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

June 3, 2025

MEMORANDUM

TO: **Council Members**

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

SUBJECT: **Proposed Conservation Resources for the Ninth Plan (Part 3) – Draft Supply Curves**

BACKGROUND:

Presenters: 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 third and final in a series of three that describes the many resources being included in the conservation supply curve for the Ninth Power Plan. Staff have now completed 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. The total EE resource potential is nearly 5,000 aMW[1] (all cost bins), with over 3,500 aMW available at a price less than $100/MWh and 2,000 aMW at a price of less than $50/MWh. This supply curve will represent all of EE potential in the next phase of the plan analysis in which it will be used as inputs to our OptGen model to ultimately be compared alongside other demand side and generating resources. Staff will also provide some details on specific measures developed since the last meeting.

[1] The final values will change slightly over the next few weeks as we adjust based on reviewer comments.

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 held a Conservation Resources Advisory Committee meeting on May 29, 2025, and presented the draft conservation supply curve:

- May2025 CRAC Draft Supply Curves for the 9th Plan

Staff also 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, and Part Two of the Conservation Resources in May 2025:

- Supply Curve Primer for EE in the Ninth Plan (July 2024)
- Proposed Conservation Resources for the Ninth Plan (Part 1) (March 2025)
- Proposed Conservation Resources for the Ninth Plan (Part 2) (May 2025)

Draft Conservation Supply Curves for the 9th Power Plan

June 2025, Council Meeting

Christian Douglass, Kevin Smit

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

Overview

Energy Efficiency (EE) Measures Added Since the Last Meeting

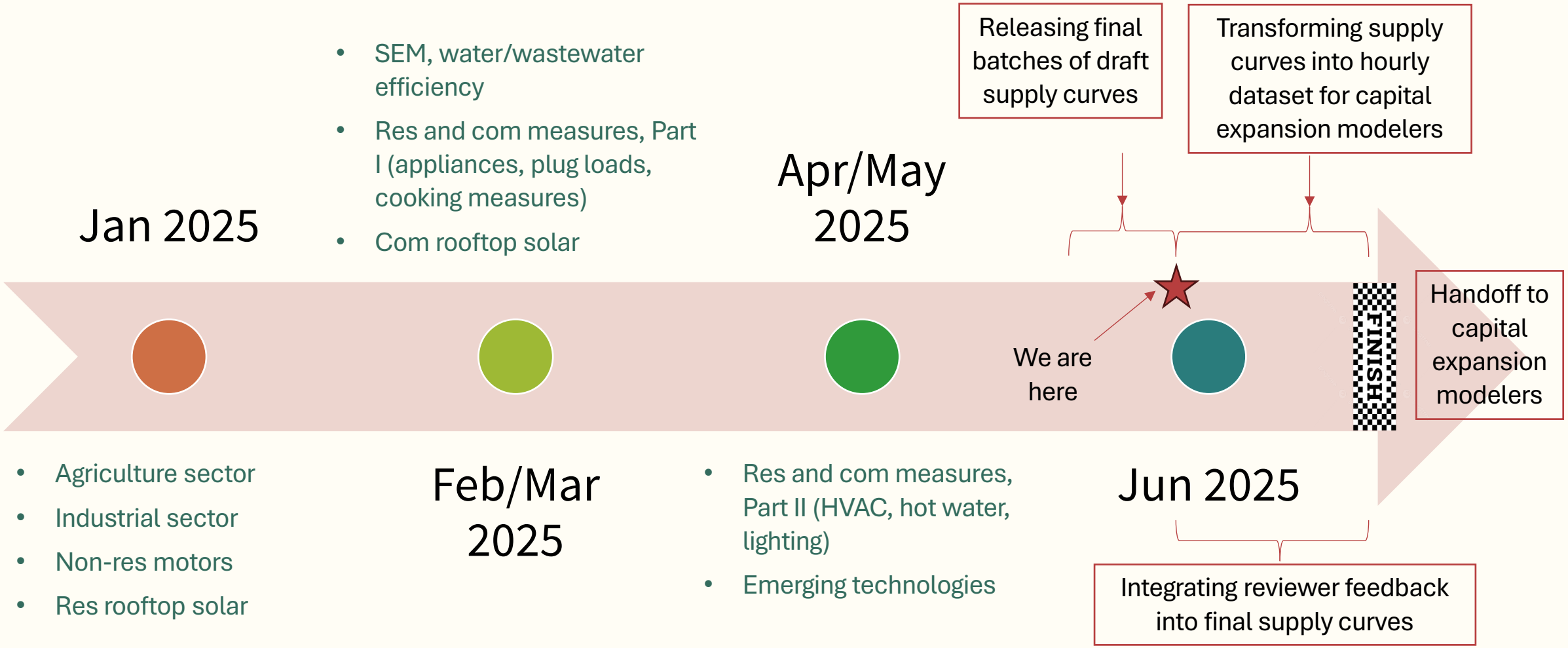
Methodology Review/ Background

Draft EE Supply Curves

- Residential
- Commercial
- Industrial
- Agriculture
- Distribution System
- Overall Supply Curve

Remaining Items and Next Steps

Conservation Supply Curve Review Timeline



Energy Efficiency Measures Added Since Last Meeting

Final Batch of 9th Plan Measures Released for Review

- Res weatherization
- Res and com hot water
- Ag lighting
- Com and ind lighting (update)
- Vehicle EE measures
  - Engine block heater controls
  - EV chargers
- Res HVAC – final measures
  - Duct sealing
  - HRV
  - Central HP retro-commissioning
  - Central AC
  - Ground source heat pumps
- Other misc. measures
  - Res drain water heat recovery
  - Com clothes washers
  - Com refrigerators/freezers

Water Heating

Total Draft 9th Plan 20-Yr Potential:
54 aMW Commercial, 383 aMW Residential

Consumer Tankless & Booster

Consumer Unitary

Consumer Split

Commercial Unitary or Packaged

Commercial Split or Built-Up

"Consumer" Water Heaters

- Tanks and tankless: 12 kW or less
- Heat pumps: 24 amps @ 250v or less

We cover these water heaters in the 9th Plan.

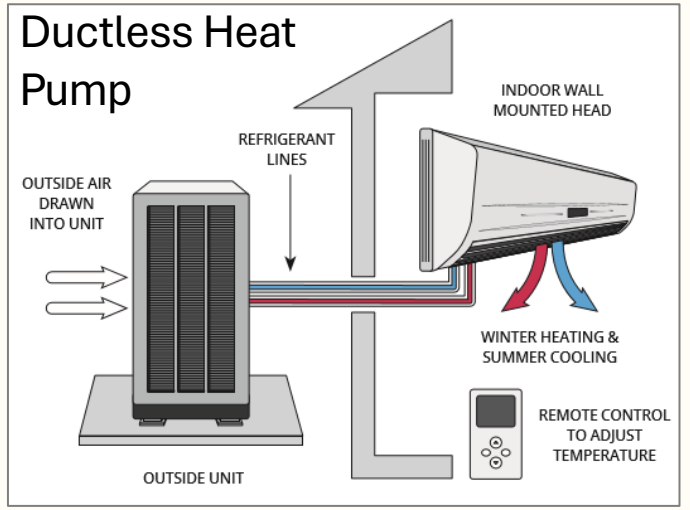
"Commercial" Water Heaters

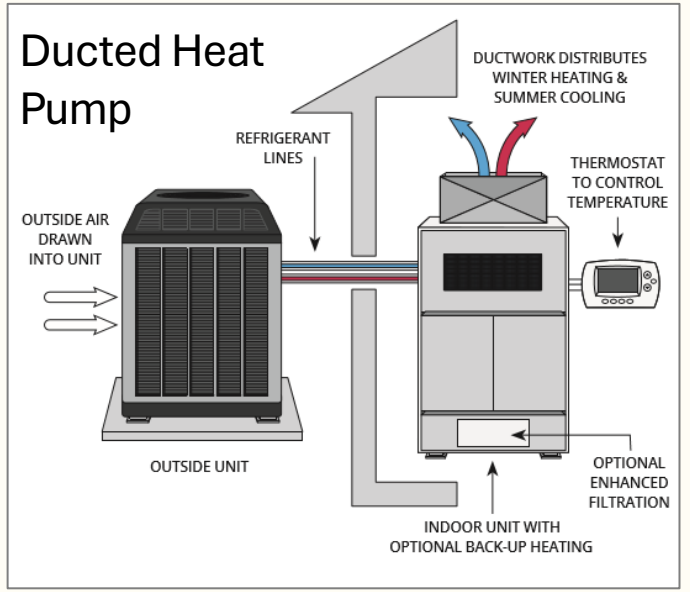
- Effectively anything larger than a consumer water heater

