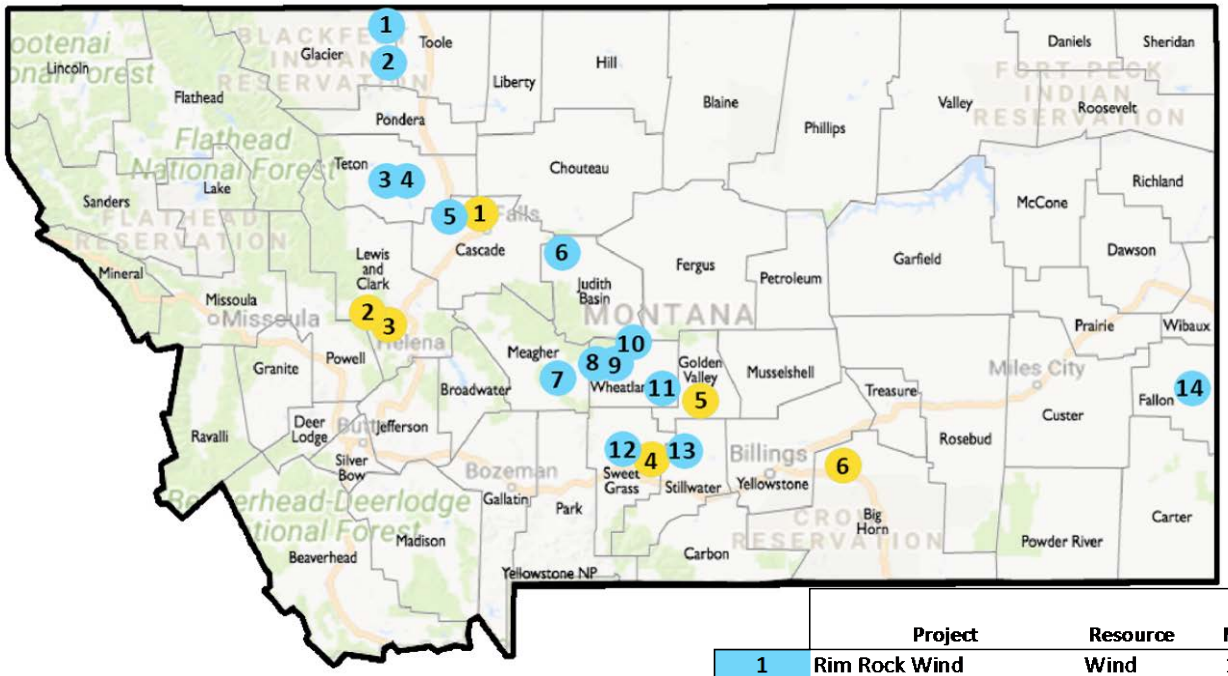



Montana’s renewable energy market opportunities

Renewable Northwest

Operating Wind and Solar Projects



	Project	Resource	MW	County	Year	$ invested (millions)
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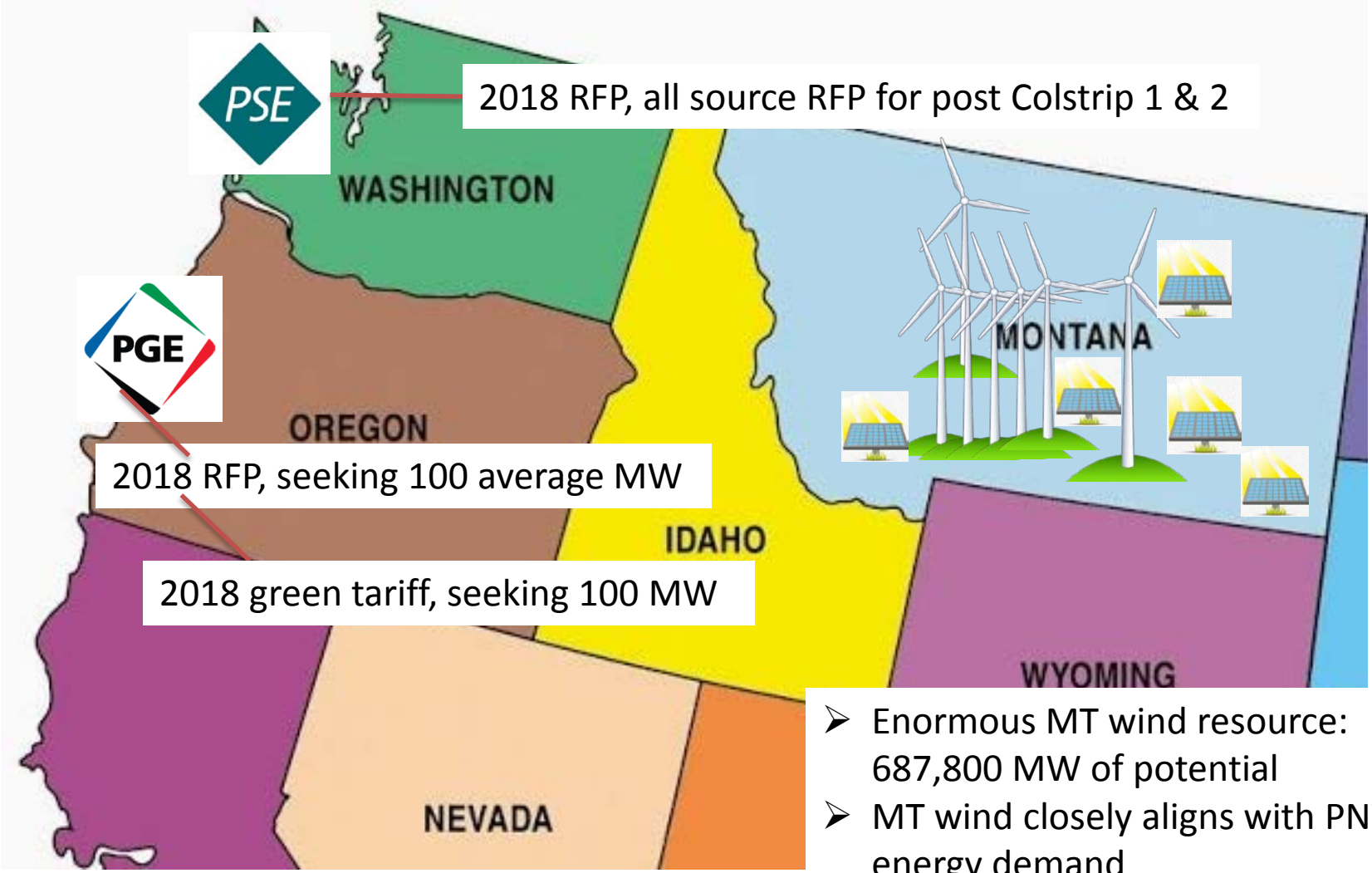
4	Magpie	Solar	3	Golden Valley	2018	4
5	River Bend	Solar	2	Sweet Grass	2017	3
6	South Mills	Solar	3	Big Horn	2017	4

Montana Renewable Resource Market Opportunities

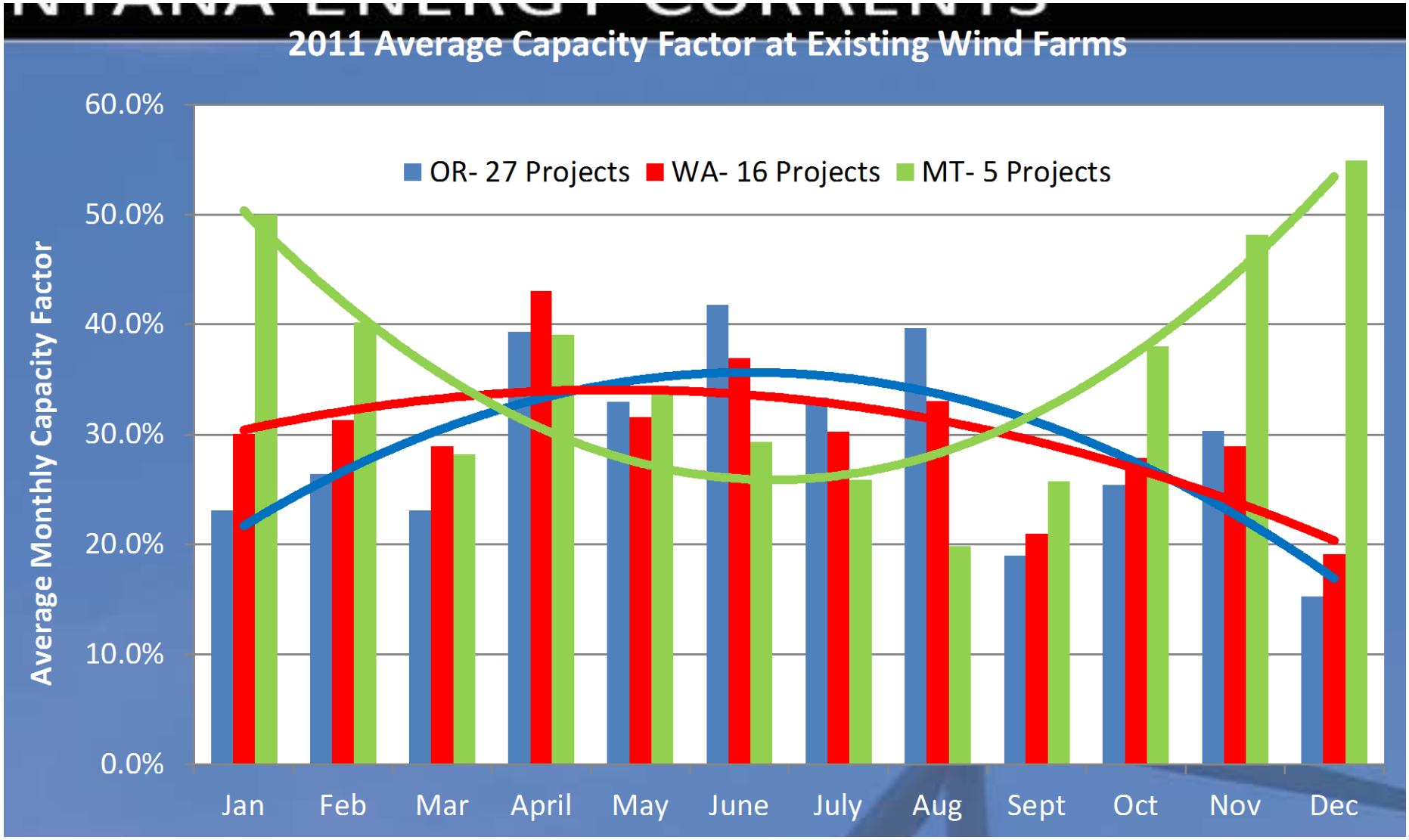
Montana Renewable Resource Market Opportunities

