Northwest **Power** and **Conservation** Council

May 6, 2025

MEMORANDUM

TO: **Council Members**

FROM: **Joe Walderman, Energy Resource Analyst**

SUBJECT: **Proposed Demand Response Potential (Part 1)**

BACKGROUND:

Presenter: Joe Walderman

Summary: This presentation is the first of a two-part series that describes the Demand Response (DR) potential being developed for the Ninth Power Plan. Staff are in the process of developing demand response supply curves, representing 28 demand response products for the Ninth Power Plan. Demand response products are represented in the supply curves by levelized cost (dollars per kilowatt-year) and total potential savings (megawatts). This presentation will provide background on how demand response has been considered in previous power plans, review the state of demand response in the region, summarize the demand response that will be considered in the Ninth Power Plan, and discuss the different parameters that staff use to define the demand response products. Demand response products will be discussed primarily by the end uses that they impact, those being space heating and cooling, water heating, irrigation, and electric vehicle charging. Certain demand response products impact the entirety of a customer's load, and these will be discussed separately. By next month staff will be finalizing all the DR supply curves that will be used as inputs into the OptGen model to compete alongside other generating and demand side resources for the Power Plan.

Relevance: Over the past year staff has been conducting research, improving assessment models, and conferring with the Demand Response Advisory Committee to build out the spreadsheets and assumptions that define our DR products. These product definitions are important for accurately comparing the suite of resource options available to the region when conducting the optimization modeling for the Ninth Power Plan.

Workplan: B.4. Develop demand side supply curves and related assumptions for plan analysis.

More info: Staff presented a Primer on DR for the Ninth Plan in September of last year:

- Primer on DR for the Ninth Plan (September 2024)

Proposed Demand Response Potential (Part 1)

May 2025 Council Meeting

Joe Walderman

Northwest Power and Conservation Council

1

Agenda

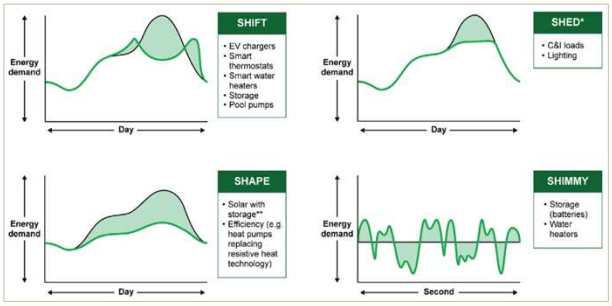
- Demand Response in the 2021 Plan
- Demand Response in the Region
- Demand Response Products Modeled
- Progress and Next Steps

2

What is Demand Response?

"Demand response is a non-persistent intentional change in net electricity usage by end-use customers from normal consumptive patterns in response to a request on behalf of, or by, a power and/or distribution/transmission system operator. This change is driven by an agreement, potentially financial, or tariff between two or more participating parties."

Most commonly used to reduce or shift load at times of peak demand or hours of greatest need



3

How Have We Treated DR in Past Power Plans?

2005: Fifth Power Plan

First plan to consider DR as a resource

Recommended the region acquire 500 MW by 2009

Included 8 action items to further develop DR resources

2010: Sixth Power Plan

No MW recommendation

Recommended the region conduct pilot studies and numerous other action items related to DR

Described pricing and program options to encourage DR

2016: Seventh Power Plan

Potential: 3,500 MW of winter peak and 3,300 MW of summer peak

Identified 600 MW of cost-effective DR

Established the Demand Response Advisory Committee (DRAC)

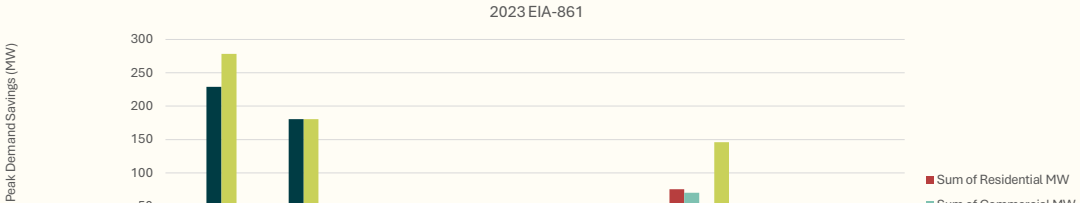
2022: 2021 (8th) Power Plan

Recommended the region examine two types of DR: Residential Time-of-Use (TOU) – 200 MW and Demand Voltage Reduction (DVR) – 520 MW