Residential HVAC

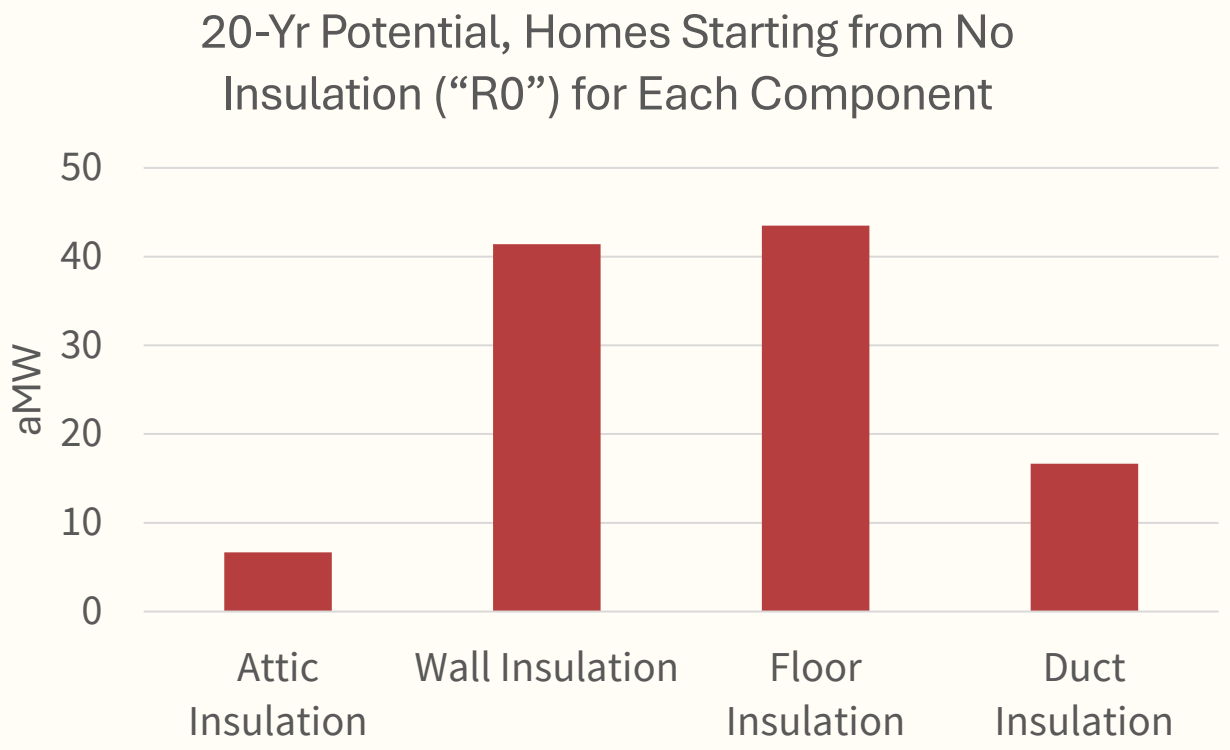
Equipment Category	Measure	Measure Type		Building Type		
		Conversion	Upgrade	Single Family	Manufactured Homes	Multi-Family
Ductless Heat Pumps	Single-Head "Displacement" Measure	X		X	X	X
	Whole Home Measure	X		X	X	X
Ducted Heat Pumps	Federal Standard ASHP	X		X	X	
	Cold Climate ASHP	X	X	X	X	
	Ground Source HP	X	X	X		
	ASHP Retrocommissioning		X	X	X	
Air Conditioning	Central AC Upgrade		X	X	X	

Draft 9P Total: ~700 aMW
2021P Total: ~600 aMW

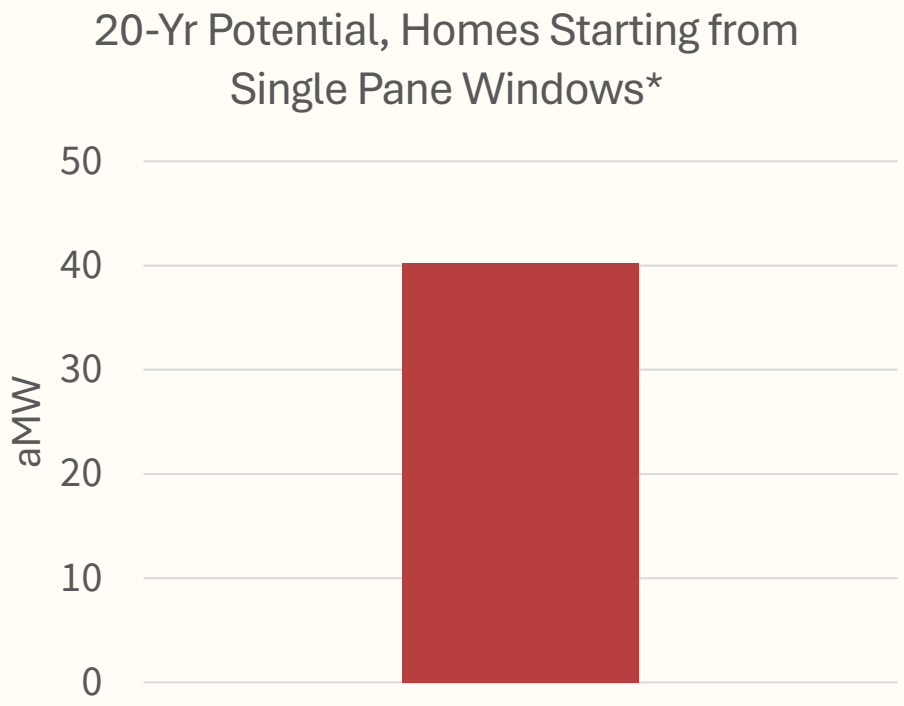




Residential Weatherization



Total “R0” Potential: ~108 aMW

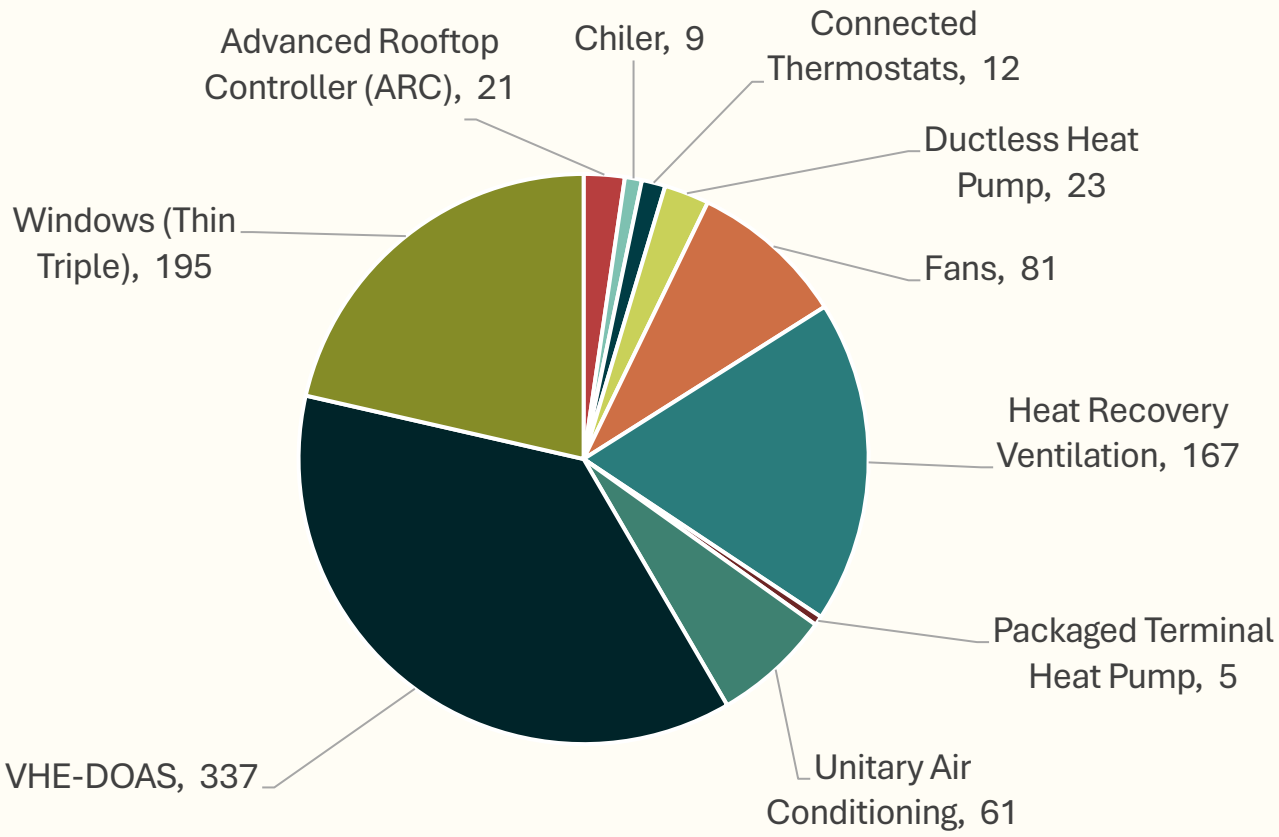


* Total savings going from a single pane window to a high-performance double-pane window.

