EXH. JM-1CT
DOCKETS UE-240004/UG-240005
2024 PSE GENERAL RATE CASE
WITNESS: JOHN MANNETTI

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-240004** **Docket UG-240005**

PREFILED DIRECT TESTIMONY (CONFIDENTIAL) OF

JOHN MANNETTI

ON BEHALF OF PUGET SOUND ENERGY

REDACTED VERSION

FEBRUARY 15, 2024

PUGET SOUND ENERGY

PREFILED DIRECT TESTIMONY (CONFIDENTIAL) OF JOHN MANNETTI

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PUGET SOUND ENERGY

PREFILED DIRECT TESTIMONY (CONFIDENTIAL) OF JOHN MANNETTI

I. INTRODUCTION

Q. Please state your name, business address, and position with Puget Sound Energy.

A. My name is John Mannetti, and my business address is 355 110th Avenue NE, Bellevue, Washington 98004. I am the Director of Strategic Energy Initiatives for Puget Sound Energy ("PSE").

Q. Have you prepared an exhibit describing your education, relevant employment experience, and other professional qualifications?

A. Yes. Please see the First Exhibit to the Prefiled Direct Testimony of John Mannetti, Exh. JM-2.

Q. What are your duties as Director of Strategic Energy Initiatives for PSE?

A. As Director of Strategic Energy Initiatives, I am responsible for PSE's emerging technology evaluation and development activities in pursuit of the company's clean energy objectives. I also lead PSE's efforts to secure public funds through federal and state programs.

Q. What topics are you covering in this prefiled direct testimony?

A. The purpose of this prefiled direct testimony is:

(i) to provide an update on PSE's targeted electrification pilot that began with Stipulation O of the settlement agreement in PSE's last general multiyear rate plan proceeding in Dockets UE-220066 & UG-220067[1] (the "Targeted Electrification Pilot");

(ii) to address PSE's proposal for a second phase of the Targeted Electrification Pilot and associated cost recovery mechanism (the "Targeted Electrification Pilot Phase 2");

(iii) to provide an overview of PSE's efforts to pursue public funding, such as under the Infrastructure Investment and Jobs Act ("IIJA")[2] and the Inflation Reduction Act ("IRA")[3];

(iv) to discuss PSE's consideration of emerging technologies, such as hydrogen, long-duration battery storage and small modular reactors; and

(v) to present PSE's proposal for a long-duration battery storage pilot.

II. TARGETED ELECTRIFICATION ACTIVITIES

A. Overview of the Targeted Electrification Activities

Q. Please describe PSE's activities under Stipulation O of the UE-220066 Settlement.

A. As part of Stipulation O in the UE-220066 Settlement, PSE committed to three general areas of work related to targeted electrification on the PSE system:

[1] *WUTC v. Puget Sound Energy*, Dockets UE-220066, *et al*. Final Order 24/10, Appx. A, Settlement Stipulation and Agreement on Revenue Requirement and All Other Issues Except Tacoma LNG and PSE's Green Direct Program (Dec. 22, 2022) (the "UE-220066 Settlement").

[2] Infrastructure Investment and Jobs Act of 2021, Pub. L. No. 117-58 (2021).

[3] Inflation Reduction Act of 2022, Pub. L. No. 117-169 (2022).

- Updated Targeted Electrification Study. PSE would conduct an updated decarbonization study aimed at maximizing carbon reductions with more up-to-date assumptions on targeted electrification.

- Targeted Electrification Pilot. PSE would develop a targeted electrification pilot that would evaluate a range of impacts to gas and electric delivery systems and PSE customers by deploying heat pump technologies, including high-efficiency electric-only solutions.

- Targeted Electrification Strategy. PSE would incorporate a targeted electrification strategy, based on the findings of the updated decarbonization study and electrification pilot, into its next natural gas Integrated Resource Plan and Biennial Conservation Plan following the conclusion of the study and pilot.[4]

(Collectively, these three areas are referred to in my testimony as "Targeted Electrification Activities").

In the past year, PSE has made progress in implementing the Targeted Electrification Activities. On December 21, 2023, PSE filed the updated targeted electrification study ("Targeted Electrification Study") with the Commission in Dockets UE-220066, et al. Section II.B below addresses the progress made with respect to the Targeted Electrification Pilot mentioned in the second bullet above. The targeted electrification strategy mentioned in the third bullet will follow the conclusion of both the Targeted Electrification Study and the Targeted Electrification Pilot.

[4] UE-220066 Settlement at ¶ 65.

