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

May 6, 2025

MEMORANDUM

TO: **Council Members**

FROM: **Kevin Smit, Manager of Power Planning Resources**

SUBJECT: **Proposed Conservation Resources for the Ninth Plan (Part 2)**

BACKGROUND:

Presenter: Kevin Smit, Christian Douglass

Summary: Conservation, or energy efficiency (EE), is defined as a resource and given priority by the Northwest Power Act when compared with generating resources. This presentation is the second in a series of three that describes many of the resources being included in the conservation supply curve for the Ninth Power Plan. Staff are in the process of developing the conservation supply curve, which is an accumulation of hundreds of EE measures, each defined by how much energy can be saved, at what cost, and when those savings occur. This presentation will provide a progress report on the development of EE potential for the plan, along with some of the reviewer feedback thus far. The main content of the presentation will be to provide information regarding major EE measures and groups of measures that have been developed. Some of the measure technologies covered this month include lighting, ductless heat pumps, ENERGY STAR appliances, conservation voltage regulation (CVR), electric motors, and industrial heat pumps. By next month, staff will be finalizing all the EE supply curves which will then be used as inputs to our OptGen model to ultimately be compared alongside other demand side and generating resources.

Relevance: Over the past year, the power division has been preparing for the Council's next power plan by conducting research, enhancing tools, and building spreadsheets that contain our EE measure definitions. The resource definitions, including EE resources, are key parameters for conducting the optimization modeling for the Ninth Power Plan. A robust public process has been (and will be) an integral part of the supply curve development.

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

More info: Staff presented a Primer on EE for the Ninth Plan in July of last year as well as Part One of the proposed conservation resources in March 2025:

- Supply Curve Primer for EE in the Ninth Plan (July 2024)
- Proposed Conservation Resources for the Ninth Plan (Part 1) (March 2025)

1

Outline

- Status of Conservation Supply Curves
- Review Comments and Responses
- Conservation Measures Completed
- Supply curve update

Today's update will focus on some of the primary energy efficiency measures and groups of measures that will be the basis for the Ninth Power Plan energy efficiency (EE) supply curves.

Council staff are developing over 130 EE measures for the Plan and will report on many of them today. Significant support is being received from the RTF analysts, consultants, CRAC members, and other reviewers.

2

Timeline and Status

Jan 2025

- Agriculture sector
- Industrial sector
- Non-res motors
- Res rooftop solar

Feb/Mar 2025

- SEM, water/wastewater efficiency
- Res and com measures, Part I (appliances, plug loads, cooking measures)
- Com rooftop solar

Apr/May 2025

- Res and com measures, Part II (HVAC, hot water, lighting)
- Distribution efficiency
- Servers and power supplies

Jun 2025

- Pass EE supply curves to capacity expansion planning modelers

3

Measures Posted for Review

- **Commercial**
  - Dishwashers
  - Packaged Terminal Heat Pumps (PTHPs)
  - Ductless Heat Pumps (DHPs)
  - Energy Management
  - Foodservice measures: Fryers, Griddles, HFHC, Ice Makers, Overwrappers, Steamers, Vending Machines, Dishwashers, Combination Ovens, Convection Ovens, Rack Ovens
  - Lighting: Building Interior, Building Exterior, Exit Signs, Streetlights, Parking Garages
  - Fans
  - Pumps, Circulation Pumps
  - Air Compressors
- **Residential**
  - Refrigerators and Freezers
  - Induction Ranges
  - Portable Spas
  - Ductless Heat Pumps (DHPs)

- **Industrial**
  - Fans
  - Pumps
  - Air Compressors
  - Energy Management
  - HVAC
  - Water Supply
  - Wastewater
  - Refrigeration
  - Process Loads
  - Heat Pumps
- **Distribution efficiency**
  - Conservation Voltage Reduction (CVR)
- **Agriculture**
  - Dairy Measures
  - Generator Block Heaters
  - Irrigation Efficiency
  - Irrigation Pumps
  - Efficient Stock Tanks

4

Feedback Summary

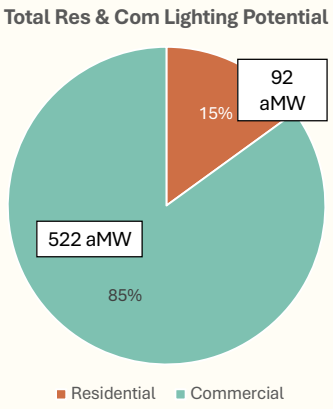
- Received over 200 reviewer comments to date
- Categorized as High, Medium, and Low
- Most comments are clear and straightforward and will be addressed by council staff
- We are working to address and respond to the comments
- We will have a workbook with all the comments, and we will describe how we addressed each comment
- We will seek CRAC feedback on items that require judgement and have significant impact