Commercial HVAC

- Heating, Ventilation, and Air Conditioning (HVAC) in commercial budlings holds significant potential
- 910 average megawatts (20-yr)
- VHE-DOAS*, triple pane windows, and heat recovery ventilation (HRV) are the largest measure categories

*VHE: Very high efficiency;
DOAS: dedicated outside air system



Commercial Refrigeration

- Plan History
  - 6th Plan – 85 aMW, 14 Measures
  - 7th Plan – 63 aMW, 8 Measures
  - 2021 Plan – 205 aMW, 38 measures
- 9th Plan Potential:
  - 31 measures
  - 94 aMW
  - Levelized cost range – mostly in the $20-$80/MWh range, a few much higher
- Top Measures:
  - Floating head pressure control (17.6 aMW)
  - Display case doors (16 aMW)
  - Scroll compressors (14.5 aMW)

Display Cases

Semi-Vertical Case, Open, Med, Remote Condenser

Horizontal Case, Open, Med, Self Contained

Service Over-Counter, Med, Remote Condenser

Walk-ins

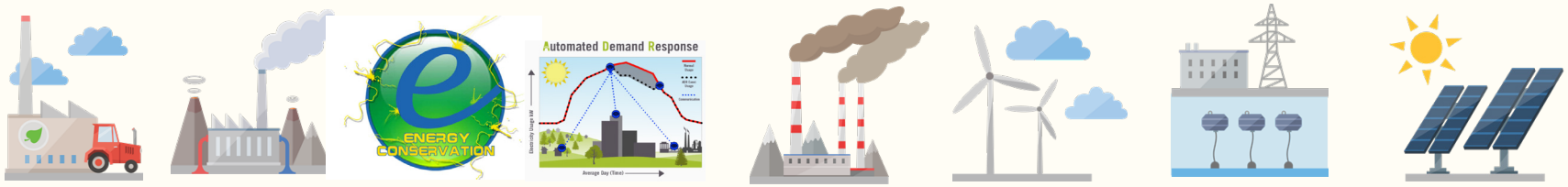
Walk-in Cooler with Display

Walk-in Freezer

Draft Supply Curves

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

Context:
Energy Efficiency as a Resource

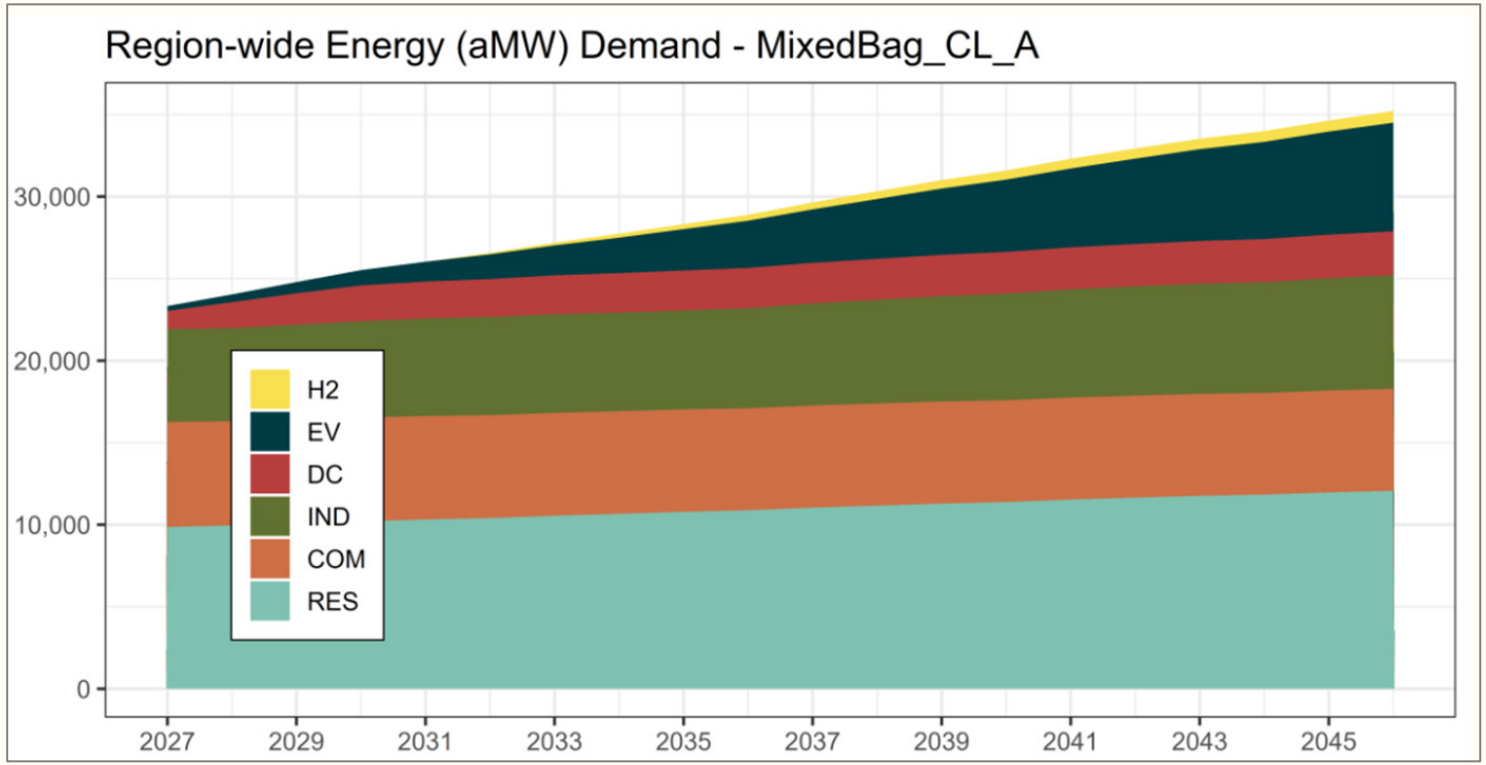


Need to Assess:

Amount of Energy & Capacity, Cost, Pace

Context: Load Forecast and EE

- Our Energy Efficiency potential estimates are always tied to the demand forecast
- Typically, the relative shares of potential by sector are proportional to the demand by sector
- The residential sector has the largest demand in 2027, followed by commercial and industrial:
  - Residential = 10,000 aMW
  - Commercial = 6,500 aMW
  - Industrial (including Ag) = 5,700 aMW



Summary Results

Remember, this is Technical-Achievable Potential. Cost-effective potential will be derived from the analysis that happens in the next phase of the power plan development. These data are inputs to our optimization models.

Sector	20-Year Achievable Potential (aMW) (all cost bins)		
	7th Plan	2021 Plan	9th Plan (PRELIM)*
Residential	2,328	2,441	2,342
Commercial	1,871	1,711	1,479
Industrial	580	790	898
Utility	218	186	225
Agriculture	126	73	66
Grand Total	**5,123**	**5,200**	**5,010***

