SIERRA CLUB COMMENTS ON PUGET SOUND ENERGY FINAL 2023 GAS INTEGRATED RESOURCE PLAN

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SIERRA CLUB COMMENTS ON PUGET SOUND ENERGY FINAL 2023 GAS INTEGRATED RESOURCE PLAN

Puget Sound Energy's 2023 gas Integrated Resource Plan is the Company's first gas plan filed since Washington enacted the Climate Commitment Act ("CCA") in 2021. This landmark legislation requires gas utilities to plan and implement major decarbonization strategies in line with the state's emission reduction targets. Unfortunately, PSE's IRP fails to align with the CCA's decarbonization targets and requirements. The plan includes a preferred portfolio that relies almost exclusively on purchasing CCA allowances, rather than pursuing available decarbonization strategies like building electrification.

Two fundamental errors in PSE's analysis lead it to select this preferred portfolio: an underestimation of the costs and risks of overreliance on allowances in contravention of the CCA's allowance market design, and an overestimation of electrification costs that leads PSE not to select *any* electrification in its preferred portfolio. Correcting these errors shows that the electrification scenario evaluated in PSE's IRP likely has a lower net present cost than the preferred portfolio, in addition to avoiding the risks associated with over-reliance on allowances.

Because PSE did not select the lowest-cost, least-risk portfolio and failed to adequately consider the risks of its preferred portfolio, its IRP does not meet the Commission's lowest reasonable cost standard. Accordingly, Sierra Club recommends that the Commission decline to acknowledge the IRP, and direct PSE in its future filings to perform a more transparent analysis that corrects the errors in this IRP and better incorporates opportunities to pursue electrification as an effective CCA compliance strategy.

Section I of these comments describes PSE's analysis and preferred portfolio. Section II describes PSE's underestimate of the costs and risks of its over-reliance on allowances. Section III describes PSE's overestimate of the costs of electrification. Section IV summarizes the cumulative impact of these errors, and demonstrates that when they are corrected the electrification scenario has a lower net present value than the preferred portfolio. Section V summarizes Sierra Club's conclusions and recommendations.

I. PSE's Preferred Portfolio Relies Almost Exclusively on Allowances, Rather than Emission Reductions, and Includes No Building Electrification

PSE's preferred portfolio relies heavily on allowances to comply with the Climate Commitment Act ("CCA"), rather than investing in emissions reductions to align PSE's operations with Washington's decarbonization targets. Passed in 2021, the CCA caps Washington's greenhouse gas emissions and requires the largest emitting sources and industries, including gas utilities, to play their part in achieving the state's goal of reducing emissions 95%

by 2050.[1] While the CCA's market-based approach provides some flexibility in the state's decarbonization pathway through an emissions allowance market, Washington's emitters must take meaningful action on decarbonization to achieve the CCA's climate and environmental justice aims.[2] Unfortunately, PSE's IRP does not reflect Washington's commitment to decarbonization and takes no meaningful steps to reduce PSE's emissions. As discussed later in these comments, this exposes PSE customers to significant compliance risk and does not satisfy the Commission's lowest reasonable cost standard.[3]

Despite Washington's advancing decarbonization policy landscape and market developments around building electrification, PSE's IRP proposes essentially no action to decarbonize its operations over the planning horizon, instead relying almost exclusively on CCA allowances. For its preferred portfolio, the Company forecasts only a 1.1% average annual decrease in emissions and a 25% net reduction in emissions from 2024 to 2050—reductions that fall well-short of the 3.5% statewide annual decrease needed to meet Washington's interim targets and stay on track to achieve 95% reductions by 2050.[4]

Even more disappointing, this small emissions reduction is entirely due to two factors: (1) reductions that would have occurred under the reference scenario even without the CCA, and (2) PSE's assumption that there will be no customer growth after 2026. The reference scenario, which represents the Company's business-as-usual case, forecasts a 9.5% reduction in emissions from 2024 to 2050. So more than a third of the 25% reduction observed in the preferred portfolio would have occurred without PSE making any concerted effort to decarbonize as required by the CCA.[5] And critically, *all* of the reductions achieved under the preferred portfolio are also achieved under the "Zero Gas Growth" sensitivity scenario, which takes no action on decarbonization but assumes no customer growth after 2026.[6] That is, the *only* factor driving the preferred portfolio's small emission reductions relative to the reference scenario is a difference in assumptions about customer growth, rather than any action by PSE to decarbonize its operations. This shows that the Company's business-as-usual preferred portfolio does essentially nothing to address emissions from its operations.

Instead of decarbonizing its operations, PSE intends to comply with the CCA largely by purchasing increasing quantities of allowances, which account for approximately 75% of the

[1] Wash. State Dep't of Ecology, *Climate Commitment Act*, *available at* https://ecology.wa.gov/Air-Climate/Climate-Commitment-Act [hereinafter "Wash. State Dep't of Ecology, *Climate Commitment Act*"]; RCW § 70A.45.020.
[2] Wash. State Dep't of Ecology, *Climate Commitment Act.*
[3] WAC § 480-90-238(2)(a)-(b).
[4] Calculated using PSE, Corrected App. F Data Input File to PSE's 2023 Final Gas Util. Integrated Res. Plan (June 16, 2023) [hereinafter "Appendix F: Gas IRP Results"], "Summary of Emissions" tab.
[5] Appendix F: Gas IRP Results, "Summary of Emissions" tab.
[6] Appendix F: Gas IRP Results, "Summary of Emissions" tab. *See also* Puget Sound Energy, 2023 Gas Util. Integrated Res. Plan at 2.11, 2.13 Table 2.4, 2.14 Figure 2.7, and 5.16 (Mar. 31, 2023) [hereinafter "Final IRP"](describing the zero customer growth scenario, noting that "the least cost plan for the Zero Growth sensitivity drove this preferred portfolio," and showing identical conservation savings ranges and portfolio additions under the preferred portfolio and zero gas growth scenarios).

Company's "emission reductions" by 2050.[7] But buying allowances is not the same as reducing emissions. As discussed below, PSE's overreliance on allowances essentially ensures that most or all of its allowances will be purchased at the ceiling price, exposing its customers to significant risk. Relying on allowances for nearly all the Company's compliance is an especially risky strategy given that there are cost-effective emissions reduction resources available today. Notably, PSE's preferred portfolio does not include *any* building electrification, despite the finding in Washington's 2021 State Energy Strategy that electrifying the vast majority of buildings is the lowest-cost, lowest-risk pathway to decarbonizing the state's buildings.[8]

II. PSE Underestimates the Cost of Allowances and Fails to Address the Risks of an Allowance-Based Compliance Strategy

PSE underestimates the costs of the allowance purchases in its preferred portfolio in at least two ways: First, under the CCA allowance auction rules, PSE will only be able to purchase the number of allowances in its preferred portfolio if it buys most of them at the ceiling price, rather than the mid-level price PSE has assumed. Second, PSE fails to account for inflation in calculating allowance prices. Correcting these two errors increases the total net present cost of allowances in PSE's preferred portfolio by $2.63 billion, as detailed in Section II.A.

PSE's analysis also fails to account for the risk of high compliance costs if additional decarbonization policies are enacted—possibly in response to CCA compliance strategies like PSE's that over-rely on allowances and threaten the integrity of the CCA's emissions cap—as well as the risk of continued reliance on increasingly expensive and volatile gas purchases. PSE's failure to account for these risks fails the Commission's lowest reasonable cost standard, as discussed in Section II.B.

A. PSE underestimates allowance costs by failing to account for CCA rules and inflation

i. CCA rules

Due to the structure of CCA allowance auction rules, many of the allowances that PSE's compliance strategy relies on are likely to be available only at the ceiling price, rather than the mid-level price that PSE's analysis assumes. As a result, PSE's analysis underestimates the net present cost of its allowance purchases in its preferred portfolio by as much as $719 million over the analysis period.[9]

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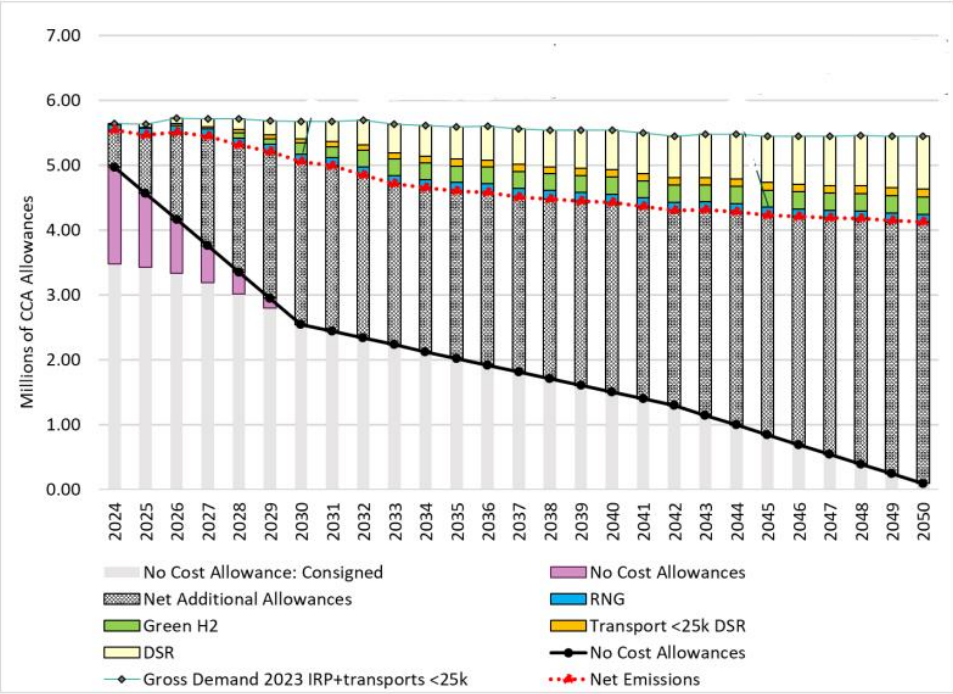
[7] Final IRP at 2.21, Figure 2.11 (showing roughly 4 $MMtCO_2e$ in allowances and 1.5 $MMtCO_2e$ in emissions reductions from other sources, including demand-side reductions).

[8] Wash. State Dep't of Com., Wash. 2021 State Energy Strategy at 15, 46, 66 (Dec. 2020), *available at* https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf [hereinafter "Wash. State Dep't of Com., Wash. 2021 State Energy Strategy"] (finding that "[d]ecarbonizing the building sector requires the state to … maximize electrification," which is the least-cost way to achieve decarbonization goals).

[9] Assumes a 6.80% discount rate consistent with PSE assumptions. *See, e.g.*, PSE Workpaper, *Final Green Hydrogen Prices (R)*, "Green H2 for 2023 IRP" tab (filed Mar. 31, 2023) [hereinafter "Final Green Hydrogen Prices"].

As shown in Figure 1 below, PSE proposes to purchase an increasing number of allowances that reaches over 4 million in 2050. This exceeds the total number of emissions that the Washington State Department of Ecology ("Ecology") expects to be available *for the entire state* in that year, since the number of available allowances declines each year to align emissions with state decarbonization targets (see Figure 2 below). The same is true for 2049.[10] In these years, it is virtually guaranteed that allowances available through auction will be exhausted, and PSE will need to purchase its allowances at the ceiling price pursuant to RCW 70A.65.160(2), contrary to its assumption that those allowances will be available at a mid-level price.

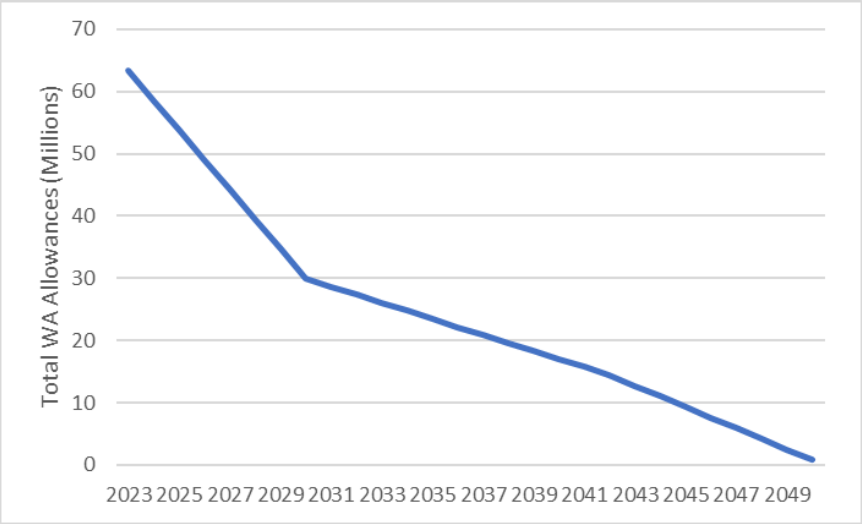
Figure 1: PSE Preferred Portfolio Allowance Needs[11]



[10] *Compare* Wash. State Dep't of Ecology, *Final Regulatory Analyses* at 54-55, *available at* https://apps.ecology.wa.gov/publications/documents/2202047.pdf [hereinafter "Wash. State Dep't of Ecology, *Final Regulatory Analyses*"] (setting forth rules that project 2.5 million available allowances in 2049 and 0.8 million in 2050), *with* Appendix F: Gas IRP Results, "Summary of Emissions" tab (projecting PSE's need for 4.0 million allowances in 2049 and 3.9 million in 2050, even after deducting PSE's consigned no-cost allowances in those years (shown in row 3)).

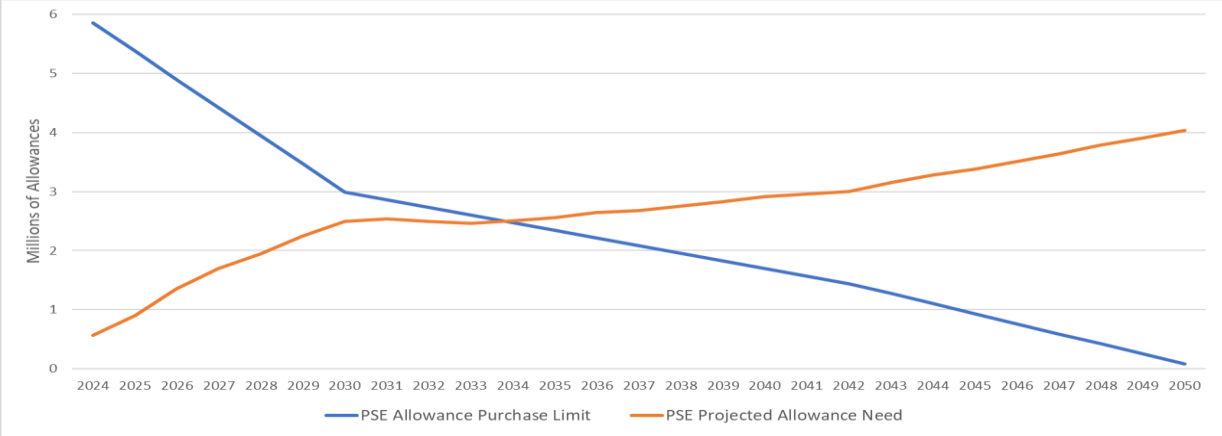
[11] Final IRP at 2.21, Figure 2.11 (Figure modified to remove two text boxes).

Figure 2: Total Washington CCA Allowances[12]



Similarly, PSE's preferred portfolio relies on significant allowance purchases in excess of the purchase limits set forth in WAC 173-446-330(1). Generally, these purchase limit rules prevent any individual entity from buying more than 10% of the total available allowances. As shown in Figure 3 below, PSE's preferred portfolio exceeds the purchase limit by an increasing amount beginning in 2034. This gap widens to a shortage of over a million allowances by 2040, and nearly 4 million by 2050.

Figure 3: PSE Required Allowances Compared to Purchase Limit[13]



[12] Wash. State Dep't of Ecology, *Final Regulatory Analyses* at 54-55. This does not include additional allowances that Ecology is expected to issue for newly covered sectors in 2027 and 2031 (waste to energy facilities and railroad, respectively). *See id.* at 37-38. However, these industries represent only a tiny fraction of statewide emissions, and can therefore be expected to have a negligible impact on the total number of allowances available. Waste Management accounts for 2.4% of Washington emissions and Rail accounts for less than 1%. *See* Wash, State Dep't of Ecology, *Wash.'s Greenhouse Gas Inventory*, *available at* https://ecology.wa.gov/Air-Climate/Reducing-Greenhouse-Gas-Emissions/Tracking-greenhouse-gases/GHG-inventories.

[13] Based on data from Figure 2 above and IRP Appendix F: Gas IRP Results, "Summary of Emissions" tab.

PSE may buy allowances in excess of the purchase limit through Allowance Price Containment Reserve ("APCR") auctions if there are allowances in the APCR account, or at the ceiling price.[14] This means that at the *very* least, PSE must purchase emissions at the APCR Tier 1 trigger price starting in 2034, even if the auction settlement price is below the APCR Tier 1 price.[15]

PSE is more likely to purchase most of its allowances at or near the ceiling price, since there is no guarantee that APCR allowances will be available, and the APCR account will quickly be exhausted if other covered entities pursue strategies similar to PSE's. Indeed, Cascade Natural Gas has filed an IRP that relies heavily on allowance purchases, requiring nearly 2 million allowances by 2050.[16] Commission Staff strongly criticized Cascade's reliance on purchases of Price Ceiling Units pursuant to RCW 70A.65.160(2), expressing concern "that these stop-gap compliance instruments are being used for long-term compliance planning."[17] Staff detailed Ecology's clear intention to minimize the use of price ceiling units to maintain the integrity of the CCA's emissions cap, consistent with the statute's core purpose.[18] PSE's IRP relies on a very similar CCA compliance strategy as Cascade's, and it creates the same likelihood that overreliance on allowances will drive prices to the ceiling as purchases exceed the company-specific purchase limits and, ultimately, the statewide total allowance cap.

To correct for PSE's unrealistic assumptions about the costs of available allowances, we assumed that PSE would purchase all of its allowances in the preferred portfolio at the ceiling price. We multiplied the number of allowances purchased in each year by the difference between PSE's assumed mid-level price and the ceiling price for that year, and discounted to present value.[19] This produced a net present cost increase of $719 million for the preferred portfolio.

We maintained PSE's assumption that it can purchase allowance prices at the floor price in the electrification scenario,[20] because this scenario does not rely on purchasing so many allowances that PSE must buy them at the ceiling price due to either exceeding PSE's purchase limit or the total number of allowances available statewide.[21]

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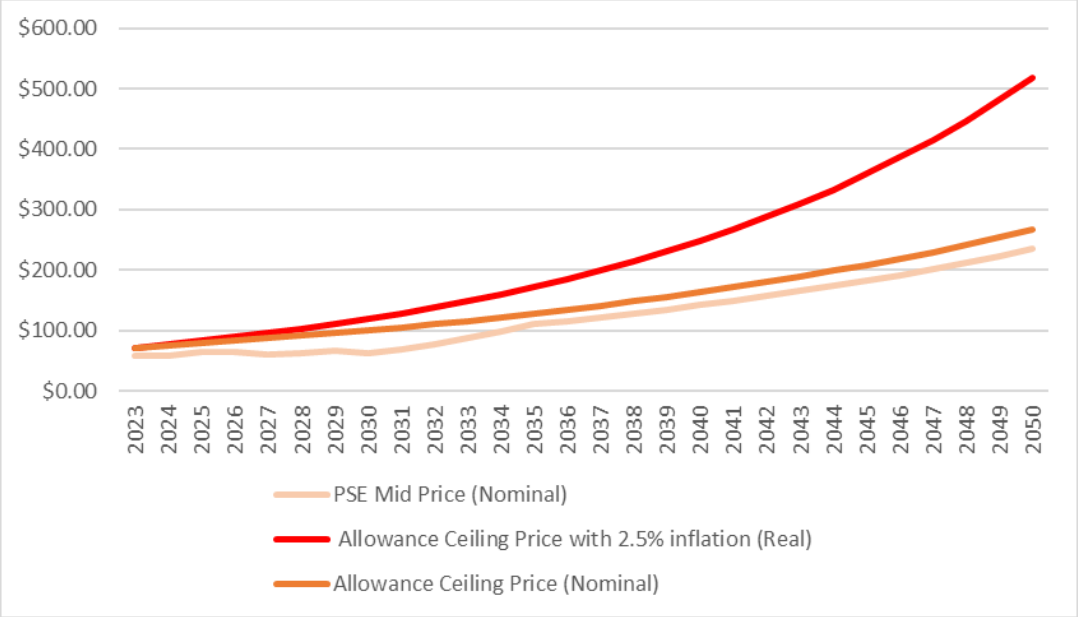
[14] *See* WAC § 173-446-370(4)(a); RCW § 70A.65.160(2).
[15] WAC § 173-446-370(4)(b)(i).
[16] Comm'n Staff Comments Regarding 2023 Nat. Gas Integrated Res. Plan., Cascade Nat. Gas Co.'s 2023 Integrated Res. Plan, Wash. Utils. and Transp. Comm'n Docket UG-220131 at 12-15 (Apr. 28, 2023) [hereinafter "Staff Comments on 2023 Cascade IRP"]. Staff's comments note the apparent discrepancy between Cascade's planned allowance requirements and current emissions of 5.85 $MMtCO_2e$. *Id.* at 12.
[17] Staff Comments on 2023 Cascade IRP at 13.
[18] Staff Comments on 2023 Cascade IRP at 13-14.
[19] We used PSE's 6.8% WACC as a discount rate, as PSE does throughout its analysis. *See, e.g.*, Final Green Hydrogen Prices, "Green H2 for 2023 IRP" tab.
[20] *See* Final IRP at 4.19, 6.21-6.22.
[21] Purchases in the electrification scenario do exceed PSE's purchase limits by a few hundred thousand in 2048-2050, but they remain well under the total number of statewide allowances. Moreover, PSE likely would not exceed its purchase limit at all in the electrification scenario after making two corrections discussed in Section III.B below: (1) removing PSE's assumption of continued gas customer growth for the electrification scenario (which results in additional emissions), and (2) correcting PSE's unreasonably high electric sector emissions estimates.

ii. Inflation

PSE miscalculates allowance prices in its IRP by failing to include inflation, causing it to underestimate the net present costs of its preferred portfolio by as much as $1.91 billion over the analysis period. In the Company's price forecast, displayed in Figure 4.7 of the IRP, the Company reports CCA allowance prices that increase from about $72 in 2023 to about $266 in 2050–an increase of 5% per year. PSE reports these allowance costs as "nominal $ /metric ton CO2eq."[22] This is incorrect; Ecology rules state that allowance prices will increase by 5% annually *plus* the rate of inflation.[23] Nominal values would be 5% plus a measure of annual inflation. The values reflected in PSE's Figure 4.7 reflect real values, not nominal values. This is problematic because PSE compares its real allowance price values to the nominal values of other decarbonization measures, and performs calculations that assume all values are nominal.

Figure 4 below shows the significant impact of PSE's miscalculation. If PSE assumes a 2.5% rate of inflation as it does elsewhere in the IRP,[24] nominal allowance prices in 2050 are roughly twice as much as PSE's analysis assumed.

Figure 4: Comparison of Real and Nominal CCA Prices Through 2050



[22] Final IRP at 4.10, Figure 4.7

[23] WAC § 173-446-335(5) ("The ceiling price for a year after 2023 shall be the ceiling price for the prior calendar year increased annually by five percent *plus the rate of inflation* as measured by the most recently available 12 months of the consumer price index for all urban consumers as of the first business day in December of the prior year.") (emphasis added); *see also* Wash. State Dep't of Ecology, *Final Regulatory Analyses* at 129-30, 137 (listing the annual floor and ceiling allowance prices that appear in Figure 4.7 at page 4.10 of the Final IRP, but clearly stating that these values are presented in real current dollars, and that "if a future year's nominal costs are of interest, the expected inflation rate can be applied to the real dollar estimates").

[24] *See, e.g.*, Final Green Hydrogen Prices, "Green H2 for 2023 IRP" tab, cell C51.