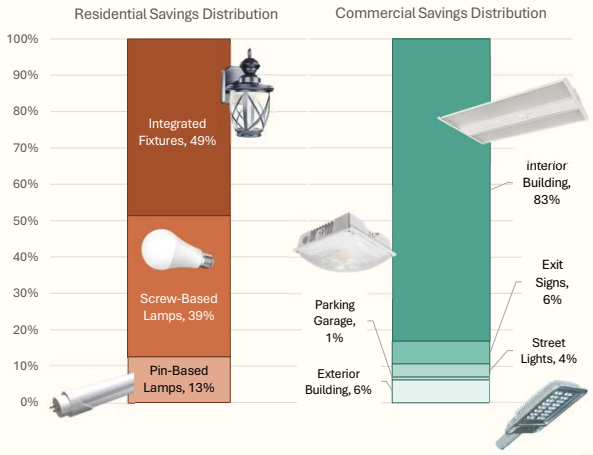
- Examples of the types of comments:
  - Revise ramp rates (too aggressive)
  - Revise ramp rates (too conservative)
  - Costs to low for industrial SEM (provided new data)
  - Costs not in 2024$
  - Washington State Energy Code air compressor requirements not properly accounted for
  - Need to include "transformer right sizing" and "phase balancing" in addition to CVR for Distribution Efficiency
  - Apply different measure shapes (e.g., cooling shape instead of ventilation for Ag Dairy fan measures)
  - Industrial pumps measure does not appear to account for past achievements
  - Improve documentation (either too little or inaccurate)

Measure Highlights

- This section will provide highlights of selected measures or groups of measures:
  - Lighting (All Sectors)
  - Ductless Heat Pumps (Residential, Commercial)
  - ENERGY STAR Appliances
  - Conservation Voltage Reduction (Distribution System)
  - Efficient Motors (Commercial, Industrial)
  - Industrial Heat Pumps

Lighting: A Look Back at the 2021 Plan

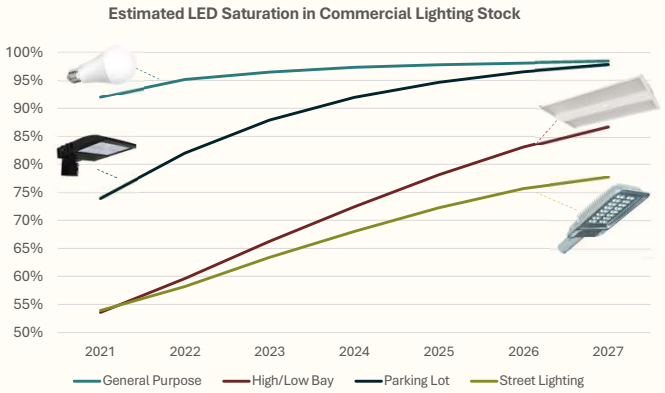




7

Lighting: Changes Since the 2021 Plan

- **Significant increases in LED efficacy and market adoption**
- **Significant decreases in LED costs**
- **Recent federal lighting standards**
  - General service lamps
- **Recent state lighting standards**
  - Mercury ban in OR (effective currently)
  - Mercury ban in WA (effective 2029)



Source: BPA Lighting Market Model

8

Lighting: Remaining Potential

- **Residential Lighting**
  - Not planning to include conservation potential for res lighting in 9th Plan*
  - Nearly all res lighting already converted to LED or subject to standards
- **Commercial Lighting**
  - Estimating a significant reduction in potential (~80 to 85%) relative to the 2021 Plan, although still a sizable resource (**~75 to 100 aMW**)
  - A few remaining areas for potential, including High Intensity Discharge (HID) lighting applications, linear fluorescents in ID and MT, lighting *controls*
  - The majority of draft 9th Plan commercial lighting potential is made up of new controls measures

* Will continue to consider opportunities, particularly those proposed by Conservation Resources Advisory Committee