PNW Region Renewable Resource Opportunities



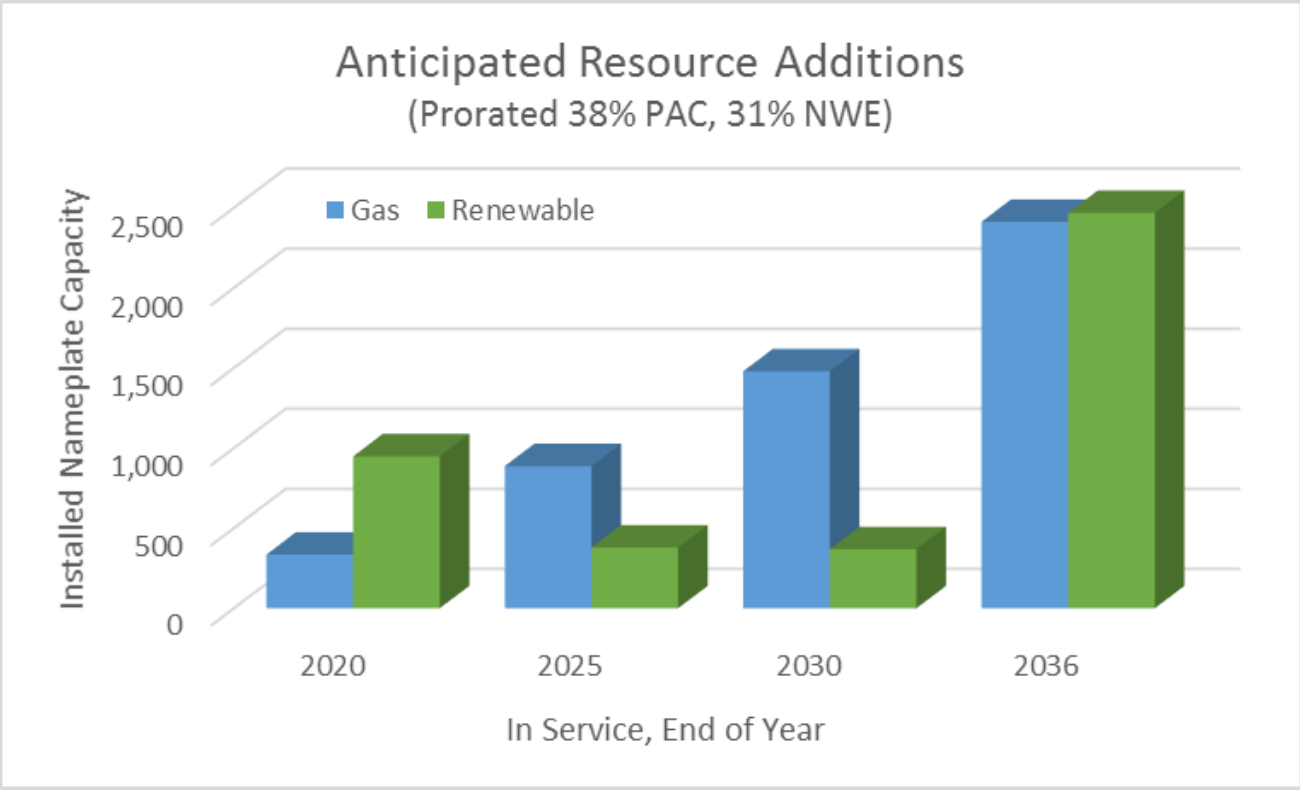
- Enormous MT wind resource: 687,800 MW of potential
- MT wind closely aligns with PNW energy demand

PNW Region Renewable Resource Opportunities



Renewable Northwest

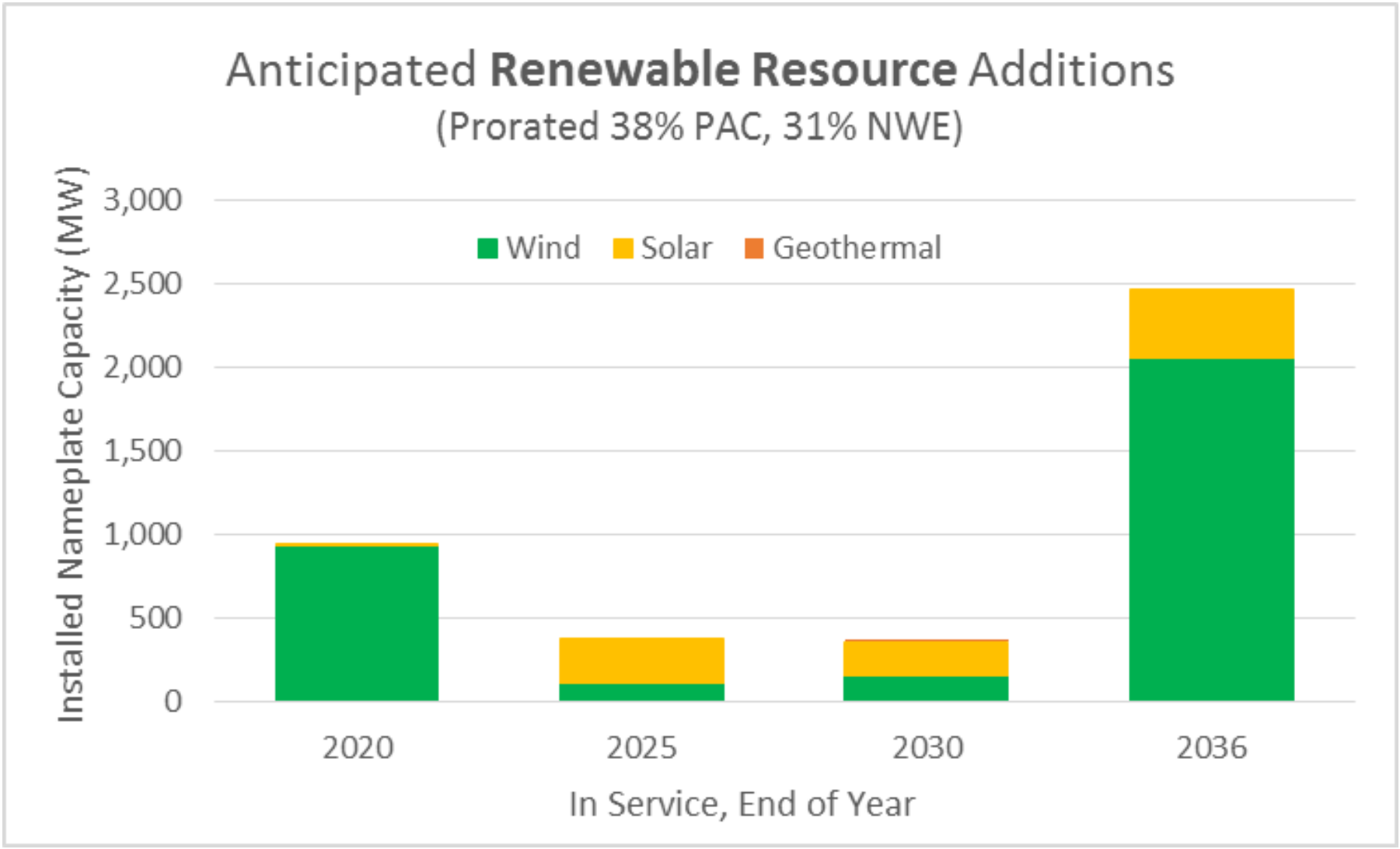
NWPCC, IRP Survey: Anticipated New Resources*



Cumulative	2020	2025	2030	2036
Gas (MW)	335	1,222	2,701	5,113
Renewables (MW)	948	1,327	1,696	4,163

* Resources identified are proxy; not binding

NWPCC, IRP Survey: Renewable Resource Breakout*



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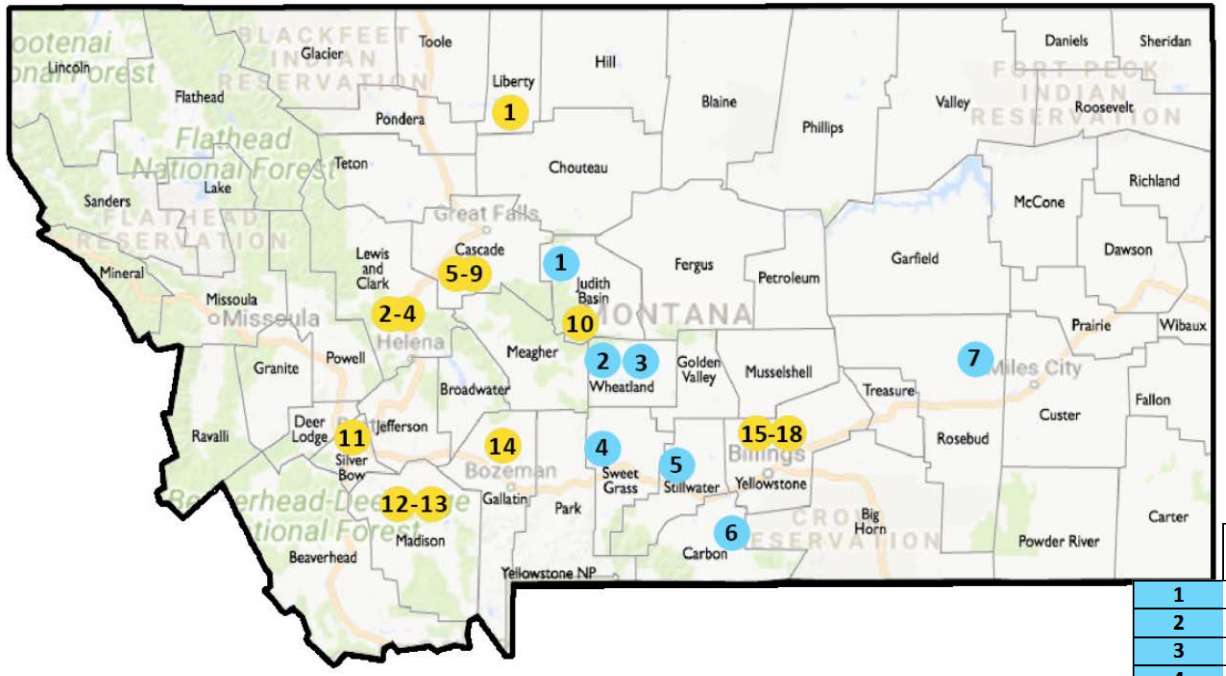
Selected Developing Wind and Solar Projects



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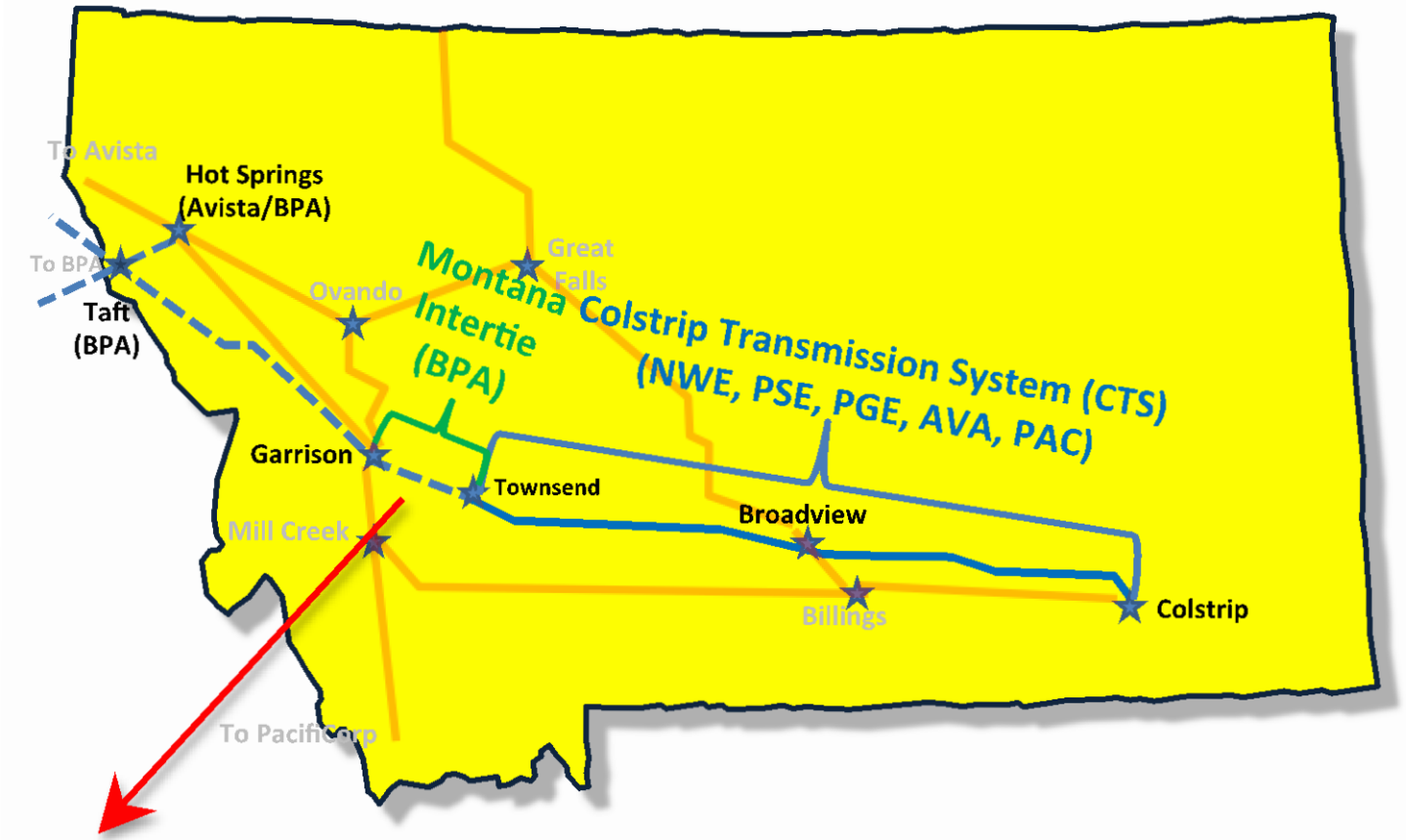
17	Meadowlark	Solar	20	Yellowstone
18	MT Sun	Solar	80	Yellowstone