Miscalculating real allowance prices as nominal prices distorts the true costs of purchasing allowances and makes PSE's preferred portfolio appear much more cost competitive compared to scenarios in which the Company invests more in emissions reductions. Updating the allowance prices to account for inflation increases the preferred portfolio's net present costs by $1.91 billion, and it increases the electrification scenario's net present costs by $0.11 billion.[25]

B. PSE's allowance-based compliance strategy exposes its customers to significant risk, which PSE fails to address

In addition to the increased costs discussed above, PSE's reliance on allowances creates significant risk for its customers. First, PSE's do-nothing strategy is completely at odds with the CCA's decarbonization mandate. This fails the Commission's lowest reasonable cost standard by failing to adequately address state policies and risks associated with GHG emissions.[26] It also exposes PSE customers to several kinds of compliance risk that PSE fails to address. As discussed above in Section II.A, PSE's extreme reliance on allowances risks driving up their prices—likely to the ceiling—as covered entities compete for scarce allowances.

Another important risk is that PSE's inaction will result in high compliance costs if Washington enacts *any* additional policies requiring actual emission reductions from PSE's operations. The purpose of the CCA's gradual phase-in and market flexibilities is not to excuse inaction until abrupt, massive, costly, and disruptive efforts are needed, but to allow covered entities to make near-term investments in smaller-scale decarbonization, and ramp these investments up as they become more familiar and cost-effective. Indeed, overreliance on the CCA's allowances and flexibilities could make new decarbonization requirements more likely by showing policymakers that the CCA is insufficient to achieve Washington's decarbonization targets. And PSE's IRP displays exactly this kind of extreme overreliance on allowances: Much like the Cascade IRP that drew heavy criticism from Commission Staff, PSE plans to significantly exceed its purchase limits for most of the planning period, which will lead to many price ceiling unit purchases.[27] This is inconsistent with Ecology's design of the allowance program and the integrity of the CCA's emissions cap.[28] The CCA is a nascent and groundbreaking decarbonization policy that is likely to be adjusted, especially if covered entities like PSE are found to be abusing its flexibilities. These adjustments could include changes to the CCA's emission caps or increases to the allowance price ceiling, for example. Since PSE's compliance approach hinges on allowances, any increase in price or decrease in available supply is likely to directly and significantly impact customer rates.

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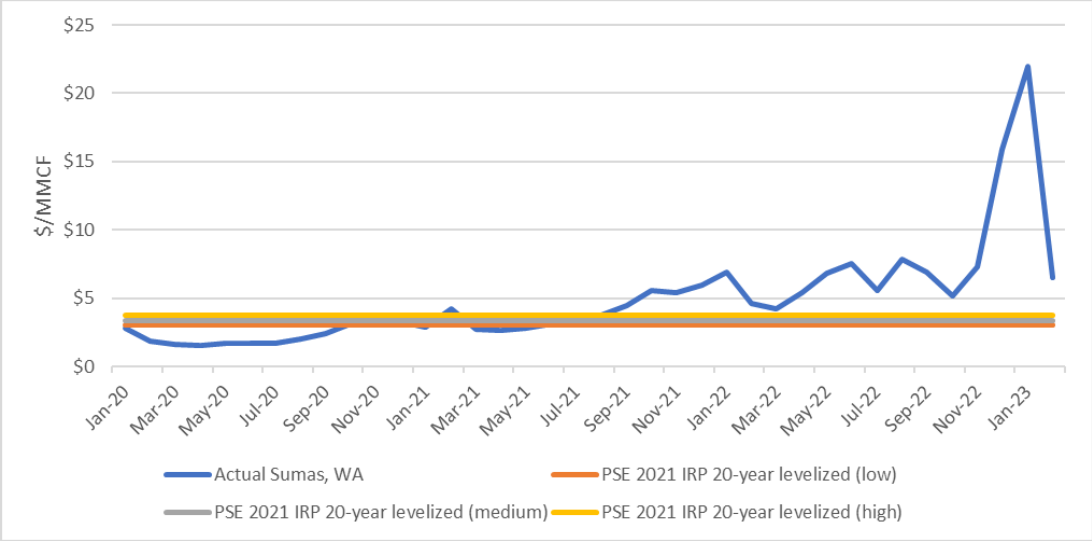
[25] These calculations assume allowances are purchased at the ceiling price in the preferred portfolio and at the floor price in the electrification scenario, as discussed above.
[26] WAC § 480-90-238(2)(b) requires an IRP's lowest reasonable cost analysis to address "the risks imposed on ratepayers, … public policies regarding resource preference adopted by Washington state or the federal government," and "the cost of risks associated with environmental effects including emissions of carbon dioxide," among others.
[27] Staff Comments on 2023 Cascade IRP at 13-14.
[28] *Id.*

Finally, under PSE's preferred portfolio, customers remain exposed to significant risks of volatile and increasing gas prices (and to the even higher and more uncertain costs of alternative fuels, to the extent the portfolio relies on them). Changing geopolitical and economic conditions have led to significant gas price surges in the Pacific Northwest. Since PSE submitted its 2021 IRP, gas prices have soared far beyond PSE's projections, as shown in Figure 5 below. Moreover, gas suppliers must also comply with the CCA, so if PSE's strategy increases allowance prices as discussed above, it may make compliance more expensive for gas suppliers, resulting in higher gas prices that are passed on to PSE's customers. Greater investments in building electrification, energy efficiency and conservation, and demand response can help reduce ratepayers' exposure to gas price risk under the preferred portfolio.

Figure 5: Comparison of Actual Natural Gas Prices at Sumas, WA with PSE's 2021 IRP gas forecast[29]



III. PSE Overstates the Cost of Building Electrification

PSE's IRP includes an analysis of two electrification scenarios: a full electrification scenario based on the Washington 2021 State Energy Strategy, and a hybrid heat pump scenario that evaluates adoption of electric heat pumps with gas backup.[30] Unless otherwise noted, these comments refer to the full electrification scenario.

PSE's analysis biases resource selection against electrification by overestimating electrification costs (as discussed in Section III.A) and by applying inconsistent assumptions that result in an apples-to-oranges comparison between the electrification and preferred portfolio scenarios (as discussed in Section III.B). These errors contribute to PSE's selection of a preferred portfolio that does not include *any* building electrification, contrary to the State Energy Strategy's finding that electrifying the vast majority of buildings is the lowest-cost, lowest-risk

[29] U.S. Energy Info. Admin, *Nat. Gas, available at* https://www.eia.gov/dnav/ng/hist/na1277_ysums-nca_3m.htm.
[30] Final IRP at 4.18-4.19, 6.20 (describing these scenarios).

pathway to decarbonizing the state's buildings.[31] Cumulatively, these errors inflate the net present cost of the electrification scenario by at least $2.1 billion compared to the preferred portfolio.

A. PSE's flawed assumptions significantly overstate building electrification costs

PSE's building electrification scenario overestimates the cost of electrification in at least three ways: First, PSE does not account for any Inflation Reduction Act ("IRA") incentive funding for electric appliances such as heat pumps. Second, PSE makes unreasonable assumptions about the measure costs of installing electric appliances. Finally, PSE applies unreasonably pessimistic assumptions about heat pump performance and the temperature at which they switch over to less efficient resistance heating, which inflates electric system costs associated with meeting peak demand, among others.

i. Omission of Inflation Reduction Act funding

PSE's analysis completely excludes the IRA's effects on electrification costs.[32] The Company's stated reason for omitting these effects is that they are not yet known, as Washington is still developing its program for distributing IRA heat pump rebates.[33] First, the fact that there is uncertainty about the precise magnitude of IRA benefits does not justify ignoring those benefits altogether–this type of uncertainty is inherently part of the forecasting involved in resource planning.

Second, PSE's rationale does not withstand scrutiny, because a significant portion of IRA benefits are in the form of a tax credit available to all households of up to $2,000 for heat pumps and heat pump water heaters, which is already in effect and known with certainty.[34] PSE included the IRA's hydrogen production tax credits in its analysis, so there is no principled reason for not including the IRA's electrification tax credits as well.[35] In fact, PSE assumed that the IRA's hydrogen tax credits would be extended through 2050 (they currently run through 2032).[36] The assumption that Congress will extend these tax credits far in the future is at least as uncertain as the assumptions that PSE would need to make to account for the IRA's other major form of support for electrification: its rebate programs. While it is true that Washington is still in the process of developing an implementation plan for programs like the High-Efficiency Electric

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[31] Wash. State Dep't of Com., Wash. 2021 State Energy Strategy at 15, 46, 66 (finding that "[d]ecarbonizing the building sector requires the state to…maximize electrification," which is the least-cost way to achieve decarbonization goals).

[32] PSE, Response to Sierra Club DR 005.e, attached to these comments as Exhibit A, confirms that PSE did not account for any IRA electrification incentives, including tax credits.

[33] Final IRP at 3.4.

[34] *See* Energy Star, *Air Source Heat Pumps Tax Credit* (Dec. 30, 2022), *available at* https://www.energystar.gov/about/federal_tax_credits/air_source_heat_pumps; Energy Star, *Heat Pump Water Heaters Tax Credit* (Dec. 30, 2022), *available at* https://www.energystar.gov/about/federal_tax_credits/water_heaters_non_solar.

[35] Final IRP at 3.1.

[36] Final Green Hydrogen Prices, "Green H2 for 2023 IRP" tab. This assumption results in PSE's assumed net cost of hydrogen production reaching zero in 2050–a surprising result that suggests PSE has not scrutinized the IRA's effects on supply-side resources as carefully as its effects on electrification opportunities.

Home Rebate Program, which provides income-qualified households up to $14,000 for electric heat pumps, ranges, and dryers, these funds have already been approved by Congress, and PSE is in a better position to make reasonable, informed assumptions about their implementation than to assume that hydrogen tax credits will be extended through 2050.[37]

Even without accounting for the IRA rebate programs, including the IRA's electrification tax credits decreases the net present cost of PSE's electrification scenario by $697 million. Because the IRA includes tax credits of up to $600 each for gas furnaces, central air conditioners, and gas water heaters,[38] we assumed that the incremental credit available for air source heat pumps was $800 (the $2,000 heat pump credit less the $600 furnace credit and the $600 air conditioner credit), and the incremental credit available for heat pump water heaters was $1,200 (the $2,000 heat pump water heater credit less the $600 gas water heater credit). We assumed that electrification tax credits would be available through 2050, consistent with PSE's assumption that hydrogen tax credits will be available over the same period.

The IRA also includes a $600 tax credit for electrical panel upgrades.[39] PSE included panel upgrade costs in its electrification scenario, but it did not indicate how many panel upgrades are performed, so we conservatively omitted panel upgrade tax credits from our analysis.[40] However, if we assume that 75% of HVAC heat pump installations require a panel upgrade, accounting for this tax credit would reduce the electrification scenario's net present costs by an additional $146 million. Our estimate of the IRA's effect is also conservative in that it does not account for the IRA's electrification rebate programs.

ii. Unreasonable electrification measure cost assumptions

Separate from PSE's failure to account for the IRA's electrification incentives, PSE's estimate of the "Measure Costs" to electrify its customers is unreasonably high, and may be the result of an error. PSE estimates the net present measure costs for the full electrification scenario as $5.4 billion.[41] PSE did not provide the information needed to fully understand how the Company reached this estimate, but our conservative analysis based on PSE's data for incremental unit costs and number of units installed suggests that the scenario's cumulative net present measure costs should be at least $1.4 billion lower than PSE's estimate.

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[37] Inflation Reduction Act of 2022, H.R. 5376, 117th Cong. § 13102 (2022). For example, PSE has a reasonable understanding of the number of households in its service territory that would qualify for income-based funding.
[38] Energy Star, *Furnaces (Nat. Gas, Oil) Tax Credits* (Dec. 30, 2022), *available at* https://www.energystar.gov/about/federal_tax_credits/natural_gas_propane_oil_furnace; Energy Star, *Central Air Conditioners Tax Credit* (Dec. 30, 2022), *available at* https://www.energystar.gov/about/federal_tax_credits/central_air_conditioning; Energy Star, *Water Heaters (Nat. Gas) Tax Credits* (Dec. 30, 2022), *available at* https://www.energystar.gov/about/federal_tax_credits/tax_credits_homeowners/water_heaters_natural_gas_oil_propane.
[39] Energy Star, *Elec. Panel Upgrade Tax Credit* (Dec. 30, 2022), *available at* https://www.energystar.gov/about/federal_tax_credits/electric_panel_upgrade.
[40] Final IRP at 6.21, Table 6.5.
[41] Final IRP at 2.18.

PSE's consultant Cadmus estimated the total and incremental costs of electric equipment in PSE's Conservation Potential Assessment, which PSE used in its analysis of electrification measure costs. These cost estimates for some equipment types are included in Appendix C to PSE's IRP, and are reproduced in Figure 6 below.

Figure 6: Cadmus Study Appliance Costs[42]

Appliance	Avg Cost per Unit	Incremental Cost
Gas Furnace + Central AC	$13,830	-
Ductless Heat Pump	$15,223	$1,393
Ducted Heat Pump	$14,800	$970
Ducted Heat Pump + Gas Furnace (Hybrid/Dual-Fuel)	$16,250	$2,420

Using PSE's data, we estimated the cumulative net present incremental costs of the residential heat pumps installed in PSE's full electrification scenario to be $350.2 million. We multiplied the incremental unit costs by the number of units installed in each year under the electrification scenario, and converted to net present value using the 6.8% discount rate that PSE uses in its analysis.[43] Measure costs in PSE's electrification scenario include equipment other than HVAC heat pumps, including water heaters, cooking equipment, dryers, panel upgrades, and commercial retrofits, but PSE did not provide sufficient information or clarity to understand how it estimated these costs.[44] Nevertheless, if we conservatively assume that the incremental unit costs for each type of electric equipment equal the average of PSE's incremental unit costs for HVAC equipment, we estimate the additional net present measure cost for other residential equipment to be $1.34 billion.[45] Combined with the HVAC equipment costs, this yields a total net present residential equipment cost of $1.69 billion. PSE did not provide sufficient information to understand how it estimated commercial electrification costs, but if we assume–again, very conservatively–that electrifying PSE's commercial customers has the same net present cost as electrifying its many more residential customers, this brings the total net present

[42] Appendix C, at A-12. PSE, Response to Sierra Club DR 005, attached to these comments as Exhibit A, confirms that PSE used this data from Appendix C to estimate electrification unit costs.
[43] PSE provided the number of heat pump units installed in its electrification scenario in Attachment B of its Response to Sierra Club DR 001, attached to these comments as Exhibit B, at 36. PSE uses its 6.8% WACC as a discount rate throughout its analysis. *See, e.g.*, Final Green Hydrogen Prices, "H2 for 2023 IRP" tab.
[44] *See* Attachment B of PSE's Response to Sierra Club DR 001, attached to these comments as Exhibit B, at 36-37; Final IRP at 6.21, Table 6.5.
[45] PSE did not provide information on how many panel upgrades it assumes to occur in its electrification scenario, so we conservatively assumed that all HVAC equipment installations would require panel upgrades. We used $1,182, the average of Cadmus's estimated incremental cost for ducted and ductless heat pumps, as an estimate of panel upgrade costs. While average panel upgrade costs may be somewhat higher, this is likely offset by the facts that not all electrification projects will require panel upgrades, and incremental costs for electric water heaters, dryers, and cooking equipment are likely well below $1,182. If we even more conservatively assume that average panel upgrade costs are $2,500 and hold all other cost assumptions constant, total net present measure costs are $4.61 billion. This is still $786 million, or 15%, less than PSE's $5.4 billion estimate.

equipment cost to $3.38 billion. PSE assumed a very high 21% program administration cost for most measures,[46] and when this is factored in it brings the total estimated net present measure cost to $4.10 billion. This estimate results from several extremely conservative assumptions, and should be considered an upper bound on electrification measure costs. Nevertheless, it is $1.4 billion, or 25%, less than PSE's $5.4 billion estimate. Using a more realistic measure cost estimate than PSE's would reduce the net present cost of its electrification scenario by at least $1.4 billion.

PSE did not provide sufficient information to understand how it reached an electrification measure cost that is so much higher than our upper-bound estimate. One possibility is that PSE inappropriately used total costs for electric equipment in its analysis, rather than incremental equipment costs. Incremental unit costs are the appropriate measure to use for this analysis, because under PSE's electrification scenario, customers "replace their gas appliances with electric heat pumps … when their existing equipment reaches the end of life," (so they would be purchasing either new electric equipment or new gas equipment).[47] But when asked to clarify what its measure costs included, the Company indicated that they may combine both baseline and incremental costs, responding: "'Measure Costs' include both the baseline costs as well as incremental costs that are shown in the Gas Utility Integrated Resource Plan ('IRP') Appendix C, page A-12, as the average cost per unit."[48] While this response is unclear, the large discrepancy between PSE's $5.4 billion final measure cost and a $4.1 billion reasonable upper-bound estimate suggests that one or more errors or seriously inappropriate assumptions are to blame. In future IRPs, PSE should provide enough information, transparency, and explanation about its electrification measure cost estimates to understand how those estimates are produced and what input assumptions they rely on.

iii. Overly pessimistic assumptions about heat pump performance

PSE's electrification scenario relies on unrealistically pessimistic assumptions about the performance of heat pump equipment, especially cold climate heat pumps. While it is difficult to determine precisely how these assumptions affected PSE's analysis based on the information provided, underestimating heat pump performance tends to result in overestimates of the peak load impacts and electric system costs of electrification. PSE estimated the electric system costs of its full electrification scenario to be $3.37 billion; these costs may be significantly lower if PSE applied more reasonable assumptions about heat pump performance.[49]

In its electrification scenario, PSE assumes that all installed heat pumps are "standard efficiency units."[50] PSE did not define "standard efficiency" by reference to any specific equipment models or specifications; instead, it based its analysis on "survey responses from

[46] Final IRP at 6.21, Table 6.5.
[47] Final IRP at 4.18.
[48] PSE, Response to Sierra Club DR 005.c, attached to these comments as Exhibit A.
[49] Final IRP at 2.18, Table 2.5.
[50] Final IRP at 4.11.

contractors/builders."[51] PSE assumed that all heat pumps switch to electric resistance backup heat at a temperature of 35F, and that they operate fully on backup heat, at a coefficient of performance ("COP") of 1, at all times when the ambient temperature is below 35F.[52] PSE did not perform any sensitivity analysis to evaluate how a higher-performing heat pump would affect its analysis.[53]

Based on the information provided, we could not determine how PSE's assumptions about heat pump performance affected its analysis, including their impacts on electric system costs and peak electric load. In comments to PSE on its draft IRP, we urged PSE to provide additional detail and clarification on this aspect of its analysis.[54] We recommend that the Commission direct PSE to clearly identify its assumed heat pump specifications, COPs, switchover temperatures, number of hours relying on backup heat, impacts on peak electric load, and related inputs and conclusions in its future filings, including its updated Gas Decarbonization Study, Targeted Electrification Strategy, and 2025 gas IRP.[55]

Despite the lack of detail on PSE's consideration of heat pump performance, it is clear that PSE's assumed switchover temperature is unrealistically conservative.[56] And because heat pump performance (especially changeover temperature, which determines how often inefficient backup resistance or gas heat is used) can affect outcomes from customers' energy bills to system-wide electric resource needs, it is "a key variable that turns out to be a significant driver" of many analyses and conclusions.[57]

Many heat pumps on the market already exceed PSE's assumed performance levels by a wide margin, and available models can be expected to become significantly higher-performing,

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[51] *See* PSE, Response to Sierra Club DR 005.h, attached to these comments as Exhibit A.
[52] *See* PSE, Response to Sierra Club DR 009, attached to these comments as Exhibit C. The coefficient of performance is the ratio of heating output relative to the energy needed to run the heat pump. A coefficient of performance greater than 1 means that the energy output is greater than the energy input.
[53] *See* PSE, Response to Sierra Club DR 009, attached to these comments as Exhibit C.
[54] Sierra Club, Comments on PSE Draft 2023 Gas Util. Integrated Res. Plan at 2 (Feb. 4, 2023), attached to these comments as Exhibit D ("The Draft IRP materials provide limited information about the assumptions used in PSE's analyses of electrification, and we urge PSE to be clearer and more transparent in its Final IRP."); *id.* at 4 ("We recommend that the Final IRP apply updated assumptions around heat pump performance, make these assumptions fully available and transparent, and clarify how they are applied in PSE's analysis.").
[55] *See* Wash. UTC v. PSE (PSE 2022 General Rate Case), Docket 22066 Final Order 24/10, Appendix A: Revenue Requirement Settlement at 35-42 (directing PSE to prepare an updated Gas Decarbonization Study that applies up-to-date assumptions about heat pump performance, along with a Targeted Electrification Strategy, and to include both the Study and the Strategy in its 2025 gas IRP).
[56] PSE has applied similar flawed assumptions about changeover temperatures in other contexts, including a gas decarbonization study that it cited in its most recent general rate case. Prefile Resp. Test. (NonConfidential) of Ed Burgess on Behalf of NW Energy Coalition, Front and Centered, and Sierra Club, Exh. EAB-1T, Wash. Utils. and Transp. Comm'n Dockets UE-220066/UG-220067 at 19-23 (July 28, 2022) [hereinafter "Burgess Test., Dockets UE-220066/UG-220067"] (describing the gas decarbonization study, its assumption of a 25F switchover temperature in the "High Electrification" scenario, and the conclusions about electrification potential that PSE drew based on the study).
[57] *Id.* at 21; *see also id.* at 25, 30 (discussing some of the significant cost savings that can result from improved heat pump performance assumptions).

more efficient, more widely available, and lower cost over the course of the IRP analysis period.[58] As detailed in testimony to the Commission prepared by Strategen Consulting on behalf of NW Energy Coalition, Front and Centered, and Sierra Club, many modern cold climate heat pumps can operate more than twice as efficiently as resistance backup heat (i.e., at a COP of 2) at temperatures as low as 5F.[59] This has enabled highly successful electrification strategies in states with significantly colder climates than western Washington, including Maine, Vermont, Minnesota, and Michigan.[60] Moreover, this level of performance would likely not even be necessary to maintain high efficiency in western Washington's relatively mild climate. The lowest Design Day temperature conditions that PSE's gas system planners generally assume is warmer than 10F, which means modern cold climate heat pumps would continue to operate at high efficiencies even during PSE's assumed coldest day.[61] Furthermore, there are significant opportunities to get maximum performance from heat pumps at minimum cost by combining electrification with improvements to building envelope efficiency, load shifting, and demand response.[62] Finally, because backup resistance heat can be used to supplement, rather than replace heat pump operation at low temperatures, PSE's assumption that heat pumps' COPs immediately drop to 1.0 at the switchover temperature is unrealistic.

We recommend that the Commission direct PSE to evaluate electrification opportunities in its future filings based on specifications for efficient, all-electric models with changeover temperatures no higher than 10F.[63]

B. PSE makes several analytical errors that skew the comparison between the building electrification scenario and preferred portfolio

PSE's comparison between the preferred portfolio and its electrification scenarios included an analysis of the electrification scenarios' impacts on the electric system. First, we want to

[58] *See* Burgess Test., Dockets UE-220066/UG-220067 at 24-25, 31 (discussing rapid ongoing advancements in cold climate heat pump technology and anticipated cost reductions).
[59] *Id.* at 24 (citing NE Energy Efficiency Partnerships, *NEEP's Cold Air Climate Heat Source, Heat Pump List*, *available at* https://ashp.neep.org/#!/product_list/; K. Purdy, *How to Find the Best Cold Climate Heat Pump*, Climate Switch, *available at* https://carbonswitch.com/best-cold-climate-heat-pump/); *see also Trane Technologies Surpasses U.S. Dep't of Energy Requirements for High-Efficiency, Cold Climate Heat Pump*, Business Wire, (Nov. 3, 2022) (reporting new model testing indicating that heat pumps can perform at -23F), *available at* https://www.businesswire.com/news/home/20221103005955/en/Trane-Technologies-Surpasses-U.S.-Department-of-Energy-Requirements-for-High-Efficiency-Cold-Climate-Heat-Pump; U.S. Dep't of Energy, *Residential Cold Climate Heat Pump Challenge*, Off. of Energy Efficiency & Renewable Energy, *available at* https://www.energy.gov/eere/buildings/residential-cold-climate-heat-pump-challenge (noting that major manufacturers are partnering with DOE on the Cold Climate Heat Pump Challenge to make electric heat pumps more effective, cheaper, more widely adopted, and grid interactive).
[60] *Id.* at 28 (citing S. Nadel, *Programs to Elec. Space Heating in Homes and Bldgs.*, Amer. Council for an Energy Efficient Econ. (June 2020), *available at* https://www.aceee.org/sites/default/files/pdfs/programs_to_electrify_space_heating_brief_final_6-23-20.pdf).
[61] *Id.* at 21, 29-30.
[62] *See, e.g., id.* at 26.
[63] Sierra Club, Comments on PSE Draft 2023 Gas Util. Integrated Res. Plan at 4 (Feb. 4, 2023), attached to these comments as Exhibit D (recommending that PSE perform this evaluation in this Final IRP).

recognize that PSE took a step towards a holistic, integrated energy delivery system modeling that considers both the gas and electric businesses. We believe this is a step in the right direction and we encourage PSE to continue going down this path.