B. The Targeted Electrification Pilot

Q. Please describe the Targeted Electrification Pilot.

A. In June of 2023, PSE launched the Targeted Electrification Pilot designed to deploy heat pumps, identify opportunities to offset electric system reliability risk, and identify barriers and provide recommendations to improve the market penetration of heat pumps, particularly in named communities.[5] The Targeted Electrification Pilot generally consists of the following elements:

- Home Electrification Assessments;
- Low-Income Heat Pump Direct Installations;
- Fuel-Switching Heat Pump Rebates;
- Multi-Family Residential Building Electrification Project in Named Communities;
- Small Business Heat Pump Direct Installations in Named Communities; and
- Targeted Electrification Pilot Evaluation.

1. Home Electrification Assessments

Q. What does the Home Electrification Assessment element of the Targeted Electrification Pilot entail?

A. Pursuant to the Home Electric Assessment element of the Targeted Electrification Pilot, PSE will complete 10,000 free, in-home electrification assessments conducted by Franklin Energy Services for PSE natural-gas customers. These

[5] The term "named communities" is a commonly-used shorthand phrase for highly impacted communities and vulnerable populations, as defined by RCW 19.405.020(23) and (40), respectively.

assessment reports provide participating customers with (i) actionable energy efficiency tips, (ii) a list of next steps to pursue electrification, and (iii) known and available financial incentives available from utilities, local, state, and federal programs, including the Inflation Reduction Act. PSE will also provide targeted marketing for fuel-switching heat pump rebates (dual-fuel customers) and the free Home Electrification Assessment (all PSE gas customers) in named communities. PSE plans to have a minimum of 30 percent of all Home Electrification Assessments conducted in named communities.

2. Low-Income Heat Pump Direct Installations

Q. What does the Low-Income Heat Pump Direct Installation element of the Targeted Electrification Pilot entail?

A. Pursuant to the Low-Income Heat Pump Direct Installation element of the Targeted Electrification Pilot, up to fifty low-income-qualified customers in PSE's dual-fuel service territory or part of the joint pilot with Seattle City Light (discussed in Section II.E) will receive whole-home weatherization and heat pump space/water heating upgrades at no cost. PSE will cover the full cost associated with the electrification projects, including the heat pumps and electrical panel upgrades, and weatherization assistance agencies will fund the whole-home weatherization.

3. Fuel-Switching Heat Pump Rebates

Q. What does the Fuel-Switching Heat Pump Rebate element of the Targeted Electrification Pilot entail?

A. Under the Fuel-Switching Heat Pump Rebate element of the Targeted Electrification Pilot, PSE will provide fuel switching rebates of between $2,400 and $4,000 to dual-fuel (active natural gas and electricity accounts) residential single-family customers of PSE that replace natural gas space heating with high-efficiency heat pumps. PSE aligned equipment requirements with tax credit requirements of the Inflation Reduction Act to assist customers in identifying and obtaining available funding. PSE cannot provide fuel-switching rebates through standard energy efficiency programs, so the fuel-switching heat pump rebate provides an additional incentive for customers pursuing electrification.

4. Multi-Family Residential Building Electrification Projects in Named Communities

Q. What does the Multi-Family Residential Building Electrification Projects in Named Communities element of the Targeted Electrification Pilot entail?

A. Under the Multi-Family Residential Building Electrification Projects in Named Communities element of the Targeted Electrification Pilot, PSE will provide heat pump direct installations for space and water heating to one or two multi-family residential buildings in named communities in PSE's dual-fuel service territory.

5. Small Business Direct Heat Pump Installations in Named Communities

Q. What does the Small Business Direct Heat Pump Installations in Named Communities element of the Targeted Electrification Pilot entail?

A. Under the Small Business Direct Heat Pump Installations in Named Communities element of the Targeted Electrification Pilot, PSE will provide heat pump direct installations for space and water heating to one or two small businesses in named communities in PSE's dual-fuel service territory.

6. Targeted Electrification Pilot Evaluation

Q. What does the Targeted Electrification Pilot Evaluation element of the Targeted Electrification Pilot entail?

A. Under the Targeted Electrification Pilot Evaluation element of the Targeted Electrification Pilot, PSE will contract with The Cadmus Group[6] to evaluate the Targeted Electrification Pilot over the 2024-2025 period. Starting in 2024, The Cadmus Group will identify barriers to heat pump adoption methods to increase market penetration of heat pumps for low-income customers, highly-impacted populations, vulnerable populations, and customers experiencing high energy burdens. The Targeted Electrification Pilot Evaluation will also aim to understand impacts of new heat pump systems on peak electricity needs during peak heating hours in areas with homes that switch from natural gas heating to heat pumps.