Wind Energy Property Taxes

Montana Wind Farm Estimates

Year	Total Property Tax	Cumulative Generation Capacity (MW)
2006	$1,252,478	135
2007	$1,676,657	147
2008	$1,690,087	166
2009	$3,799,032	376
2010	$5,373,699	376
2011	$5,298,567	387
2012	$4,788,389	457
2013	$8,773,583	646
2014	$8,646,457	665
2015	$8,092,802	665
2016	$8,502,041	690
2017	$8,511,711	690
Total	**$66,405,501**	

Montana's 500 kV Transmission System



90 miles of the Montana Intertie cost half as much as the next 15,000 miles of BPA's network transmission rates.

Montana Wind Farm Property Tax Summary

Estimated Wind Farm Property Tax Contributions in Montana, 2006-2017

From 2006-2017 it is estimated that Montana wind farms contributed approximately $66 million in total property taxes with a current generating capacity of 690 megawatts (MW). Since 2013, Montana wind farms have averaged $8.5 million annually in estimated property taxes. Over the entire 12 year period, Montana wind farms contributed over $5.5 million per year in estimated property taxes. Montana wind farms vary considerably in generation capacity with a maximum of 210 MW and a minimum of 2.8 MW. In 2016, Montana wind farms produced 2,140 gigawatt hours (GWh) which was 7.7% of the state's net electricity generation.[1]

Property tax estimates are based on data provided by the Montana Department of Revenue. The table *Montana Wind Farm Estimates* (top right) includes an estimation of total (state and local) property tax contributions in Montana and generation capacity from 2006 through 2017.

Montana Wind Farm Estimates

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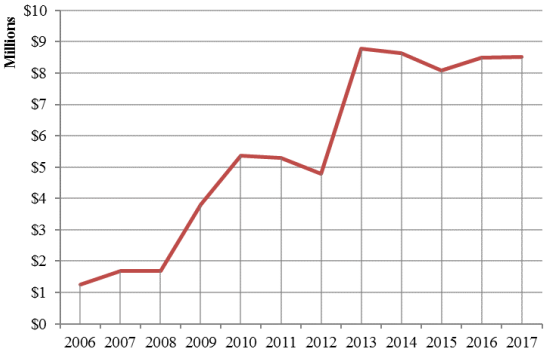
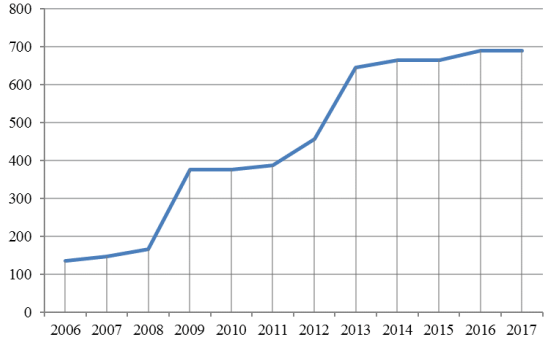
Total Property Tax Estimate



Cumulative Generation Capacity (MW)



Montana Wind Farm Estimates – Geographic Breakdown

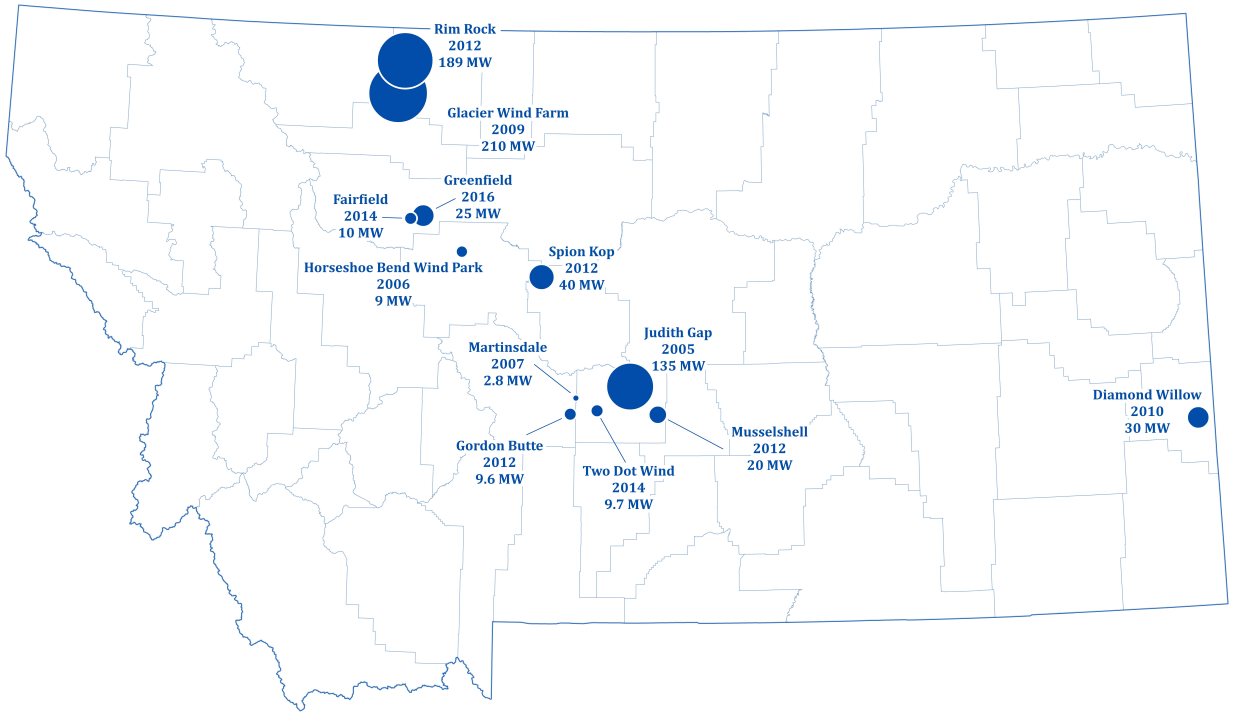
Montana's utility scale wind farms are located within seven counties: Cascade, Fallon, Glacier, Judith Basin, Meagher, Teton, Toole, and Wheatland. The table *Montana Wind Farm Estimates – Geographic Breakdown* (below) details the estimated total property tax payments made by wind farms located within these respective counties. The table includes yearly, total, and annual average data. The annual average data is specific to each county – it only includes years in which estimated property taxes were collected. Wind farms located within Toole County have the largest share of total estimated property tax with just over $29 million (44% of the total). Toole County wind farms also have the highest annual average with just over $3 million per year.

Montana Wind Farm Estimates - Geographic Breakdown

	Wheatland	Cascade	Fallon	Toole	Glacier	Meagher	Judith Basin	Teton
2006	$1,252,478							
2007	$1,332,881	$343,777						
2008	$1,427,243	$189,684	$73,159					
2009	$1,393,581	$189,106	$123,946	$1,940,635	$151,763			
2010	$1,372,808	$212,424	$81,369	$2,548,845	$1,158,252			
2011	$1,436,095	$198,394	$131,931	$2,466,029	$1,066,118			
2012	$1,561,280	$203,765	$161,292	$1,886,301	$842,718	$133,033		
2013	$1,983,497	$227,587	$166,357	$4,118,239	$1,813,685	$142,214	$322,004	
2014	$1,940,705	$172,267	$177,212	$4,179,117	$1,720,425	$132,879	$323,852	
2015	$2,095,415	$137,651	$201,680	$3,915,942	$1,038,569	$130,442	$296,806	$276,297
2016	$2,042,863	$103,032	$226,737	$4,138,521	$1,273,787	$136,222	$318,957	$261,921
2017	$1,912,860	$107,436	$269,883	$4,033,767	$1,056,328	$146,069	$350,822	$634,546
Total	**$19,751,705**	**$2,085,124**	**$1,613,567**	**$29,227,396**	**$10,121,645**	**$820,859**	**$1,612,441**	**$1,172,764**
Yearly Average	$1,645,975	$189,557	$161,357	$3,247,488	$1,124,627	$136,810	$322,488	$390,921

Wind Farms of Montana - Map

The map represents all Montana wind farms by name, first year of operation, and generation capacity. The points for each wind farm are proportional to their respective power generation capabilities.



New or Expanding Industry

Montana wind farms may qualify for a special tax status through the New or Expanding Industry (NEI) property tax application.[2] NEI allows for wind farms to be taxed at either 25% or 50% of their taxable value in the first 5 years after construction.[3] Following the 5 year period, this percentage increases an equal amount (15% or 10%) each year until the 10th year when the full taxable value is attained. Not all wind farms qualify, and the governing body of the affected county, city, or town must approve each project for NEI tax status. Furthermore, a property's taxable value is calculated based on market value which depreciates over time. In theory, the NEI property tax application and the depreciation of market value will result in a relatively consistent tax levy for an individual wind farm with NEI status.