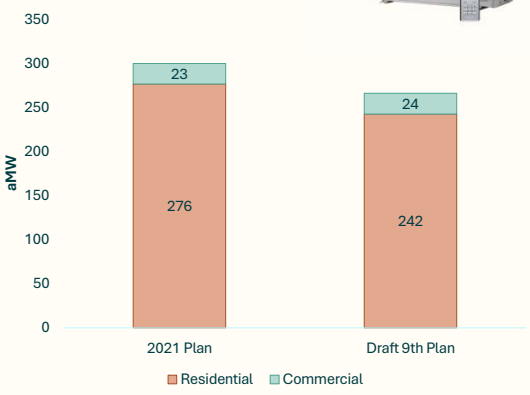
"Sensor-Ready" Light Fixture

Occupancy + Daylight Sensor

9

Ductless Heat Pumps

- Council staff released draft 9th Plan efficiency measures for ductless heat pumps (DHPs) in April
- Staff estimates significant remaining potential for DHPs in both residential and commercial buildings (~265 aMW in total)
- DHP potential driven by large remaining share of electric baseboard and other electric room heating still in the region
- Note that much of this potential is looking relatively expensive (> $100/MWh)



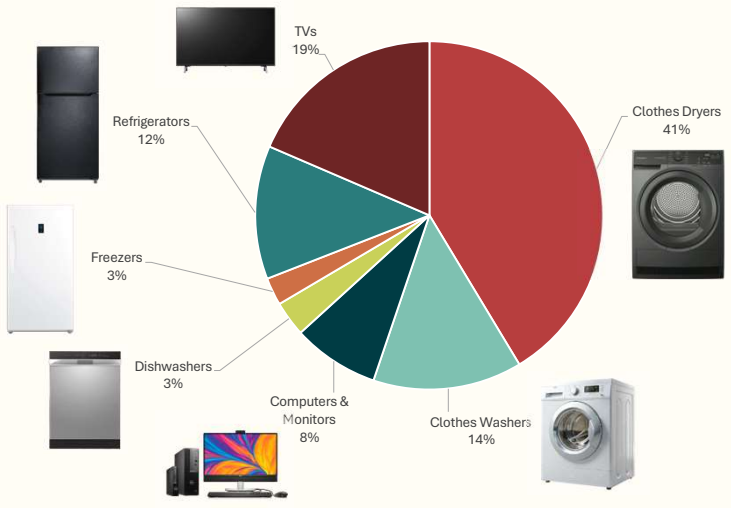
10

ENERGY STAR Appliances

- Although appliances have gotten significantly more efficient over the decades, ENERGY STAR-rated appliances continue to provide significant savings potential:
  - Computers (desktops and laptops)
  - Computer monitors
  - TVs
  - Refrigerators and freezers
  - Clothes washers & dryers
  - Dishwashers

11

ENERGY STAR Savings Potential

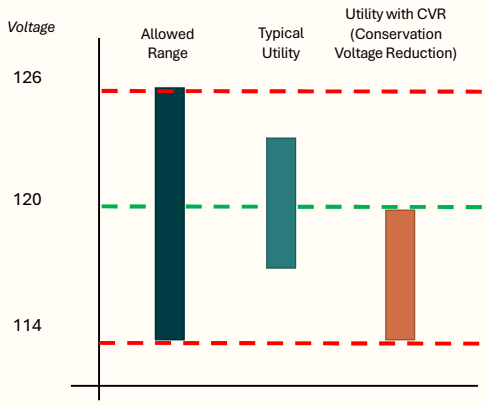


Total Draft 9P ENERGY STAR Potential:
645 aMW

12

Distribution Efficiency: CVR

- Distribution system equipment settings and/or upgrades can save energy by reducing line voltage and balancing line loading while still maintaining adequate power quality
  - Energy savings come from reduced losses and lower consumption from some (but not all) devices
  - Primary measure is CVR – Conservation Voltage Regulation/Reduction
- Potential is over 200 aMW with costs ranging from $18/MWh to $58/MWh
- Still under consideration:
  - Transformer Right Sizing
  - Phase Balancing
  - Grid-Enhancing Technologies (GETs)
  - Reconductoring
  - More efficient distribution transformers



13

Electric Motors

- In the Pacific Northwest, motors consume 72 % of industrial electricity
  - Motors are present in many different types of equipment in almost every commercial building or industrial facility
- Two main measure types:
  - Increased equipment efficiency
  - Installation of variable speed control (VFD)
- Preliminary Ninth Plan Potential:
  - 213 aMW in the commercial sector
  - 283 aMW in the industrial sector

14

Industrial Heat Pumps

- Heat pumps are increasingly being used in the industrial sector for process heating:
  - 3,000 – 4,000 units in Europe
  - Hundreds of units in the US
  - Some in the NW (e.g., Clark PUD)
- IHPs are currently applicable up to about 160C
- IHP efficiencies (COPs) range from 2.6 to 5.8
- Key applications can be found in Pulp and Paper, Wood Products, Chemical, High Tech, and Food Processing
- Potential is estimated to be around 45 aMW with levelized costs in the $60-$85/MWh range