However, at least three analytical errors in PSE's comparison undermine its conclusion that the preferred portfolio yields the lowest reasonable cost: First, PSE applies different assumptions about customer growth in different scenarios. Second, PSE's assessment of the electrification scenario's social cost of greenhouse gas emissions ("SCGHG") is inconsistent with the findings of leading analyses. Finally, PSE's analysis includes transmission and distribution ("T&D") costs for its electric system but not for its gas system. These errors inflate the net present cost of the electrification scenario by at least $0.95 billion compared to the preferred portfolio.

i. Inconsistent customer growth assumptions

As discussed in Section I above, PSE assumes zero new gas customer growth under the preferred portfolio, but it does not apply this assumption to the electrification scenario.[64] The zero-growth assumption is a reasonable reflection of Washington policy, which is moving away from using gas in new buildings consistent with the state's climate, health, and air quality goals. But PSE's inconsistent application of that assumption skews its analysis. Assuming continued gas customer growth in the electrification scenario means more gas customers (or prospective gas customers) will need to be electrified under the scenario, with the associated measure costs and electric system costs. In the preferred portfolio, these prospective new gas customers still electrify, but the costs of that electrification are not accounted for in the analysis. This artificially inflates the electrification scenario costs relative to the preferred portfolio.

To correct for PSE's inconsistent application of the zero-growth assumption, we reduced the net present cost of the electrification scenario by $0.95 billion. This reflects the difference between the total net present cost of the reference scenario ($10.72 billion) and the preferred portfolio/zero-growth scenario ($9.77 billion).[65] This approach may even underestimate the degree to which applying the zero-growth assumption would reduce the electrification scenario's costs. This is because the electrification scenario assumes that customers with gas equipment will electrify when their current equipment burns out. Without the no-growth scenario, new customers in the electrification scenario would originally use gas equipment, and pay for electrification retrofits when their equipment burns out. Reducing the electrification scenario's costs by $0.95 billion would account for the avoided costs of serving these new customers with gas equipment (since this is the difference between serving new gas customers in the reference scenario and not serving those new customers with gas in the zero-growth scenario), but it would not account for the avoided costs of retrofitting these customers to electricity down the road.

[64] *See, e.g.*, Final IRP at 1.4 (describing incorporation of the zero gas growth assumption in the preferred portfolio), 4.18 ("We assumed mid-growth in customer gas demand [for the electrification scenario]."), 6.16, Table 6.1 (comparing gas demand assumptions across scenarios), 6.21, Table 6.6 (showing that the electrification scenario assumes gas growth).
[65] Final IRP at 2.16, Figure 2.9.

ii. Flawed analysis of SCGHG

PSE's analysis concludes that the electrification scenario's net present SCGHG ($3.74 billion) is slightly higher than that of the reference scenario ($3.31 billion).[66] PSE's suggestion that electrification will increase electric sector emissions more than it reduces gas sector emissions is highly suspect.[67] Many expert analyses, including Washington's State Energy Strategy, have concluded that electrification results in significant net emission reductions–this is precisely why these analyses have identified electrification as a key decarbonization strategy for Washington. PSE's conclusion appears inconsistent with these findings, which is cause for skepticism.

Moreover, Washington already has one of the cleanest grids in the country, and the Clean Energy Transformation Act ("CETA") will drive further emission reductions on the path to a carbon-neutral grid by 2030 and 100% clean generation by 2045. PSE forecasts that most of the added electricity demand under the electrification scenario will occur after 2030, when Washington's grid is at its cleanest. Again, there is serious reason to doubt PSE's conclusion given its inconsistency with established findings. This conclusion may be driven in part by PSE's assumptions about heat pump performance, discussed in Section III.A above, since these assumptions could influence electrification's contributions to peak load and the resulting reliance on peaking resources, which can be relatively emissions-intensive.

PSE did not include the SCGHG in its estimates of net present portfolio costs, and we have not attempted to quantitatively assess the reduction in SCGHG for the electrification scenario that would result from more realistic assumptions about electric sector emissions factors and heat pump performance.[68]

iii. Inconsistent consideration of T&D costs

PSE's estimated portfolio costs include transmission and distribution ("T&D") costs for its electric system, but not for its gas system.[69] This asymmetric consideration of T&D costs biases the analysis against electrification, which increases electric T&D costs but reduces the need for gas T&D investments by shifting load from gas to electricity. PSE's electrification scenario includes $740 million in incremental electric T&D costs relative to the reference scenario, but omits the corresponding and potentially significant gas T&D savings. Gas T&D costs that could be avoided through electrification include purchases, repairs, and replacements of transmission and distribution pipelines, compressor stations, metering and regulating equipment, etc. As electrification advances to the point where whole sections of the gas system can be

[66] Final IRP at 6.24, Table 6.7.
[67] *See* PSE, Response to Sierra Club DR 006.a, attached to these comments as Exhibit E ("Electrification results in higher electric demand. This means more energy is needed to serve this additional demand, resulting in higher dispatch of the natural gas facilities and higher market purchases, which lead to higher emissions for the [electrification] portfolio [than for the reference scenario].").
[68] PSE, Response to Sierra Club DR 011.a, attached to these comments as Exhibit F; *see* Final IRP at 2.16, n.9.
[69] *Compare* Final IRP at 4.16-4.17 (discussing incorporation of incremental electric T&D costs) *with* Final IRP at 2.16-2.17 ("The [gas] distribution system is not part of the SENDOUT model, so we did not include costs for the distribution systems."); *see also* Final IRP at 6.24, Table 6.7.

decommissioned (and gas system expansions into new developments can be completely avoided), avoided gas T&D costs can be expected to grow significantly. These avoided costs are not captured in PSE's analysis.

IV. Correcting PSE's Analytical Errors Indicates that the Building Electrification Scenario Is Likely Lower-Cost than PSE's Preferred Portfolio

As discussed in the previous sections, there are several unreasonable assumptions and analytic errors in PSE's analysis that cause it to overestimate the costs of its electrification scenario and underestimate the costs of its preferred portfolio. We were able to estimate the impacts on PSE's portfolio costs that result from some of these errors, but not all of them. The combined impacts of the errors that we were able to estimate are presented in Table 1 below. These corrections to PSE's analysis indicate that the electrification scenario likely has a lower total net present cost than PSE's preferred portfolio, and that the savings may exceed $2 billion.

Table 1: Estimate of Total Portfolio Cost NPV with Revised Assumptions (in Billions)[70]

	Preferred Portfolio	Electrification Scenario
PSE IRP Portfolio Cost	$9.77	$13.26
Allowance Cost to Ceiling	$0.72	-
Allowance Cost Inflation	$1.91	$0.11
IRA Tax Credits	-	($0.70)
Electrification Measure Cost Correction	-	($1.40)
Consistent Customer Growth Assumption	-	($0.95)
Corrected Portfolio Cost	$12.40	$10.33

The modifications to PSE's cost estimate that are incorporated into Table 1, and that support the finding that the electrification scenario is likely lower-cost than the preferred portfolio, include:

- Increasing the allowance price to the ceiling price under the preferred portfolio, to reflect the likelihood that PSE's overreliance on allowances will drive their prices to the ceiling;
- Adding a 2.5% annual rate of inflation to allowances;

[70] Based on Final IRP at 2.18, Figure 2.9, and corrections made in Sections II and III above.

- Accounting for the IRA tax credits that are already available for electrification projects;
- Reducing electrification measure costs (exclusive of any rebates) to the upper-bound reasonable value; and
- Consistently applying the zero customer growth assumption in both the preferred portfolio and the electrification scenario.

The corrected net present cost of the electrification scenario is so much lower than that of the preferred portfolio that this result holds even if some of the corrections described above are not included, or if their magnitudes are somewhat different. For example, we found that even if allowance prices in the electrification scenario are increased from the floor to the ceiling (which is highly unlikely because the electrification scenario does not require enough allowance purchases to drive their price to the ceiling) and adjusted for inflation, the resulting $1.39 billion increase in the electrification scenario's net present cost is still not enough to make the preferred portfolio the lower-cost option. These robust results suggest that electrification has a significant advantage as a cost-effective CCA compliance strategy, consistent with findings in the Washington State Energy Strategy.

Importantly, there are additional issues with PSE's analysis discussed throughout these comments that could not be quantified or included in Table 1, but that nonetheless support the conclusion that a portfolio with significant amounts of electrification may be lower-cost and lower-risk than PSE's allowance-heavy preferred portfolio. These issues include:

- PSE's failure to address compliance risks associated with its allowance-heavy CCA compliance strategy, including risks of facing high costs to comply with future climate policies following PSE's failure to act on decarbonizing its operations (Section II.B)
- PSE's failure to address the risks of volatile and rising gas prices (Section II.B)
- PSE's failure to account for funds available through IRA rebate programs, which have been approved by Congress and will roll out in Washington relatively quickly and predictably (Section III.A)
- PSE's unrealistically pessimistic assumptions about current and future heat pump performance (Section III.A)
- PSE's unrealistic conclusions about the SCGHG of its electrification scenario compared to the reference scenario (Section III.B)
- PSE's consideration of incremental electric T&D costs but not incremental gas T&D costs (Section III.B)

Quantifying these effects would likely increase the difference between the net present costs of the electrification scenario and the preferred portfolio presented in Table 1.

V. Conclusion and Recommendations

We recommend that the Commission decline to acknowledge PSE's IRP, direct PSE to significantly reduce its reliance on allowances, and incorporate a more transparent, realistic analysis of electrification into future filings, including in a refiled 2023 IRP if the Commission determines that refiling is appropriate. We recognize that non-acknowledgement is not to be taken lightly, and should be accompanied by clear direction from the Commission on the changes that will enable future IRP filings to be acknowledged. However, this is PSE's first gas IRP filing since the CCA was enacted, and the Commission's decision will be critically important in setting expectations for CCA-compliant IRPs going forward.

Ultimately, PSE's IRP does not represent a meaningful effort to decarbonize PSE's operations in compliance with the CCA, and it proposes a risky, allowance-dependent compliance strategy that if acknowledged would set PSE on a dangerous course that diverges from the CCA's decarbonization requirements and overall emissions cap. The strategy in PSE's preferred portfolio does not satisfy the Commission's lowest reasonable cost standard,[71] because it does not adequately consider the fundamental "risks imposed on ratepayers" or the "cost of risks associated with environmental effects including emissions of carbon dioxide" that arise from PSE's severe overreliance on CCA allowances and its underestimate of their costs (as detailed in Section II above). PSE's strategy also does not select the "lowest cost mix of resources," because the net present cost of its electrification scenario is lower than that of its preferred portfolio (as demonstrated in Section IV above).

Fortunately, PSE has a lower-cost, significantly lower-risk strategy available: significantly greater emphasis on and investment in electrification. This is no surprise. The CCA's emission caps and allowance market were designed to encourage major emitters to efficiently pursue decarbonization, rather than relying on "stop-gap compliance instruments" like Price Ceiling Units "for long-term compliance planning."[72] So it is expected that electrification, which the State Energy Strategy and other analyses have identified as the primary lowest-cost, lowest-risk strategy for decarbonizing Washington's buildings, would be a lower-cost CCA compliance option for PSE than relying exclusively on allowance purchases. Indeed, this is exactly what our analysis in Section IV shows. And because an electrification-focused strategy would rely far less on allowance purchases, it would avoid the risks to PSE's ratepayers discussed in Section II above. We recommend that the Commission direct PSE to pursue significantly more electrification in future IRP analysis and action plans, consistent with these findings.

We also recommend that the Commission direct PSE in its future filings to provide a substantially more transparent analysis of electrification and alternatives that corrects the unreasonable assumptions and analytical errors identified in these comments. Our specific recommendations for improving this analysis are included in the list below, and the rationale underlying those recommendations is found in Sections II and III above.

[71] WAC § 480-90-238(2)(a)-(b), 3(g).
[72] Staff Comments on 2023 Cascade IRP at 13.

In summary, Sierra Club's specific recommendations for the Commission and for PSE include:

- Decline to acknowledge PSE's 2023 IRP.
- Direct PSE to overhaul its capital forecast and decarbonization strategy to better incorporate electrification, consistent with the finding that it is a lower-cost, lower-risk CCA compliance strategy than overreliance on allowances.
- Assume that CCA allowances will be purchased at the ceiling price for any portfolios that use more allowances than will be available statewide or significantly exceed PSE's purchase limit.
- Appropriately account for inflation in estimating CCA allowance prices by applying the inflation rate that PSE uses elsewhere in its IRP analysis.
- Appropriately account for volatility and increases in gas and alternative fuel prices.
- Expressly consider the risks of CCA compliance strategies that would make it difficult or costly to comply with policies that require additional decarbonization (e.g., by failing to make near-term investments that make it less costly to achieve long-term decarbonization targets).
- Account for IRA electrification incentives, at minimum including currently-available tax credits, and including rebate incentives as relevant programs are developed.
- Fully document and explain all inputs, assumptions, and analytical methods that are used to estimate electrification measure costs.
- Apply reasonable assumptions in developing electrification measure costs, including clear and consistent use of incremental equipment costs for scenarios that assume electric equipment replaces gas equipment upon burnout.
- Fully document and explain all inputs, assumptions, and analytical methods regarding heat pump specifications, COPs, switchover temperatures, number of hours relying on backup heat, impacts on peak electric load, and related inputs and conclusions in future filings, including PSE's updated Gas Decarbonization Study, Targeted Electrification Strategy, and 2025 gas IRP.
- Apply reasonable assumptions about heat pump specifications, COPs, switchover temperatures, and other performance metrics that accurately reflect the range of models that are currently available and can be expected to be available over the planning period. These assumptions should be based on efficient electric models with switchover temperatures no higher than 10F. Ideally, these assumptions should be based on specifications for particular models, or at least compared to the specifications of particular models to assess their reasonableness and the sensitivity of the analysis to model specifications.
- Comply with all relevant requirements of the 2022 PSE General Rate Case settlement in developing PSE's updated Gas Decarbonization Study, Targeted Electrification Strategy, and 2025 gas IRP, and in making these analyses available and transparent.
- Continue moving toward holistic, integrated energy delivery system modeling that considers both the gas and electric businesses.

- Apply consistent customer growth assumptions when comparing the preferred portfolio to other scenarios under consideration (recognizing that one or more sensitivity scenarios may adjust these assumptions, as long as the primary scenarios under consideration can be compared using the same customer growth assumptions).
- Apply reasonable assumptions about the current and future emissions intensity of PSE's electric system that accurately account for CETA compliance.
- Apply consistent treatment to T&D costs by either including T&D costs for both the electric system and the gas system, or by omitting T&D costs for both systems.

Thank you for the opportunity to submit these comments.

Dated: June 5, 2023

Respectfully submitted,

/s/ Jim Dennison

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Docket: UG-220242

Sierra Club
Comments on Puget Sound Energy
Final 2023 Gas Integrated Resource Plan

Exhibit A
PSE, Response to Sierra Club Data Request 005

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

Docket UG-220242
Puget Sound Energy
PSE 2023 Integrated Resource Plan

SIERRA CLUB INFORMAL DATA REQUEST NO. 005:
REQUESTED BY: Jim Dennison

Please refer to Table 2.5 at page 2.18 of the IRP.

a. For each Electrification Policy listed, please provide the quantity of fully electric and hybrid heat pumps installed per year and associated unit costs.

b. Please detail any other costs included in “Measure Costs.”

c. Please explain whether “Measure Costs” includes the full cost of the appliance (as shown in Appendix C, page A-12) or the incremental cost. If the costs included are incremental costs, please identify and explain the baseline from which incremental costs are measured.

d. For calculating the “Measure Costs,” what portion of the appliance costs shown on Appendix C, page A-12 are included? For example, does measure cost include a portion of the appliance costs borne by the customer, a portion of costs borne by PSE, or the total cost? If a portion of the costs is included, please explain what that portion is.

e. Please refer to page 2.19 of the IRP, which states that the costs in Table 2.5 “do not reflect the cost of any IRA incentives.” Does this statement include tax credits available under the IRA, such that the costs in Table 2.5 do not reflect those tax credits? For any answer other than “yes,” please explain.

f. Please detail whether and how any available incentive funds are used in calculating the “Measure Costs,” recognizing that IRA incentives are not included as stated at page 2.19 of the IRP.

g. Please detail the quantity and unit cost of appliances other than heat pumps considered in "Measure Costs.”

h. Please identify the specific make(s) and model(s) of equipment used to formulate assumptions used in PSE’s analysis of the “Full Electric” and “Hybrid Heat Pump” electrification policy scenarios, and provide complete equipment specification information as provided by the manufacturer(s) for this equipment.

i. Please provide the assumed lifespan of each appliance or asset included in the "Measure Costs" or "Electric System Costs."

Response:

a. Please refer to slides 34 – 37 of Attachment B to Puget Sound Energy's ("PSE") Response to Sierra Club Informal Data Request No. 001 for the number of fully electric and hybrid heat pumps installed per year. Attached as Attachment A to PSE's Response to Sierra Club Informal Data Request No. 005, please find an MS Excel spreadsheet containing the appliance unit costs.

b. Please see PSE's Response to Sierra Club Informal Data Request No. 005(a) for information regarding other costs included in "Measure Costs."

c. "Measure Costs" include both the baseline costs as well as incremental costs that are shown in the Gas Utility Integrated Resource Plan ("IRP") Appendix C, page A-12, as the average cost per unit.

d. PSE's gas IRP uses total cost in its analysis, so the total incremental costs are included in the "Measure Costs" shown in Appendix C, page A-12.

e. Yes, the costs in Table 2.5 of the IRP do not reflect tax credits under the IRA.

f. No incentive funds are included in the measure costs other than the elements included in the gas IRP, Appendix C, Table 24.

g. Please see the unit costs in Attachment A to PSE's Response to Sierra Club Informal Data Request No. 005, the quantities are per PSE's Response to Sierra Club Informal Data Request No. 005(a), above.

h. The costs used in the analysis of the "Full Electric" and "Hybrid Heat Pump" policy scenarios are not based on specific equipment makes or models but rather use survey responses from contractors/builders of full replacement equipment and hybrid heat pump applications.

i. The effective useful life of an air source heat pump is assumed to be 15 years.

ATTACHMENT A to PSE's Response to Sierra Club Informal Data Request No. 005

Docket: UG-220242

Sierra Club
Comments on Puget Sound Energy
Final 2023 Gas Integrated Resource Plan

Exhibit B
PSE, Response to Sierra Club Data Request 001, Attachment B

Gas Utility IRP

September 22, 2022

PUGET SOUND ENERGY

Safety Moment

As we are heading into fall with raining season ahead, some safe driving tips:

- Follow S.A.F.E.R driving tips:
  - **S**pace - Allow enough space between cars.
  - **A**ttitude - Be patient and do not tailgate other cars.
  - **F**oresight - Ensure that you are seen by others by using turn signals, headlights and brakes lights are in good condition, and avoid others' blind spots.
  - **E**yesight – Stay focused, don't text and drive
  - **R**esponsibility – Always wear seat belts, and remind passenger to wear seat belts even in the back seat

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Welcome to the Webinar and Thank you for Participating!

If you **want to type a question regarding the presentation,** insert **"Slide X followed by your question"** in the chat box!

If you **have a technical issue or a general question**, please type it in the chat box.

Please **keep yourself on mute** unless you are speaking.

If you want to **ask a question verbally,** click the 'Reaction' button and click on the **'Raise Hand'** option and we will call on you.

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Facilitator Requests

- Engage constructively and courteously towards all participants
- Respect the role of the facilitator to guide the group process
- "Take space and make space"
- Avoid use of acronyms and explain the technical questions

Agenda

Time	Agenda Item	Presenter
1:00 – 1:10 p.m.	Opening	Sophie Glass, Triangle Associates
1:00 – 1:15 p.m.	Recap from August 24 Meeting	Phillip Popoff, PSE
1:15 – 1:20 p.m.	Inflation Reduction Act Impacts	Jennifer Coulson, PSE
1:20 – 1:40 p.m.	Final Gas Scenarios and Sensitivities	Jennifer Coulson, PSE
1:40 – 2:40 p.m.	Conservation Potential Assessment (CPA) Results	Gurvinder Singh, PSE Aquila Velonis, Cadmus Group
2:40 – 2:50 p.m.	Break	
2:50 – 3:55 p.m.	Final Climate Commitment Act (CCA) Pricing and Gas Alternatives	Gurvinder Singh, PSE Steve Schueneman, PSE Bill Donahue, WFD Consulting
3:55 – 4:00 p.m.	Next Steps	Sophie Glass, Triangle Associates
4:00 p.m.	Adjourn	Sophie Glass, Triangle Associates

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Today's Speakers

Phillip Popoff
Director, Resource Planning Analytics, PSE

Jennifer Coulson
Manager, Operations and Gas Analysis, PSE

Bill Donahue
WFD Consulting

Sophie Glass
Co-facilitator, Triangle Associates

Gurvinder Singh
Consulting Energy & Resource Planning Analyst, Resource Planning and Analysis, PSE

Aquila Velonis
Senior Associate, Cadmus Group

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Recap from August 24 Resource Adequacy Meeting

Phillip Popoff

Director, Resource Planning Analytics, PSE

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Themes Heard at the August 24 Meeting

Themes/ questions heard at August 24th Meeting (Resource Adequacy)	Answer
PSE needs to provide more context and clarity on the steps in which IRP stakeholders can have a role in conservation planning.	PSE prepares a Biennial Conservation Plan (BCP) consistent with RCW 19.285.040(1), WAC 480-109-120, and requirements outlined in Appendix A of the Commission Order 01 of Docket UE-190905. Stakeholder engagement related to the development of the BCP occurs at various steps of plan development, as described in the BCP. In addition, after the BCP is filed with the Washington Utilities and Transportation Commission by November 1st of every odd-numbered year, the public has opportunities to submit written comments on the BCP within 30 days of the utility's filing and participate at any WUTC meetings to review and consider the BCP.
Participation in the IRP process is critical to stakeholders.	PSE agrees that stakeholder engagement is critical to the IRP process. We are assessing the stakeholder process for the next IRP cycle in order to improve the process.
It is critical to include the most recent data in forecasting models.	PSE agrees. It is important to include the most recent data in forecasting models as feasible.
It is good to see that PSE is incorporating climate change into modeling and resource planning.	Thank you for your comment.
Concerns about PSE's commitment to meeting the 2030 CETA requirements.	PSE is committed to achieving the 2030 CETA requirements, as outlined in our 2021 Clean Energy Implementation Plan (CEIP).

More responses on unanswered questions from August 24 meeting and feedback form are addressed in Feedback Report.

Inflation Reduction Act Impacts

Jennifer Coulson

Manager, Operations and Gas Analysis, PSE

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Overview of IRA Impacts on the Gas Utility

2023 Gas Utility IRP

- The new Production Tax Credit (PTC) & Investment Tax Credit (ITC) are really focused on resources that would support the electric utility
- However, **the following impact the gas utility**
  - **2023 Gas Utility IRP**
    - **PTC for new technologies includes hydrogen** and hydrogen hubs, making this technology more cost effective. This will be included in PSE's analysis
  - **Future IRP cycle**
    - **Methane Emissions Reduction Program**: Beginning in 2025, the EPA will begin calculating and enforcing methane emissions fees from covered gas processing, transmission and storage facilities. Likely to impact wholesale gas prices in the future.
    - **Energy Efficiency Home Rebates:** The legislation establishes pair of consumer home energy rebate programs, focused on lower & moderate-income consumers, totaling $9 billion. One of the programs is exclusively focused on electrification rebates.
    - The **Alternative Fuel Tax Credit (AFTC)**, a $0.50/gal excise tax credit utilized by PSE customers for natural gas transportation uses, has been extended through 2024.