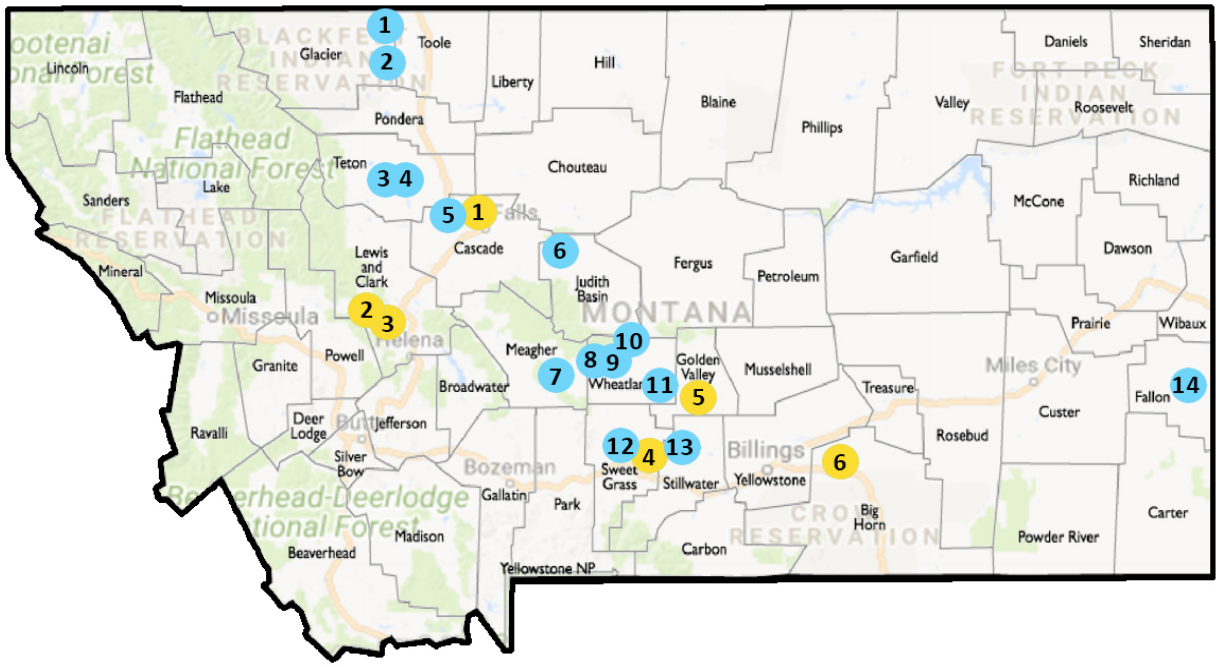
Notes

From 2009-2010 generation capacity does not increase but the total tax estimate increases significantly because of the operational start time of Glacier Wind Farm II. Glacier Wind Farm II began operations in late 2009 moving the majority of its total property tax contributions to the following year; however, the generation capacity for Glacier Wind Farm II is counted in 2009 due to operations beginning in 2009. As such, the table may not reflect a consistent tax-to-generation capacity ratio due to two factors: 1) operational years not aligning with tax years (as is the case with Glacier Wind Farm II), and 2) depreciation and differing NEI tax statuses.

[1] U.S. Energy Information Administration
[2] MCA 15-24-1402
[3] The 25% option was added in 2017. All current wind farms fall under the 50% option.

Operating Wind and Solar Projects in Montana

May 2018



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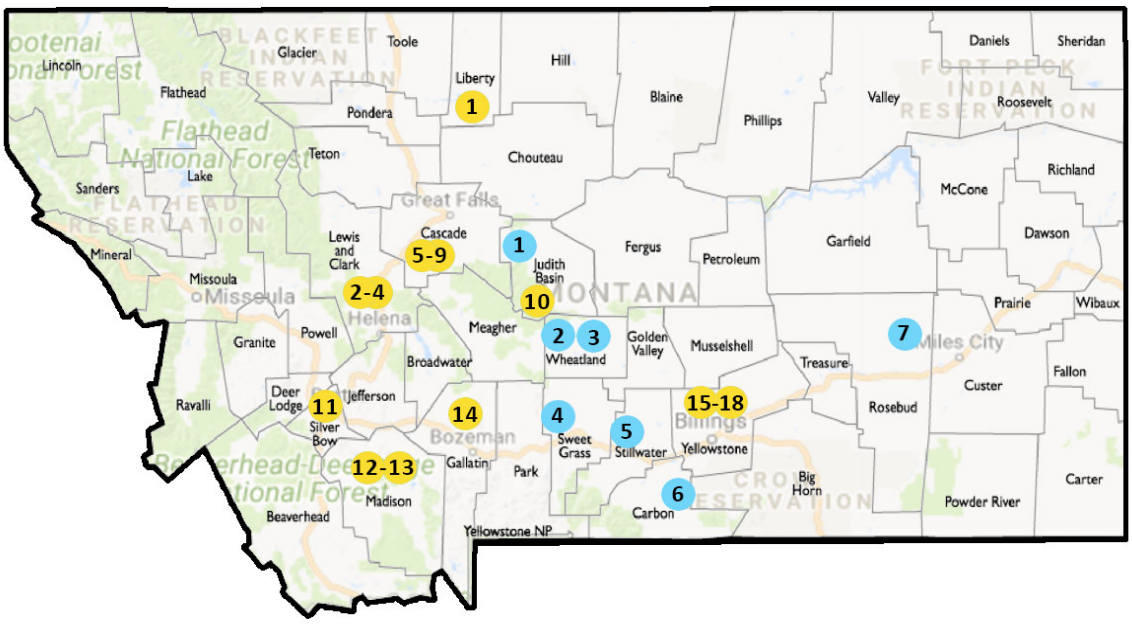
For more info contact:

Jeff L. Fox
Montana Policy Manager
Jeff@RenewableNW.org
406-599-2916

Renewable Northwest

Selected* Wind and Solar Projects Under Development

May 2018



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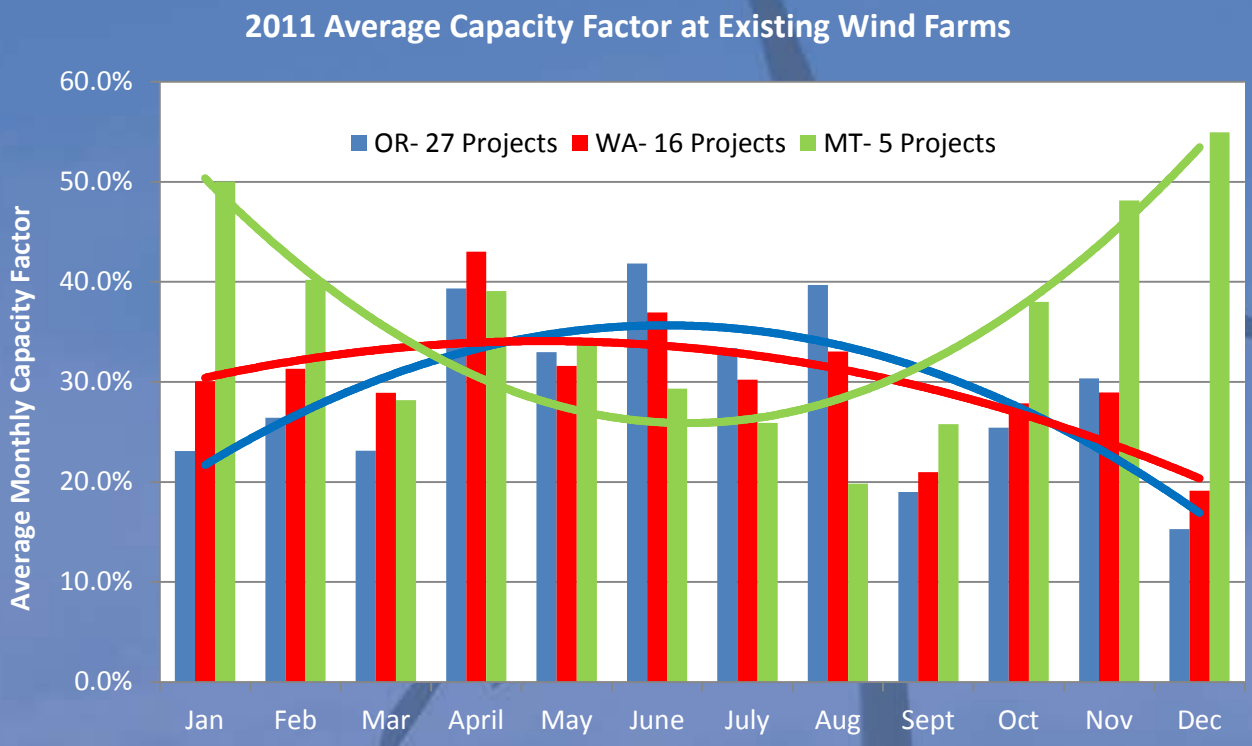
* Many additional wind and solar projects are under development. Projects selected based upon discussions with developers.

Montana Wind Output Complements Existing Pacific NW Wind Farms

It is widely known that Montana has an excellent wind resource with multiple sources ranking Montana in the top 5 states for wind power potential. In addition, studies have shown that Montana wind blows hardest in the winter months, complementing existing wind farms and generally tracking demand profiles in the Pacific Northwest.



The graph above is based on 2011 average monthly capacity factor of existing wind farms across three states: Montana, Oregon, and Washington. The curved lines represent the polynomial best fit trend line for the data illustrated in the bars. It indicates that additional development of Montana wind would complement the output from wind farms developed in Oregon and Washington, which has occurred primarily along the Columbia River Gorge. Overall capacity factor averages for the three states illustrated are: Montana 36.1%, Washington 30.1%, and Oregon 29.1%.

Resources

Wind Production Data from US EIA, 2011: EIA-923

Additional information: Charles R. Shawley, Ph.D., *The Impacts of Integrating Montana Wind Resource on Transmission System Operators and Utilities in the Pacific Northwest*, 2011.

Summary of Utility Integrated Resource Plans

Gillian Charles
The Energy Authority
April 18, 2018

About the Council

- Multi-state compact formed through the Northwest Power Act of 1980
  - Members (8) appointed by the governor's of Washington, Oregon, Idaho and Montana
- Authorized by the Act to develop
  - a regional power plan to meet the energy needs of the region at the lowest cost
  - a program to protect, mitigate, and enhance fish and wildlife that have been affected by the construction and operation of hydroelectric projects in the Columbia basin

Today's Discussion

Integrated Resource Plans (IRP)

IRP Components

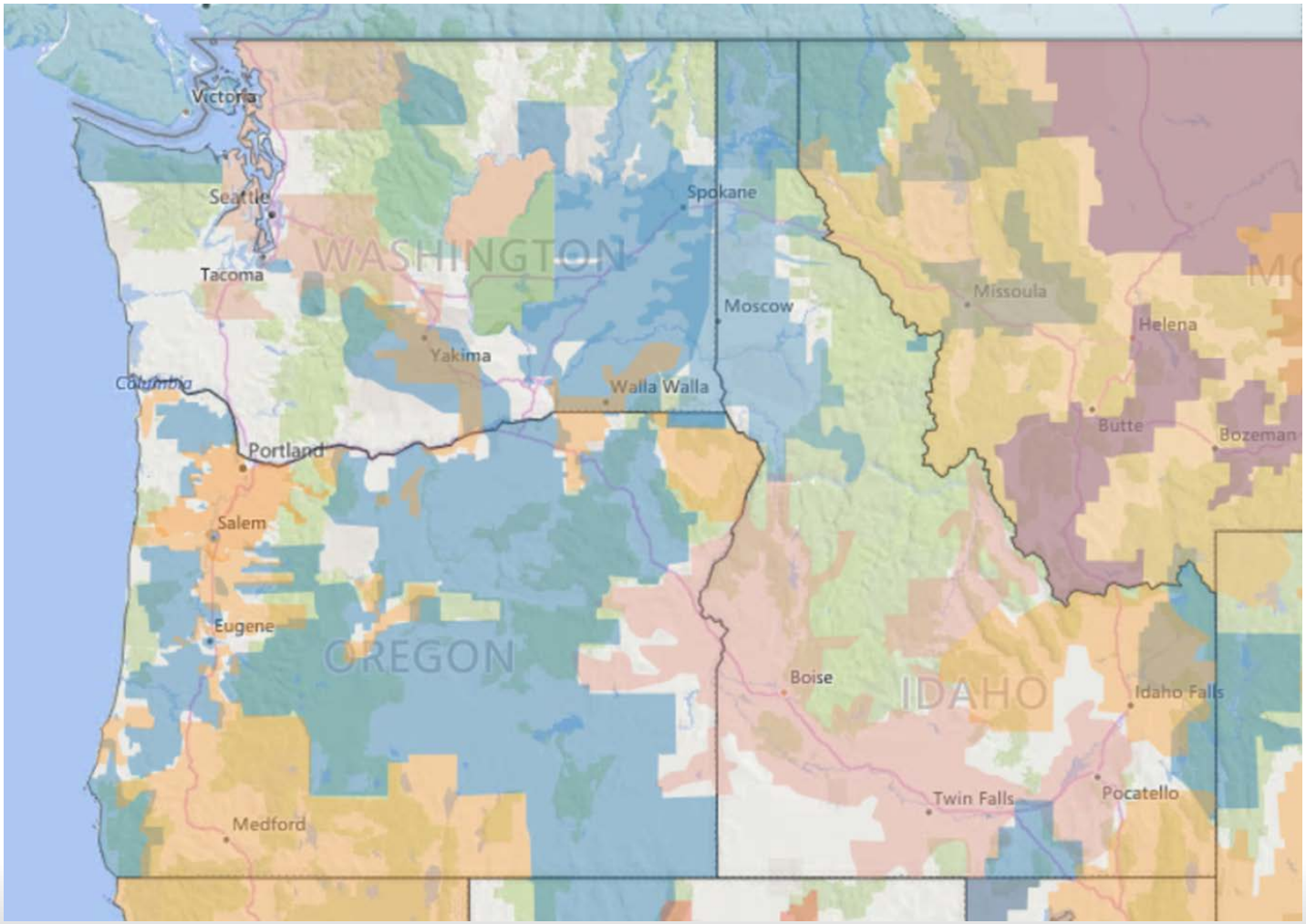
Anticipated Resource Needs

Trends, Observations

Components, Latest IOU IRPs filed

WHAT IS AN IRP?