[6] The Cadmus Group, Inc. is an environmental consulting services firm that provides sustainability consulting, program management, scientific and risk analysis, strategic communications, regulatory support, evaluation, and technical assistance for the transportation, healthcare, and energy sectors.

C. Program Management for the Targeted Electrification Activities

Q. How long does PSE anticipate implementing the elements of the Targeted Electrification Pilot?

A. PSE anticipates implementing all elements of the Targeted Electrification Pilot, with the sole exception of the Targeted Electrification Pilot evaluation, by December 31, 2024. The Cadmus Group will begin the Targeted Electrification Pilot evaluation element in early 2024, and this evaluation will provide regular updates and insights to aid in the development of the targeted electrification strategy. As per the terms of the UE-220066 Settlement, PSE will publish a report summarizing the results of the Targeted Electrification Pilot, no later than January 2025, and PSE will consider findings from the Targeted Electrification Pilot in PSE's key planning processes.

Q. Does PSE plan to share the results of its Targeted Electrification Activities with the public?

A. Yes. PSE filed the Updated Electrification Study with the Commission on December 21, 2023, in Dockets UE-220066, et al.

Pursuant to the terms of Stipulation O of the UE-220066 Settlement, PSE will file a report summarizing the results of the Targeted Electrification Pilot, including the number of residential and commercial customers engaged through each of the

measures identified above, as a compliance requirement in Dockets UE-220066, et al., no later than January 2025.[7]

Pursuant to the terms of Stipulation O of the UE-220066 Settlement, PSE will file the Targeted Electrification Strategy for its electric service territory as a compliance filing in Dockets UE-220066, et al. by January 2025.[8]

Q. Does PSE plan to consult with the Conservation Resources Advisory Group regarding incorporating the findings from the Targeted Electrification Pilot in the 2025 Biennial Conservation Plan for the 2026-2027 biennium?

A. Yes. PSE will consult with the Conservation Resources Advisory Group ("CRAG") regarding incorporating the findings from the Targeted Electrification Pilot in the 2025 Biennial Conservation Plan for the 2026-2027 biennium. Costs, customer uptake, and other learnings from the Targeted Electrification Pilot should provide insights to the CRAG with respect to conservation programs. PSE anticipates collaborating with CRAG participants to build and refine recommendations.

[7] *See* UE-220066 Settlement at ¶ 67.b.
[8] *See id*. at ¶ 68.

Q. Does PSE plan to consult with the Low-Income Advisory Committee and the CRAG to ensure that the Targeted Electrification Pilot benefits low-income participants?

A. Yes. PSE will continue to consult with the Low-Income Advisory Committee ("LIAC") and the CRAG to ensure that the Targeted Electrification Pilot benefits low-income participants. PSE typically provides updates to the LIAC at monthly meetings, which include time for questions and feedback. The CRAG meeting cadence for 2024 is already determined and will include at least four meetings with opportunities to share progress on the low-income elements of the Targeted Electrification Pilot.

Q. How will the Updated Targeted Electrification Study and the Targeted Electrification Pilot inform the Targeted Electrification Strategy?

A. The Updated Targeted Electrification Study and the Targeted Electrification Pilot will form the base of the Targeted Electrification Strategy, consistent with paragraph 68 of Stipulation O of the UE-220066 Settlement.[9] Data and analysis from the Targeted Electrification Study and Targeted Electrification Pilot will inform program costs, benefits, and recommendations within the Targeted Electrification Strategy.

[9] *See id*. at ¶ 68.

D. Cost Recovery for Targeted Electrification Activities

Q. What is PSE's projected budget for the Targeted Electrification Activities?

A. In Stipulation O of the UE-220066 Settlement, PSE "commit[ted] to an investment of up to $15 million in Company funds for the [Targeted Electrification Activities] through the end of 2024, which will be deferred for consideration of recovery in PSE's next general rate case." [10] As provided in Table 1 below and consistent with Stipulation O, PSE projects a budget of about $15 million through 2024 for the Targeted Electrification Activities.

Table 1. Projected Budget for Targeted Electrification Activities

Targeted Electrification Activity	Projected Budget
Updated Targeted Electrification Study	$573,798.10
Targeted Electrification Pilot	$12,451,201.90
Targeted Electrification Strategy	$1,975,000.00
Total	**$15,000,000.00**

As of November 2023, PSE spent $2,864,567 on the Targeted Electrification Activities. Please see the Second Exhibit to the Prefiled Direct Testimony of John Mannetti, Exh. JM-3, for projected budgets associated with elements of Targeted Electrification Activities.

[10] *See id*. at ¶ 65.