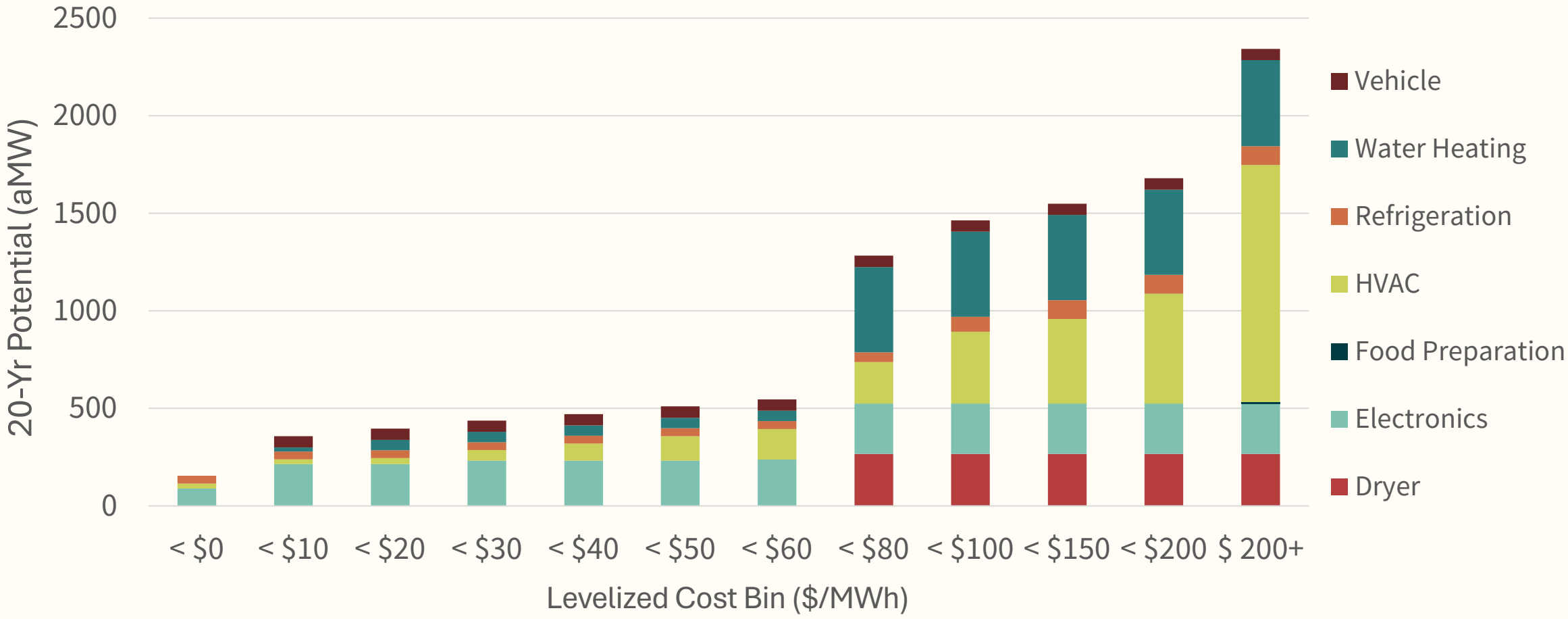
*All values in this presentation are Preliminary. Minor adjustments from advisory committee reviews will be incorporated by the end of June 2025.

Residential Sector

The NW Residential Sector

- EE measures for homes:
  - Single family
  - Multi-family
  - Manufactured homes
- Covers about 6.5 million households in the region
- Diverse set of measures
- About 30 measure workbooks

Residential EE Supply Curve

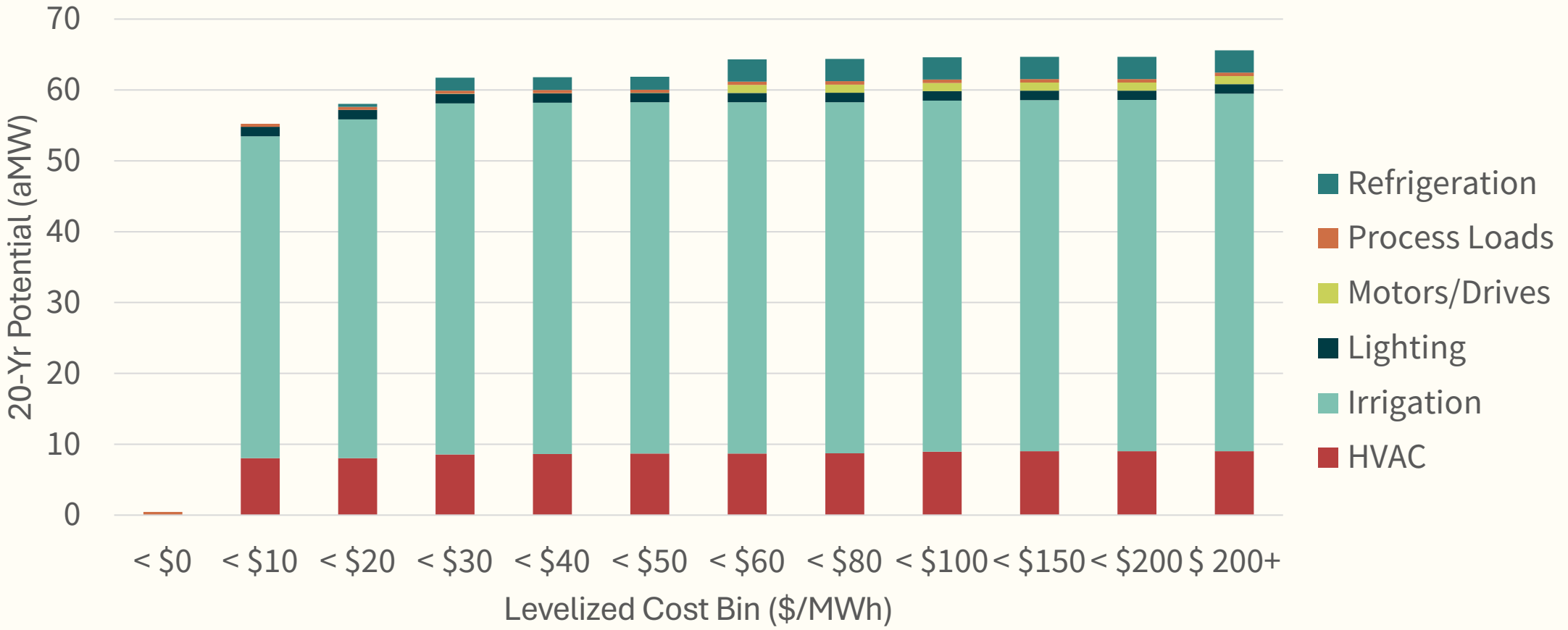


Key Findings – Residential

End Use	Achievable Potential 2046 (aMW) All Cost Bins	Notes
Lighting	0	LEDs are current practice or covered under standard.
HVAC (Equipment & Weatherization)	1,216	Additional measures and updated analysis. Many are high cost.
Water Heating	440	Mainly HPWHs that may or may not be captured by 2029 federal standard.
Dryers	267	Lots more work on heat pump dryers (though slow ramp rate)
Refrigerators and Freezers	96	Despite increasing federal standards, there continues to be significant above standard savings
Misc (Electronics, Food Prep)	323	Mostly TVs (114 aMW), clothes washers (89 aMW), and computers (37 aMW)
Total	**2,342**	

Agriculture Sector

Agricultural EE Supply Curve



Key Findings – Agriculture Sector

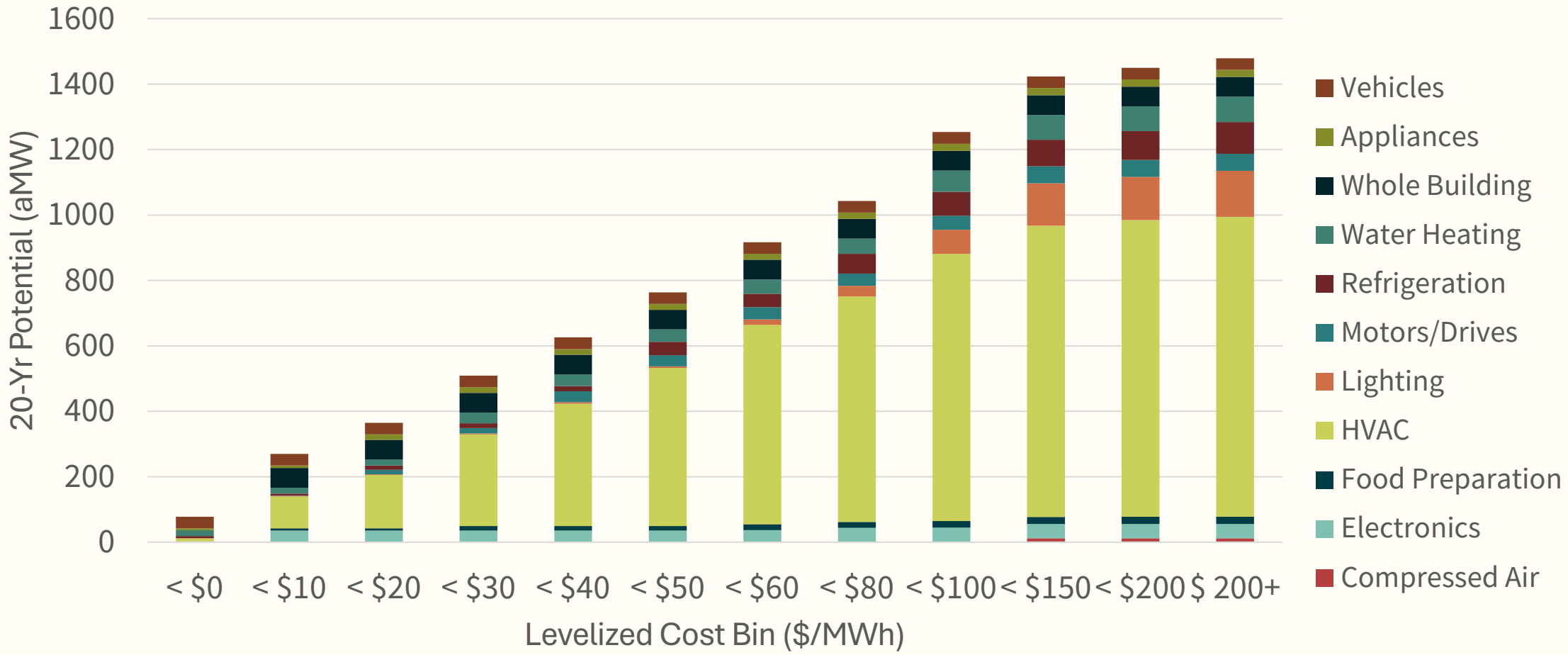
End Use	Achievable Potential 2046 (aMW) All Cost Bins	Drivers of changes
Irrigation Hardware/ Efficiency	18	Savings analysis, additional measures including Variable Rate Irrigation
Irrigation Water Management	18	Advanced Irrigation Management & Surveillance, variable rate irrigation
Lighting	1	Higher LED saturation
Dairy	5	More measures, including fans
Indoor Ag Dehumidification	8	New measure
Efficient Motors, pumps	14	Pump upgrades
Other	1	Efficient stock tanks, generator engine block heater controls
Total	**66**	