Regional Power Planning and Integrated Resource Plans



Utility service territories, SNL maps

What is an IRP?

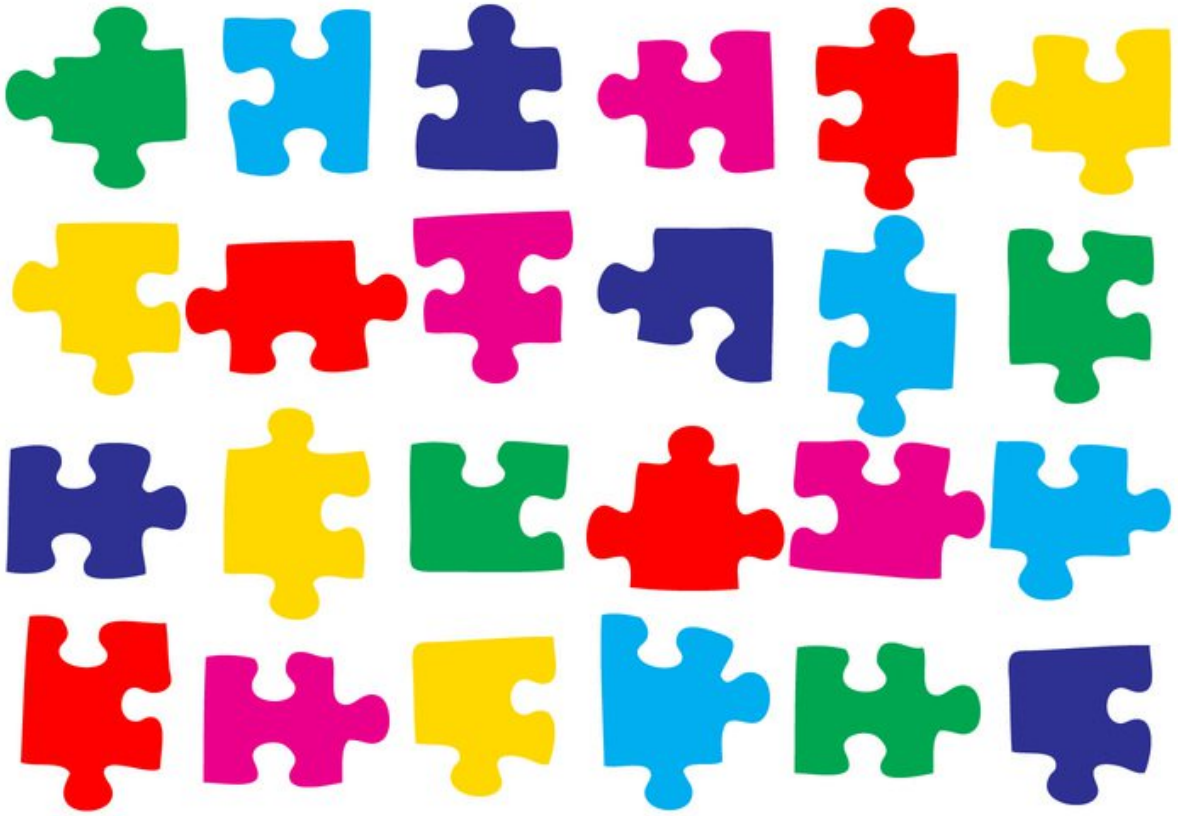
- An Integrated Resource Plan is a utility's framework to meet future resource needs
  - Least-cost, least-risk analysis includes:
    - Forecast of future demand, fuel prices, market
    - Cost and availability of new energy efficiency and generating resources
    - Load and resource balance
    - Various scenarios, sensitivities
  - Long-term strategy (20+ years) of resource acquisition and interim (2 – 5 years) action plan
- IRPs are developed every 2-3 years; continuous evolution

Disclaimers

- Focus on IOUs
- Electric IRPs only; not gas
- Figures and numbers are in different year dollars; they have not been normalized to a single year
- IRPs are only a snapshot

Latest IOU IRPs

Utility	Date Filed
Avista	August 2017
Idaho Power	June 2017
NorthWestern Energy	March 2016* Next IRP scheduled late 2018
PacifiCorp	April 2017
Portland General Electric	November 2016* 2016 IRP Update – Feb 2018 Kick-off for 2019 IRP in Feb
Puget Sound Energy	November 2017



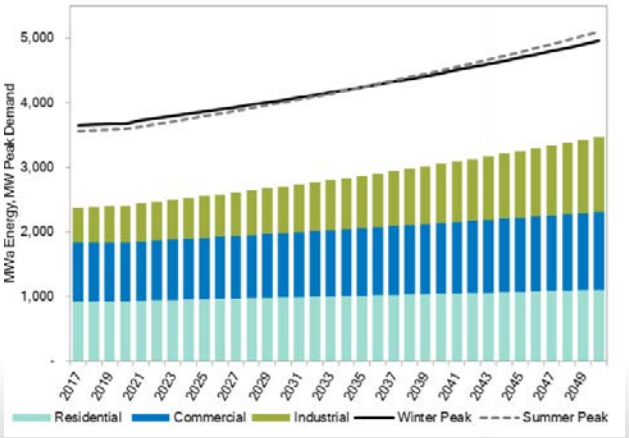
Summary of the fundamentals of the planning process

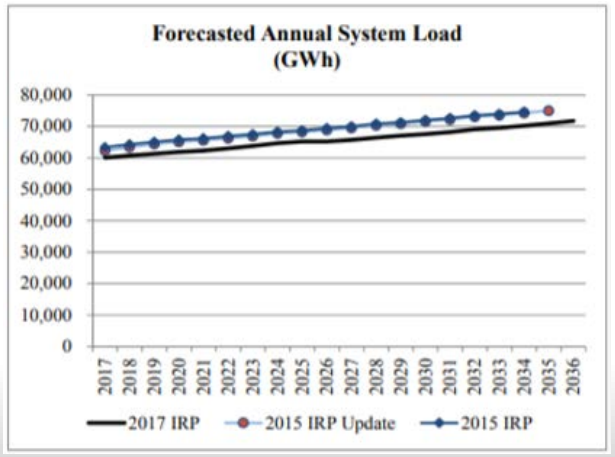
IRP COMPONENTS

Demand Forecasts

Average energy, peak winter/summer

- Region recovering from effects of 2008-09 recession
  - Average annual growth rate typically between 0.5 – 1.5%
- Reliable seasonal peak may be changing
  - Summer peak load growing at a higher rate than winter peak
    - PGE forecasts summer peak overtaking winter peak in 2035, Avista in 2100
- Several recent IRPs have lower load forecasts than previous IRPs
- Continued energy efficiency acquisitions and demand response contribute to lower load growth





Source: (L) Chart from PGE 2016 IRP
(R) Chart from PacifiCorp 2017 IRP;

Gas Price Forecasts

- Many utilities seem to be converging around ~$4/MMBtu levelized gas price; Gas price forecasts dependent on hub
- Efficient hydraulic fracturing has led to abundance of shale; conversely, increased use of natural gas for baseload and peaking resources

FIGURE 10: REFERENCE CASE NATURAL GAS PRICES FOR SUMAS AND AECO HUBS

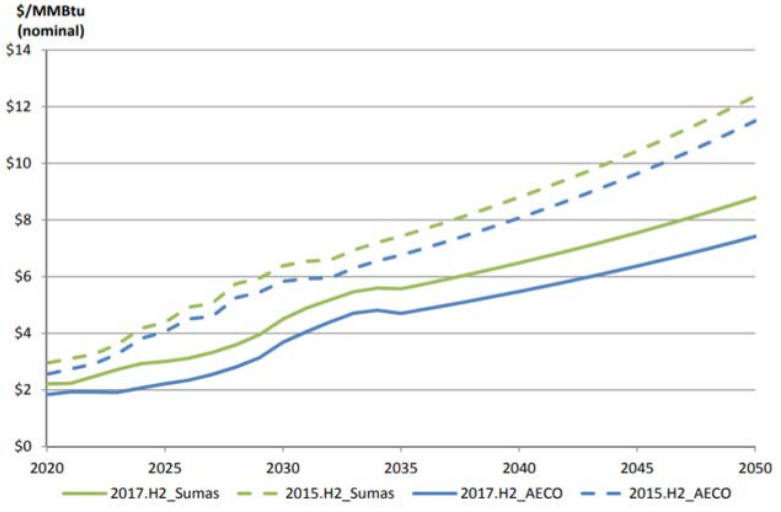
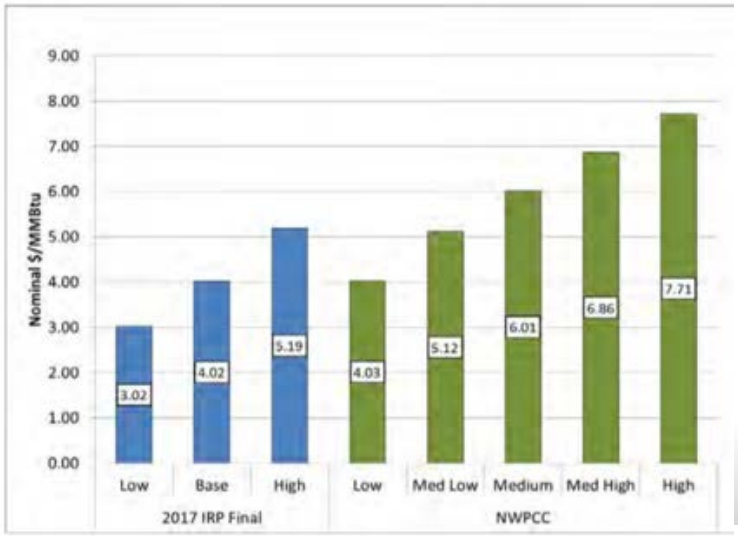


Figure 4-10: PSE 2017 IRP Gas Prices Compared to NPCC Seventh Power Plan Gas Prices (adjusted to nominal values)