Q. What is the projected budget for the Targeted Electrification Pilot?

A. As indicated in Table 1 above, the projected budget for the Targeted Electrification Pilot is $12,451,201.

Table 2 below provides the projected budgets for the individual elements that comprise the Targeted Electrification Pilot.

Table 2. Projected Budget for Targeted Electrification Pilot

Targeted Electrification Pilot Element	Projected Budget
Home Electrification Assessments	$4,505,830.00
Low-Income Direct Heat Pump Installations	$4,938,132.90
Fuel-Switching Heat Pump Rebates	$2,000,000.00
Multi-Family Residential Building Electrification Projects in Named Communities	$200,000.00
Small Business Direct Heat Pump Installations in Named Communities	$200,000.00
Targeted Electrification Pilot Evaluation	$154,000.00
Development, Overhead, Administration, and Marketing	$453,239.00
Total	**12,451,201.90**

Q. What is PSE's request regarding costs associated with the Targeted Electrification Activities?

A. Consistent with Stipulation O of the UE-220066 Settlement, PSE requests recovery of its investment in the Targeted Electrification Activities in the amount of $15 million in base rates.

Q. How does PSE propose to allocate the costs of the Targeted Electrification Activities?

A. As discussed in the Prefiled Direct Testimony of Chris Mickelson, Exh. CTM-1T, PSE proposes to allocate the $15 million of costs of the Targeted Electrification Activities consistent with paragraph 67.g. of the UE-220066 Settlement:

> Costs will be spread to each electric rate schedule based on the schedule's share of total Targeted Electrification Pilot program funding expended for that schedule. For clarity, costs will not be allocated to Schedule 449 customers.[11]

E. Other Targeted Electrification Activities of PSE

Q. Is PSE engaged in other targeted electrification programs unrelated to the Targeted Electrification Pilot?

A. Yes. PSE and Seattle City Light are conducting a joint pilot aimed at installing heat pumps in twenty homes in a Seattle neighborhood through the Low-Income Weatherization Program. To demonstrate the effects of targeted electrification efforts on energy burden, customers participating in this joint pilot will receive a

[11] *Id*. at ¶ 67.g.

custom usage analysis to inform them of their (i) annual space heating cost prior to the installation of heat pumps, (ii) estimated annual space heating cost with an installed heat pump and weatherization, and (iii) estimated annual space heating cost with an installed heat pump, weatherization, and PSE Bill Discount Rate enrollment.

Q. How did PSE become involved in the joint pilot with Seattle City Light?

A. The joint pilot with Seattle City Light originated out of PSE's initial design of the Targeted Electrification Pilot, which was a full-home electrification program for a limited number of low-income qualified customers living in a neighborhood in Seattle. Throughout 2023, PSE met with parties to the UE-220066 Settlement regarding the Targeted Electrification Pilot to solicit feedback on pilot design. Parties to the UE-220066 Settlement expressed concern that a full-home electrification pilot for a limited number of low-income qualified customers was not of sufficient scope for the Targeted Electrification Pilot. After receiving this feedback, PSE changed the scope of the Targeted Electrification Pilot to be the broader offering discussed above, with rebates for heat pumps to a broader range of customers and the direct installation of heat pumps in homes of low-income customers and in a few multifamily buildings and small businesses in named communities. PSE's initial design for the Targeted Electrification Pilot, however, evolved into the joint pilot with Seattle City Light. Costs for the joint pilot with Seattle City Light will be recovered as part of the Low-Income Direct Heat Pump Installation budget item in the Targeted Electrification Pilot.

III. TARGETED ELECTRIFICATION PILOT PHASE 2

A. Overview

Q. Does PSE anticipate developing and implementing a second phase of the Targeted Electrification Pilot?

A. Yes. Building on the Targeted Electrification Pilot, PSE proposes the development and implementation of a second phase of the Targeted Electrification Pilot ("Targeted Electrification Pilot Phase 2") in its dual fuel service territory. PSE intends that its Targeted Electrification Pilot Phase 2 will provide heat pump incentives to sustain current customer offerings, assess whether targeted electrification can alleviate the need to expand the natural gas delivery system in a capacity constrained area, and broaden the customer reach of the first phase of the Targeted Electrification Pilot.

Q. What are the key components of PSE's proposed Targeted Electrification Pilot Phase 2?

A. The key components of PSE's proposed Targeted Electrification Pilot Phase 2 are as follows:

- three proposed low-income and equity-based pilots programs:
  - a low-income heat pump direct installation pilot;
  - a small businesses heat pump pilot in named communities;

- a multi-family heat pump rebate in named communities pilot;

- a proposed targeted electrification of natural gas-constrained geographic area pilot; and

- two proposed targeted electrification pilots for additional customer classes:

  - an income-qualified heat pump rebates pilot; and

  - a commercial and industrial targeted electrification grant pilot.