New measure in the 9th Plan

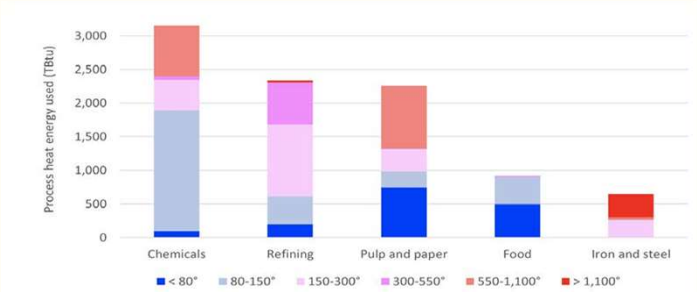
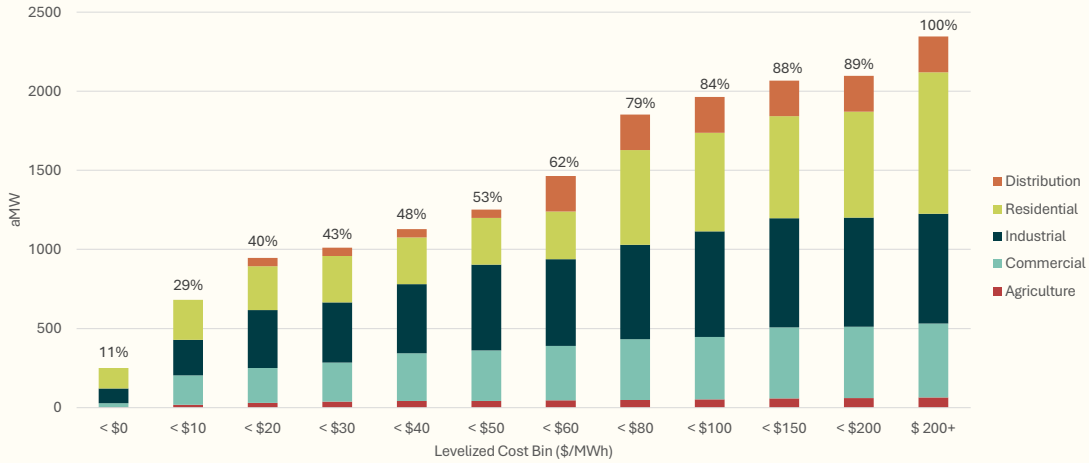


Figure 1. Process heat demand at different temperature (°C) levels in select U.S. Industrial l groups. Data source: McMillan 2019.

15

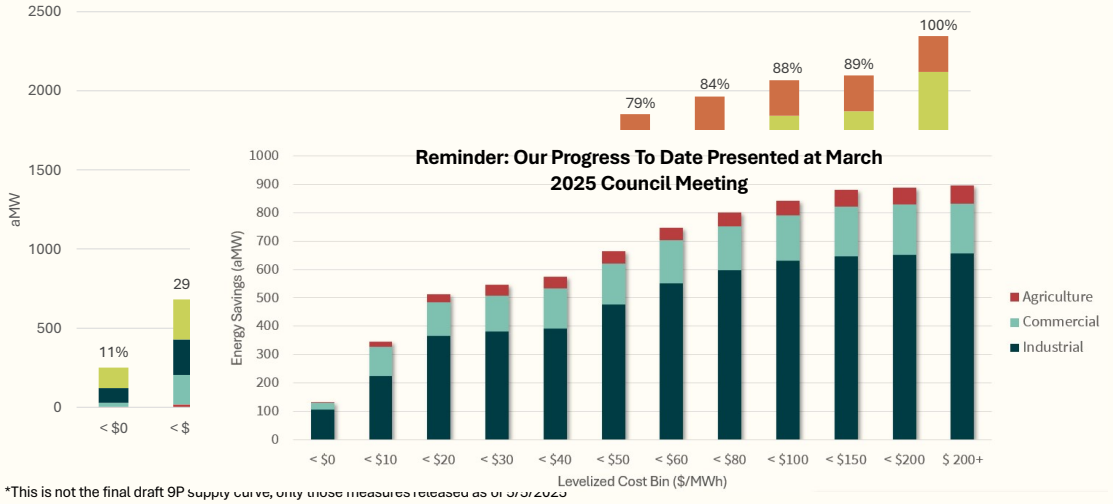
Draft 9P EE Supply Curve *to Date**



*This is not the final draft 9P supply curve, only those measures released as of 5/5/2025