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Final Scenarios and Sensitivities

Jennifer Coulson

Manager, Resource Planning and Analysis

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How Does PSE Model Different Conditions to Get a Portfolio?

- IRP builds long-term portfolio – mix of resources to meet customer gas needs – based on demand, price and applicable laws
- IRP analysis will look forward to 2050; the exact combination of conditions and risks are unknown
- Uses scenarios and sensitivities to help model and understand potential outcomes based on various conditions

What are scenarios?

Scenarios **test how different sets of economic and policy conditions affect portfolio costs and risks**, followed by the inputs used to create those scenarios

What are sensitivities?

Sensitivities start with the optimized, least cost Reference Case Scenario portfolio produced in the scenario analysis and **change a resource, environmental regulation or other condition to examine the effect of that change on the portfolio.**

Example:

Scenario #	Scenario Name	Parameters		
		A	B	C
1	Reference Case	X	Y	Z
2	abc	A	B	C

	Sensitivity Name	Parameters		
		A	B	C
1	Reference Case	X	Y	Z
A	abc	X	Z	Z

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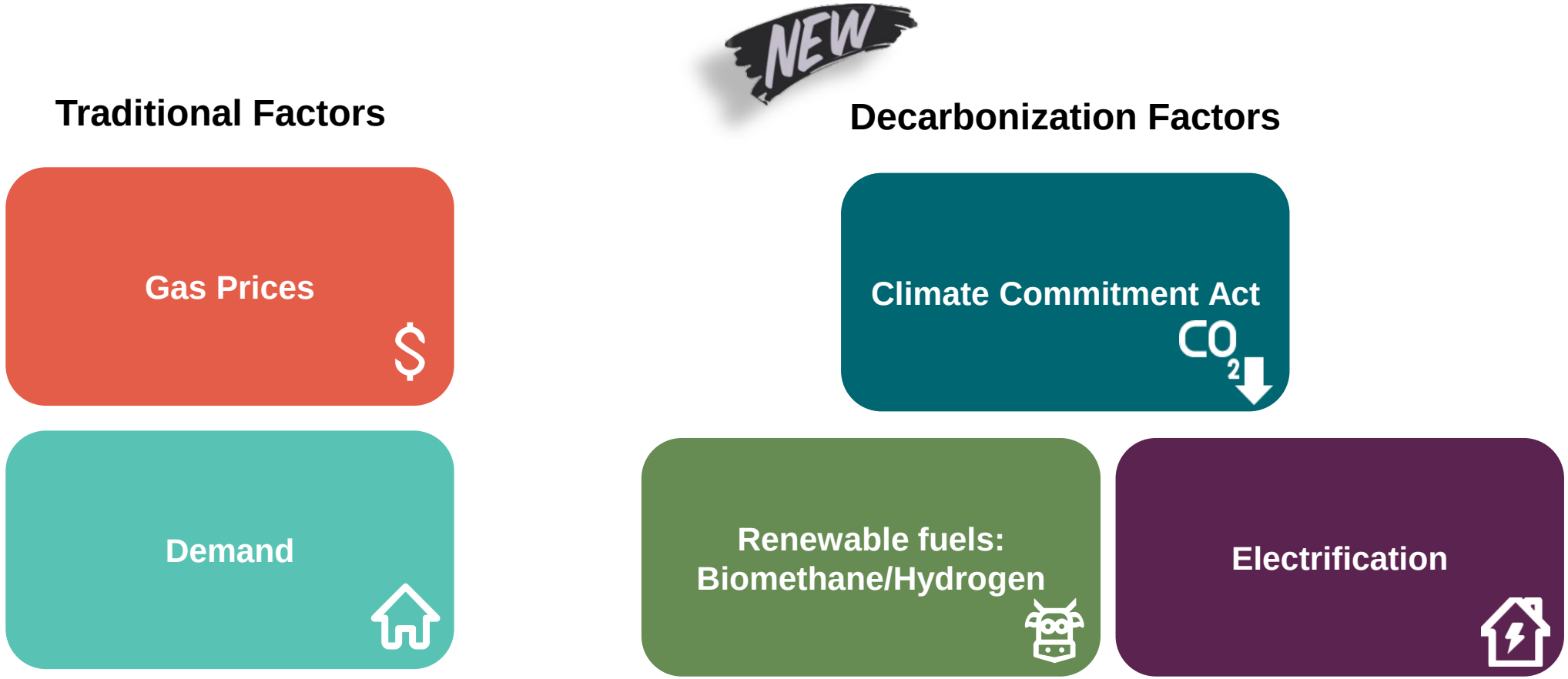
Input Components that were Considered in the Development of the Scenarios



Changes Since March 31st Stakeholder Meeting

Removal of some of the input components reduced the number of scenarios but increased the number of sensitivities:

- Clarifications
  - Hybrid heat pump treated as a conservation measure
  - Externality cost not applied to renewable fuels
  - Incorporating what we understand of the Inflation Reduction Act
- CCA Draft rules released
  - Consolidated carbon policies scenarios to a sensitivity
- Incorporation of stakeholder feedback
  - ✓ Will model State Energy Strategy as electrification scenario
  - ✓ Added no gas growth sensitivity
  - ✓ RNG sourced in WA only now a sensitivity, using North America for all other scenarios and sensitivities
  - ✓ Will include cold weather and ground source heat pumps along with hybrid heat pumps

2023 Gas IRP: Scenarios

	Scenario #	Scenario Name	CCA				Typical Gas IRP Parameters		
			Carbon Constraint Parameter	Allowance Price	Renewable Fuel Source Location	Heating Load Shift	Demand	Gas Growth?	Gas Price
★	1	Reference Case	Price	Expected	North America	Economic	Mid (F22)	yes	Mid
★	2	Electrification - State Energy Strategy (SES)	Follow SES line	Floor	North America	Force in Cadmus Electrification Results	Zero by 2050	no	Mid

★ Scenario will have an electric analysis modeled in Aurora

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2023 Gas IRP: Sensitivity

	Sensitivity Name	CCA		Renewable Fuel		Typical Gas IRP Parameters	
		Carbon Constraint Parameter	Allowance Price	Renewable fuel source location	SCGHG Added?	Demand	Gas Price
1	Reference Case	Price	Expected	North America	No	Mid (F22)	Mid
A	Allowance Price High	Price	Ceiling	North America	No	Mid (F22)	Mid
B	Allowance Price Low	Price	Floor	North America	No	Mid (F22)	Mid
C	Carbon Constraint	Free Allowance line	Expected	North America	No	Mid (F22)	Mid
D	Alternative Fuel Location WA	Price	Expected	WA	No	Mid (F22)	Mid
E	Alternative Fuel without SCGHG	Price	Expected	North America	Yes	Mid (F22)	Mid
★ F	HHP Policy	Price	Expected	North America	No	Mid (F22) - policy driven HHP adoption	Mid
G	No gas growth	Price	Expected	North America	No	Zero gas growth after 2026	Mid
H	High Gas Price	Price	Expected	North America	No	Mid (F22)	High

★ Sensitivity will have an electric analysis modeled in Aurora

Note: 'No' on SCGHG adder = no penalty

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Conservation Potential Assessment Results

Gurvinder Singh
Consulting Energy & Resource Planning Analyst, Resource Planning and Analysis, PSE

Aquila Velonis
Senior Associate, Cadmus Group

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2023 IRP: Conservation Potential Assessment – Natural Gas

September 22, 2022

Meeting Agenda

1. Scope Overview
2. Results
   a) Energy Efficiency
   b) Gas to Electric Conversion

Study Scope

Resources	Energy Efficiency (EE)

Fuels	Natural Gas – EE, Gas to Electric

Primary Objectives

- Produce updated forecasts of achievable technical potential
- 2024 – 2050
- Develop supply curve inputs

Updated Data

- Load and customer forecasts
- Updated customer segmentation
- PSE measure case
- Program accomplishments
- Updates based on codes and standards
- Climate change adjustments
- Non-Energy Impacts (NEIs)
- Named Communities & Equity

Natural Gas Energy Efficiency Potential Results

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Natural Gas Energy Efficiency Potential

2023 Achievable Technical Potential

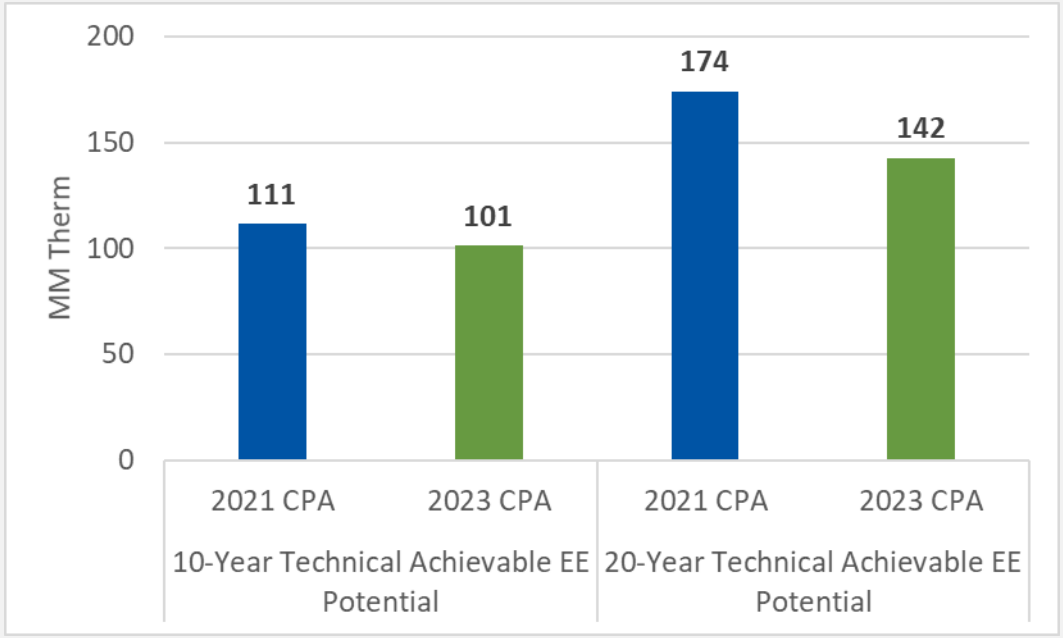
Sector	2-year (2025)	4-year (2027)	10-year (2033)	27-year (2050)
Cumulative Achievable Technical Potential (MMTherm)				
Residential	10	21	59	111
Commercial	7	14	39	51
Industrial	1	1	3	3
Total	18	37	101	165

Sector	2-year (2025)	4-year (2027)	10-year (2033)	27-year (2050)
Cumulative Achievable Technical Potential (MMTherm)				
Transport	4	9	23	26

Transport Customers:

- Less than 25k tons of CO_2 annual emissions - 309 small commercial and industrial sites
- Included in the CPA as a compliance requirement for the Climate Commitment Act (CCA)

Comparison to 2021 CPA



9% decrease in 10-year total potential

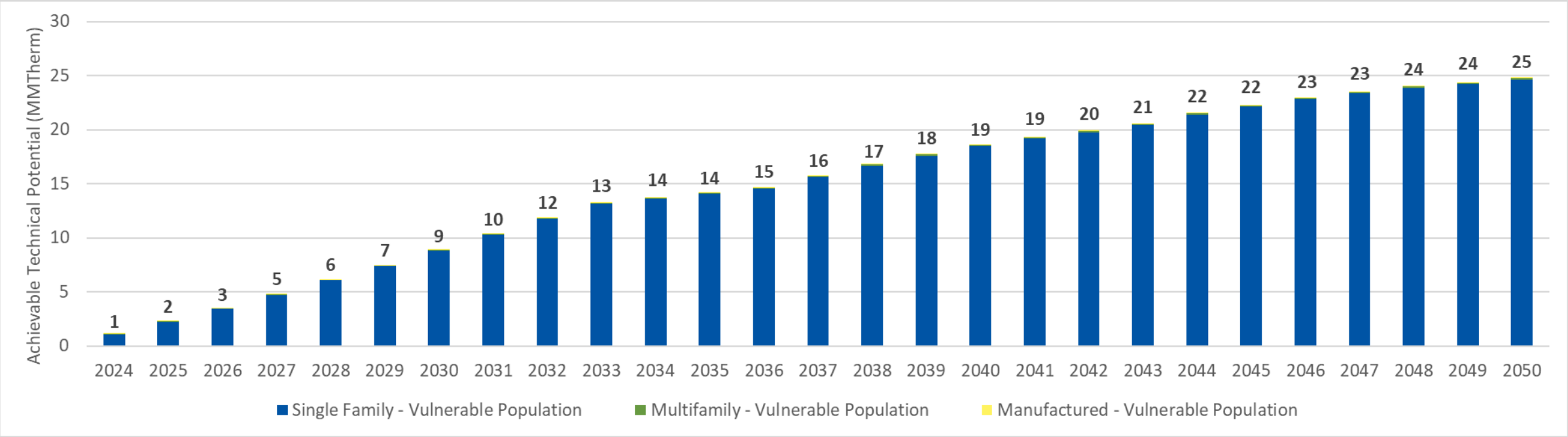
18% decrease in 20-year total potential

The 2023 IRP natural gas study period spans 27 years

The 2021 IRP spans 20 years

Figure shows only the first 20 years for comparison purposes

Natural Gas Energy Efficiency Potential for Vulnerable Populations



Vulnerable Population Potential:

- 22% of the residential potential (25 MMTherm) by 2050
- Levelized cost bundles are changed to 2/3 of TRC to reflect vulnerable populations on the supply curve

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Top Residential Measures

Cumulative Achievable Technical Potential (MMTherm)

Measure Name	10-Year	27-Year
Furnace - Premium Efficiency	8.6	26.3
Water Heater - ENERGY STAR Tankless	2.6	25.3
Smart Thermostat	10.6	11.3
Integrated Space and Water Heating	1.3	9.6
Duct Sealing	6.2	6.2
Window - Storm Window	5.2	5.2
Insulation - Attic	5.1	5.1
Insulation - Wall	4.8	4.8
Windows	2.7	2.8
Duct Insulation	1.8	1.8

Measure Changes from the Last CPA:

- Less potential for gas furnaces (lower UEC due climate change impacts lowering heating loads)
- Higher incremental costs for furnaces compared to the last CPA
- Lower showerhead potential (WA code)
- Added NEIs to more measures
- Updated to PSE Business as well new Council/RTF workbooks

Top C&I Measures

Cumulative Achievable Technical Potential (MMTherm)

Commercial

Measure Name	10-Year	27-Year
Re-Commissioning	7.6	7.6
Energy Management System	5.6	5.6
Space Heat - Gas Furnace	1.5	4.3
Window - Secondary Glazing	4.2	4.2
Weatherization - Attic/Roof Insulation	3.3	3.3
Pipe Insulation - Space Heat	3.0	3.0
Water Heat LE 55 Gal	0.3	3.0
Space Heat - Gas Boiler	1.2	2.8
Kitchen Hood - Demand Controlled Ventilation	2.0	2.0
Fryer	0.8	1.8

Industrial

Measure Name	10-Year	27-Year
Waste Heat From Hot Flue Gases To Preheat	0.37	0.37
Improve Combustion Control Capability And Air Flow	0.36	0.36
Process Improvements To Reduce Energy Requirements	0.32	0.32
Install Or Repair Insulation On Condensate Lines And Optimize Condensate	0.31	0.31
Heat Recovery And Waste Heat For Process	0.31	0.31
Optimize Heating System To Improve Burner Efficiency, Reduce Energy Requirements And Heat Treatment Process	0.18	0.18
Equipment Upgrade - Boiler Replacement	0.17	0.17
Thermal Systems Reduce Infiltration; Isolate Hot Or Cold Equipment	0.17	0.17
Equipment Upgrade - Replace Existing HVAC Unit With High Efficiency Model	0.15	0.15
Analyze Flue Gas For Proper Air/Fuel Ratio	0.15	0.15

Gas to Electric Conversion

Gas to Electric - Overview

RESIDENTIAL AND COMMERCIAL

- Incorporating EE impacts of replacing natural gas equipment with electric equipment within PSE's service area
  - Determine electric and natural gas baseline sales impact
  - Measure impacts and costs (levelized costs)
  - Associated electric and natural gas energy efficiency potential estimates

INDUSTRIAL

- An analysis that converted a portion (~30%) of natural gas loads based on prior analysis by Cadmus and E3.

PSE Service Area Impacts:

Electric only – natural gas equipment converts to electric (increases PSE electric load)

Natural gas only – converted to electric equipment (reduces PSE natural gas load)

Combination service – converted to electric equipment (increases PSE electric load and reduces PSE natural gas load

Study End-Uses	Residential	Commercial	Electric Only ▲	Natural Gas Only ▼	Combination Service ▲▼
Heat Pump	X	X	Electric		Electric
Hybrid Heat Pump/Gas Back-Up	X		Electric	Gas back-up	Electric/Gas back-up
Furnace	X	X		Gas	Gas
Boiler	X	X		Gas	Gas
Other Gas Heat	X			Gas	Gas
Dryer	X		Electric	Gas	Both
Cooking	X	X	Electric	Gas	Both
Water Heat	X	X	Electric	Gas	Both

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Gas to Electric Conversion Alternatives

Electrification supply curve based on three supply curves:

- **Market Hybrid Heat Pump/Gas Back-up**: Selection based on cost effectiveness in gas portfolio model and adoption capped based on customer survey
- **Policy Hybrid Heat Pump/Gas Back-up**: End of life replacement of gas equipment with hybrid heat pumps reaching 100% annual adoption within the study horizon
- **Policy Full Replacement**: End of life replacement of gas end uses with electric heat pumps (no gas back-up) reaching 100% annual adoption within the study horizon

In analyzing these alternatives, consider:

- Implementation ramp rates
- Interaction with energy efficiency savings – both gas and electric
- Total cost will include impacts on electric system
- Non-energy benefits of cooling from heat pumps

Heat Pump Research conducted to inform residential adoption for the market hybrid/back-up scenario and costs for all scenarios

- Customer survey results provided maximum adoption values for various heat pump applications
- Contractor/Builder interviews results provided cost data (equipment and conversion cost)

Gas to Electric – Technologies

Space/water heating systems, stoves/cooktops, and clothes dryers for existing customers and new constructions in the residential and commercial sectors

Sector	Electric Converted - Policy Full Scenario	Natural Gas Replaced - Policy Full Scenario
Residential	Ductless Heat Pump (DHP)	Furnace Full Replacement
Residential	Air Source Heat Pump (ASHP) - Market Average	Furnace Full Replacement
Residential	DHP	Boiler Full Replacement
Residential	DHP	Gas Wall Unit Full Replacement
Residential	Cooking (Electric) - Market Average	Cooking (Gas)
Residential	Dryer (Electric) - Non-Heat Pump	Dryer (Gas)
Residential	Water Heat - Market Average	Water Heat (Gas)
Commercial	Air Source Heat Pump - Market Average	Furnace/Boiler Full Replacement
Commercial	Cooking (Electric) - Market Average	Cooking (Gas)
Commercial	Water Heat - Market Average	Water Heat (Gas)
Industrial	Target Reduction Conversion of Natural Gas Load 30% Reduction	

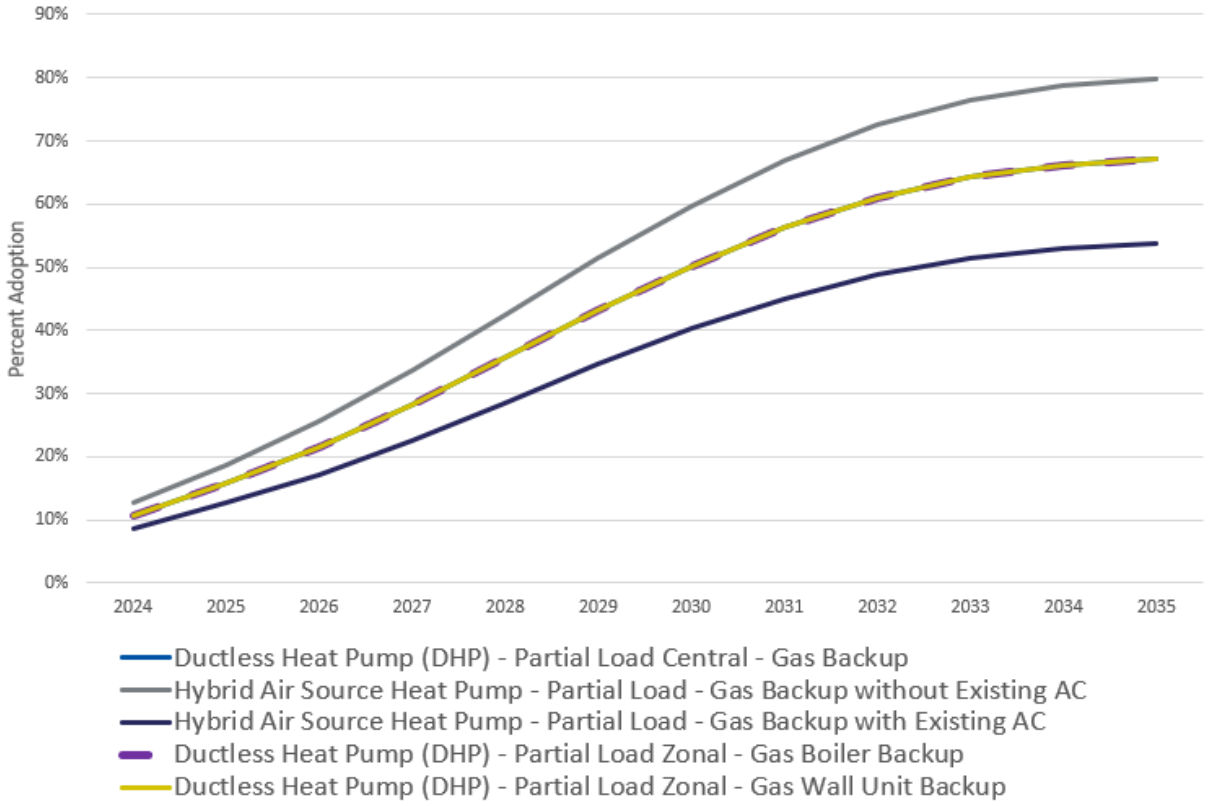
Sector	Electric Converted - Policy Hybrid and Market Hybrid Scenarios	Natural Gas Replaced - Policy Hybrid and Market Hybrid Scenarios
Residential	DHP with Furnace Back-up	
Residential	Hybrid ASHP with Furnace Back-up	
Residential	DHP with Boiler Back-up	
Residential	DHP with Gas Wall Unit Back-up	
Residential	Cooking (Electric) - Market Average	Cooking (Gas)
Residential	Dryer (Electric) - Non-Heat Pump	Dryer (Gas)
Residential	Water Heat - Market Average	Water Heat (Gas)
Commercial	Air Source Heat Pump - Market Average	Furnace/Boiler Full Replacement
Commercial	Cooking (Electric) - Market Average	Cooking (Gas)
Commercial	Water Heat - Market Average	Water Heat (Gas)
Industrial	Target Reduction Conversion of Natural Gas Load 30% Reduction	