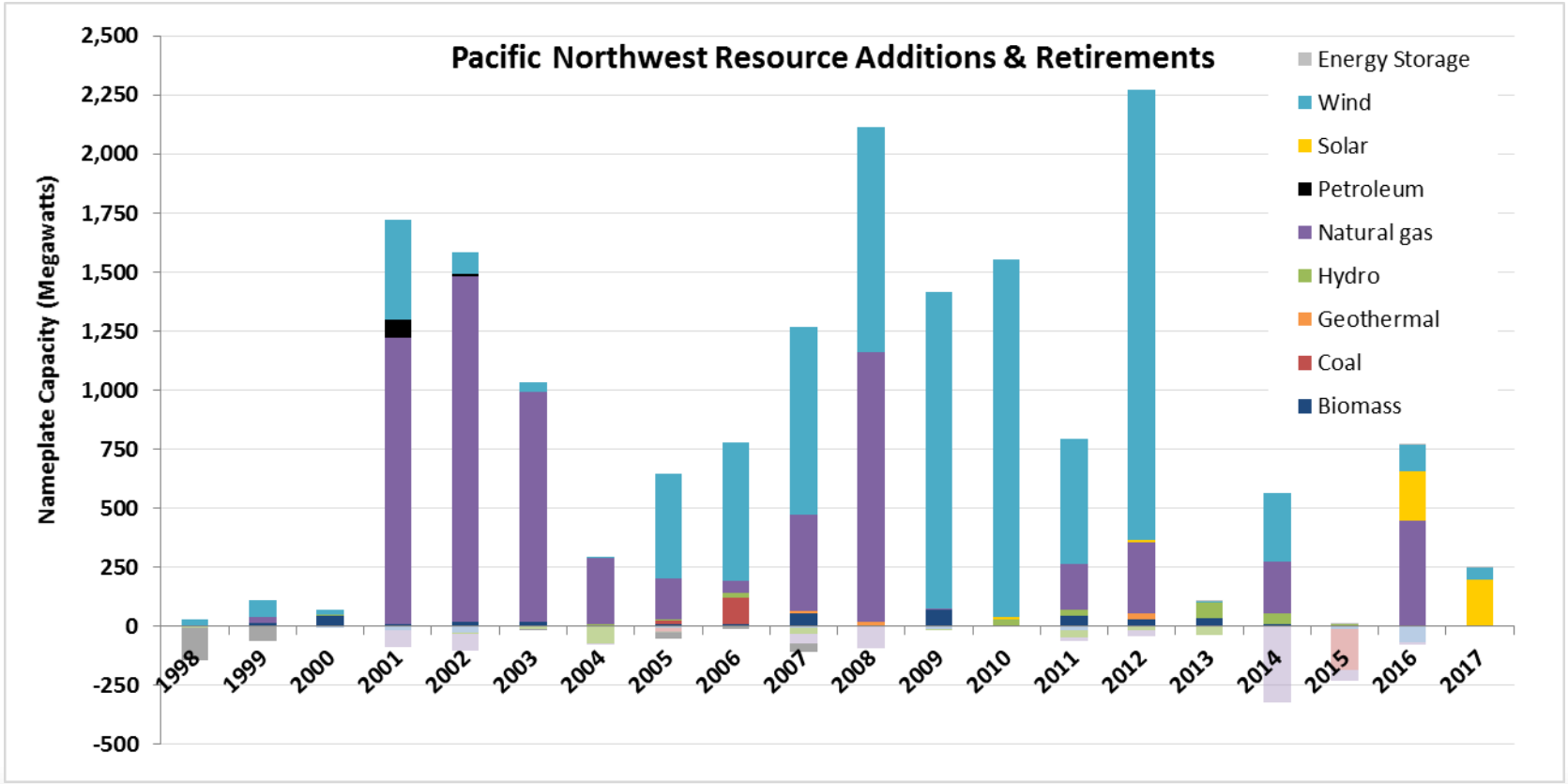


Source: (L) Chart from PGE 2016 IRP Update; (R) Chart from Puget Sound Energy 2017 IRP

Wholesale Electricity Price Forecast

- Mid-Columbia prices and forecast remain low
  - Direct relationship to lower natural gas prices
  - Introduction of variable energy resources (wind, solar) – low variable cost

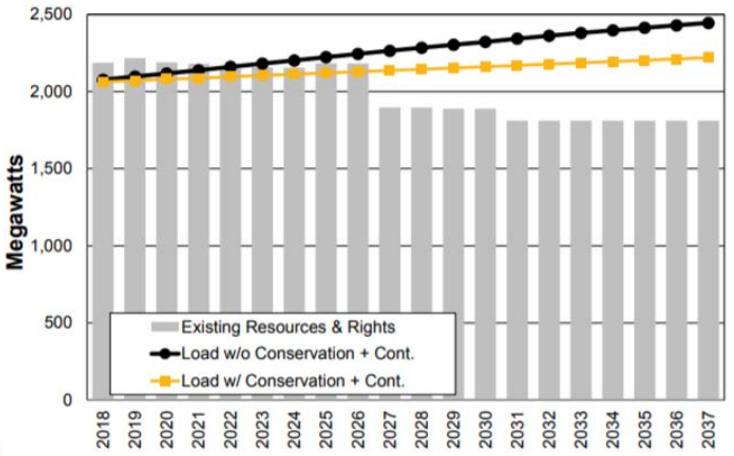
Existing Resources



Source: Northwest Power and Conservation Council

Load/Resource Balance

- Balance future expected load requirements with portfolio of existing resources
- Additional considerations utilities are facing:
  - Recent PURPA contracts
  - Expiring existing contracts
  - Retiring resources (coal)



Source: Chart from Avista 2017 IRP

Planned Coal Retirements - Region

Plant	Retirement Date	Capacity & Op Yr	Location	Ownership
J. E. Corette	2015	173 MW (1968)	Billings, MT	PPL Montana**
Hardin	2018	116 MW (2006)	Hardin, MT	Rocky Mountain Power (Not related to PAC)
Boardman*	2020	600 MW (1980)	Boardman, OR	PGE, Idaho Power (90/10)
Centralia – 1 Centralia – 2	2020 2025	670 MW (1971) 670 MW (1971)	Centralia, WA	TransAlta
Colstrip – 1 Colstrip – 2	2022	360 MW (1975) 360 MW (1976)	Colstrip, MT	PSE, Talen Energy (50/50)
North Valmy – 1 North Valmy – 2	2019 2025	254 MW (1981) 268 MW (1985)	Valmy, NV	Idaho Power, NV Energy (50/50)
Jim Bridger – 1*** Jim Bridger – 2***	2028 2032	578 MW (1974) 578 MW (1975)	Sweetwater, WY	PAC (2/3), Idaho Power (1/3)
Regional Total		**3,037 MW****		

* Ceasing coal-fired production; future of Boardman plant TBD
** Out of region (OOR)
*** Not a commitment; only part of PAC 2017 IRP forecast. Decision on SCR to be made by PAC in early 2018. Idaho power also evaluating SCR and early retirement in their IRP process with no decision yet.
**** includes 50% of North Valmy; does not include Corette or Bridger

Major Sensitivities Studied*

- Climate Change – effects on hydrosystem, consumer behavior, population migration
- (Uncertainty of) future environmental regulations
  - Carbon cost
  - Cost of compliance vs. early retirement
- Carbon reduction – higher RPS, greater renewables, higher EE, etc.
- Emerging loads, e.g. plug-in electric vehicles
- Early resource retirements (coal and gas)
- Repowering existing wind projects
- Transmission – new and upgrades
- Locational resources, e.g. Montana wind

* List is not exhaustive!

Resource Options

- Energy efficiency, demand response
- Net metering (rooftop solar) and demand side management
- New generating resources and upgrades to existing generation
- Energy storage
- Small scale resources – geothermal, biomass
- Emerging technologies

Resource Cost and Potential

Key component of determining future resource options is an estimate of cost and potential of:

- Energy Efficiency – conservation potential assessments (CPA)
- Demand Response
- Generating Resources
- Transmission