16

Draft 9P EE Supply Curve *to Date**



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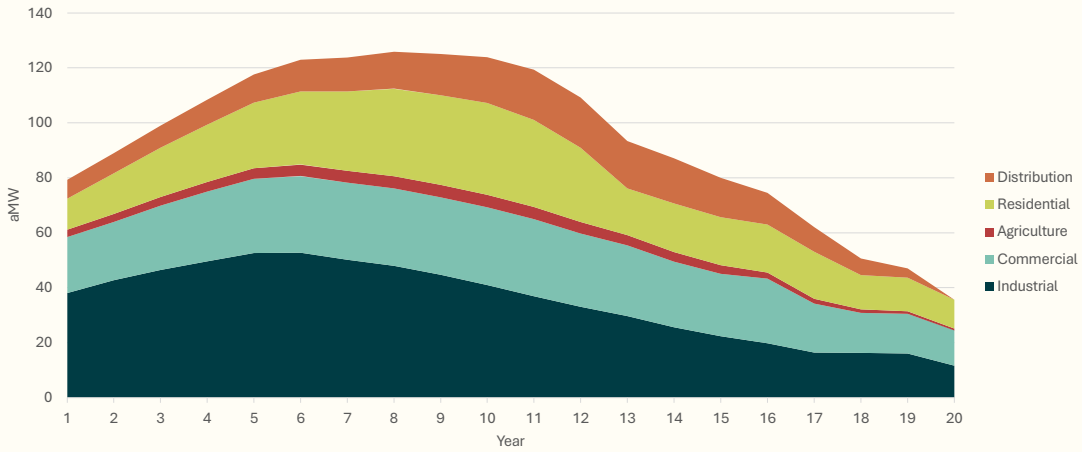
17

Draft Annual Incremental EE *to Date**

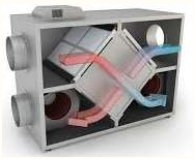


*This is not the final draft 9P incremental EE, only those measures released as of 5/5/2025

18

Work in Progress

- Commercial Grocery Refrigeration Measures
  - Adding doors to open display cases
  - Air curtains
  - Compressor upgrades
- Commercial HVAC Measures
  - Heat recovery ventilation
  - Variable refrigerant flow
  - Windows – triple pane, attachments
- Residential and Commercial Water Heating
- ENERGY STAR Computer Servers and Power Supplies
- Emerging Technologies/Measures
  - Commercial Deep Retrofits
  - Luminaire Level HVAC Controls
  - Distribution system measures



19

Questions?

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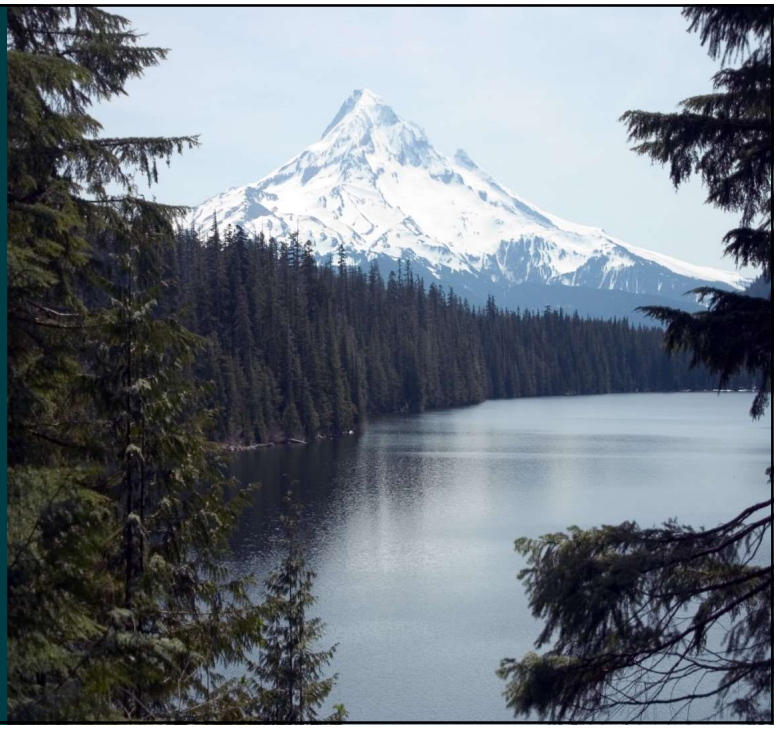

20