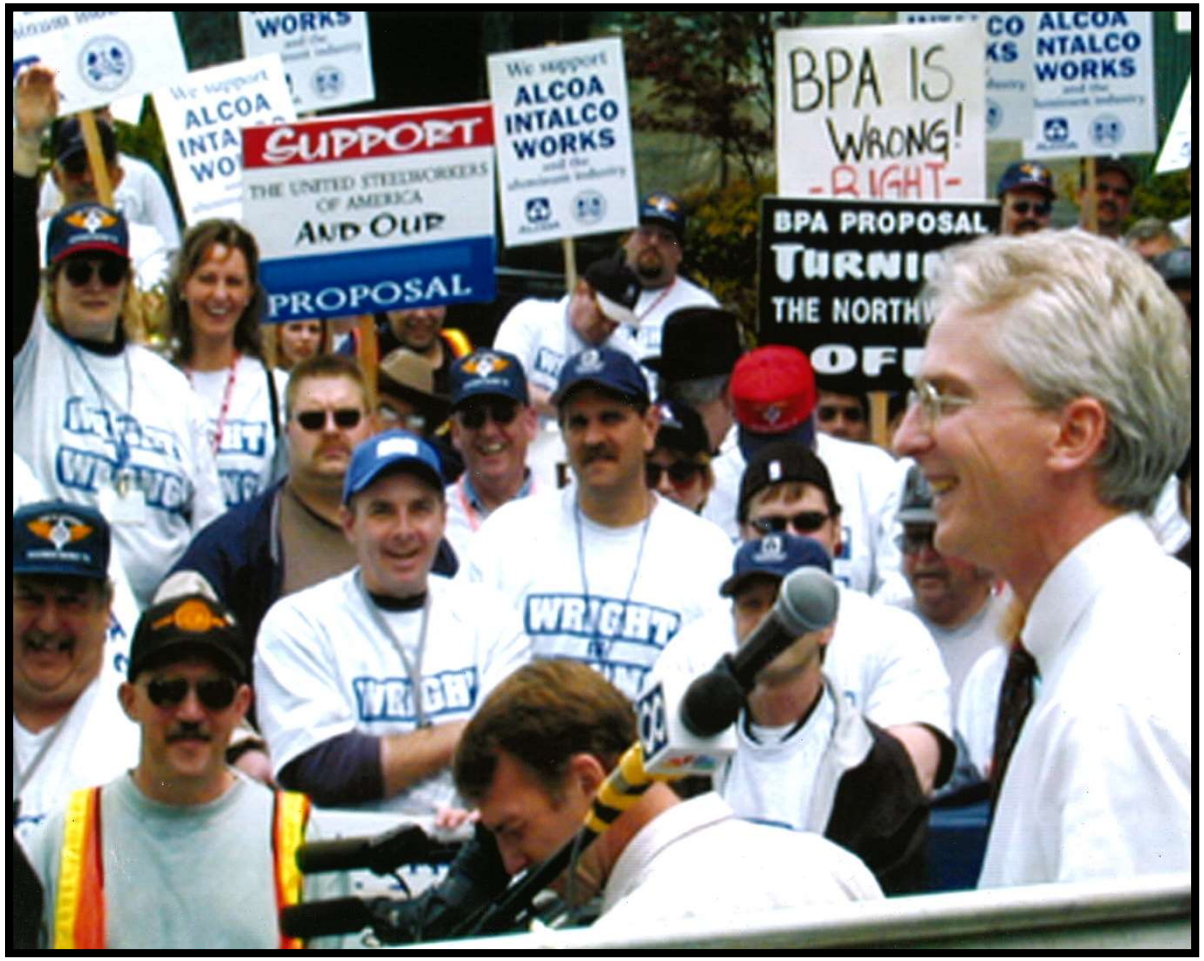
Resource Adequacy Symposium

Steve Wright, General Manager
Chelan County PUD



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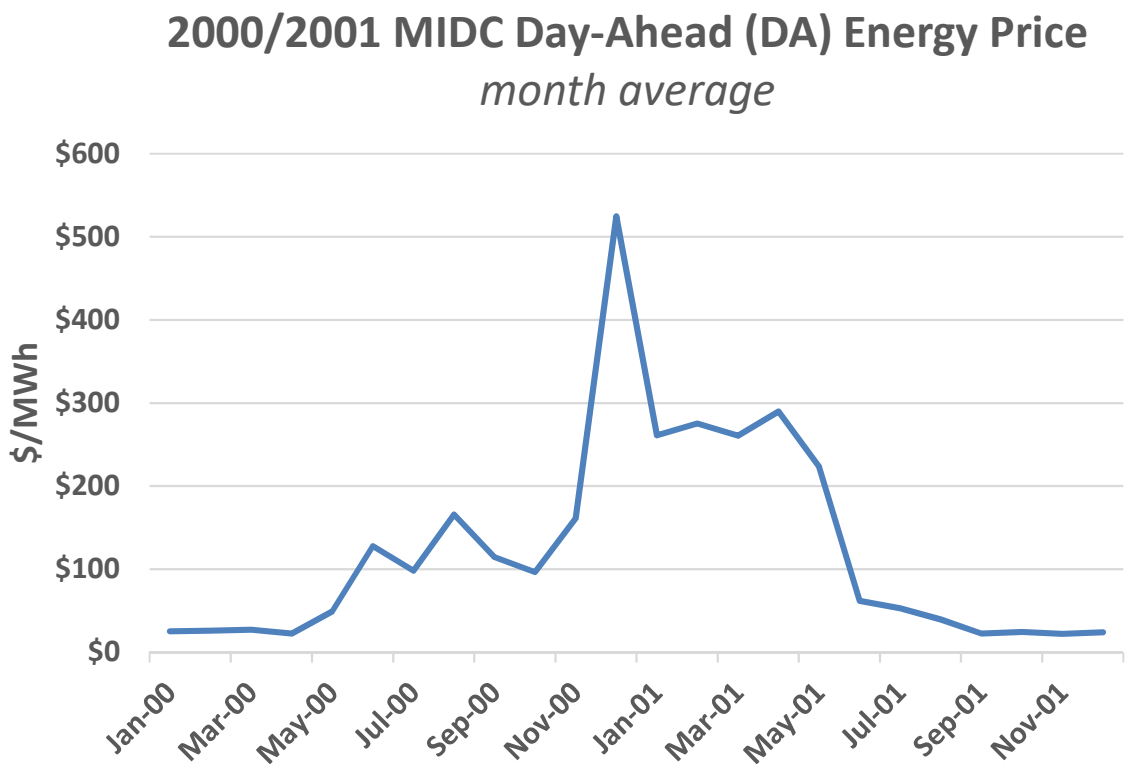
DJ DA	Peak	Off Peak	Flat
MIDC index	$/MWh	$/MWh	$/MWh
1/1/2000	$27.38	$23.19	$25.59
2/1/2000	$26.86	$25.03	$26.17
3/1/2000	$27.79	$26.36	$27.27
4/1/2000	$27.87	$15.89	$22.83
5/1/2000	$59.79	$34.12	$49.26
6/1/2000	$181.43	$52.73	$127.70
7/1/2000	$122.25	$66.16	$98.08
8/1/2000	$213.47	$96.08	$166.08
9/1/2000	$134.80	$87.92	$114.72
10/1/2000	$103.69	$85.69	$96.71
11/1/2000	$171.98	$144.07	$161.29
12/1/2000	$554.38	$446.55	$524.64
1/1/2001	$278.30	$239.03	$261.17
2/1/2001	$287.37	$258.81	$275.21
3/1/2001	$276.62	$227.66	$260.71
4/1/2001	$317.47	$251.83	$289.74
5/1/2001	$276.29	$153.14	$223.45
6/1/2001	$70.34	$48.41	$62.00
7/1/2001	$60.10	$41.22	$53.04
8/1/2001	$45.88	$30.05	$39.71
9/1/2001	$24.28	$20.69	$22.72
10/1/2001	$26.10	$21.79	$24.49
11/1/2001	$23.94	$20.43	$22.36
12/1/2001	$26.63	$21.55	$24.24



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Los Angeles Times

Calculus of Drought, Power Crisis to Prove Deadly to Salmon

By KIM MURPHY APRIL 10, 2001 | 12 AM
TIMES STAFF WRITER

SEATTLE — In a ritual as old as the coming of spring, today marks the official beginning of the chinook salmon's fabled migration down the Columbia River to the sea. Because of the West Coast's electricity crisis, many of them will die.

Severe drought and the need to feed water through the massive hydropower turbines along the river have brought about a long-feared collision between electricity needs and the endangered salmon that are an icon of the Pacific Northwest.

Under an emergency order issued last week--expected to be extended Friday to cover much of the rest of this year--the Bonneville Power Administration has ordered power generation to take precedence over water flows needed to carry young salmon safely across eight hydropower dams to the Pacific Ocean.

The result, federal biologists said, is that a large number of salmon will be sucked down into the deadly generating turbines at each dam, producing major mortalities in fish that already are threatened with extinction.

MOST READ

1 Who wants to leave California? Young voters can't afford housing, and conservatives feel alienated

2 Trump demands Schiff's resignation over characterization of Ukraine call

DEVELOP RESOURCE ADEQUACY PROGRAM

Complete Oct. 2 *→ Spring 2020* *→ Spring 2021* *→ Spring 2022*

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