Robust analysis included as part of IRP

Photo credit: PGE flickr

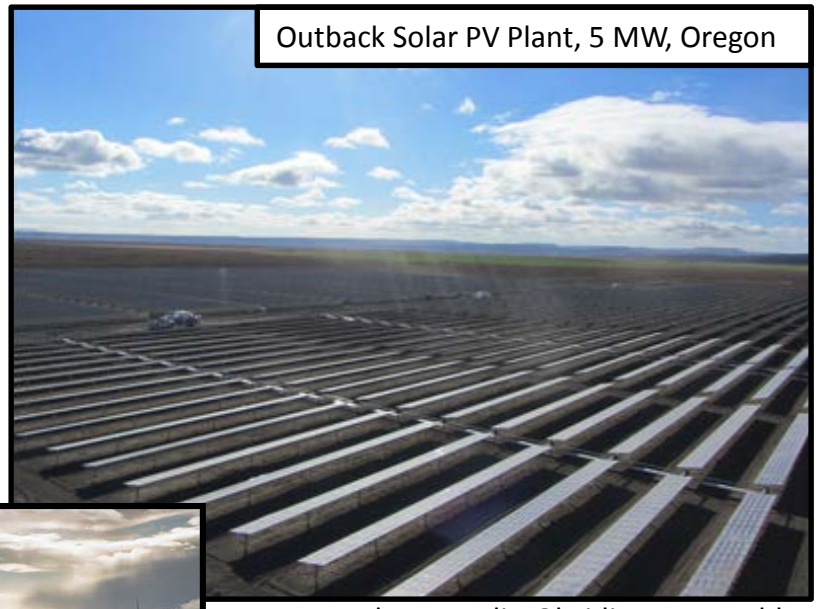


Photo credit: Obsidian Renewables

Photo credit: PGE flickr

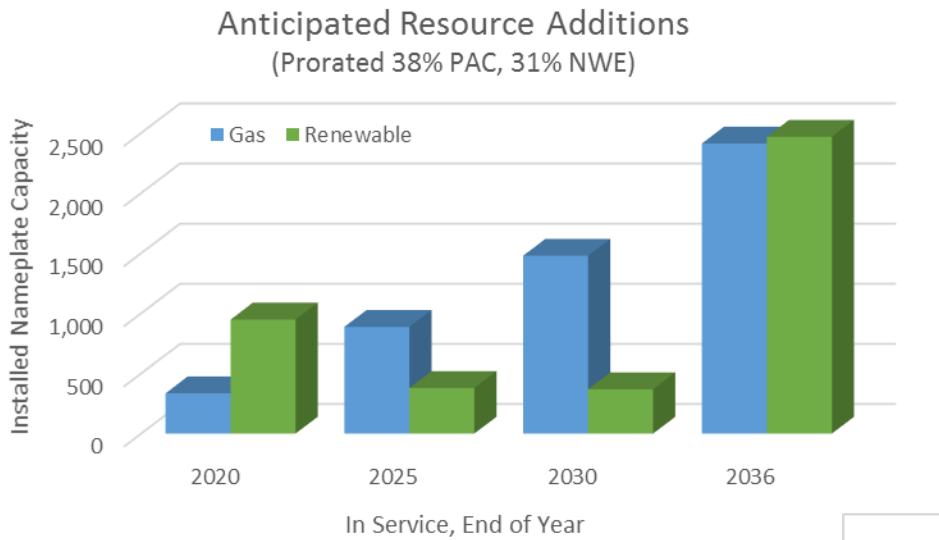
ANTICIPATED FUTURE RESOURCES IDENTIFIED

Caveats

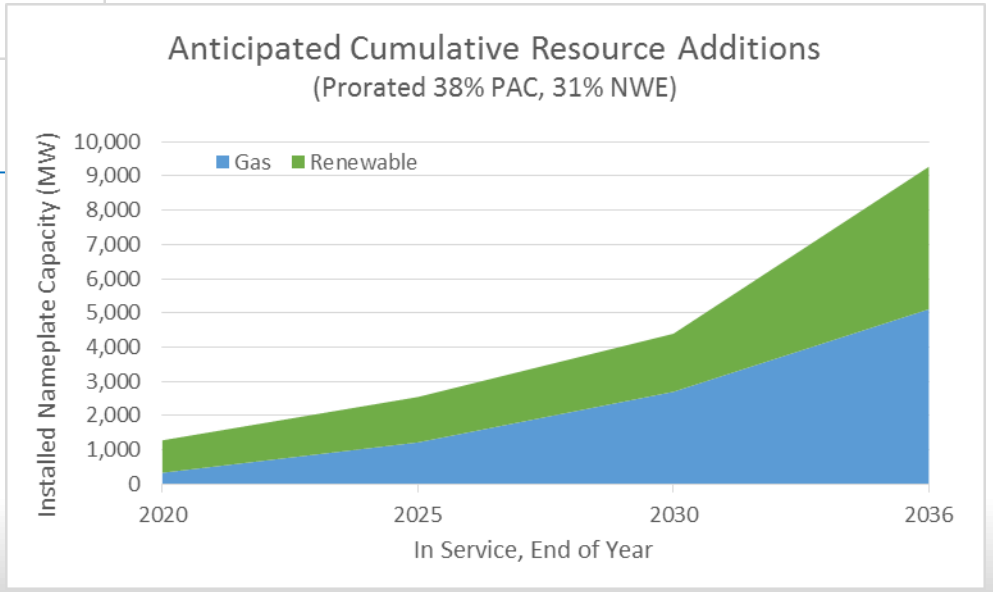
- Aggregates **new** physical resources only
- Does **not include** anticipated EE, DR, energy storage, market purchases, transmission development, repowered wind
- Resources identified are proxy; not binding
- The farther out, the greater the uncertainty
- Includes IOUs only:

Utility	% New Resources Included
Avista 2017 IRP	100%
Idaho Power 2017 IRP	100%
NorthWestern 2015 IRP	31%
PacifiCorp 2017 IRP	38%
Portland General 2016 IRP	100%
Puget Sound 2017 IRP	100%

Anticipated New Resources*



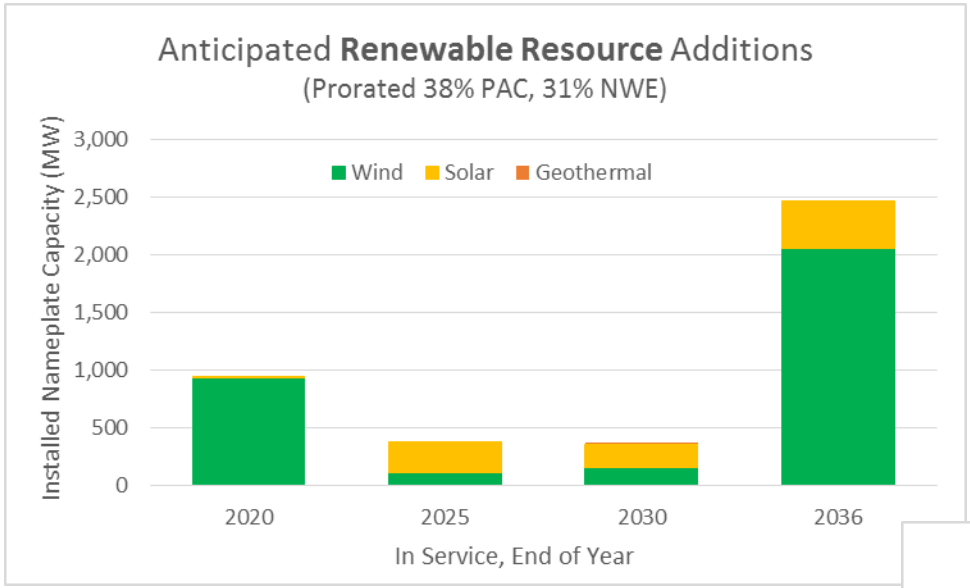
	2020	2025	2030	2036
Gas (MW)	335	887	1,479	2,412
Renewables (MW)	948	379	367	2,468



Cumulative	2020	2025	2030	2036
Gas (MW)	335	1,222	2,701	5,113
Renewables (MW)	948	1,327	1,696	4,163

* Resources identified are proxy; not binding

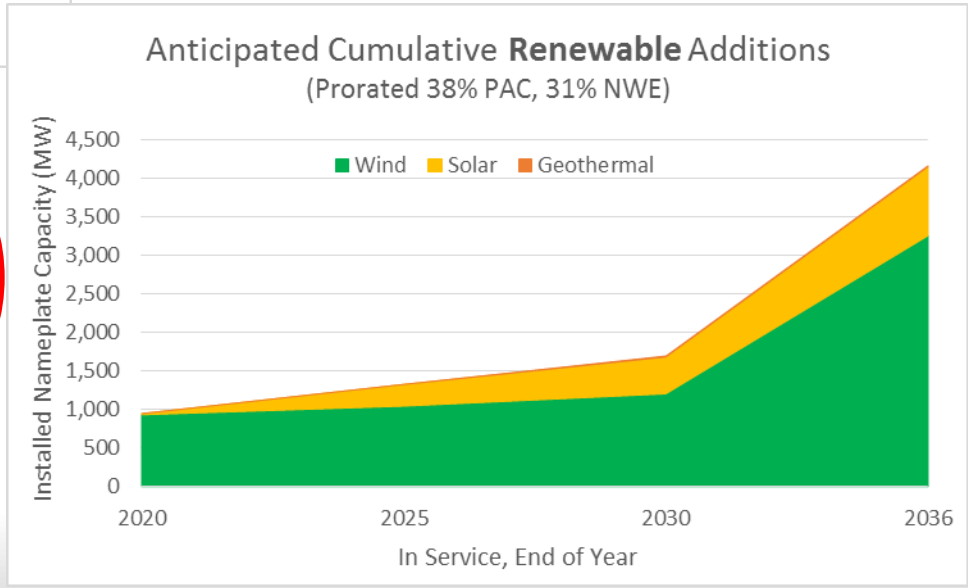
Renewable Resource Breakout*



State Renewable Portfolio Standards	
Washington 9% thru 2019 15% by 2020	**Montana** 15% by 2015
Oregon 20% by 2020 **27% by 2025** **(formerly 25% thereafter)** 35% by 2030 50% by 2040	

Wind	2016	2017	2018	2019	2020
PTC	100%	↓ 20%	↓ 40%	↓ 60%	n/a
ITC	30%	24%	18%	12%	n/a

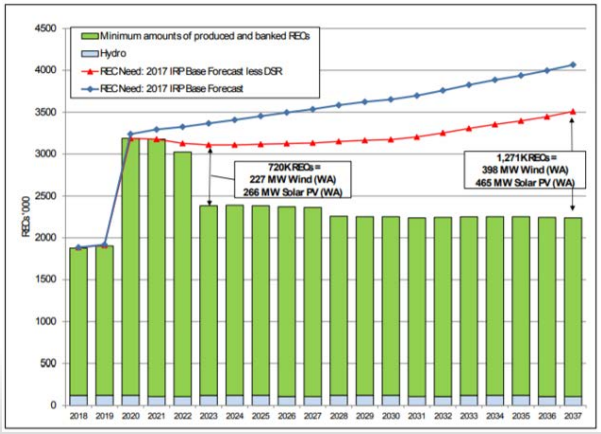
SolarPV	2019	2020	2021	2022	2023
ITC	30%	26%	22%	10%	10%

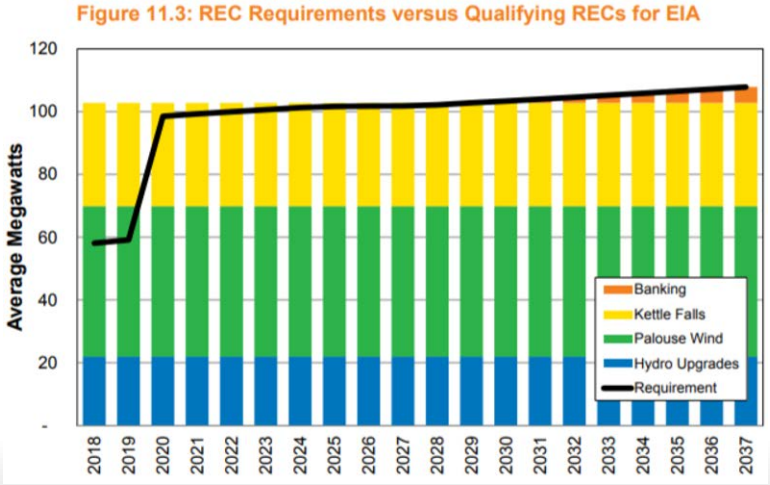


* Resources identified are proxy; not binding

RPS Compliance: Current and Future Obligations

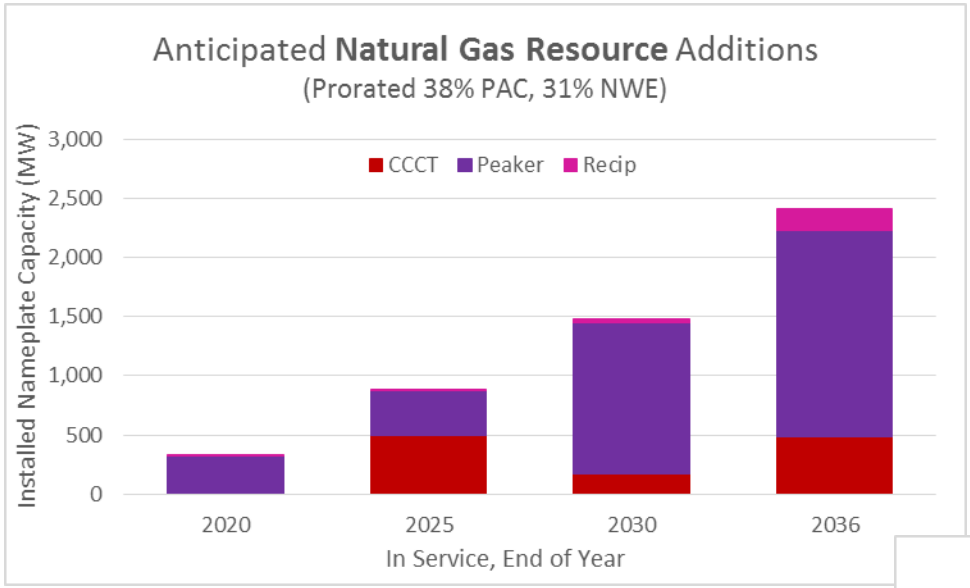
- Early acquisition of renewable resources to take advantage of expiring tax credits
- Wind, solar, and hydro upgrades
- Unbundled RECs play greater role when energy isn't needed





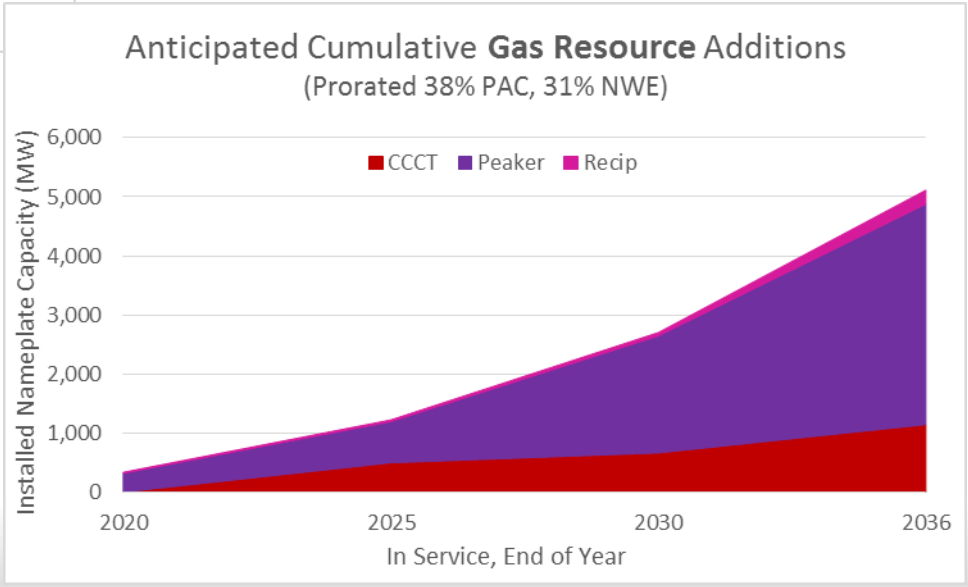
Source: (L) chart from PSE 2017 IRP
(R) Chart from Avista 2017 IRP