1. <u>Low-Income Heat Pump Direct Installation Pilot</u>

Q. Please describe the Low-Income Heat Pump Direct Installation Pilot element of PSE's proposed Targeted Electrification Pilot Phase 2.

A. If approved and implemented, the Low-Income Heat Pump Direct Installation Pilot for PSE's proposed Targeted Electrification Pilot Phase 2 would support residential, single-family, combined electric and gas customers of PSE with natural gas heating and incomes that fall at or below 80% of the Area Median Income ("AMI"). Participants in this pilot would receive a comprehensive, no-cost offering, which includes coverage of home weatherization expenses through the existing PSE Low-Income Weatherization program. Additionally, PSE would use funding from the proposed Targeted Electrification Pilot Phase 2 to cover the installation costs of heat pump systems for space and/or water heating, along with any related work needed for installation (e.g., electric panel upgrades/replacements, rerouting exhausts, etc.).

PSE anticipates that the Low-Income Heat Pump Direct Installation Pilot for PSE's proposed Targeted Electrification Pilot Phase 2 would utilize low-income agencies to manage eligibility verification and facilitate the installation of all measures. By collaborating with low-income agencies, PSE would work to alleviate the impact of underlying disparities and systemic inequalities to provide low-income customers with access to and benefits from affordable and energy-efficient homes. Over calendar years 2025 and 2026, PSE anticipates that the Low-Income Heat Pump Direct Installation Pilot for PSE's proposed Targeted Electrification Pilot Phase 2 would enroll up to 115 eligible customers at a projected total cost of $4,600,000.

2. <u>Small Businesses Heat Pump Pilot in Named Communities</u>

Q. Please describe the Small Businesses Heat Pump Pilot in Named Communities element of PSE's proposed Targeted Electrification Pilot Phase 2.

A. The Small Businesses in Named Communities Pilot is targeted at small businesses in named communities in PSE's dual fuel territory, specifically those using natural gas for space and/or water heating. The focus of this pilot is to enhance existing energy efficiency offerings with the addition of heat pumps for space and/or water heating. Over calendar years 2025 and 2026, PSE anticipates that the Small Businesses in Named Communities Pilot would engage up to twenty small businesses in named communities at a total projected cost of $1,000,000.

3. Multi-Family Heat Pump Rebate in Named Communities Pilot

Q. Please describe the Multi-Family Fuel-Switching Heat Pump Rebates in Named Communities Pilot element of PSE's proposed Targeted Electrification Pilot Phase 2.

A. The Multi-Family Fuel-Switching Heat Pump Rebates in Named Communities Pilot provides incentives to customers in residential multi-family buildings with natural gas space heating in named communities in PSE's dual fuel territory. Participants in this initiative would be eligible for a $2,000 rebate to install heat pump systems that replace natural gas heating systems. Over calendar years 2025 and 2026, PSE anticipates that the Multi-Family Fuel-Switching Heat Pump Rebates in Named Communities Pilot will engage customers in up to 1,000 dwelling units at a total projected cost of $2,000,000.

4. Targeted Electrification of Natural Gas-Constrained Geographic Area Pilot

Q. Please describe the Targeted Electrification of Natural Gas-Constrained Geographic Area Pilot element of PSE's proposed Targeted Electrification Pilot Phase 2.

A. The Targeted Electrification of Natural Gas-Constrained Geographic Area Pilot would target fuel switching for space and water heating and complement PSE's existing Demand Side Management Programs to reduce gas volume demand to avoid capacity expansions of the gas delivery system. This pilot specifically targets dual fuel customers with natural-gas heated residential single-family

homes in gas-constrained areas, with the initial phase set to commence in Duvall, Washington. Recognizing the challenges posed by constrained natural gas areas, this pilot aims to provide increased support to identified customers through tailored efforts, which may involve heightened outreach and incentives. Over calendar years 2025 and 2026, PSE anticipates that the Targeted Electrification of Natural Gas-Constrained Geographic Area Pilot will engage up to 500 customers at a total projected cost of $4,000,000.

5. <u>Income-Qualified Heat Pump Rebate Pilot</u>

Q. Please describe the Income-Qualified Heat Pump Rebate Pilot element of PSE's proposed Targeted Electrification Pilot Phase 2.