Commercial Sector

The NW Commercial Building Sector

- EE measures for buildings & equipment for commercial buildings (non-res, non-ind)
- Covers about 4.1 billion sf and 348,000 establishments in PNW (forecasted by 2046)
- 18 different building types, including office buildings, retail stores, grocery stores, restaurants, hospitals, schools, etc.
- 2019 CBSA provides detailed stock data regarding HVAC systems, heating fuels, window areas, etc.
- Diverse set of EE measures
- About 45 measure workbooks

Commercial EE Supply Curve



Commercial EE Potential by Category

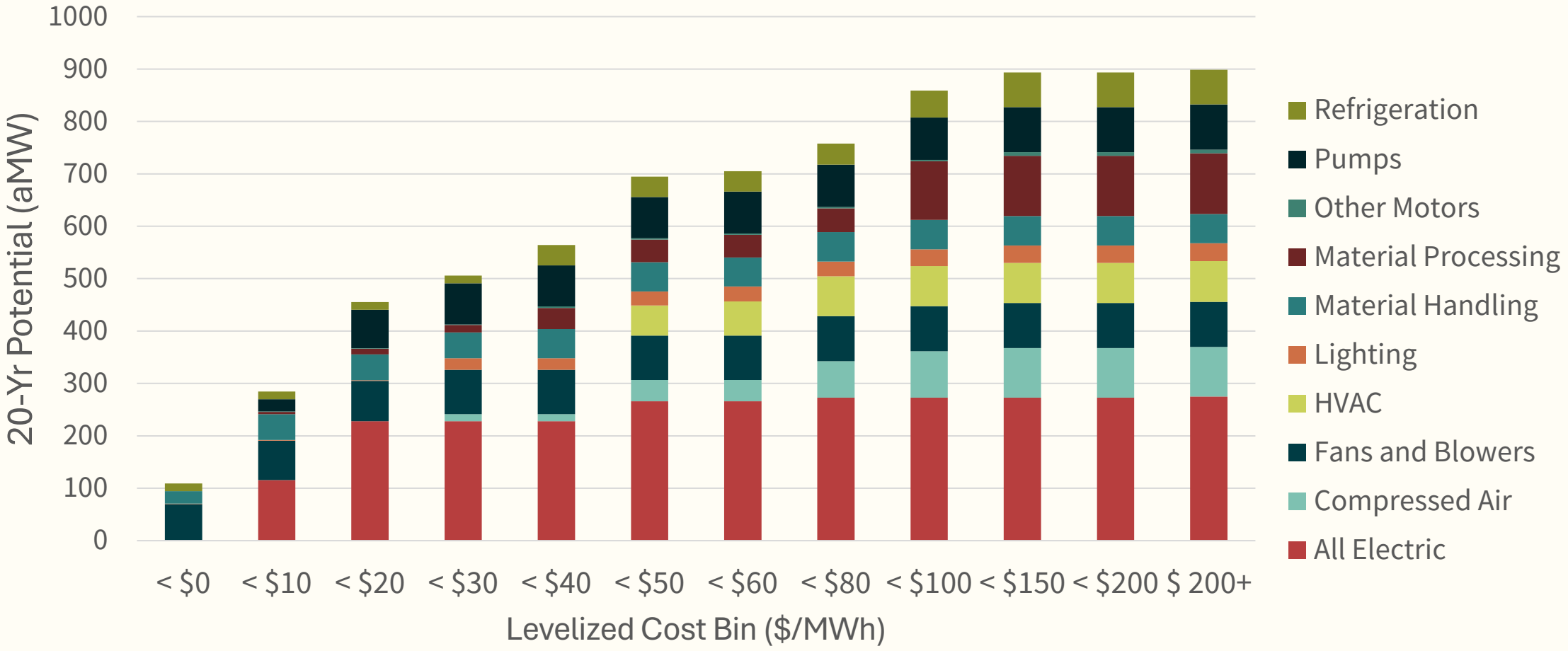
End Use	Achievable Potential 2046 (aMW) - All Cost Bins	Notes
Lighting	140	LED lighting & controls for indoor, exterior, street & roadway applications. Most remaining potential is through controls.
HVAC	916	Efficient Fans and Variable Speed Drives, VHE-DOAS, Ductless Heat Pumps, and Windows
Refrigeration	97	Grocery Refrigeration, Water Coolers, Icemakers, Vending
Motors/Drives	52	Pumps (VS Drives, Optimization) Circulation Pumps
Electronics	44	Embedded data centers, primarily Servers, computers, monitors
Other	229	Engine Block Heater Controls, Heat Pump Water Heaters, Commercial Clothes Washers, SEM
Total	1,479	

Industrial Sector

The NW Industrial Sector

- 18 segments (Industries) including from pulp and paper, food processing, refrigerated warehouses, computer chip manufacturing, etc.
- Over 70% of the electricity consumed in the industrial sector is by motors, including pumps, fans, conveyors, grinders, and compressors
- The industry consumes over 46,000 GWh (5,300 aMW) growing to 53,000 GWh (6,100 aMW) by 2046