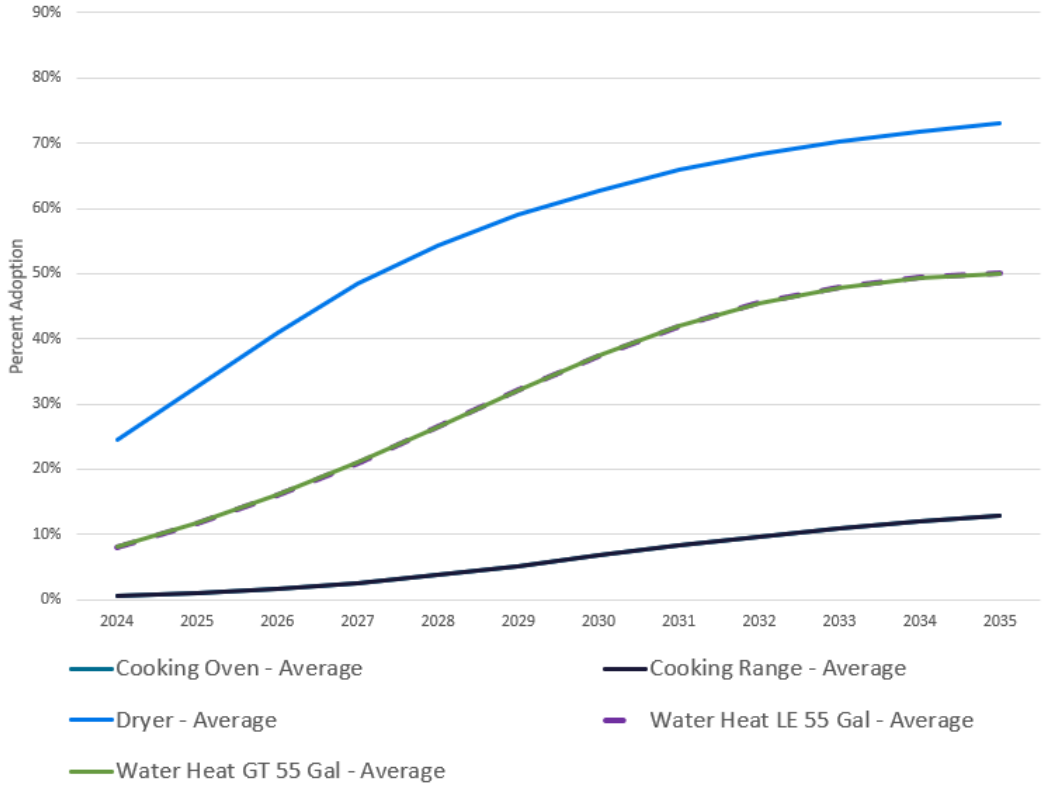
*Green lines highlights the residential difference from Policy Full to the Market Hybrid and Policy Hybrid scenarios

Hybrid/Back-up Assumptions:

- 88% electric consumption vs. 12% natural gas consumption based on BeOpt modeling using Seattle area weather data
- Assumed 35-degree setpoint cut-off

Adoption Curve: Residential Market Hybrid Heat Pump Scenario – (Single Family Example)





Heating Loads:

Adoption based on customer surveys (at 100% of incremental costs)

Ramp rate based on Council heat pump adoption (Lost Opportunity 5 Medium)

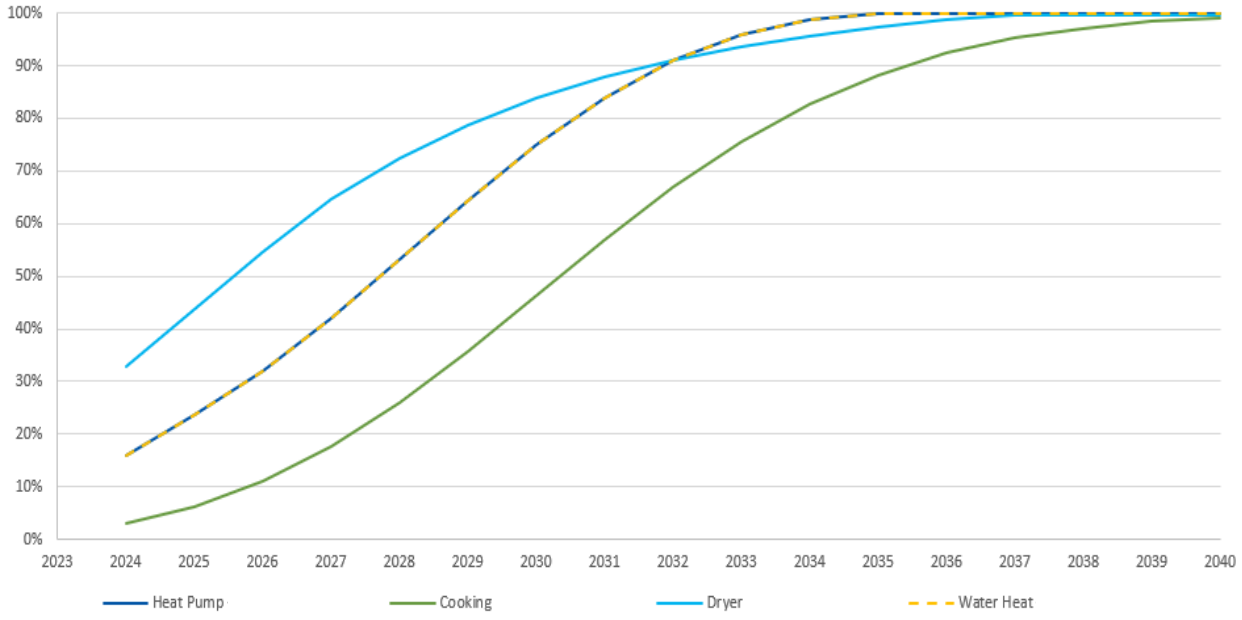
Other Loads:

- Dryer (75% max) - assume limited market barriers for dryers
- Water heat (50% max) - assume water heat has similar market adoption as ASHP
- Cooking (14% max) - based on customer survey (without incentives)

Ramp rates based on Council 2021 Power Plan

Adoption Curves (Continued)

Residential Policy Full Replacement and Policy Hybrid Heat Pump Scenarios Adoption Curves

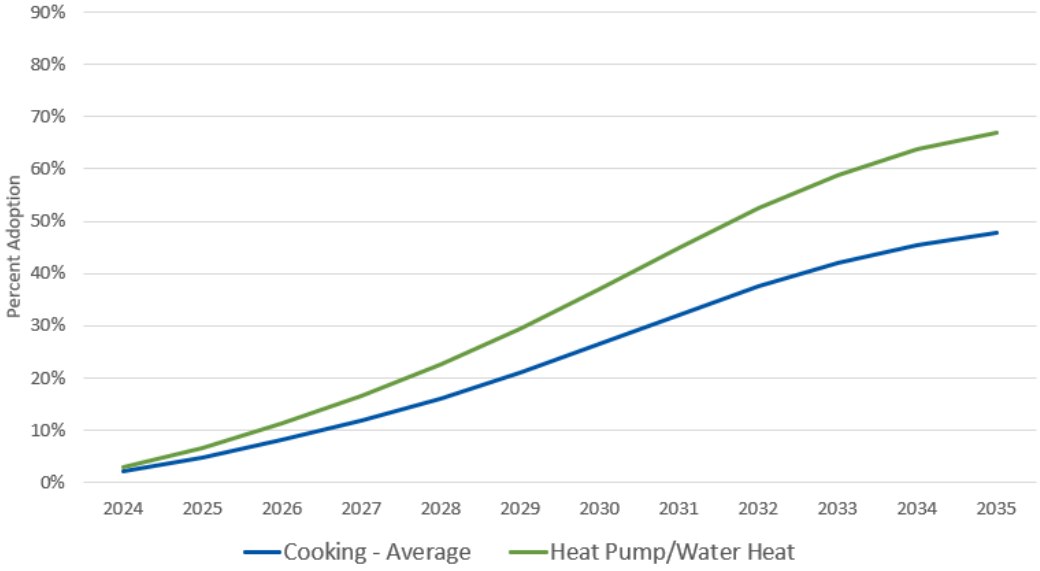


Residential Adoption Estimated:

- End of life equipment reaches maximum adoption of 100%

Ramp rates based on Council 2021 Power Plan

Commercial Adoption Curves

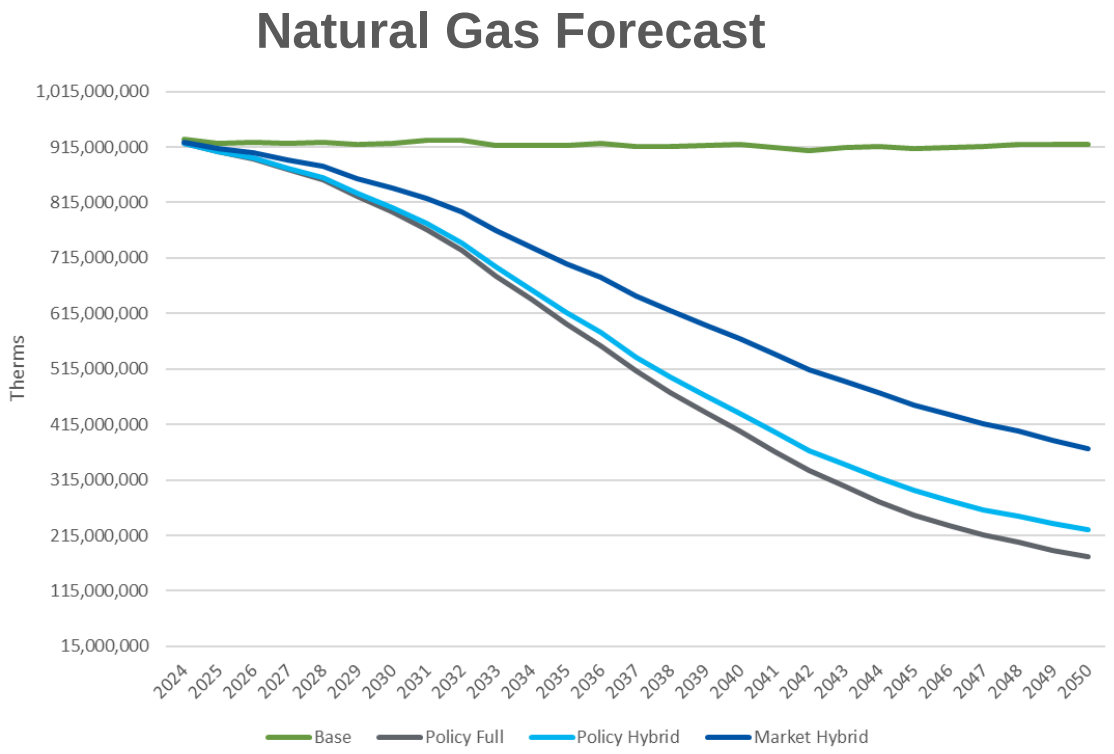


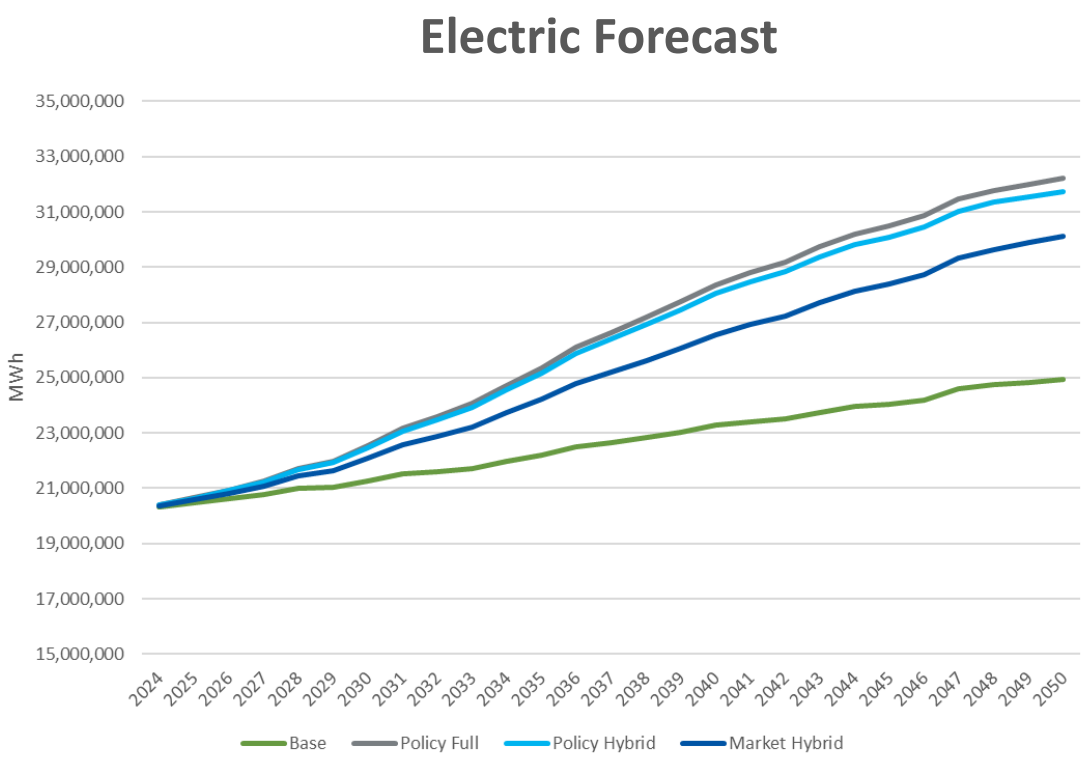
Commercial Adoption Estimated:

- Heat Pump and water heat (70% max) – based on ACEEE 2020 study "Electrifying Space Heating in Existing Commercial Buildings: Opportunities and Challenges"
- Cooking (50% max) - assume market barriers for converting some gas cooking equipment (estimated)

Ramp rates based on Council 2021 Power Plan

Impact on the Baseline Forecast (All Sectors)

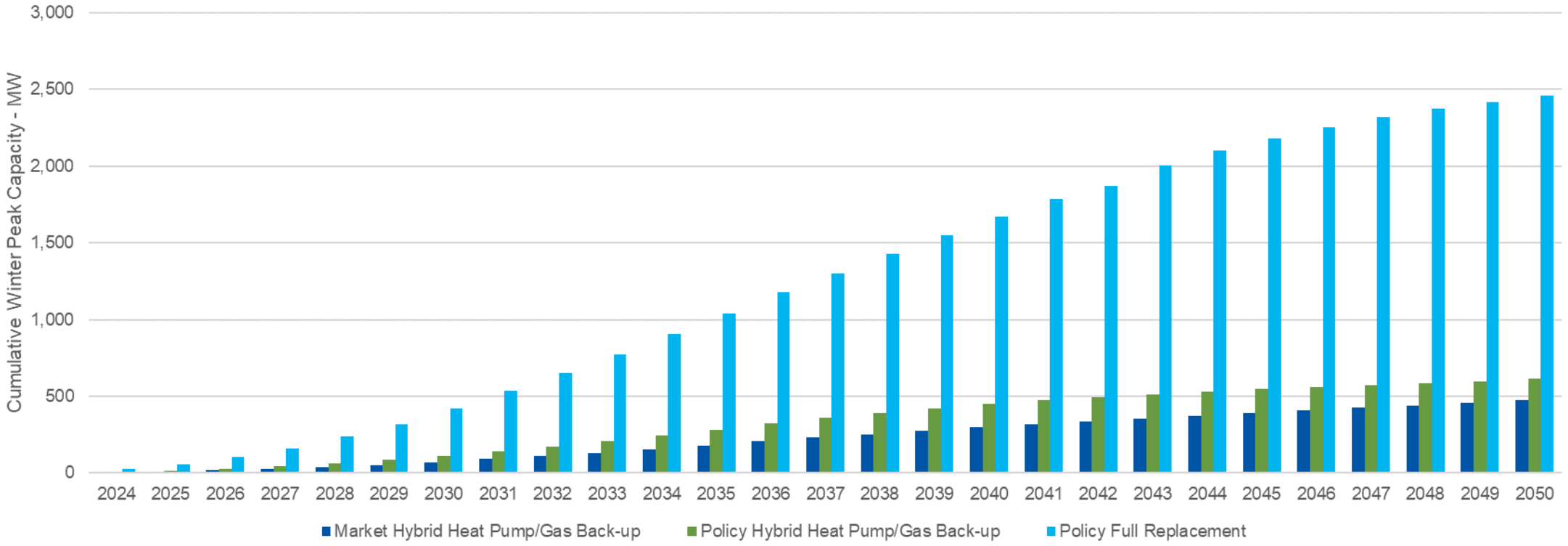




Gas to Electric Forecast Impact

- **Policy Full Replacement (Policy Full):** 29% electric increase and 81% gas decrease in 2050 from the base case forecast
- **Policy Hybrid Heat Pump (Policy Hybrid)**: 27% electric increase and 76% gas decrease in 2050 from the base case forecast
- **Market Hybrid Heat Pump (Market Hybrid):** 21% electric increase and 60% gas decrease in 2050 from the base case forecast

Added Peak Demand – By Scenario (All Sectors)



- Policy Full Replacement scenario shows 2,459 MW increase to the PSE system peak by 2050
- Policy Hybrid Heat Pump/Gas Back-up is roughly a quarter of the full replacement scenario (612 MW) by 2050
- Market Hybrid Heat Pump/Gas Back-up is 473 MW by 2050

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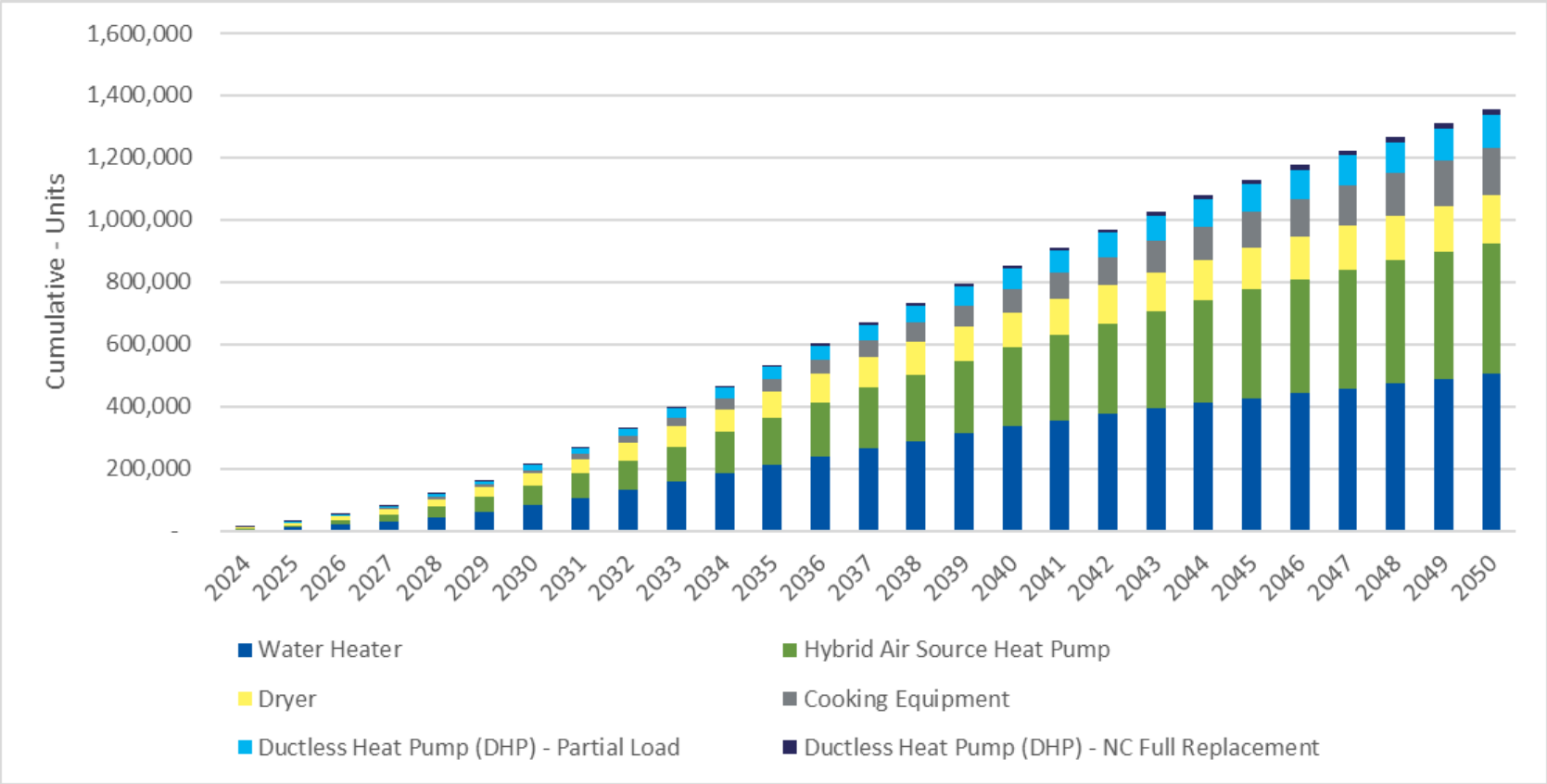
Residential Equipment Adoption – Market Hybrid Heat Pump Scenario



Units in 10-years:

- ~115k Hybrid air source heat pumps (includes existing and new construction)
- ~157k Water heaters
- ~64k Dryer equipment
- ~35k Ductless heat pumps
- ~26k Cooking equipment

Units in 27-years:

- ~419k Hybrid air source heat pumps
- ~506k Water heaters
- ~154k Dryer equipment
- ~124k Ductless heat pumps
- ~151k Cooking equipment

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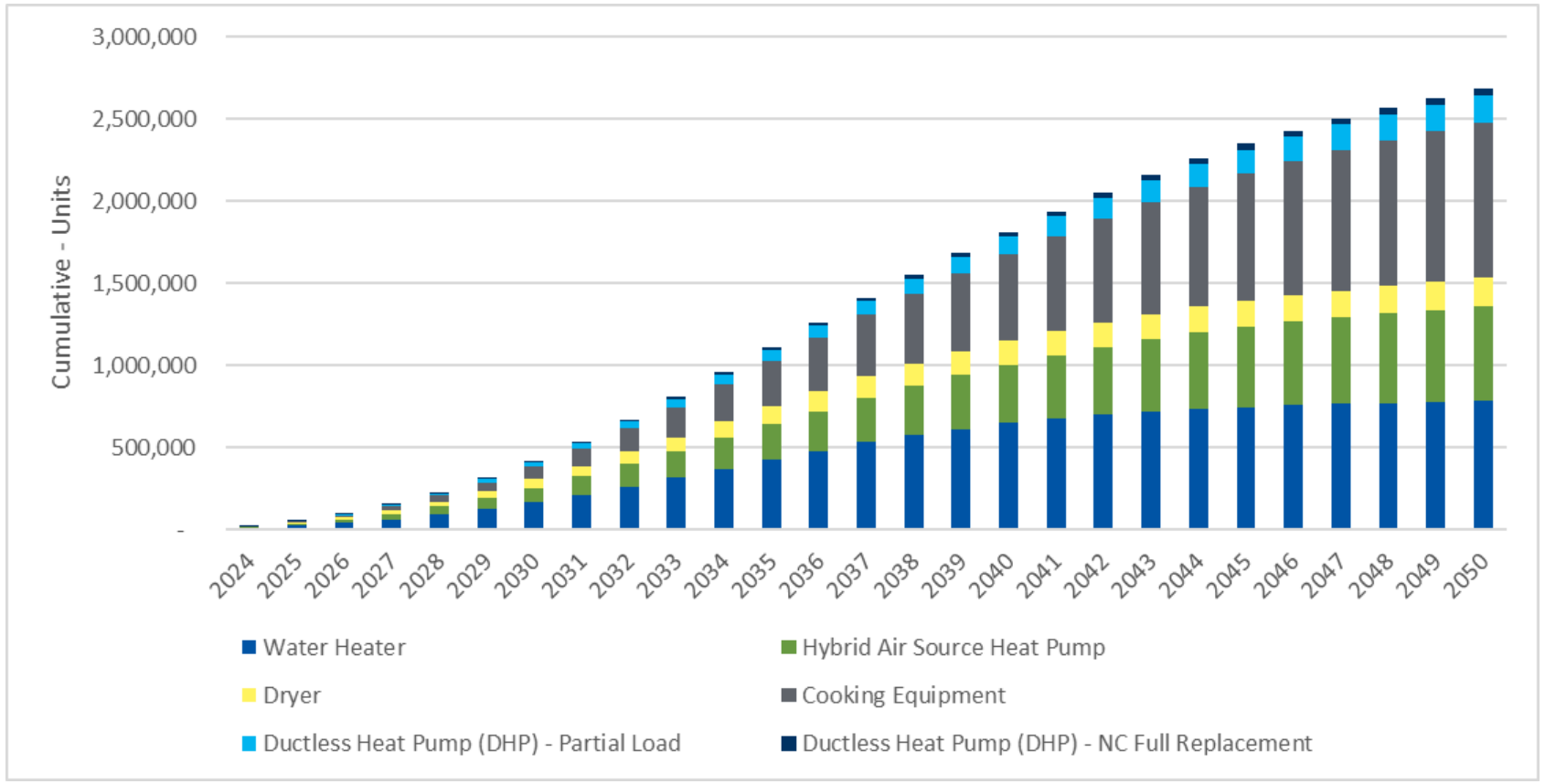
Residential Equipment Adoption – Policy Hybrid Heat Pump Scenario



