Northwest **Power** and
Conservation Council

September 4, 2024

MEMORANDUM

TO: **Council Members**

FROM: **Joe Walderman, Resource Analyst**

SUBJECT: **Demand Response Methodology Primer**

BACKGROUND:

Presenters: Joe Walderman, Kevin Smit

Summary: In preparation for the Ninth Power Plan, staff are continuing to provide the Council with a series of presentations on different aspects of developing the Plan. This presentation will describe the approach for developing our demand response (DR) resources that will be analyzed in the Plan.

Relevance While demand response is not explicitly referenced or defined in the Northwest Power Act, the functions that are provided through demand response programs are recognized throughout the Act. The concepts, definitions, and provisions regarding, electric power, peaking capacity, resources, and reserves all apply to demand response.

Workplan: B.2.1 Prepare for the ninth power plan, developing a draft scope, preparing models and inputs, and developing environmental methodology

Background: 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.

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The Council has been including demand response in its power plans since the Fifth Plan (2010). DR can be beneficial to a utility by shifting loads from times of peak or significant need, to times when the need or costs are lower. From the regional perspective, DR may be an important part of managing loads to optimize the overall system cost. Therefore, Council staff will again define a series of DR products by identifying their costs and demand reduction potential. Staff will work with our Demand Response Advisory Committee and regional utilities to identify and define these products and develop them into a set of supply curves that will enable them to be modeled alongside of generating resources and energy efficiency.

More Info: DR in the 2021 Power Plan

Demand Response Primer for the Ninth Power Plan

September 2024

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Agenda

Background	Supply Curve Development Process	DR in the 9th Plan

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Background

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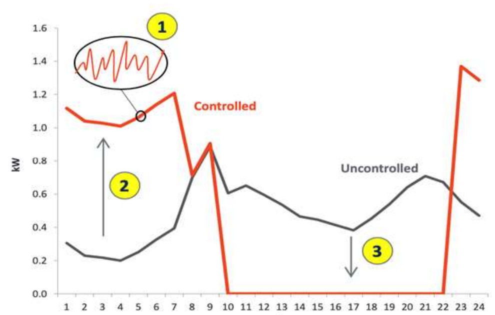
Demand Response (DR) Definition

- DR 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
- DR is most commonly used to reduce demand at the time of peak or hours of greatest need

Water Heating Load Profile



1. Heating element controlled with near-instantaneous response to provide **balancing services**
2. Off-peak **load building** to reduce wind curtailments or reduce ramping of thermal generation
3. **Peak demand reduction** to reduce need for generation capacity and/or T&D capacity, and to avoid peak energy prices

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How Have We Treated DR in Past Power Plans?

2005: Fifth Power Plan

- First plan to consider DR as a resource
- Recommended that 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
- Recommended the region acquire 600 MW of cost-effective DR

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
- Established the Demand Response Advisory Committee (DRAC)

DR Needs and Opportunities

<u>Increased Need</u>

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

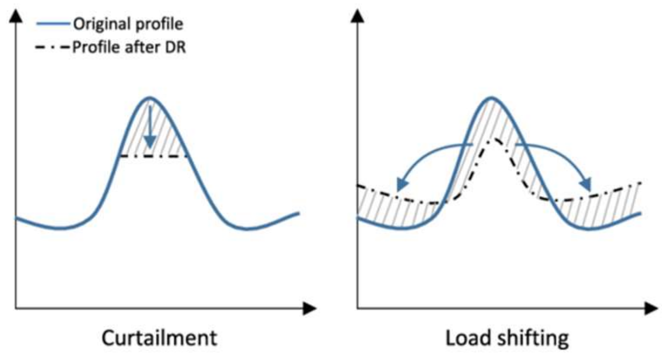
<u>Expanded Opportunity</u>

- 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

DR Use Cases

Shed: Demand response programs can act like efficiency by shedding load at times of peak demand

Shift: Demand response programs can shift load from times of peak demand to other times in the day



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Types of Demand Response

Direct Load Control (Firm)

- Loads directly controlled by utility
- Typically based on equipment such as a thermostat or water heater
- Allows either interruptions of electrical equipment or appliances that are directly controlled by the utility or are scheduled ahead of time.
- Examples:
  - Connected thermostats
  - Irrigation load control
  - Water heater switch

Price-Based (Non-Firm)

- Customer controlled changes in load
- Driven by pricing signals
- Examples:
  - Time-of-Use (TOU)
  - Real Time pricing
  - Critical Peak Pricing

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Supply Curve Development Process

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General Modeling Steps

- Define Demand Response Products
- Estimate Technical Potential
- Estimate Achievable Potential
- Calculate Levelized Costs
- Develop Supply Curves