Estimated 3,721 MW of summer DR potential and 2,761 MW of winter potential

4

Reported DR for the Region – 2023 EIA-861

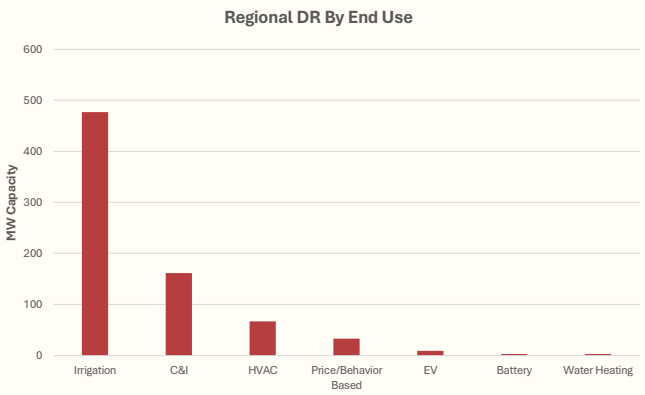


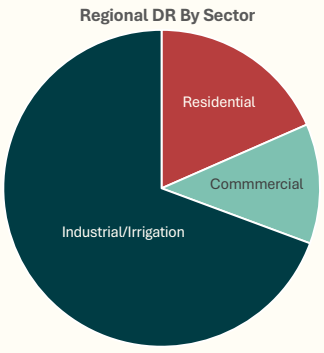
	Idaho Power Co	PacifiCorp	Flathead Electric Coop Inc	Montana-Dakota Utilities Co	Idaho Power Co	PacifiCorp	Portland General Electric Co	PUD No 1 of Snohomish County	Puget Sound Energy Inc
	ID		MT		OR		WA		
Sum of Residential MW	23.20	0.00	17.34	0.00	0.30	0.00	75.57	0.17	24.74
Sum of Commercial MW	25.70	0.00	0.00	0.38	10.30	0.00	70.61	0.00	0.00
Sum of Industrial MW	229.00	180.40	0.00	19.08	5.30	5.20	0.00	0.00	0.00
Sum of Total MW	277.90	180.40	17.34	19.46	15.90	5.20	146.18	0.17	24.74

5

Existing DR in the Region

- Region appears to be implementing 725 MW of DR capacity
- Many pilots are being developed and transitioned to full programs





6

DR Needs and Opportunities

Increased Need

- More intermittent resources on the gird
- Greater constrains around transmission and distribution infrastructure
- 2021 plan identified flexibility as a significant need going forward

Expanded Opportunity

- Greater grid communication at the load level enabling more DR
  - More smart appliances
  - CTA 2045 heat pump water heater standard
- More flexibility at the load level through EVs and BTM batteries
- Greater saturation of advanced metering infrastructure

7

Demand Response Products

8

Electric Vehicle Charging

- Active Managed Charging
  - EV charging times are shifted to off-peak hours through WiFi-enabled charger controls or vehicle telematics
- EV TOU NEW
  - Time-varying rates targeted to EV owners and designed to encourage shifting charging to off-peak hours

DRAC supported splitting to two EV products and representing EV DR as a frequently deployable resource

HVAC

- AC and Heat Switch
  - Directly curtails central AC or heat load through a load control switch placed on a customer's air conditioning or heating unit.
- Bring your own Thermostat (BYOT)
  - Uses existing WiFi-enabled thermostats to automatically change the setpoint temperature on heating or cooling systems to preheat/precool and then adjust during peak events to lower energy demand

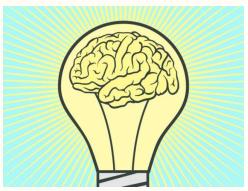
** Products for residential and commercial*

Water Heating

Products for Electric Resistance (ERWH) and Heat Pump Water Heaters (HPWH)

- Load Switch
  - A load switch installed on the water heater completely turns off water heating during the DR event period
- Grid-Interactive
  - A communication module is installed through an existing CTA-2045 standard port, enabling more precise control of the water heater and allowing preheating to help ride out events

Oregon and Washington require all new electric water heaters to include a CTA-2045 communications port



Irrigation

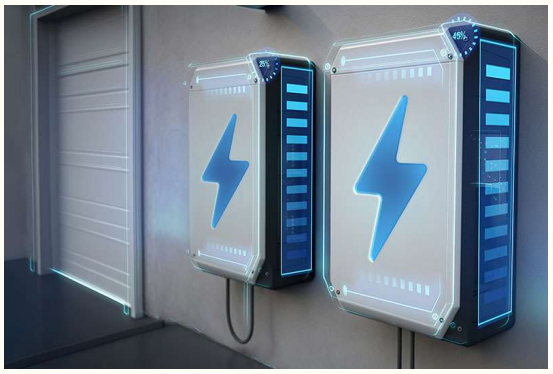
- Remotely curtails agricultural irrigation pumps during the summer season
  - Products for small/medium and large farms
- Vast majority of potential is east of the Cascades
  - Larger amount of irrigated acres
  - Greater load from irrigation due to well pumping (most farms west of the Cascades use canals)
- Final potential will be derated by the 477 MW capacity of Idaho Power and PacifiCorp programs since the maturity of these programs mean they were baked into the load forecast