Units in 10-years:

- ~162k Hybrid air source heat pumps (includes existing and new construction)
- ~315k Water heaters
- ~86k Dryer equipment
- ~62k Ductless heat pumps
- ~184k Cooking equipment

Units in 27-years:

- ~569k Hybrid air source heat pumps
- ~786k Water heaters
- ~179k Dryer equipment
- ~206k Ductless heat pumps
- ~945k Cooking equipment

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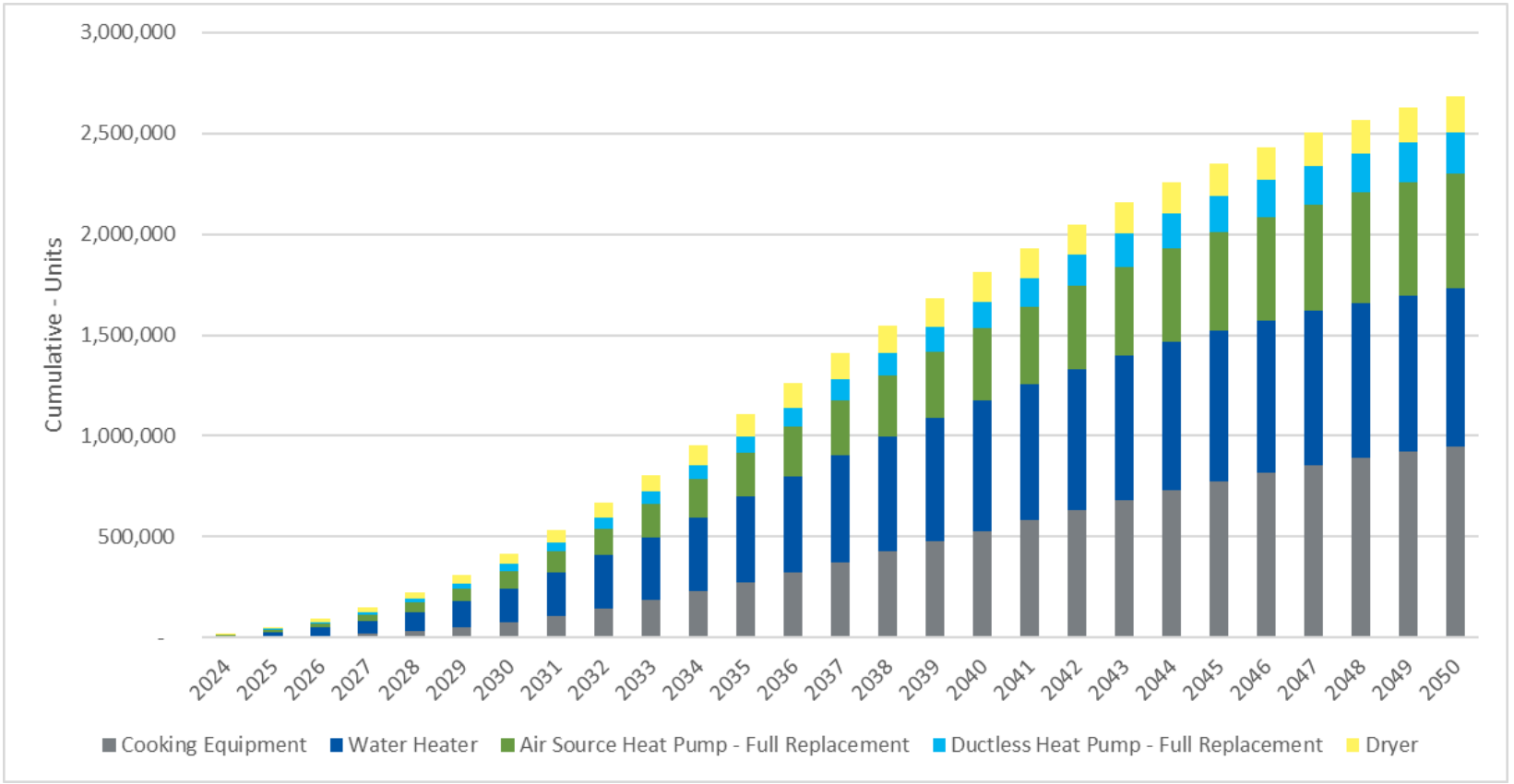
Residential Equipment Adoption – Policy Full Replacement Scenario



Units in 10-years:

- ~160k Air source heat pumps
- ~314k Water heaters
- ~85k Dryer equipment
- ~60k Ductless heat pumps
- ~184k Cooking equipment

Units in 27-years:

- ~569k Air source heat pumps
- ~786k Water heaters
- ~179k Dryer equipment
- ~206k Ductless heat pumps
- ~945k Cooking equipment

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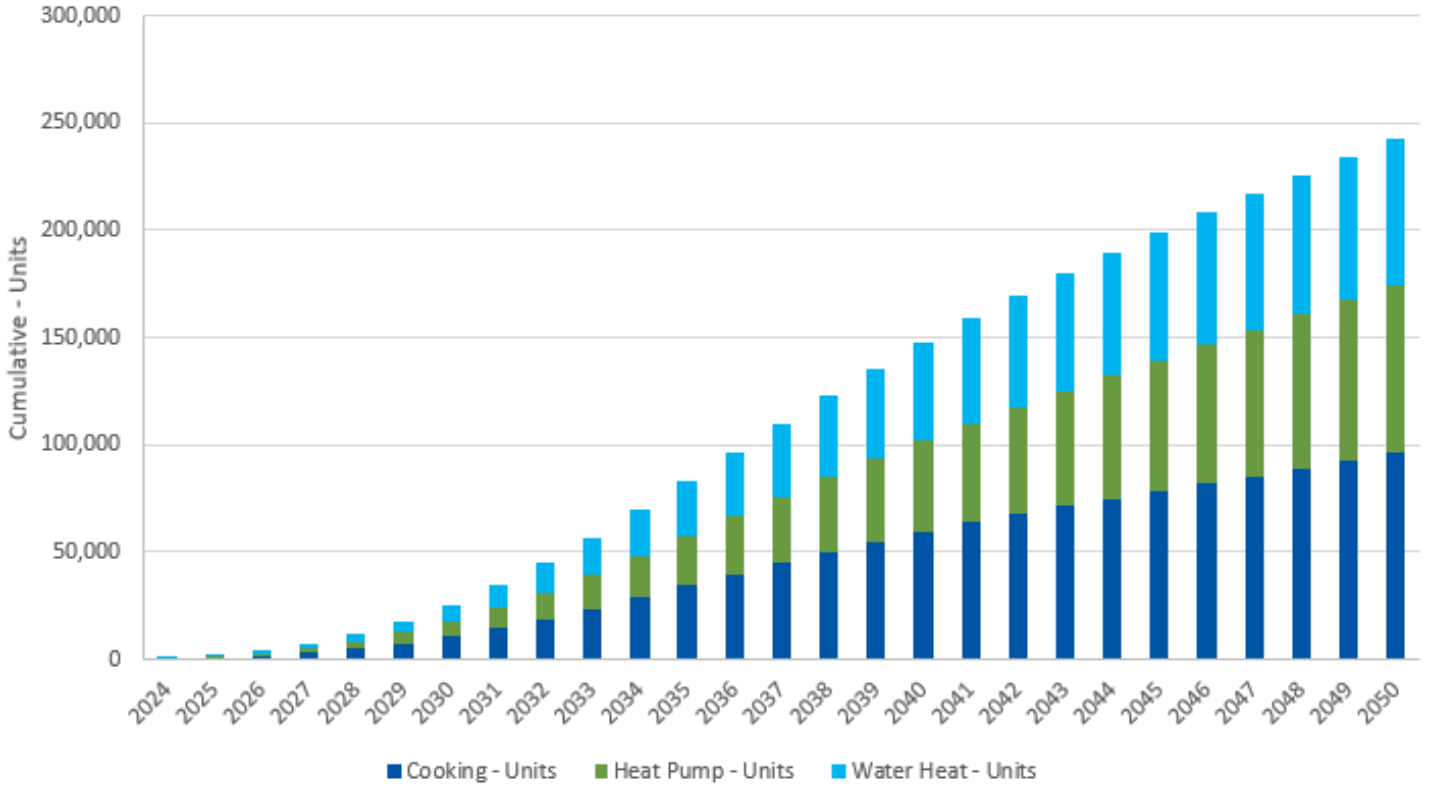
Commercial Equipment Adoption Forecast



Units in 10-years:

- ~15,800 Heat pump units
- ~17,400 Water heater units
- ~23,800 Buildings with cooking equipment

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Energy Efficiency Potential Impact

Sector	Achievable Technical Potential, Cumulative 2050			
	27-Year Base Energy Efficiency Potential	27-Year Policy Full Energy Efficiency Potential	27-Year Policy Hybrid Energy Efficiency Potential	27-Year Market Hybrid Energy Efficiency Potential
Electric (MWh)				
Residential	2,614,783	4,049,002	3,602,076	3,283,504
Commercial	2,020,415	2,303,609	2,303,609	2,303,609
Industrial	162,004	163,938	163,938	163,938
Total	**4,797,202**	**6,516,549**	**6,069,624**	**5,751,051**
Natural Gas (MMTherms)				
Residential	111	26	31	50
Commercial	51	19	19	19
Industrial	3	3	3	3
Total	**165**	**48**	**53**	**71**

*Table excludes transport customers

Policy Full scenario has the highest electric energy efficiency potential and lowest natural gas energy efficiency potential from equipment and retrofit measures

Policy Hybrid scenario has 27% higher electric energy efficiency potential than the base potential and 68% lower natural gas energy efficiency potential than the base potential

Market Hybrid scenario has 20% higher electric energy efficiency potential than the base potential and 57% lower natural gas energy efficiency potential than the base potential

Gas to Electric Levelized Cost Calculation

Costs Included	Benefits Netted Out
PV Capital Cost of Equipment Conversion	PV of Natural Gas Avoided
Program Cost (HVAC equipment program admin adder based on EE potential estimates, all other end-uses based on 21% of equipment conversion cost)	PV of Conservation Credit (10% of conserved natural gas energy)
Added Electric Energy Costs	PV of Non-Energy Impacts
Added Electric Generation Capacity Costs (for non-hybrid systems)	
Added Electric T&D Costs (for non-hybrid systems)	
Panel Upgrade Cost	

CADMUS

Questions

Aquila Velonis

Senior Associate | Portland, OR

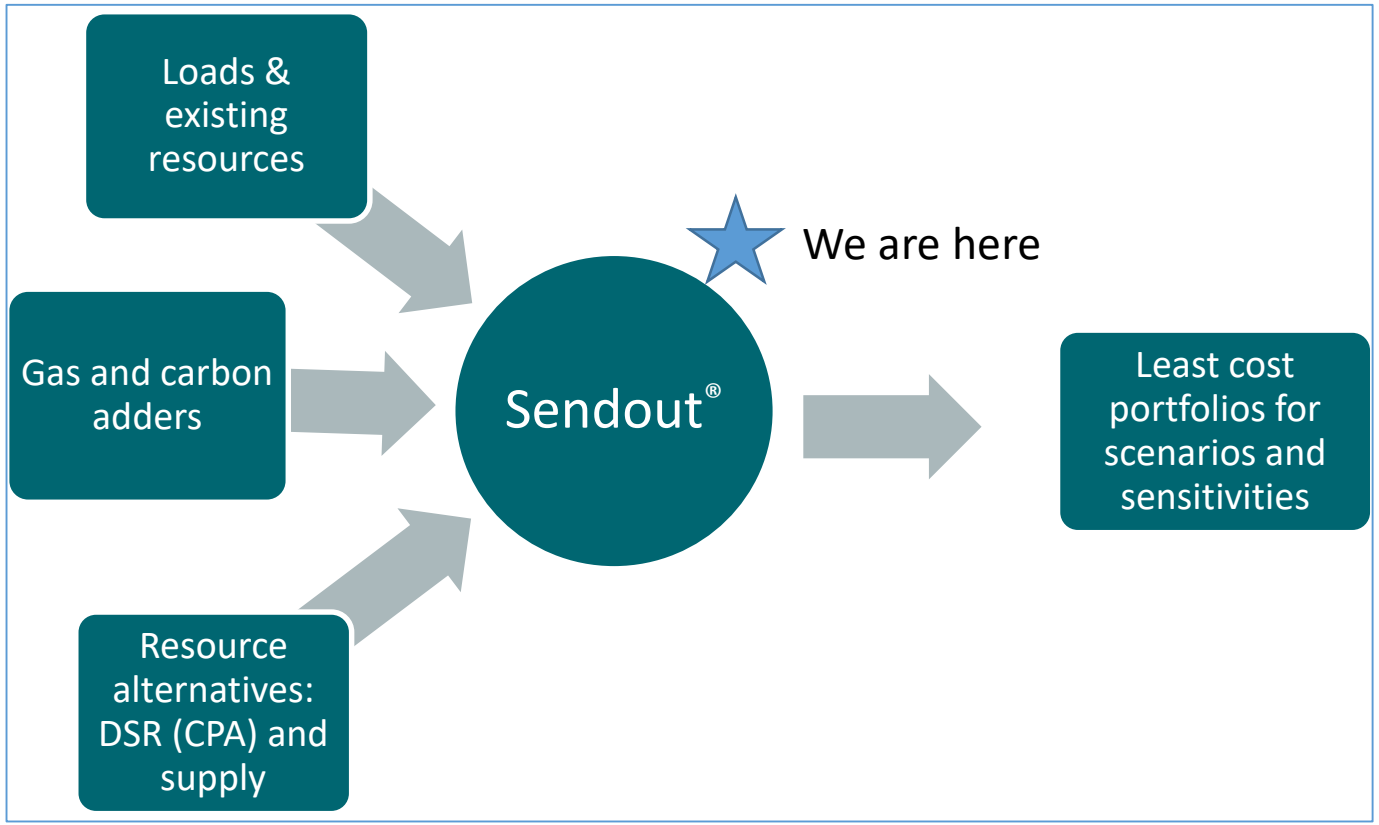
Contact: 503.467.7156

Gamze Gungor Demirci

Associate | Phoenix, AZ

Contact: 503.467.7132

Next Steps



PUGET SOUND ENERGY

Break

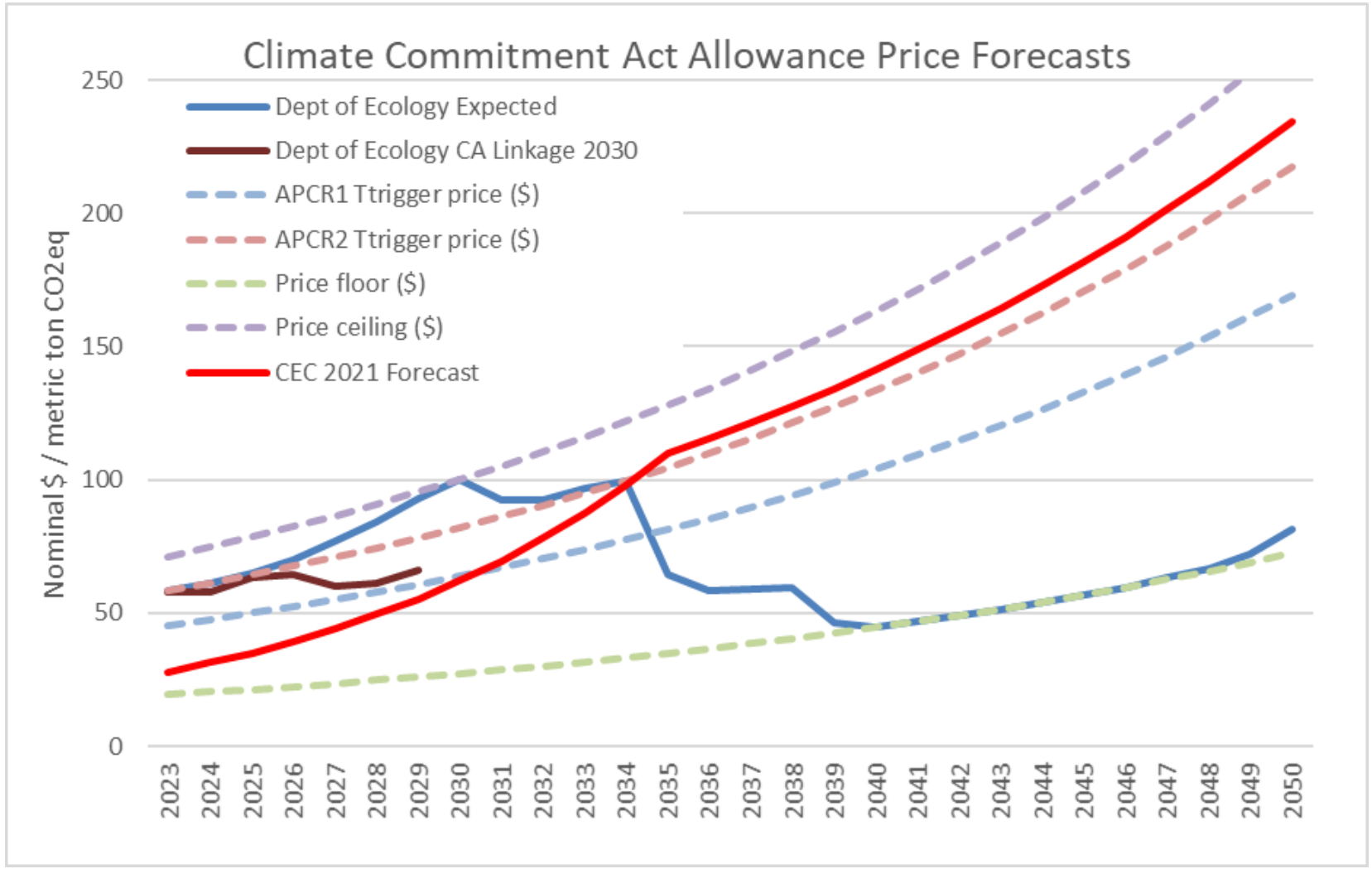
Please return in 10 minutes

Final CCA Pricing & Gas Alternatives

Gurvinder Singh
Consulting Energy & Resource Planning Analyst, Resource Planning and Analysis, PSE

PUGET SOUND ENERGY

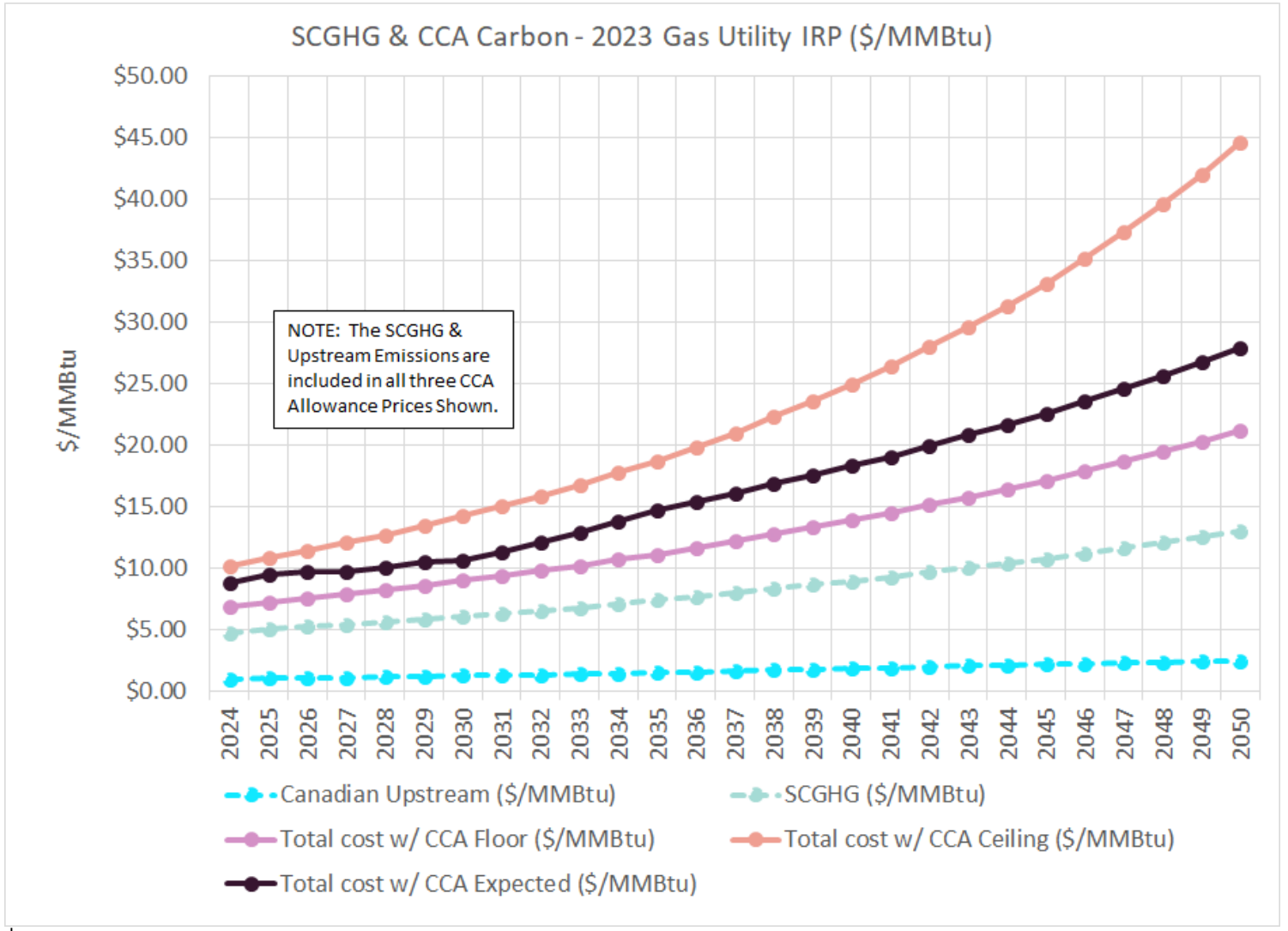
CCA Update: Allowance Pricing Forecast



- Dept. of Ecology (Ecology) expected price assumes no CA linkage
- Ecology looked at timing for linkage (forecast for 2030 linkage shown)
- PSE believes CA linkage is highly likely at some point
- 2023 IRP CCA allowance price assumption is the Ecology CA Linkage 2030, then transition to the CEC 2021 Forecast

PUGET SOUND ENERGY

2023 Gas Utility IRP Annual Carbon Price Adders



- CCA expected carbon price is the hybrid
- CCA ceiling and floor prices shown for reference
- Used Ecology emissions rate to get from $/metric to $/MMBtu
- These will be added to natural gas price to get total conventional gas costs