A. The Income-Qualified Heat Pump Rebate Pilot would support income-qualified dual fuel customers of natural gas-heated residential single-family homes to transition their home's main heating source from gas to electric. Participants would be eligible for a $2,400 Efficiency Boost Rebate, with Efficiency Boost being an existing conservation program that provides higher rebates for income-qualified customers falling below or equal to 90 percent of the AMI. This pilot would encourage fuel switching and energy efficiency, thereby making sustainable heating options more financially viable for income-qualified households. Over calendar years 2025 and 2026, PSE anticipates that the Income-Qualified Heat Pump Rebate Pilot will engage up to 300 customers at a total projected cost of $1,200,000.

6. Commercial and Industrial Targeted Electrification Grant Pilot

Q. Please describe the Commercial and Industrial Targeted Electrification Grant Pilot element of PSE's proposed Targeted Electrification Pilot Phase 2.

A. The Commercial and Industrial Targeted Electrification Grant Pilot would leverage existing energy efficiency processes to facilitate electrification of commercial and industrial customers in PSE's dual fuel territories. This pilot would incorporate (i) expected gas savings, (ii) upgrade or incremental costs for electrification, and (iii) current gas energy efficiency incentive levels ($/therm). By offering custom grants, this pilot would strive to make electrification economically viable for commercial and industrial customers and inform future commercial and industrial fuel switching program design. With an existing program incentive cap set at 70 percent of the project cost, PSE anticipates that the Commercial and Industrial Targeted Electrification Grant Pilot would encourage up to twenty locations to electrify over calendar years 2025 and 2026, at a total projected cost of $6,000,000.

B. Program Management for the Targeted Electrification Pilot Phase 2

Q. Why is PSE proposing a Targeted Electrification Pilot Phase 2 in this proceeding?

A. PSE's proposed Targeted Electrification Pilot Phase 2 utilizes the momentum generated by the first phase of the Targeted Electrification Pilot, aligns with

PSE's 2030 clean energy goals, and presents an opportunity for PSE and the region to continue exploring the effectiveness of targeted electrification efforts. If the Commission were to approve PSE's proposed Targeted Electrification Pilot Phase 2, PSE anticipates that these additional offerings would further the understanding of costs, customer demand, and obstacles related to implementing electrification initiatives for participating customers. These offerings, if implemented, could provide a foundation for program design, customer education, contractor training requirements, and grid integration challenges. Additionally, the projects and programs proposed in the Targeted Electrification Pilot Phase 2 help reduce Climate Commitment Act compliance obligations of gas customers.

Q. What is PSE's proposed timeline for implementing the Targeted Electrification Pilot Phase 2?

A. If approved, PSE would implement the Targeted Electrification Pilot Phase 2 during the multiyear rate plan period (i.e., approximately January 2025 to December 2026).

Q. Did PSE consider equity when developing the Targeted Electrification Pilot Phase 2?

A. Yes. The program offerings of the Targeted Electrification Pilot Phase 2 described above focus primarily, although not exclusively, on low-income customers and customers in named communities. In particular, the pilot aims to provide insight on ways to mitigate, if not eliminate, the barriers to electrification for low-income

customers and customers in named communities in order to provide more equitable access to electrification.

C. Cost Recovery for Targeted Electrification Pilot Phase 2

Q. What is the projected budget to implement the Targeted Electrification Pilot Phase 2 through the end of 2026?

A. The projected budget to implement the Targeted Electrification Pilot Phase 2 through the end of 2026 is $22,300,000. Please see Table 3 below for the projected budget for the Targeted Electrification Pilot Phase 2 by program and calendar year.

Table 3. Projected Budget for the Targeted Electrification Pilot Phase 2 Through the End of Calendar Year 2026

Effort	Year	Amount	Est. QTY	Est. Spend
Low-Income Heat Pump Direct Installs	2025	$40,000	50	$2,000,000
	2026	$40,000	65	$2,600,000
Constrained NG Areas Focus (Duvall)	2025	$8,000	250	$2,000,000
	2026	$8,000	250	$2,000,000
Income Qualified Fuel Switching HP Rebates	2025	$4,000	100	$400,000
	2026	$4,000	200	$800,000
Small Business Direct Installs	2025	$50,000	10	$500,000
	2026	$50,000	10	$500,000
Multi-Family Rebates	2025	$2,000	500	$1,000,000
	2026	$2,000	500	$1,000,000
Commercial & Industrial	2025	$300,000	10	$3,000,000

Table 3. Projected Budget for the Targeted Electrification Pilot Phase 2 Through the End of Calendar Year 2026

Effort	Year	Amount	Est. QTY	Est. Spend
Custom Grant Pilot	2026	$300,000	10	$3,000,000
Marketing	2025/2026	$1,000,000	1	$1,000,000
Overhead and Evaluation	2025/2026	$2,500,000	1	$2,500,000
			Total	$22,300,000
			Direct Customer Benefit	84%
			Operating Costs	16%

Q. How does PSE propose to recover the costs of the Targeted Electrification Pilot Phase 2?

A. PSE proposes to recover the costs of the Targeted Electrification Pilot Phase 2 through Electric and Gas Schedules 141DCARB Decarbonization Rate Adjustment.