Natural Gas Breakout *



MW Installed	2020	2025	2030	2036
CCCT	0	497	166	481
Peaker	318	379	1,285	1751
Recip	17	11	28	180

- Need for capacity resources greater, over baseload energy resources
- Frame technology the overwhelming choice for new gas peaking resources
- Reciprocating engines still viable option, but more expensive



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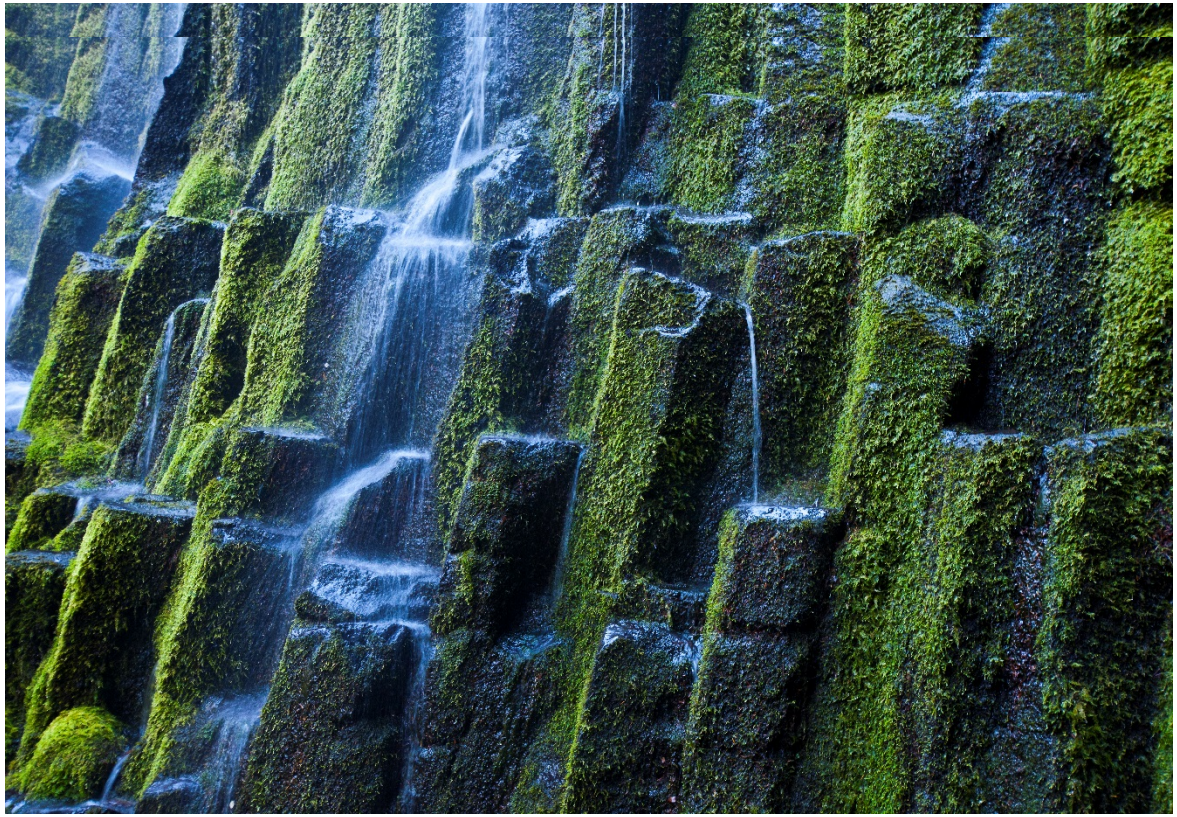


Photo credit: Proxy Falls, Northwest Power and Conservation Council

TRENDS, OBSERVATIONS

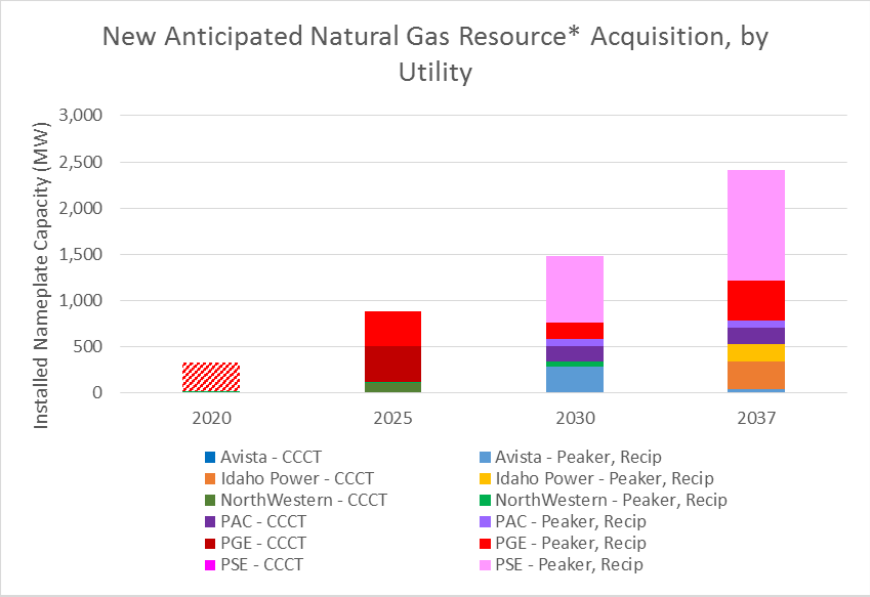
Observations

- Energy efficiency and demand side strategies pursued first, keeping load growth low and delaying the need for resource acquisition
- Changes in Oregon RPS, combined with expiring federal tax credits have accelerated renewable resource acquisition
- Uncertainty over environmental regulations and carbon legislation → a lot of retirement and replacement scenarios for existing coal plants
- Fundamental change in treatment/analysis of resource acquisition: less resource-specific, more generic capacity vs. energy need
- RFP process plays an increasing role in defining new resource acquisition

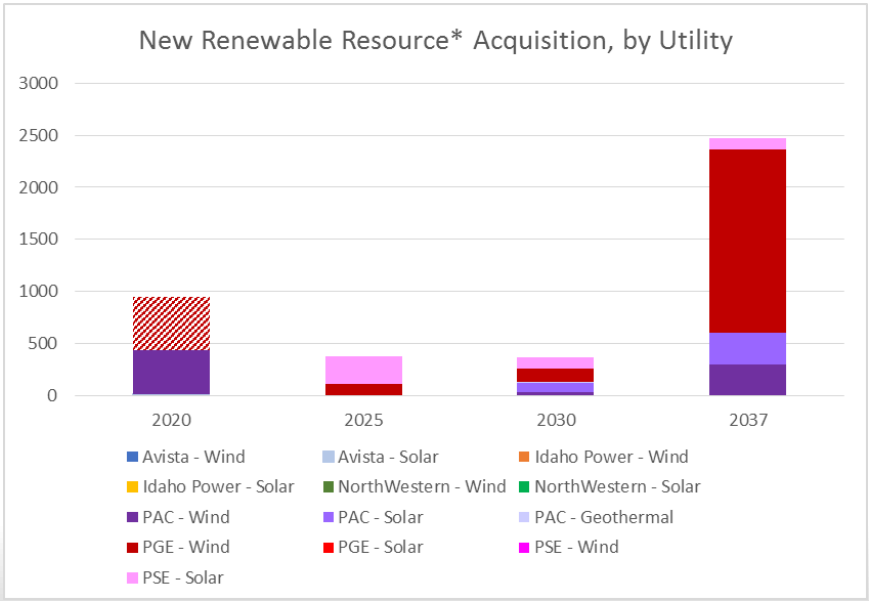
Resource Trends

- RPS obligations, retiring coal plants and expiring contracts play the biggest role in future resource planning gaps – greater than load growth
- Increased utilization of existing resources as a cost-effective option to meet RPS and future resource needs
  - Hydropower upgrades, repowered wind
- Utilities analyzing demand side management strategies and energy storage technologies
  - Introduction of cost-effective battery storage in later years of several IRPs
- Solar PV costs have continued to decline

What's next? (i.e. Plans change!)



- IRP is a framework of future resource acquisition
- What is identified as a future need in an IRP is *not necessarily* what a utility will end up procuring
- Ex: PGE identified early generic and efficient capacity resources in IRP, but recent RFP activity suggests different strategy of meeting near-term resource requirements



* Resources identified are proxy; not binding

Current Activities, Highlights: Acquisitions, Requests for Proposals

- PGE signed (2) PPAs with BPA for 200 MW of annual capacity (surplus hydro) and (1) PPA w/ Avangrid for 100 MW of seasonal capacity
- Avista issued RFP for solar in April 2017
  - Adams-Neilson solar project (28MWdc), EOY 2018
- PacifiCorp released RFP for 1,000+ MW wind and solar (projects must be operational by EOY 2020)
  - Wyoming wind projects
  - Repowering existing wind
- PGE to issue RFP for 310 MW renewable resources in 2018
- PSE to release "all source" RFP in 2018 (for delivery in 2022)
- Idaho Power pursuing Boardman to Hemingway transmission in its action plan

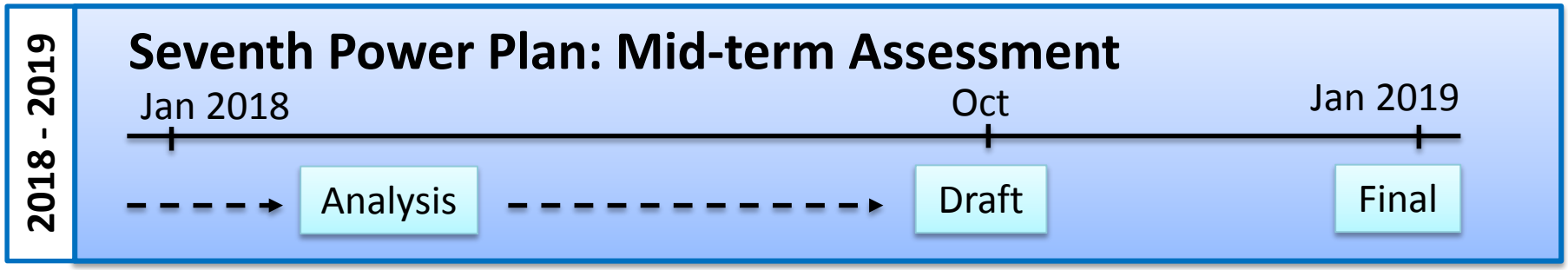
Council Plug: Upcoming advisory committee meetings

Generating Resources (GRAC) – April 26

- Updating generating resource cost estimates

Conservation Resources (CRAC) – June 5

Demand Response (DRAC) – June 20



Questions?

Gillian Charles

Energy Policy Analyst

gcharles@nwcouncil.org

503.222.5161