Industrial EE Supply Curve



Industrial Potential By Category

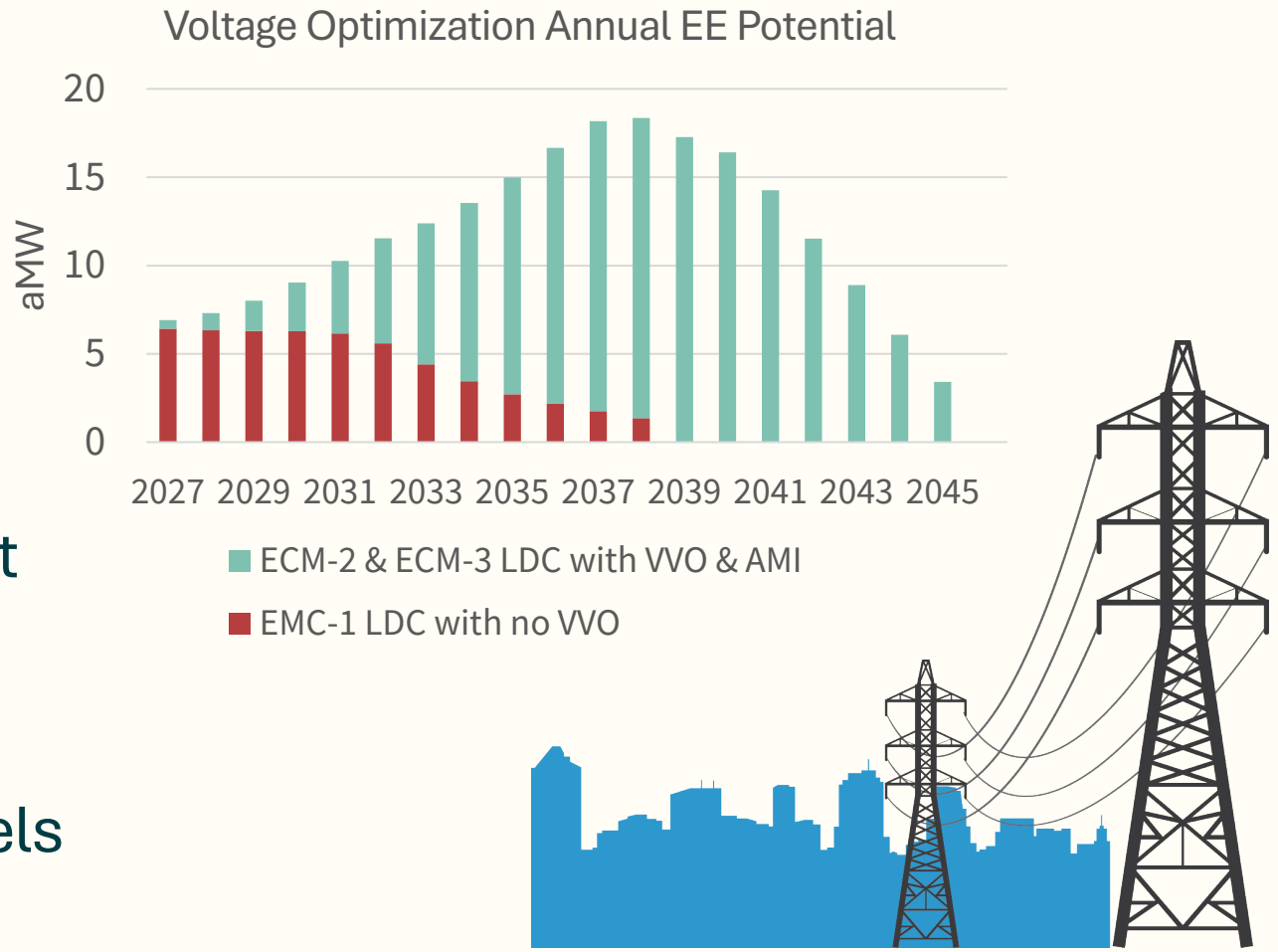
Industrial Measure Categories	Achievable Potential 2046 (aMW) All Cost Bins	Notes
Pumps	86	Variable speed, trim, optimization
Strategic Energy Management	228	Two levels: SEM1 and SEM2
Fans and Blowers	86	New research – NEEA and DOE standards
Lighting	34	LED High Bay Lighting, Controls
Compressed Air	95	DOE standards data (10-200 HP), Custom for larger (>200HP)
Refrigeration	66	Upgrade refrigeration systems in fruit storage and refrigerated warehouses
Water/Wastewater	47	Significant revision based on project data
HVAC	78	Heat, Cooling and Ventilation
Industrial Heat Pump	67	Heat pumps for process heating
Other (Includes Advanced Motors)	111	Advanced Motors, Process Improvements, Forklifts, EB Heater Controls
Total	**898**	

Utility

Distribution Efficiency: Conservation Voltage Regulation

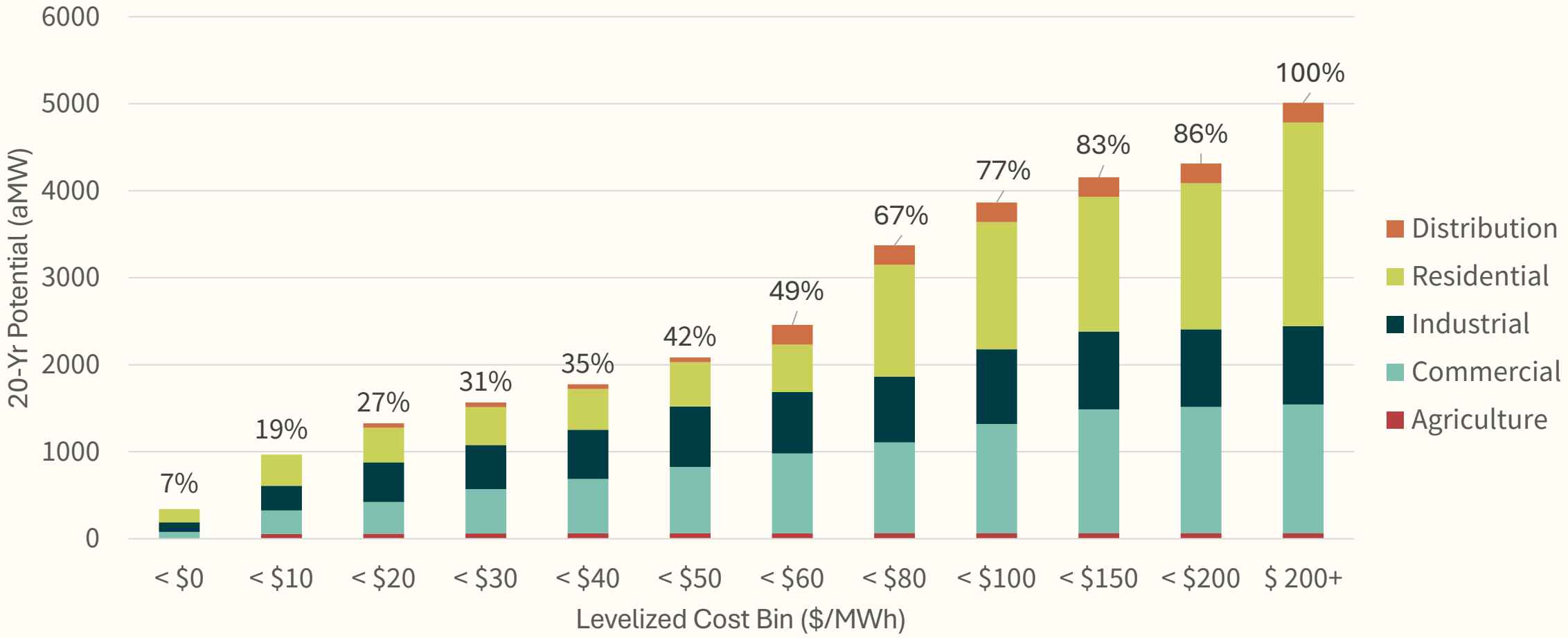
Savings Potential:
~225 aMW by 2046 at cost of $17 to $59/MWh

- CVR remains a relatively low-cost EE measure
- CVR and DVR will be treated together in our optimization models