Please see the Prefiled Direct Testimony of Susan E. Free, Exh. SEF-1T, for details about Electric and Gas Schedules 141DCARB and the recovery of costs for the Targeted Electrification Pilot Phase 2 thereunder.

D. Benefits of the Targeted Electrification Pilot Phase 2

Q. How will the Targeted Electrification Pilot Phase 2 and associated cost recovery mechanism benefit customers?

A. Customers will be benefited by PSE proactively pursuing targeted electrification programs and applying those lessons learned into future programs. Through the

Targeted Electrification Pilot Phase 2, PSE aims to maintain fuel conversion support in the existing Low Income Weatherization Program and the Small Business Direct Install Program, both of which cannot deliver those benefits today except through the active Targeted Electrification Pilot. PSE also hopes to learn if an income qualified rebate and a multi-family rebate program can gain traction in the marketplace to inform refinements to these offerings in the future. This will be PSE's first program focused on the commercial and industrial market and aims to validate if the custom grant program offering combines well with the existing energy efficiency programs, and meets the needs for commercial customers to initiate fuel switching opportunities. Finally, PSE needs to validate if focusing fuel switching efforts in constrained areas can gain sufficient traction to mitigate capacity constraints. These offerings also provide opportunities for PSE to engage with customers and the contractors that perform the various upgrades to learn more about their reasons for moving ahead, barriers they overcame, benefits they secured, and areas to improve the process.

Q. Will PSE conduct an evaluation of the Targeted Electrification Pilot Phase 2?

A. Yes. PSE will engage with The Cadmus Group to evaluate each program offering of the Targeted Electrification Pilot Phase 2. The Cadmus Group is the organization conducting the evaluation of the initial Targeted Electrification Pilot.

IV. PSE IS ACTIVELY PURSUING PUBLIC FUNDING OPPORTUNITIES

A. PSE's Public Funding Approach and Strategy

Q. Please describe PSE's understanding of the Commission's Final Order 24/10[12] ("Order 24/10") as it relates to the pursuit of public funding opportunities.

A. The Commission's Order 24/10 approved the UE-220066 Settlement on several conditions. One of these conditions included the requirement for PSE to demonstrate all offsetting benefits received or for which it has applied through the Infrastructure Investment and Jobs Act and the Inflation Reduction Act of 2022, when seeking review and recovery of capital investments and power costs. At the time, Order 24/10 recognized that the impact of these laws on rates were not yet known, but that it was apparent that they could affect PSE's operations during the multiyear rate plan. Further, Order 24/10 requires PSE's reporting with respect to the recovery of its capital investments and power costs to include all funding, tax benefits, or any other benefit for which PSE has and has not applied and, if it has not, the reasons justifying its decision to not pursue the IRA and IIJA funding options.

[12] *See WUTC v. Puget Sound Energy*, Dockets UE-220066, et al., Final Order 24/10 (Dec. 22, 2022).

Q. What is PSE's strategy and longer-term plan for pursuing and managing public funding opportunities?

A. PSE is committed to leveraging funding opportunities that are available through state and federal programs that can accelerate efforts to reduce carbon emissions, as well as reduce the costs associated with the transition to clean energy and improve affordability for customers. Upon passage of the IIJA in November 2021, PSE hired external consultants to assist PSE in the evaluation of a wide range of funding opportunities and to develop an application strategy. These efforts resulted in some successes and some learnings that PSE will apply to future rounds of funding. PSE is also actively tracking, evaluating, and applying for newly emerging funding opportunities tied to the IIJA and IRA.

In early 2023, PSE implemented an internal process to track, evaluate, and report on public funding opportunities (grants, tax credits, loans) as they become available. The process involves subject matter experts embedded within the business that work as a team to seek out and respond to new funding opportunities. These opportunities fall into three main categories:

- **Direct Funding Opportunities** – Direct funding opportunities are opportunities that directly enable PSE's clean energy strategy and goals and where PSE would be the main recipient of the funds.

- **Strategic Partnership Opportunities** – Strategic partnership opportunities are opportunities where PSE is not the main recipient but can help drive funding to strategic partners (tribes, municipalities, industry, academia, etc.) that complement or accelerate PSE's clean energy strategy and goals.