C&I Demand Curtailment

- Targets large commercial and industrial customers, providing incentives for custom load curtailment strategies and event-based energy shifts. The offering is technology agonistic and flexible, with a mix of behavioral/manual participants and other customers who opt for direct load control
- Products for commercial as well as industrial

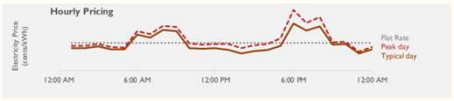
Battery Demand Response

- Bring Your Own Battery NEW
  - Customers with existing batteries are paid incentive to allow utility to discharge battery during peak hours
- Utility-Financed Battery NEW
  - Utility pays for most of battery cost in exchange for more frequent and less restrictive control of battery charge and discharge



Price-Based and System Demand Response

Time of Use (Residential and Commercial)	A residential time-varying rate offering designed to encourage customers to shift their energy use to off-peak times, reducing overall demand during peak periods
Critical Peak Pricing (Residential, Commercial, and Industrial)	Higher prices during peak events (called), lower prices during other times
Real Time Pricing (Industrial)	Hourly (generally) electricity prices set day-ahead (or less)
Demand Voltage Regulation (All)	DVR is a technique that uses voltage regulation to reduce demand and manage voltages in power systems during peaks



15

DR Supply Curve Assumptions

16

Cost Parameters

Setup Costs	O&M Costs	Equipment Cost	Marketing Cost	Value of Lost Service (Derived from incentive)
$	*$/ participant* or *$/ year*	*$/ new participant*	*$/ new participant*	*$/ new participant*
• A one-time cost associated with setting up the demand response program in its first year	• An ongoing cost, either a $ per year or $ per participant per year basis. This represents the ongoing operations and maintenance cost for the DR program, including labor and materials, and administrative overhead	• An estimate of the incremental cost of any equipment required to enable DR connectivity with an end use	• An estimate of the cost required to spread awareness, adoption, and satisfaction with a DR program	• Service or utility lost from participation in the demand response program • Derived as percentage of incentive, the cost of one-time enrollment and ongoing annual compensation paid to host load for participation in the demand response program

17

Impact Parameters

Eligibility	Program Participation	Event Participation	Peak Load Impact	Ramp Period	Attrition
% of customer count or *% of end use load*	*% of eligible customers* or *eligible end use load*	*% success rate*	*kW per participant* or *% of end use load*	*Years*	*% of existing participants per year*
• Percent of customers in the region that are eligible for a given demand response program based on load class or equipment saturation	• Estimate of the percentage of eligible customers that will be enrolled in a given program when fully ramped	• Estimate of the percentage of enrolled and participating customers in the program that will be participating in a given demand response event (eg customer override, switch failure, connectivity issues)	• Average kW of demand reduction per participant observed at the meter for a given demand response event	• Number of years to reach maximum achievable potential	• Estimated percentage of existing participants dropped from the program per year

18

Demand Response Assumptions for Capital Expansion Modeling

19

Dispatch Parameters

Hours per Season – Max hours called per season

Average Event Duration – Number of hours called

Events per Season – How many times events are called

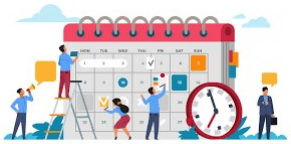
Hourly availability – When during the day events can be called (Contracting work through RTF to develop certain DR shapes)

20

Dispatch Assumptions

Event-Based
10-15 events per season lasting 3-8 hours in duration

- HVAC
- Irrigation
- BYO Battery
- Critical Peak Pricing



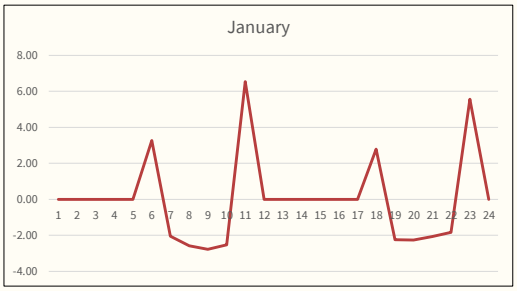
Frequently Deployable
Utilized almost every day for energy shifting

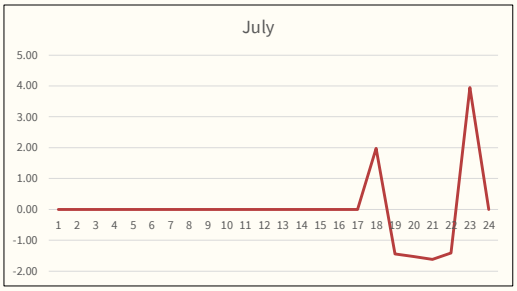
- Water Heating
- EV Charging
- Time of Use
- DVR
- Real Time Pricing