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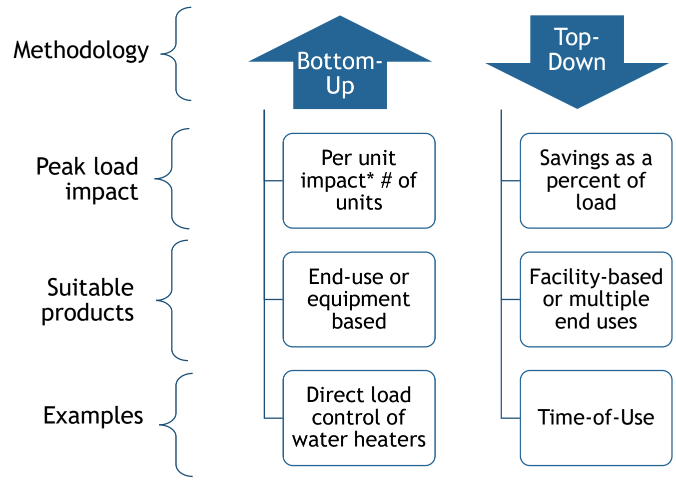
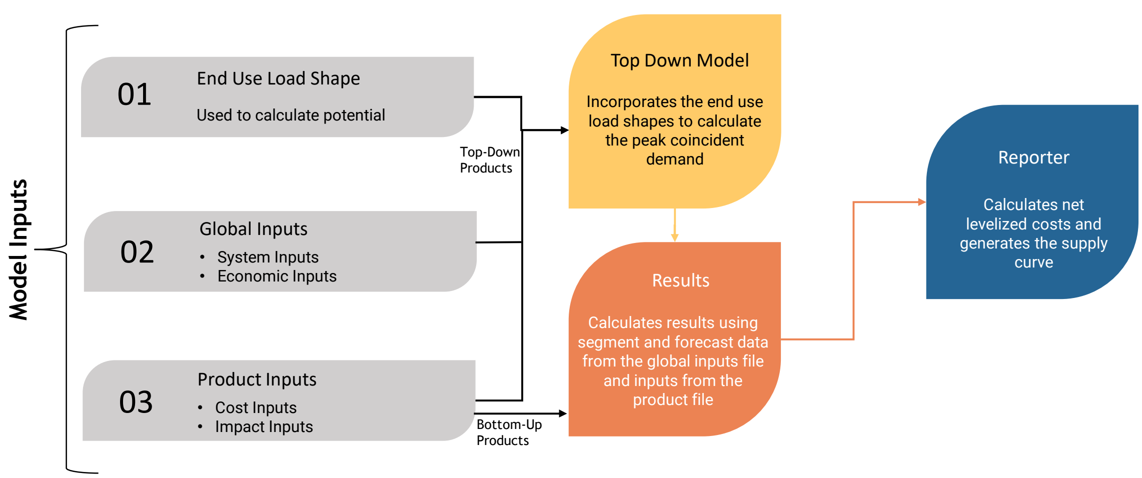
How to Estimate Potential



High-level Modeling Process



Downstream Data Steps – Products Process

Costs
Incentive, O&M, labor, inflation, discount rate (Data from DRAC DR survey and research)

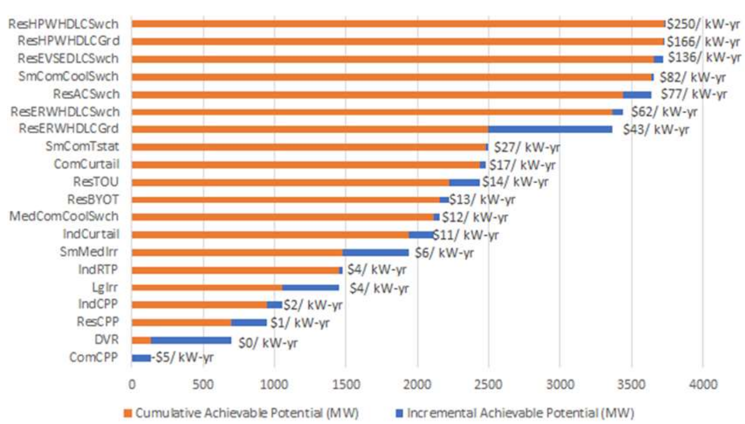
Ramp rates
Pace of adoption over time

Peak load impacts
Season, peak definition, load shape (Sector and end-use specific)

Event participation
# of events, length of events, sector, segment, customer counts, end-use shares, sales forecast (Data from DRAC DR survey and research)

DR Supply Curve Example

- Like EE, DR products are defined by their kW impacts and costs
- A supply curve is developed that includes a variety of “bins” by cost or shape
- The supply curve is formatted to meet the model requirements



DR Products

23 demand response products were included in the 2021 Plan:

Summer Only	Winter Only	Dual Season
AC Switch (Res and Com)	Heating Switch	Bring-Your-Own-Thermostat (Res and Com)
		Water Heater (heat pump and electric resistance) - switch
		Water Heater (heat pump and electric resistance) - grid-connected
		Electric Vehicle Supply Equipment control
Irrigation Control		Residential Time-of-Use
		Critical Peak Pricing (Res and Com)
		Demand Curtailment (Com and Ind)
		Real Time Pricing

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What's New for DR in the 9th Plan

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New Products Under Consideration

- Battery Energy Storage Programs (eg PGE's Smart Battery Pilot)
- Expanded EV Charging Programs (EV TOU, Non-Residential Managed Charging)
- Lighting Controls and Refrigeration Controls