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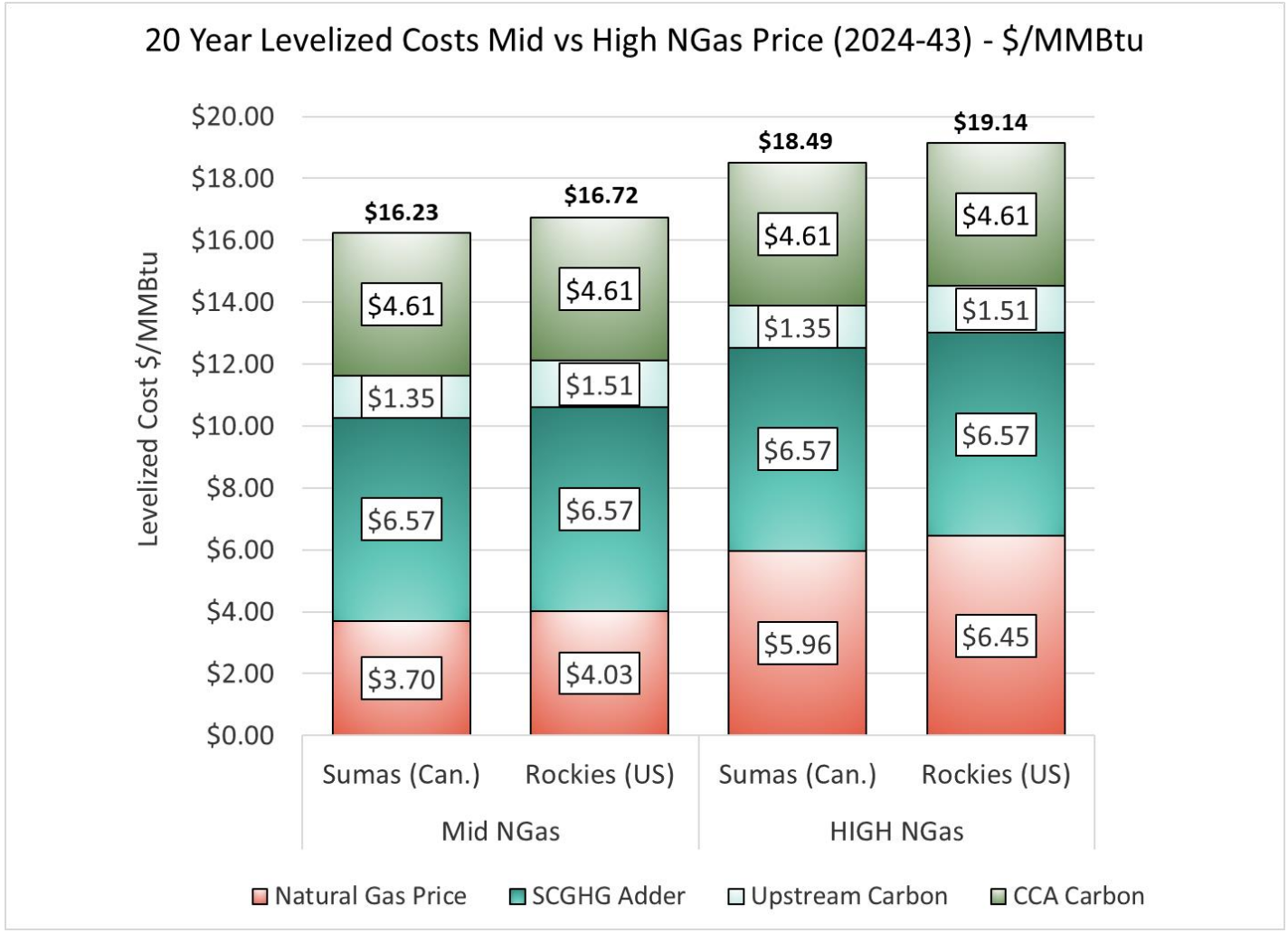
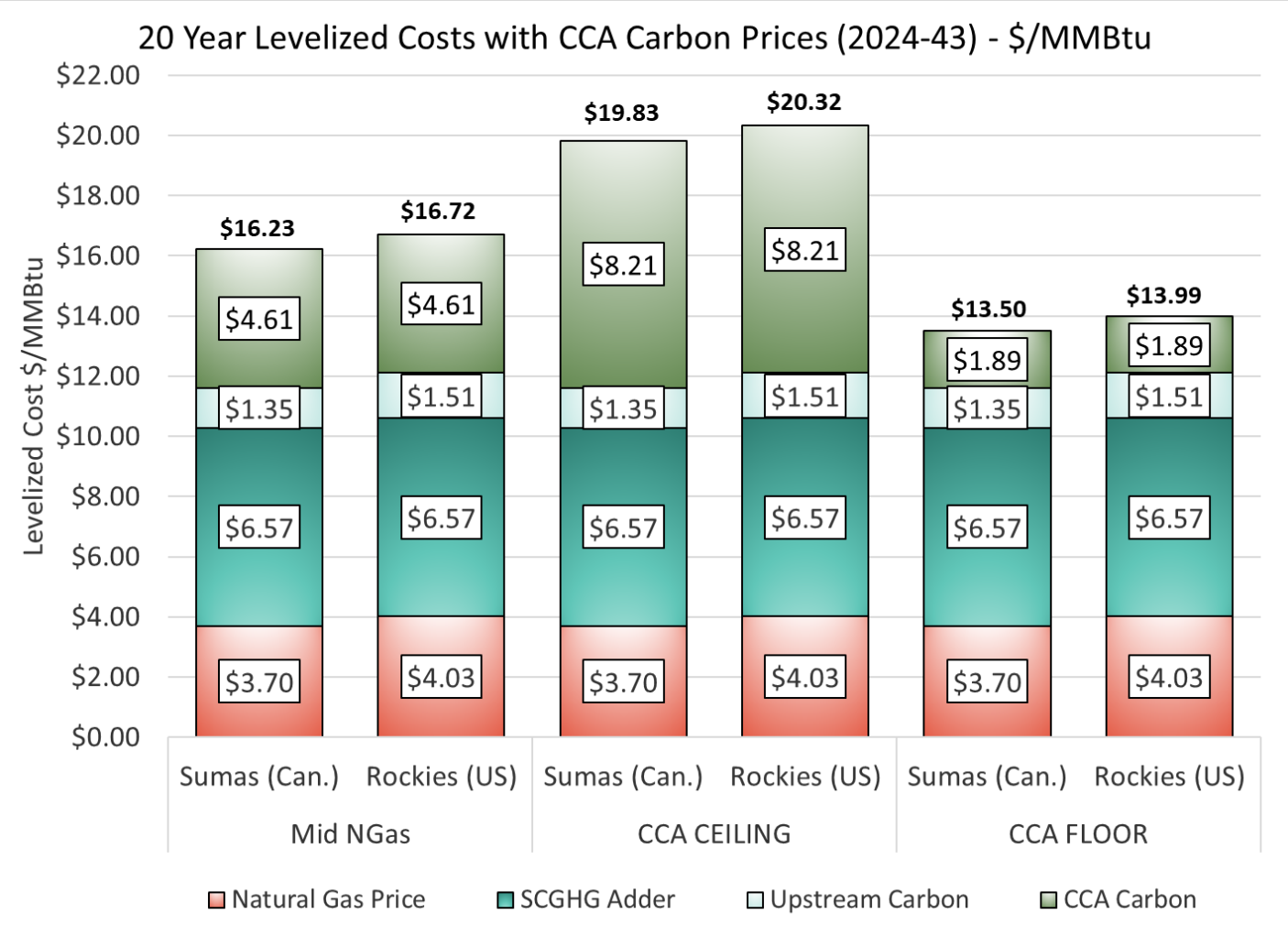
Natural Gas and Carbon Price Assumptions



- Mid natural gas price forecast consists of forward marks as of May 2022 and Wood Mackenzie's long-term outlook released spring 2022.
- Mid natural gas price forecast based on forward marks 2024-2028 and Wood Mackenzie from 2028-2050.
- High natural gas price forecast derived from Council's high gas forecast in 2021 Plan.
- SCGHG adder based on UTC forecast (May 26, 2022).
- Upstream carbon based on GHGenius and GREET models (updated emissions rate to align with CCA).
- CCA carbon price is hybrid: Ecology to 2030 and California Energy Commission after 2030.

PSE PUGET SOUND ENERGY

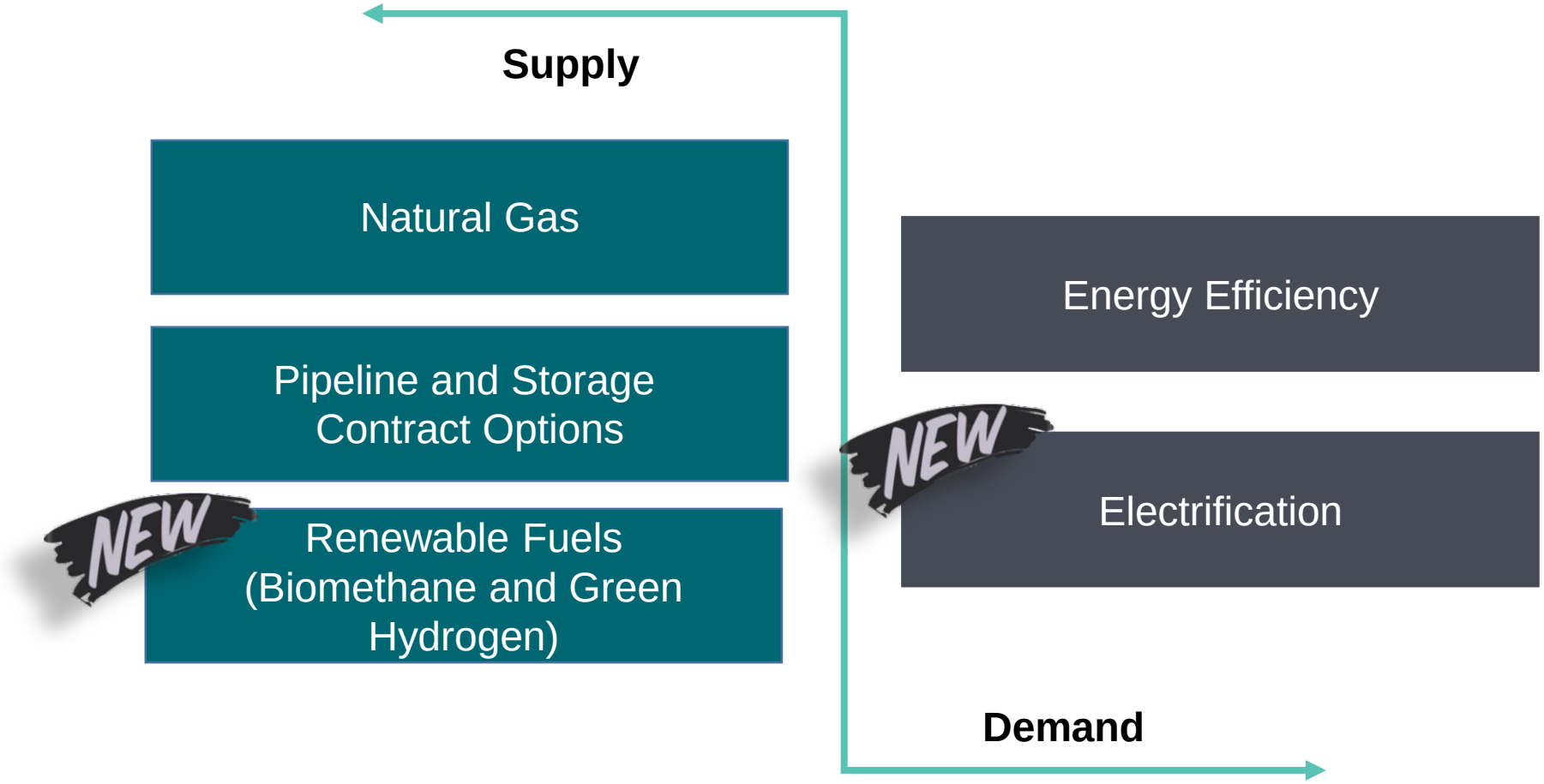
CCA Carbon Price Scenarios



- CCA expected price based on Ecology to 2030 and California Energy Commission after 2030.
- CCA ceiling price with Mid Natural Gas prices for all hubs (Sumas and Rockies shown).
- CCA Floor price with Mid Natural Gas prices for all hubs (Sumas and Rockies shown).
- SCGHG and upstream emissions are same as Mid or reference scenario.

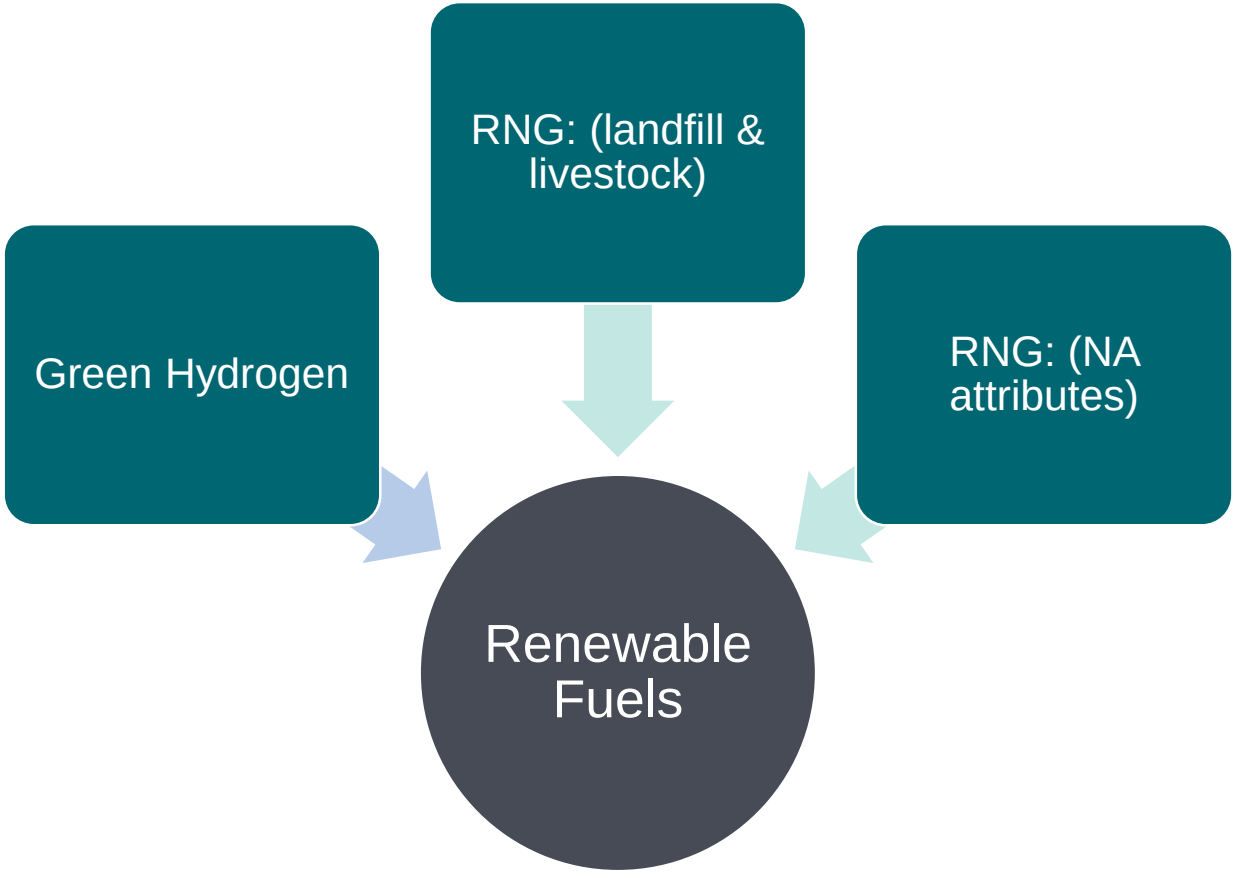
PUGET SOUND ENERGY

2023 Gas Utility IRP: Resource Alternatives



PUGET SOUND ENERGY

Emerging Renewable Fuel Options



PUGET SOUND ENERGY

Green Hydrogen Overview

- **Hydrogen Hub**
  - PSE is engaged with multiple other entities in seeking DOE hydrogen hub grant funding. We are aiming to demonstrate the value of hydrogen in decarbonizing the gas and electric generation sectors.

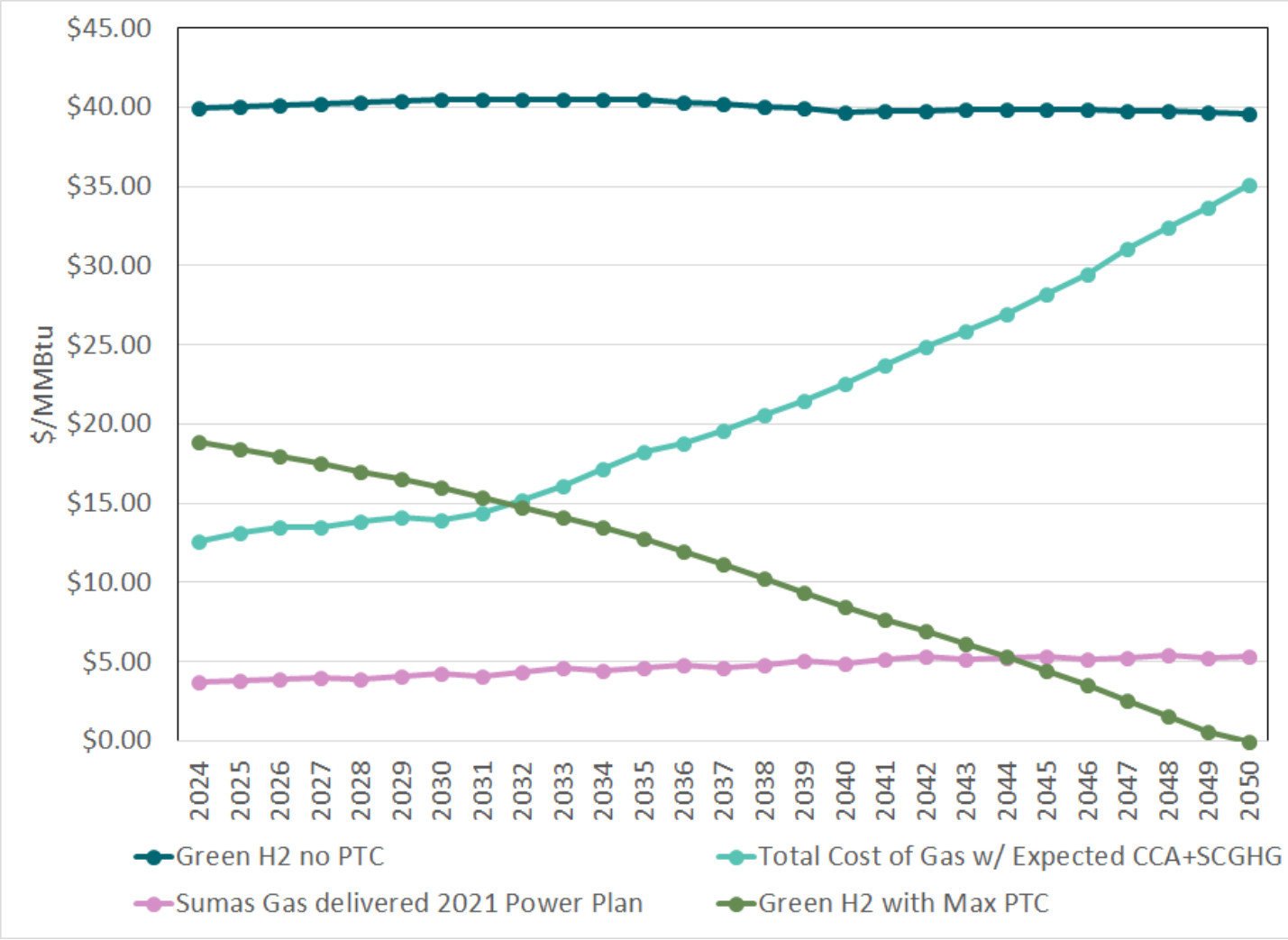
- **Inflation Reduction Act**
  - Production and investment tax credits have the potential to lower fuel costs in such a way that green hydrogen will be competitive with conventional natural gas in the early 2030s.
  - If a producer utilizes low carbon electricity and meets union labor and wage requirements, the production tax credit is up to $3 per kg.
  - The demand for green hydrogen will also create additional demand for green power, above and beyond regional demand for baseload requirements.

Green Hydrogen Overview

- **Pilot Projects**
  - PSE is planning the next stage of pilot projects to assess impacts of fuel blends on customer equipment. Our current plan is to install a solar powered electrolyzer at one of our operating bases, and assess the operational impact on furnaces, stoves, and fireplaces from blended fuel.

- **Research and Development**
  - PSE is engaging with Pacific Northwest National Laboratory (PNNL) and other agencies to evaluate the impacts of blended gas on underground storage facilities, and the gas distribution system.
  - PSE is looking to sponsor research into synthetic methane based on green hydrogen and captured carbon dioxide.