21

Dispatch Example: Grid Connected Water Heating

- Assumed frequent deployment, treated as daily load modifier
- Grid-connected module allows preheating in advance of DR load shedding events
- Achievable potential assigned to highest average hour and scaled down based on load shape



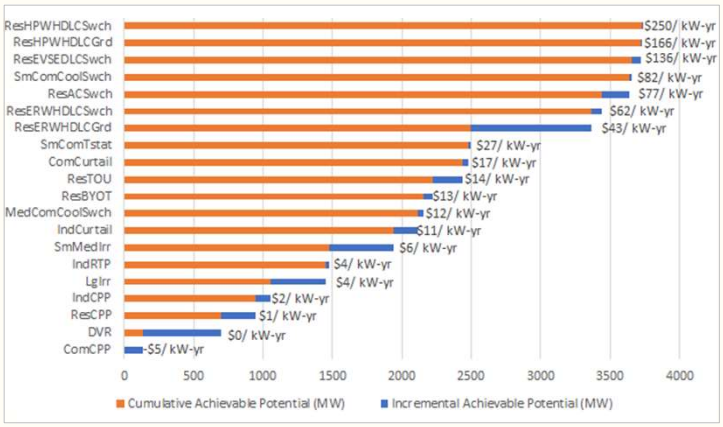


22

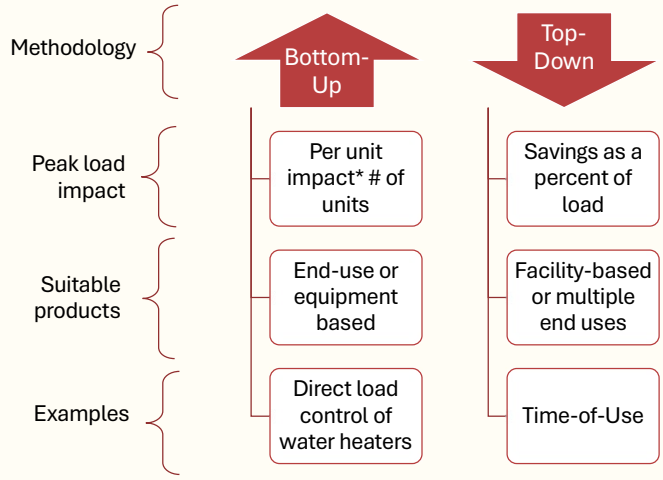
Progress and Next Steps

- DRAC meetings reviewing input assumptions for all DR products
- DR product assumptions out for review
- Finalizing DR model with updated assumptions
- Will present final supply curve for Ninth Plan next month

Example: 2021 Plan DR Supply Curve

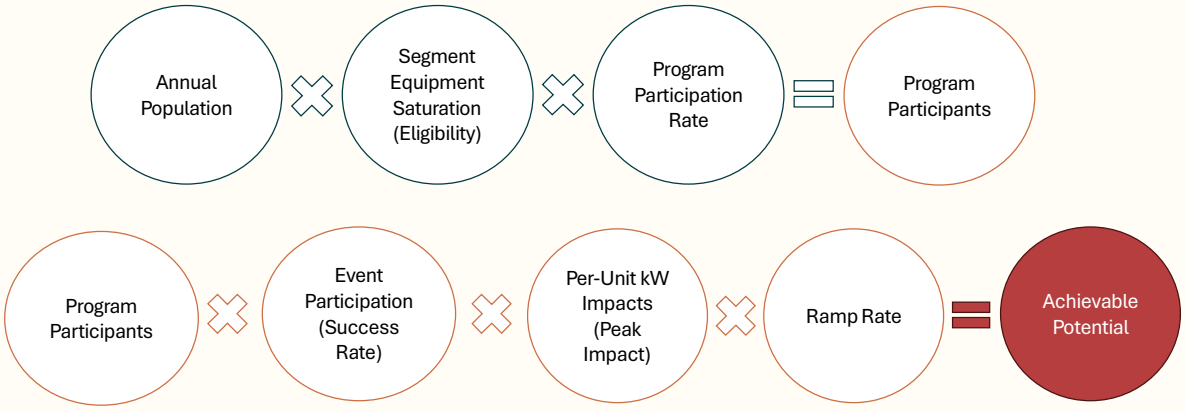


How to Estimate Potential



25

Reminder of Bottom Up DR Potential Assessment Methodology



26

Illustration of Top-Down Methodology to Estimate Potential

- Top-down is more granular, using end use load shapes
- Peak coincidence factor represents % of load that is coincident with peak flagged hours in system shape
- Impact is estimated from % of peak load reduction of eligible load basis

DR in Action