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9th Plan Considerations

- NEW PRODUCTS
- DRAC DR SURVEY
- BINNING
- LOCATIONAL DR BY BA
- T&D DEFERRAL

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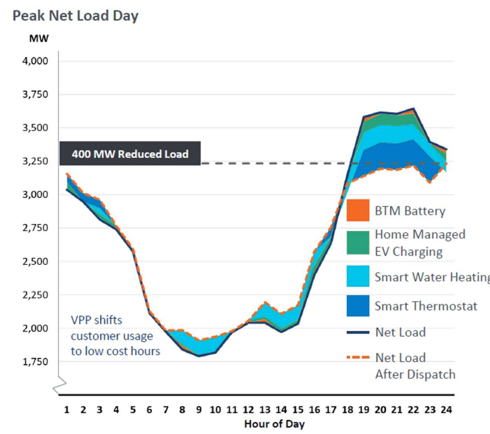
Virtual Power Plants (VPPs)

- Aggregations of DERs and demand response that can balance electric loads and provide utility-grade grid services like a traditional power plant
- Requires enhanced communication and coordination of programs to meet specific grid needs
- Staff is conducting research to consider if and how VPPs could be included in the 9th Plan



Next Steps

- Enhance our DR supply curve model (Summer, Fall 2024)
- Issue a regional DR survey (Fall)
- Host a series of DRAC meetings to review DR product assumptions (Fall-Winter)
- Finalize DR product assumptions and supply curves (Spring 2025)

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Products Selected

Product-Scenario	Parameters	Units	Values	Notes
DVR-Summer	Eligible Sectors		All	
DVR-Summer	Eligible Segments		All	
DVR-Summer	Eligible End Uses		All	
DVR-Summer	Other Eligibility Requirements			
DVR-Summer	Setup Cost	$	$75,000	$150k annual
DVR-Summer	O&M Cost	$ per kW pledged per year	$5	$10 annual
DVR-Summer	Equipment Cost	$ per new kW pledged	$35	$70 annual
DVR-Summer	Marketing Cost	$ per new kW pledged	$0	
DVR-Summer	Incentives (annual)	$ per kW pledged per year	$0	
DVR-Summer	Incentives (one time)	$ per new kW pledged	$0	
DVR-Summer	Additional cost parameter 1			
DVR-Summer	Additional cost parameter 2			
DVR-Summer	Additional cost parameter 3			
DVR-Summer	Attrition	% of existing participants per year		
DVR-Summer	Population	Segment/end-use load	Estimated by model	
DVR-Summer	Eligibility	% of segment/end-use load	varies by segment	
DVR-Summer	Peak Load Impact	% of eligible segment/end-use load	3%	
DVR-Summer	Program Participation	% of eligible segment/end-use load	100%	
DVR-Summer	Event Participation	%	97%	
DVR-Summer	Ramp Period	Number of years to reach maximum achievable potential	5	Updated 2/15/21
DVR-Summer	2022	Ramp rate as % of maximum achievable potential	20%	
DVR-Summer	2023	Ramp rate as % of maximum achievable potential	40%	
DVR-Summer	2024	Ramp rate as % of maximum achievable potential	60%	
DVR-Summer	2025	Ramp rate as % of maximum achievable potential	80%	
DVR-Summer	2026	Ramp rate as % of maximum achievable potential	100%	

Product-Scenario	Parameters	Units	Values	Notes
ResTOU-Summer	Eligible Sectors		Residential	
ResTOU-Summer	Eligible Segments		All	
ResTOU-Summer	Eligible End Uses		All	
ResTOU-Summer	Other Eligibility Requirements			
ResTOU-Summer	Setup Cost	$	$75,000	$150k annual, shared with winter
ResTOU-Summer	O&M Cost	$ per year	$37,500	$75k annual, shared with winter
ResTOU-Summer	Equipment Cost	$ per new participant	$0	
ResTOU-Summer	Marketing Cost	$ per new participant	$25	$50 annual, shared w winter
ResTOU-Summer	Incentives (annual)	n/a		
ResTOU-Summer	Incentives (one time)	n/a		
ResTOU-Summer	Additional cost parameter 1			
ResTOU-Summer	Additional cost parameter 2			
ResTOU-Summer	Additional cost parameter 3			
ResTOU-Summer	Attrition	% of existing participants per year		
ResTOU-Summer	Population	Segment load	Estimated by model	
ResTOU-Summer	Eligibility	% of segment load	85%	Based on EIA 861 Advanced Meter
ResTOU-Summer	Peak Load Impact	% of eligible segment load	5.7%	Summer peak load impact
ResTOU-Summer	Program Participation	% of eligible segment load	28%	
ResTOU-Summer	Event Participation	n/a	100%	
ResTOU-Summer	Ramp Period	Number of years to reach maximum achievable potential	3	Updated 2/15/21
ResTOU-Summer	2022	Ramp rate as % of maximum achievable potential	33%	
ResTOU-Summer	2023	Ramp rate as % of maximum achievable potential	66%	
ResTOU-Summer	2024	Ramp rate as % of maximum achievable potential	100%	

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