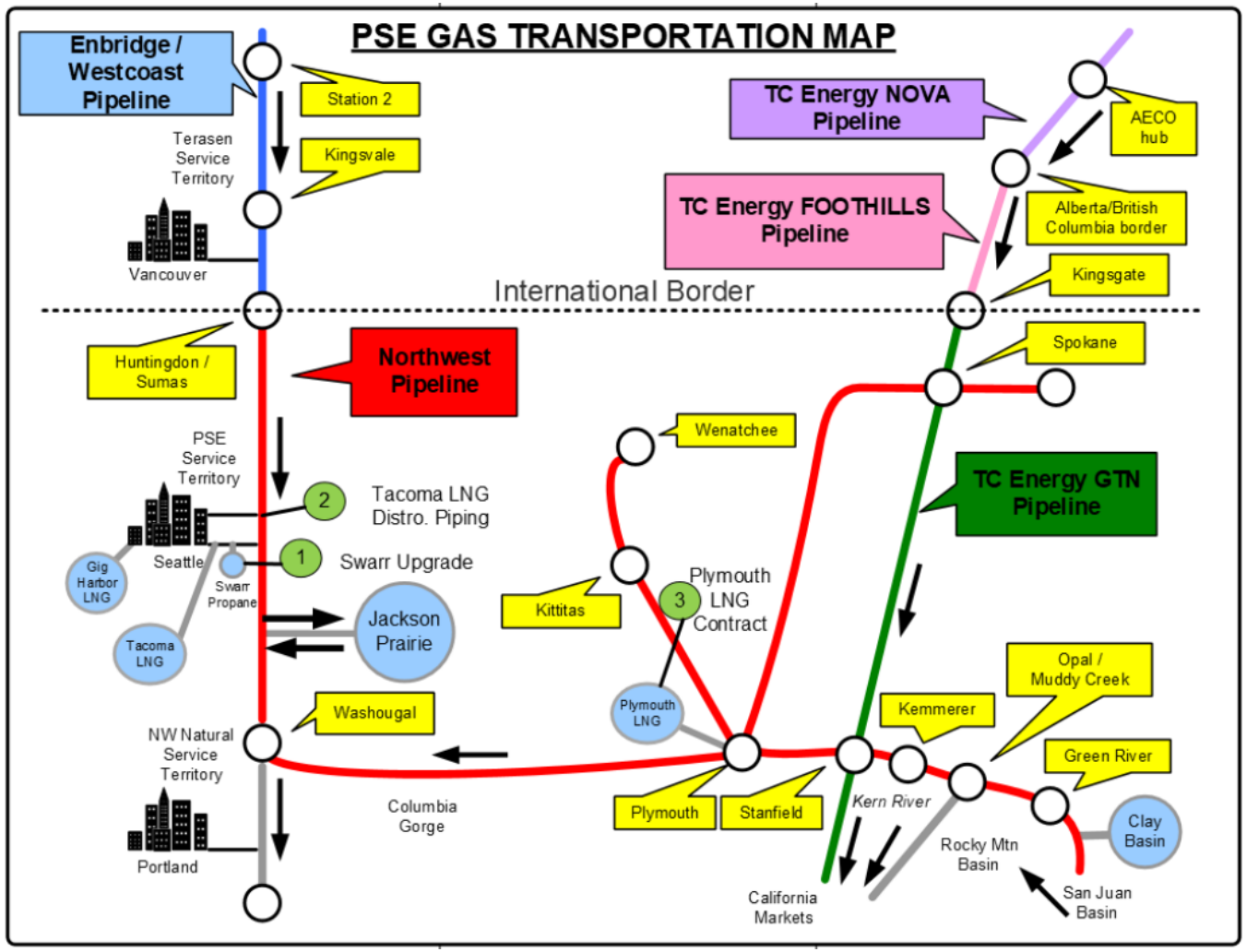
Green Hydrogen Price Assumptions



- Green H2 Cost curve based on electrolysis using renewable electricity input
- Assumes delivery on PSE distribution system
- Green H2 are levelized costs in nominal $
- Assumes PTC at $3.0/kg of Hydrogen & 10-year from production date.
- PTCs available over IRP study horizon

PUGET SOUND ENERGY

Resource Alternatives – Pipelines and Peaking Resources



1 - Swarr on-system peaking resource

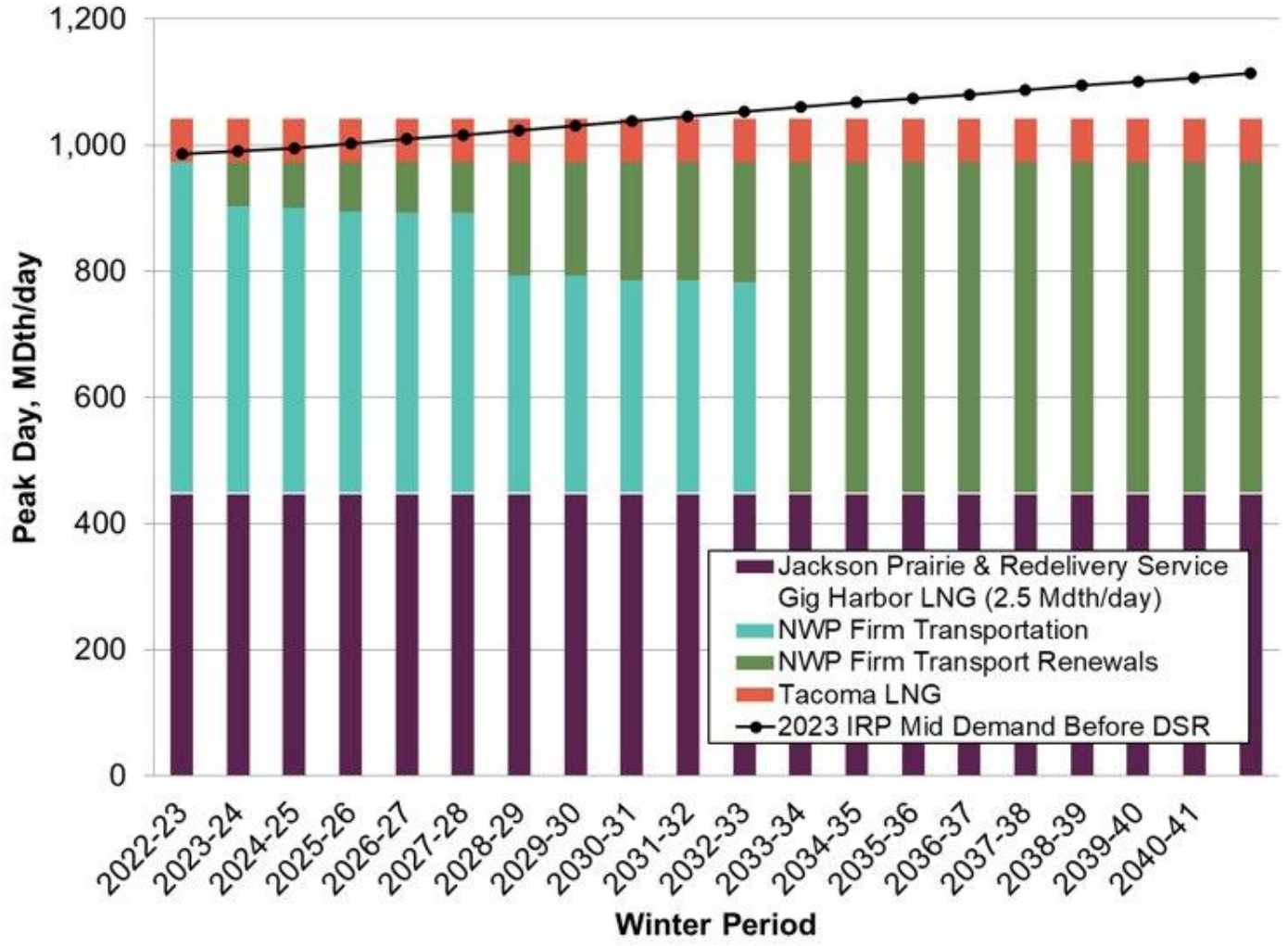
2 - LNG distribution upgrade

3 - Plymouth LNG storage contracts with TF-1 on Northwest pipeline to deliver gas to PSE

Pipeline renewals

PUGET SOUND ENERGY

Pipeline Renewals and Energy Efficiency



- March 2022 meeting chart
- Being long, energy efficiency has no incremental benefit on the capacity value
- By letting the portfolio decide pipeline capacity renewals, this allows energy efficiency to compete with resource additions

PUGET SOUND ENERGY

RNG in the 2023 Gas Utility IRP

Pending the Final CCA rules and the PSE IRP analysis, PSE is remaining engaged with several project developers

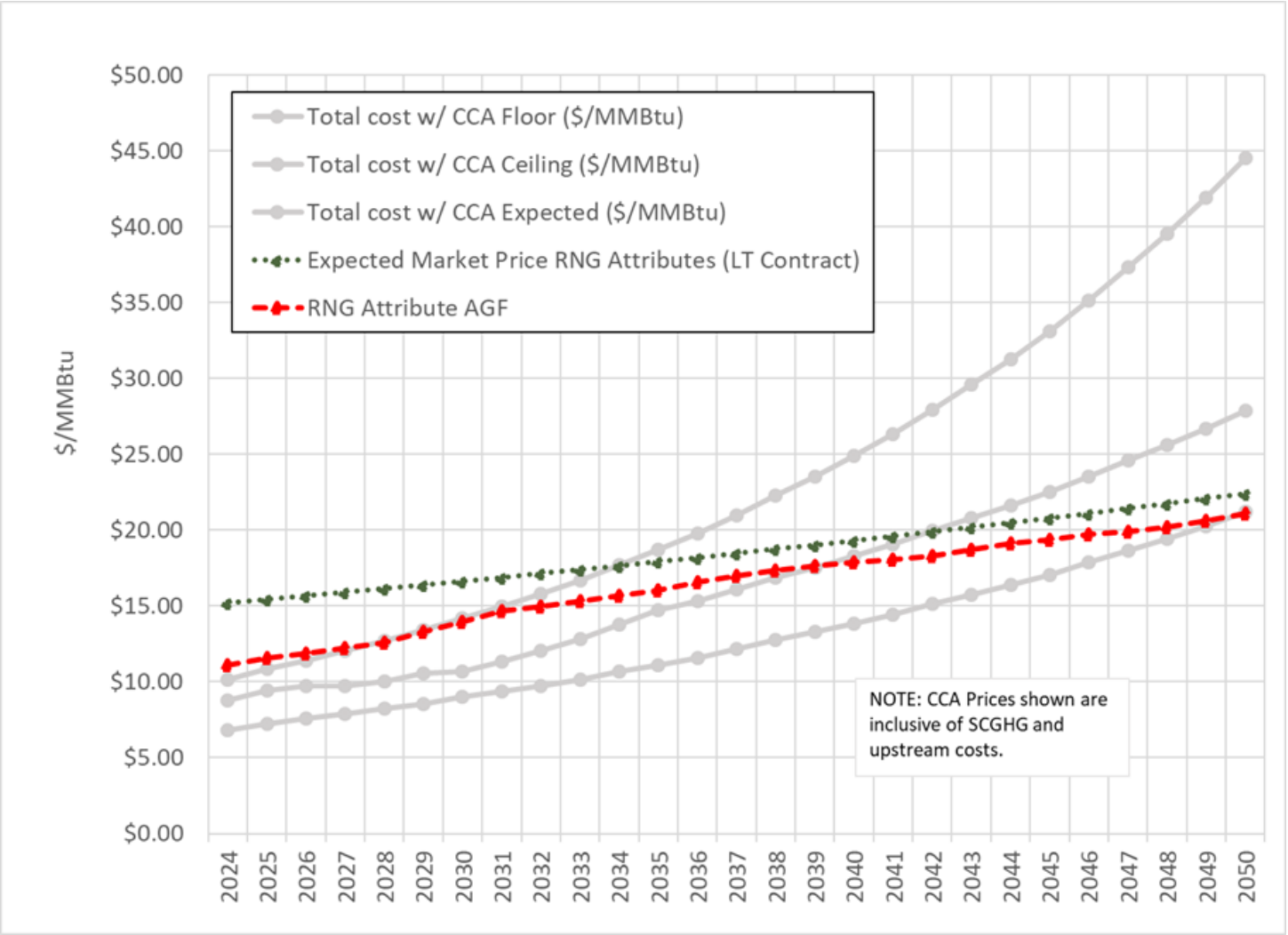
- Washington based RNG projects, both physical and attribute only
- North American RNG – attribute only from large portfolios of small projects
- Ensuring RNG sources are well-documented on accepted platforms (MRETS, etc.)

Advantage to LT RNG contract:

- Secures supply from “best” projects before demand rises
- Price may be higher than CCA price in near-term but secures ”fixed” price for LT
- Avoids uncertainty of CCA and Social Cost of Carbon prices in evolving compliance markets
- ….and that is currently the only way to buy RNG

PUGET SOUND ENERGY

RNG Attributes



PUGET SOUND ENERGY

Next Steps

Sophie Glass, Co-facilitator, Triangle Associates

PSE PUGET SOUND ENERGY

IRP Stakeholder Feedback Process

Feedback form:	PSE IRP - Feedback Form
Sept. 26	A recording of the webinar and the transcript of the chat will be posted to the IRP website so those who were unable to attend can review.
Sept. 29	Feedback forms are due. Feedback should focus on questions regarding the presentation.
Oct. 20	A feedback report of **questions** collected from the feedback form, along with PSE's responses, and a meeting summary will be shared with stakeholders and posted to pse.com/irp.

Next Steps and Stay in Touch

Next meetings with IRP stakeholders

- Sept. 28 and 30, 2022 – Portfolio Benefits Analysis Drop-In Sessions
- Nov. 17, 2022: Updates and feedback on draft results of electric and gas portfolio
- March 1, 2023: Updates and feedback on draft results of 2023 Electric Progress Report and Gas Utility IRP

irp@pse.com

pse.com/irp

PUGET SOUND ENERGY

Appendix

PUGET SOUND ENERGY

Common Acronyms

Acronym	Meaning
BCP	Biennial Conservation Plan
CCA	Climate Commitment Act
CEIP	Clean Energy Implementation Plan
CETA	Clean Energy Transformation Act
CPA	Conservation Potential Assessment
DHP	Ductless heat pump
DSR	Demand-side resources
GHG	Greenhouse gas
EE	Energy efficiency
IRA	Inflation Reduction Act
ITC	Investment Tax Credit
LNG	Liquified natural gas
MMBtu	Metric Million British Thermal Unit
MMTherm	Million therms
PNNL	Pacific Northwest National Laboratory
PTC	Production Tax Credit
RNG	Renewable natural gas
SCGHG	Social cost of greenhouse gas

Docket: UG-220242

Sierra Club
Comments on Puget Sound Energy
Final 2023 Gas Integrated Resource Plan

Exhibit C
PSE, Response to Sierra Club Data Request 009

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

Docket UG-220242
Puget Sound Energy
PSE 2023 Integrated Resource Plan

SIERRA CLUB INFORMAL DATA REQUEST NO. 009:
REQUESTED BY: Jim Dennison

Please refer to page 6.18 footnote 16 which states: "The assumption for the switchover temperature is 35F."

a. Noting that this switchover temperature was assumed for the Hybrid Heat Pump scenario, please describe whether a switchover temperature was also assumed for the Electrification scenario (i.e., a switchover to resistive heating rather than heat pump operation). If so, what switchover temperature was assumed in the Electrification scenario?

b. Please provide all underlying workpapers in excel format with formulas intact, including temperature forecasts, used to identify the number of hours that fully-electric heat pumps operate the electric resistance backup (i.e., number of hours below the switchover temperature described in subpart a above).

c. Did PSE conduct any sensitivity analysis to determine whether a heat pump with better performance at cold temperatures than the selected equipment would experience fewer hours when the heat pump must rely on its backup electric resistance heating element? If so, please describe any sensitivity analyses conducted by PSE as well as the results and any underlying workpapers.

d. During times when fully electric heat pumps operate the electric resistance backup, did PSE assume that 100% of the heating need is met by the electric resistance backup? For any answer other than "yes," please provide the portion of the heating load that is met by the electric resistance backup, the portion that is met by the heat pump, and the assumed coefficient of performance ("COP").

Response:

a. Yes, Puget Sound Energy ("PSE") assumed a switchover temperature for the Electrification scenario, and the switchover temperature was consistent at 35 degrees Fahrenheit.

b. Please refer to PSE's Response to Sierra Club Informal Data Request No. 008(a).

c. The sensitivity described was not part of the 2023 Gas Utility Integrated Resource Plan or any prior decarbonization analysis.

d. Yes, during times when fully electric heat pumps operate the electric resistance backup, PSE assumed that 100% of the heating need is met by the electric resistance backup.

Docket: UG-220242

Sierra Club
Comments on Puget Sound Energy
Final 2023 Gas Integrated Resource Plan

Exhibit D
Sierra Club,
Comments on PSE Draft 2023 Gas Utility Integrated Resource Plan

February 14, 2022

Puget Sound Energy
PO Box 97034, BEL10W
Bellevue, WA 98009-9734
Sent via email to irp@pse.com

Re: Comments on PSE Draft 2023 Gas Utility Integrated Resource Plan

Thank you for the opportunity to provide these opportunities on PSE's Draft 2023 Gas IRP, on behalf of Sierra Club and its more than 27,500 members in Washington, many of whom are PSE customers. A critical element of the IRP process is evaluating how PSE will meet its decarbonization obligations under the Climate Commitment Act, and what role it will play in carrying out Washington's broader decarbonization goals and policies. Electrification is the most well-founded strategy for decarbonizing Washington's buildings and transitioning away from fossil gas, as recognized in the 2021 State Energy Strategy and a growing number of local, state, and federal policies.[1] PSE's IRP must recognize this reality, and incorporate a serious, accurate assessment of opportunities to pursue decarbonization and avoid stranded gas system investments through building electrification.

Unfortunately, the Draft IRP applies several unrealistic assumptions and analytic methods that lead it to significantly underestimate the potential for full electrification. As a result, the IRP and Preferred Portfolio significantly over-rely on incomplete and unproven decarbonization strategies including alternative fuels, carbon allowance purchases, and partial or "hybrid" electrification. We support many of the recommendations and concerns about the IRP's assessment of electrification raised by other commenters, including the Washington Clean Energy Coalition, Climate Solutions.

Our comments focus on the need for accurate assumptions about the performance, availability, and cost of heat pump equipment, particularly efficient cold climate heat pumps. As discussed

[1] Washington State Department of Commerce, *Washington 2021 State Energy Strategy* at 15,46, 66 (Dec. 2020), (finding that "decarbonizing the building sector requires the state to maximize electrification," which is the least-cost way to achieve decarbonization goals), https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf.

below, PSE's unrealistic assumptions about these foundational inputs are significant drivers of the IRP analysis, leading it to underestimate the opportunity and overestimate the cost of full electrification. We urge PSE to update its IRP assumptions to more realistically reflect the current and expected state of the heat pump market.

The Draft IRP materials provide limited information about the assumptions used in PSE's analyses of electrification, and we urge PSE to be clearer and more transparent in its Final IRP. The available information suggests that PSE significantly has underestimated the availability, efficiency, and performance of heat pumps, especially all-electric cold climate heat pumps. For example, the "Full Electrification" scenario assumes that all installed heat pumps are "standard efficiency units."[2] Details on the specifications of these units do not appear to be included in the Draft IRP materials, but it is highly unlikely that all heat pumps installed over the multi-decade analysis period will perform at the levels of today's standard efficiency units. Additionally, the "Hybrid Heat Pump" scenario assumes that heat pumps switch over to backup heat (provided by gas in this case) at an unreasonably high temperature of 35F.[3] Presumably, a similar switchover temperature is assumed for other electrification scenarios and at other points in the analysis. PSE has applied similar flawed assumptions about changeover temperatures in other contexts, including a gas decarbonization study that it cited in its most recent general rate case.[4] Because heat pump performance (and especially changeover temperature, which determines how often inefficient backup resistance or gas heat is used) can affect outcomes from customers' energy bills to system-wide electric resource needs, it is "a key variable that turns out to be a significant driver" of many analyses and conclusions.[5]

Many heat pumps on the market already exceed PSE's assumed performance levels by a wide margin, and available models can be expected to become significantly higher-performing, more efficient, more widely available, and lower cost over the course of the IRP analysis period.[6] As detailed in testimony to the UTC prepared by Strategen Consulting on behalf of NW Energy Coalition, Front and Centered, and Sierra Club, many modern cold climate heat pumps can operate more than twice as efficiently as resistance backup heat at temperatures as low as 5F.[7]

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[2] Draft IRP at Chapter 4, *Key Analytical Assumptions* at 4.11.
[3] Draft IRP at Chapter 6, *Gas Analysis* at 6.17.
[4] Washington Utilities and Transportation Commission Dockets UE-220066/UG-220067, *Prefiled Response Testimony of Ed Burgess on Behalf oF NW Energy Coalition, Front and Centered, and Sierra Club*, Exh. EAB-1T, at 19-23 (describing the gas decarbonization study, its assumption of a 25F switchover temperature in the "High Electrification" scenario, and the conclusions about electrification potential that PSE drew based on the study) [hereinafter, "Burgess Testimony"].
[5] *Id.* at 21; *see also id.* at 25, 30 (discussing some of the significant cost savings that can result from improved heat pump performance assumptions).
[6] *See id.* at 24-25, 31 (discussing rapid ongoing advancements in cold climate heat pump technology and anticipated cost reductions).
[7] *Id.* at 24 (citing NE Energy Efficiency Partnerships, *NEEP's Cold Air Climate Heat Source, Heat Pump List*, https://ashp.neep.org/#!/product_list/; K. Purdy, "How to Find the Best Cold Climate Heat Pump," Climate Switch, https://carbonswitch.com/best-cold-climate-heat-pump/); *see also* "Trane Technologies Surpasses U.S. Department of Energy Requirements for High-Efficiency, Cold Climate Heat Pump." Business Wire, Nov. 3, 2022 (reporting

This has enabled highly successful electrification strategies in states with significantly colder climates than Washington, including Maine, Vermont, Minnesota, and Michigan.[8] Moreover, this level of performance would likely not even be necessary to maintain high efficiency in Washington's relatively mild climate. The lowest Design Day temperature conditions that PSE's gas system planners generally assume is warmer than 10F.[9] And there are significant opportunities to get maximum performance from heat pumps at minimum cost by combining electrification with improvements to building envelope efficiency, load shifting, and demand response.[10]

We recommend that the Final IRP apply updated assumptions around heat pump performance, make these assumptions fully available and transparent, and clarify how they are applied in PSE's analysis. In particular, we recommend that PSE evaluate the benefits and costs of electrification based on specifications for efficient, all-electric models with changeover temperatures no higher than 10F.[11]

Thank you for the opportunity to provide these comments. We look forward to continuing to engage in PSE's resource planning process.

Sincerely,

Jim Dennison
Associate Attorney
Sierra Club
jim.dennison@sierraclub.org

---

new model testing indicating that heat pumps can perform at -23F), https://www.businesswire.com/news/home/20221103005955/en/Trane-Technologies-Surpasses-U.S.-Department-of-Energy-Requirements-for-High-Efficiency-Cold-Climate-Heat-Pump; US Department of Energy, "Residential Cold Climate Heat Pump Challenge." Energy.gov, Office of Energy Efficiency & Renewable Energy (noting that major manufacturers are partnering with DOE on the Cold Climate Heat Pump Challenge to make electric heat pumps more effective, cheaper, more widely adopted, and grid interactive), https://www.energy.gov/eere/buildings/residential-cold-climate-heat-pump-challenge.

[8] *Id.* at 28 (citing S. Nadel, *Programs to Electrify Space Heating in Homes and Buildings*, Amer. Council for anEnergy Efficient Economy (June 2020), https://www.aceee.org/sites/default/files/pdfs/programs_to_electrify_space_heating_brief_final_6-23-20.pdf).

[9] *Id.* at 21, 29-30.

[10] *See, e.g.*, *id.* at 26.

[11] Since backup resistance heat can be used to supplement, rather than replace heat pump operation at low temperatures, we also recommend that PSE assume heat pumps' COPs do not immediately drop to 1.0 at the switchover temperature.

Docket: UG-220242

Sierra Club
Comments on Puget Sound Energy
Final 2023 Gas Integrated Resource Plan

Exhibit E
PSE, Response to Sierra Club Data Request 006

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

Docket UG-220242
Puget Sound Energy
PSE 2023 Integrated Resource Plan

SIERRA CLUB INFORMAL DATA REQUEST NO. 006:
REQUESTED BY: Jim Dennison

Please refer to the spreadsheet titled "UG-220242-App_F_Gas IRP Results.xlsx" filed with the final IRP on May 31, 2023, tab "Electrification Costs."

a. Please narratively explain why emissions costs are lower for the Reference scenario than the "Full Electrification" and "Hybrid Heat Pumps" scenarios beyond 2028.

b. Please provide emissions costs that factor in avoided costs of gas demand for each scenario. If estimates of these emissions costs are not available, please provide any existing analyses, studies, and workpapers, in fully functional electronic format with formulas intact, that could form the basis of such an estimate.

Response:

a. Electrification results in higher electric demand. This means more energy is needed to serve this additional demand, resulting in higher dispatch of the natural gas facilities and higher market purchases, which lead to higher emissions for the portfolio.

b. The avoided costs of gas comprise of the costs reflected in Puget Sound Energy's Response to Sierra Club Informal Data Request No. 001(b).

Docket: UG-220242

Sierra Club
Comments on Puget Sound Energy
Final 2023 Gas Integrated Resource Plan

Exhibit F
PSE, Response to Sierra Club Data Request 011

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

Docket UG-220242
Puget Sound Energy
PSE 2023 Integrated Resource Plan

SIERRA CLUB INFORMAL DATA REQUEST NO. 011:

Please refer to Figure 2.9 at page 2.18 of the IRP, and Workpaper Appendix F: Gas IRP Results, "Total System Average Cost."

a. The NPV values in Figure 2.9 appear to be lower than the NPV values in the workpaper. For example, the reference scenario shows a $10.72 billion NPV in Figure 2.9 but Cell D32 of the Workpaper shows a $21.76 billion NPV. Please explain which NPV value is correct and explain why the numbers differ.

b. If the values in Figure 2.9 are correct, please provide a "Total System Average Cost" Workpaper that reflects these values.

c. Cell BA 33 in the Workpaper identifies the "No Growth Sensitivity- Ceiling Price" as the "Preferred Portfolio." Please confirm whether the table that extends from Cell AX34 to BC62 is the preferred portfolio.

Response:

a. The NPV numbers in Figure 2.9 of Puget Sound Energy's ("PSE") Integrated Resource Plan ("IRP") are correct. These show what PSE refers to as the direct costs. Specifically, the social cost of greenhouse gas ("SCGHG") was removed, which was included for planning purposes for conservation and carbon reduction measures, but removed from total costs, because customers will not pay them in bills. Additionally, no cost allowances are included to reflect a similar opportunity cost impact to the planning analysis, but are removed from the Total System Average Costs shown in "Appendix F: Gas IRP Results" because customers will not be charged for no cost allowances.

b. Attached as Attachment A to PSE's Response to Sierra Club Informal Data Request No. 011, please find a Total System Average Cost workpaper that reflects the values in Figure 2.9.

c. The cell BA33 is mislabeled, and a corrected Appendix F was filed in Docket UG-220242 on May 16, 2023. The Preferred Portfolio is the No Growth Sensitivity and extends from cells AX01 to BC30.

ATTACHMENT A to PSE's Response to Sierra Club Informal Data Request No. 011