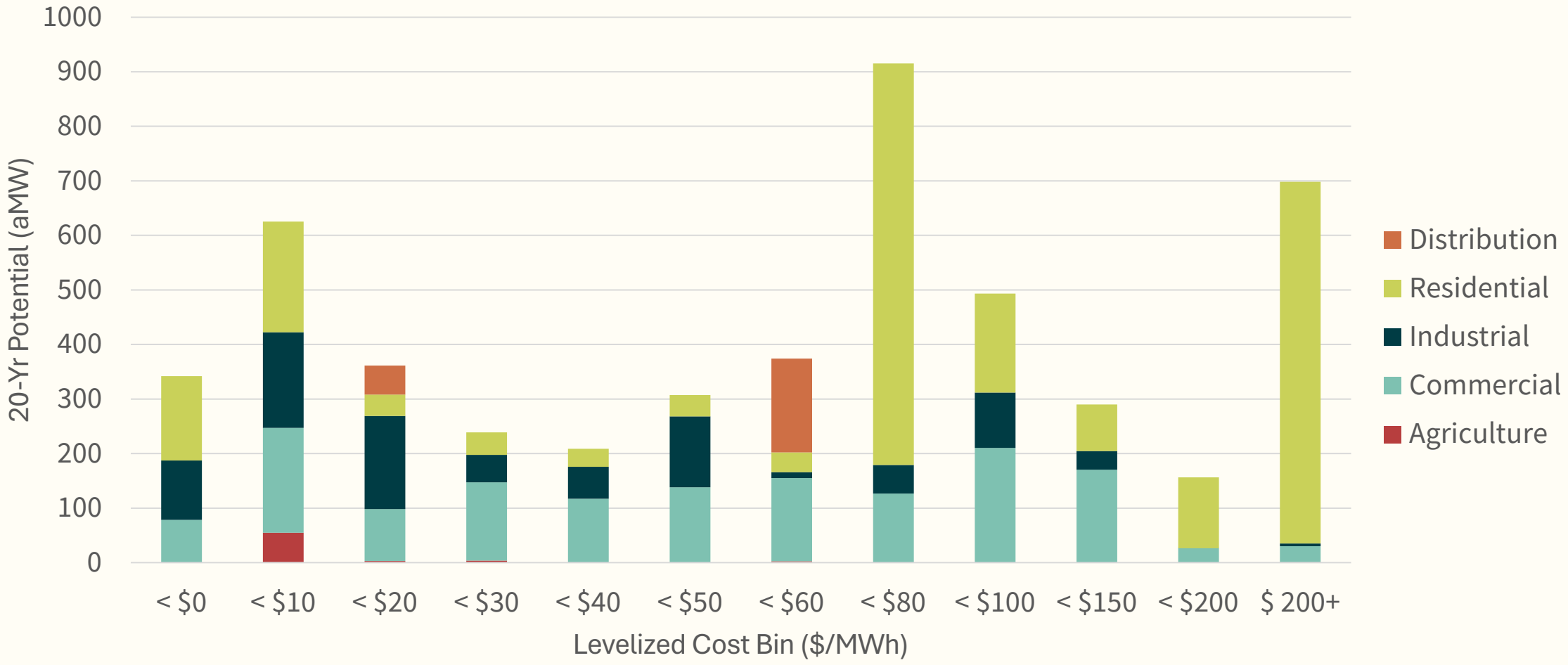


Total Supply Curve

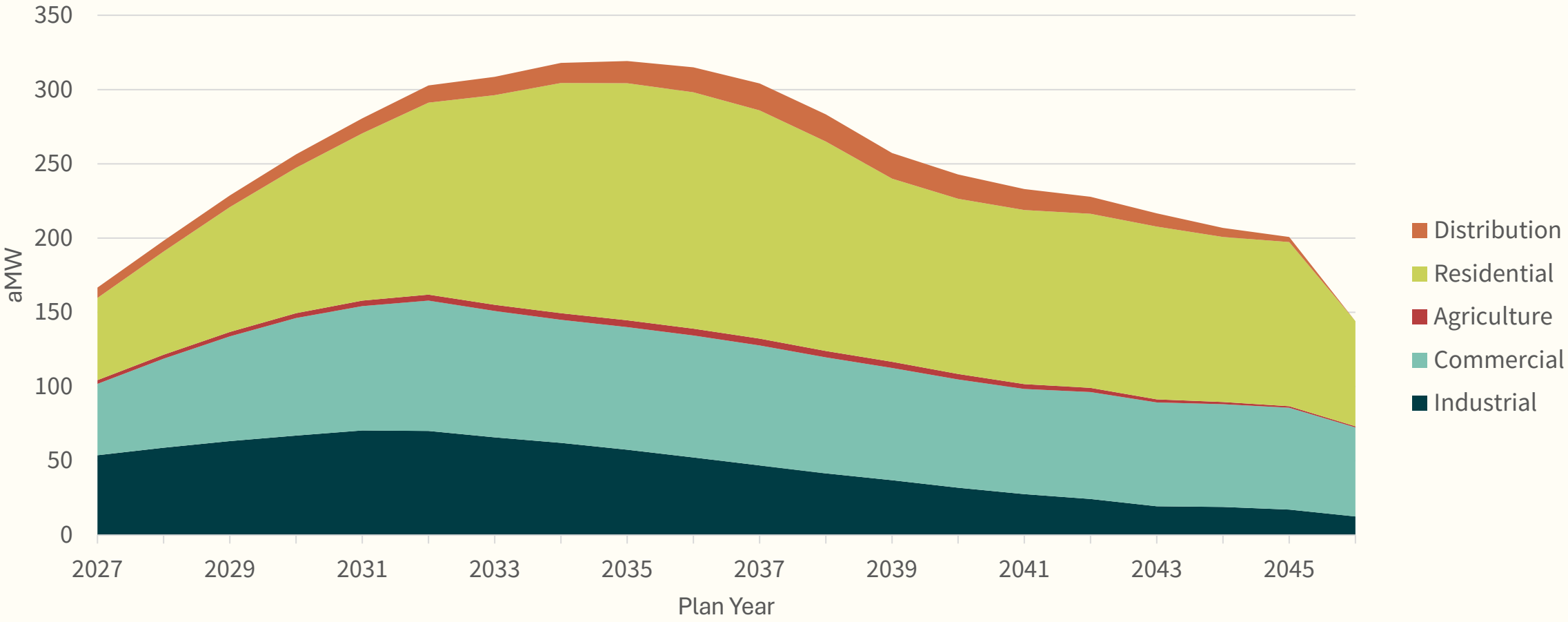
Aggregate Supply Curve: Cumulative



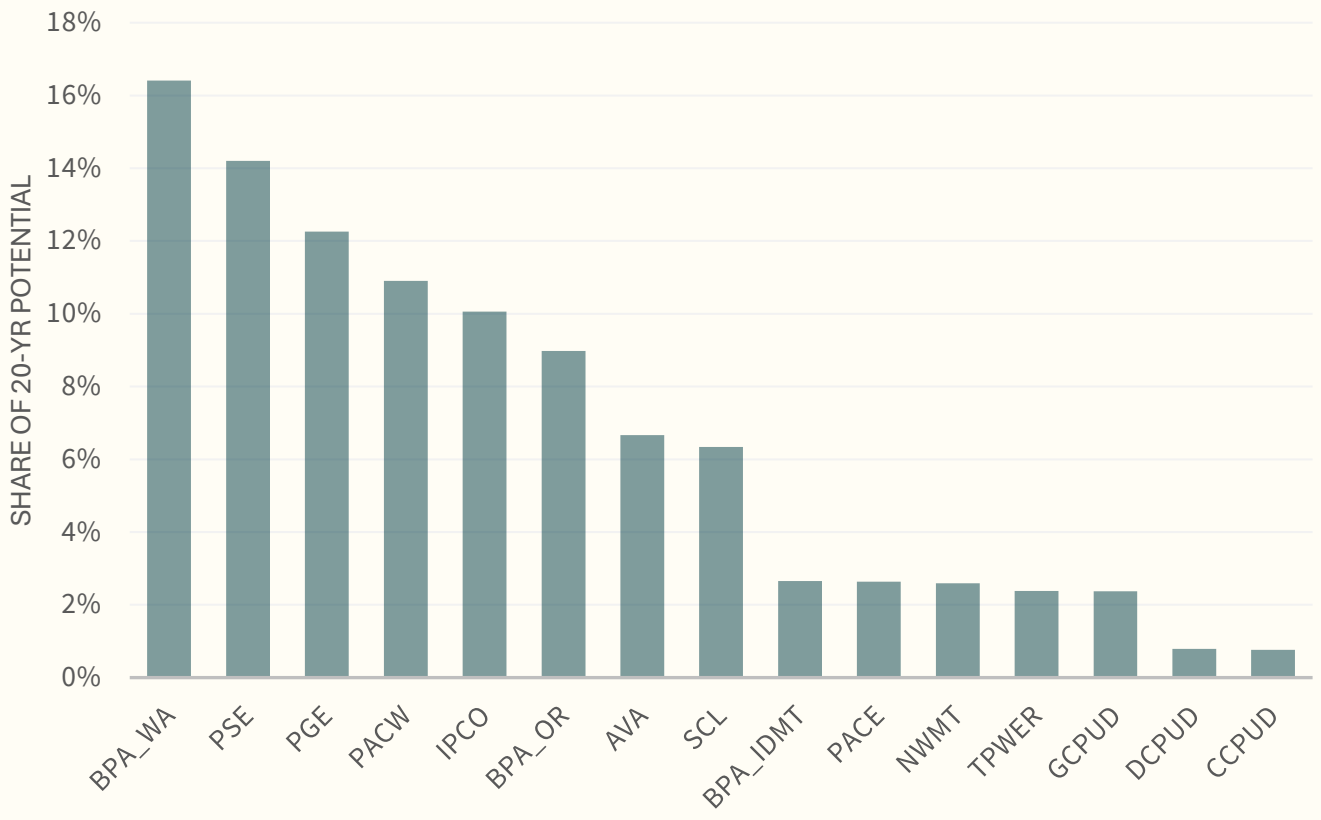
Aggregate Supply Curve: Incremental

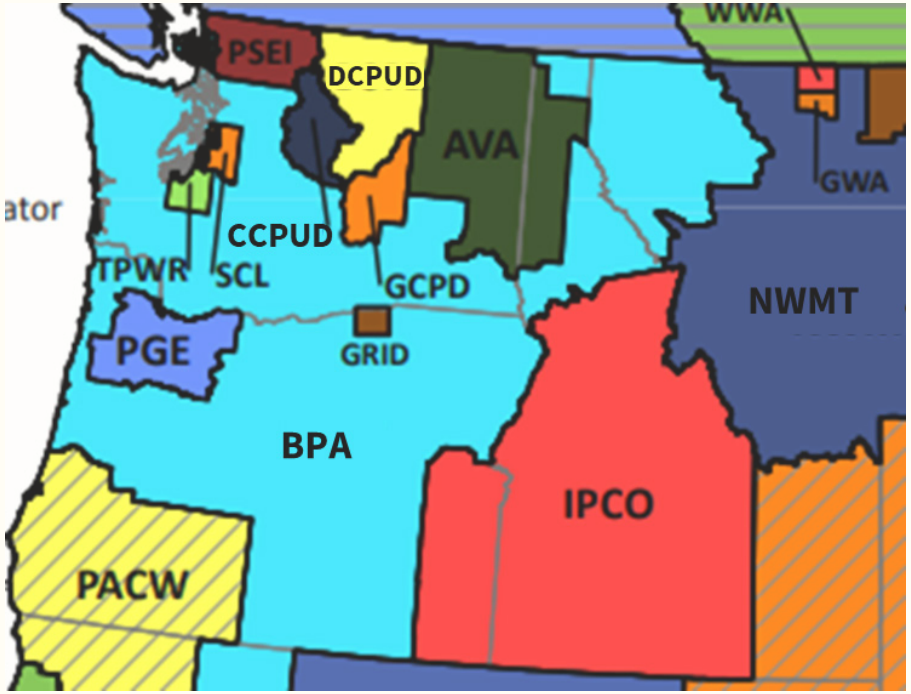


Annual Conservation Potential

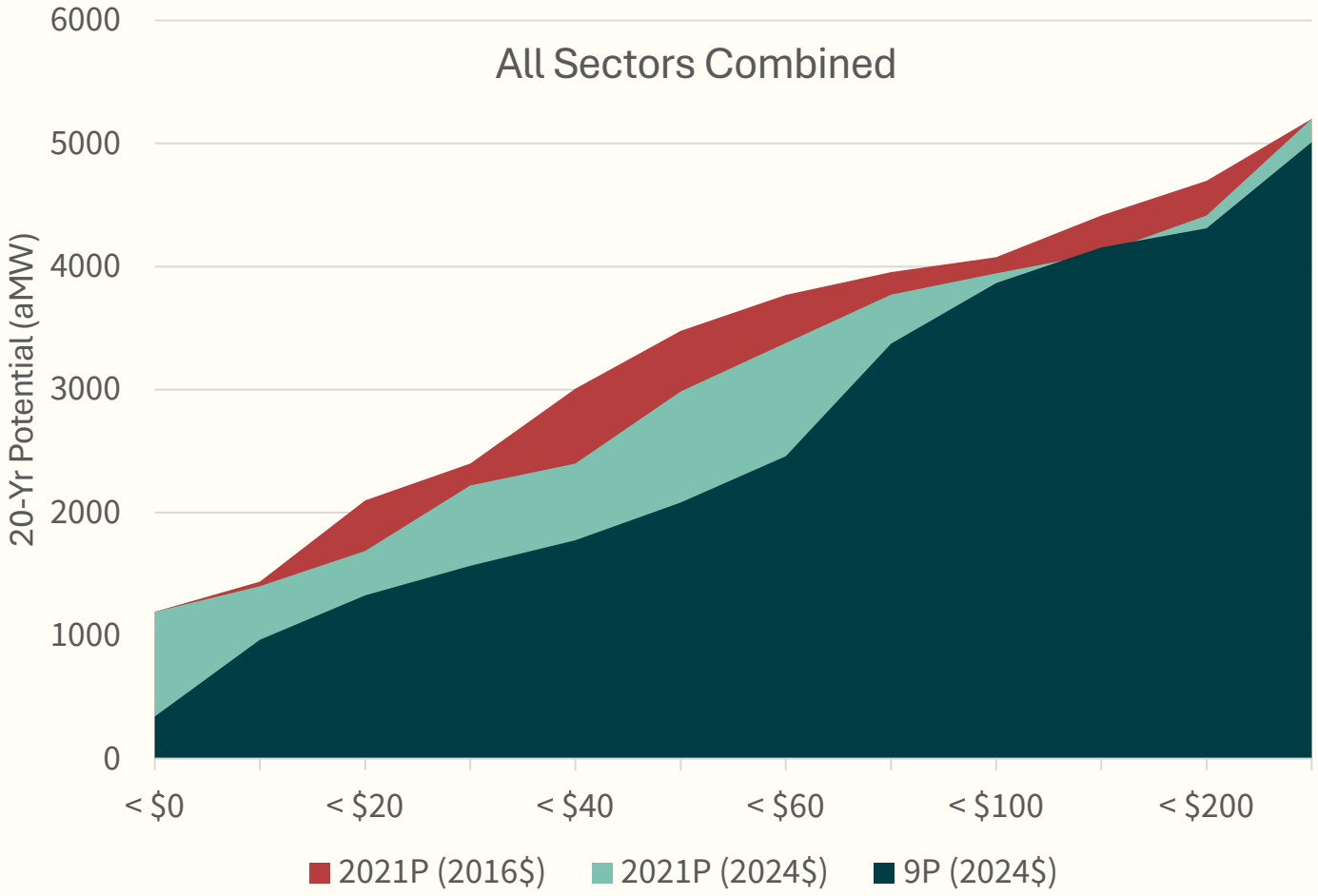


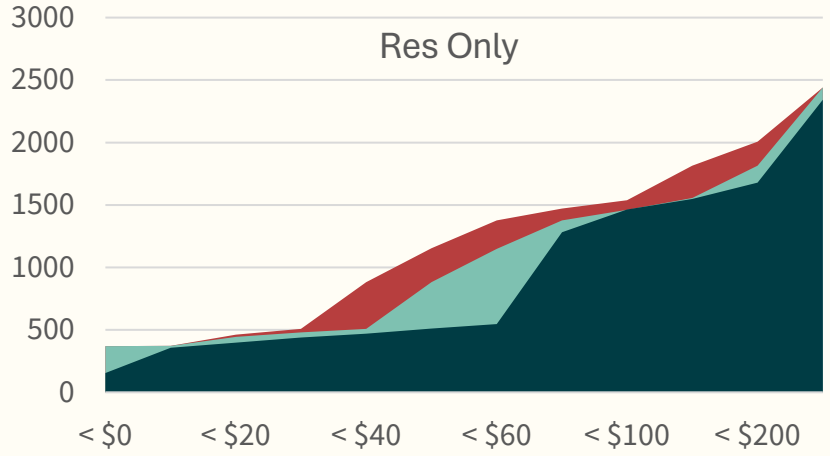
Share of 20-Yr Draft Potential, by Modeling Zone

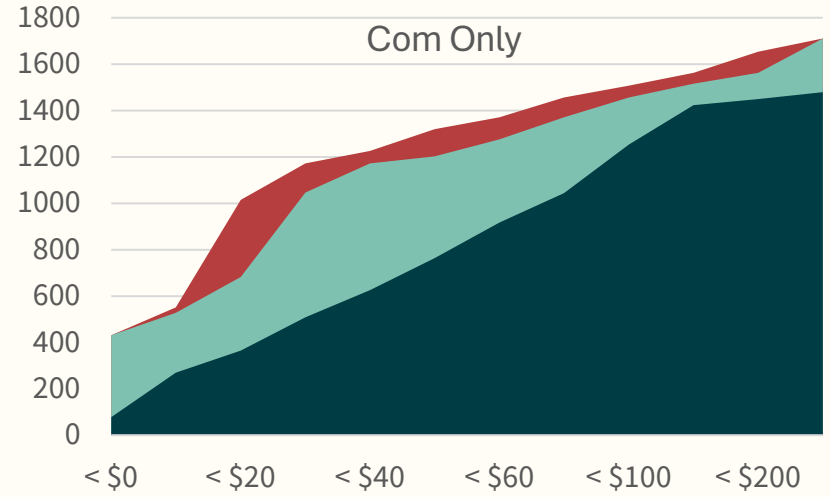




Draft 9P vs. 2021P Supply Curves







Yes, there is a little bit left to do…

- Expect to receive comments through mid-June
- Finalize workbooks based on reviewer comments & data updates (end of June)
- Finalize our emerging technology assumptions
- Re-run all measure workbooks with our final assumptions
- Bundle the supply curves into cost bins for OptGen (end of June)

As a result, the final supply curve values will change a little bit, but we don't expect major swings. We'll report back a summary of any changes to the Council.

Next Steps for Conservation (Summer-Fall)

- Wait and see what our modeling work is showing, but in the meantime…
- Adjust supply curves for the various scenarios, as needed
- Begin developing other elements of the “Conservation Program”
  - What recommendations for research are needed?
  - What gaps are there in the EE market?
- Begin thinking about the Model Conservation Standards (MCS)
- (next year) Target setting, cost-effectiveness methodology, avoided costs