- **Customer Education and Engagement Opportunities** – Customer education and engagement opportunities are opportunities for funding made available through state and federal programs that can help PSE customers to decarbonize or lower their energy costs.

Through this process, PSE hopes to create a transparent and efficient system for managing public funding opportunities within the organization. Please see the Third Exhibit to the Prefiled Direct Testimony of John Mannetti, Exh. JM-4, for a list of opportunities that PSE is currently tracking, updated as of January 2024.

Q. How is PSE aligning projects with the potential for future public funds?

A. Currently, PSE is maintaining an active inventory of projects that align with potential opportunities to secure future public funds and working with internal subject matter experts to evaluate. When public funds become available, the subject matter experts are engaged to compare projects to the fund type and eligibility to determine if one or more project is a good candidate for the funding opportunity. The list of opportunities selected to pursue or to not pursue is reviewed and approved by management on a recurring basis.

B. Funding Opportunities/Offsetting Benefits that PSE Has Pursued from the IIJA and IRA in 2022 and 2023

Q. What was the criteria/process for evaluating funding opportunities/offsetting benefits from the IIJA?

A. As mentioned earlier, PSE hired external consultants after the passage of the IIJA in November 2021, to support PSE in the evaluation of funding opportunities that

would provide benefits to PSE customers and align with PSE's strategic needs. The consultant also provided insight on best practices for successfully applying for federal grants, which they drew, in part, from successful grant awards of their past clients that arose from the American Recovery and Reinvestment Act.[13]

The consultants began working with a cross-section of PSE employees in December 2021 to build an approach for the IIJA application process. From December 2021 to February 2022, PSE evaluated grant opportunities for which a utility could receive direct funding as well as grant opportunities for which a utility could be a strategic partner or a sub-grantee. PSE identified the following grant opportunities under the IIJA as having the highest alignment with PSE's operations and needs:

1. Grid Resilience and Innovative Partnerships ("GRIP") through the Department of Energy
    a. Section 40101(c) or Topic Area 1: Grid Resilience Grants
    b. Section 40107 or Topic Area 2: Smart Grid Grants (Grid Flexibility)
2. IIJA provision 40333 and Energy Policy Act of 2005 Secs. 242, 243 and 247: Hydroelectric Incentives Funding in the Bipartisan Infrastructure Law
3. Sec. 60401: Middle Mile Broadband
4. Sections 11401, 30018, 71101: Electric Vehicles
5. Sections 40541, 40554, 40552: Energy Efficiency
6. Section 40314: Hydrogen Hubs

[13] American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5 (2009).

Q. What direct funding opportunities did PSE pursue from the IIJA and why?

A. Early in 2022 when the consultant work was being finalized, a Funding Opportunity Announcement had not yet been made available for most grants, and specific requirements were unknown. Therefore, PSE projects and programs were assessed for readiness and impact against the general grant descriptions and some scoring criteria that had been released by the U.S. Department of Energy at the time. Based on this scoring process, PSE decided to move forward with grant applications in four areas: Grid Flexibility, Grid Resilience, Hydroelectric Incentives Funding, and Hydrogen Hub.

Q. Can you describe the funding opportunities that PSE pursued relating to grid flexibility and grid resilience?

A. The U.S. Department of Energy combined Grid Flexibility and Grid Resilience into a single Funding Opportunity Announcement called Grid Resilience and Innovation Partnerships Program ("GRIP").[14] In July 2022, PSE contracted with different external consultants to provide support in the development of applications for Smart Grid Grant (BIL section 40107) and Grid Resilience Grant (BIL section 40101(c)) under the GRIP funding opportunity. PSE selected the external consultant primarily based on project approach, success of the consultant with prior grant opportunities, pricing, and flexibility to be responsive to timing milestones established by the U.S. Department of Energy.

[14] *See generally* Grid Deployment Office, *Grid Resilience and Innovation Partnerships (GRIP) Program*, U.S. Department of Energy https://www.energy.gov/gdo/grid-resilience-and-innovation-partnerships-grip-program.

On December 16, 2022, PSE submitted concept papers for both a Smart Grid and Grid Resilience Grant. The U.S. Department of Energy responded on February 2, 2023 with letters of encouragement for PSE to submit full applications for both grants.

On March 16, 2023, PSE submitted a Smart Grid grant application for the maximum possible award of $50 million. The portfolio of projects included in the proposal would have helped PSE implement smart grid technologies to modernize PSE's transmission and distribution grid by adding flexibility, intelligence, and responsive system attributes. The projects would have helped enhance automation and control of distribution and transmission assets to improve PSE's ability to prevent outages and recover from them more quickly. PSE had planned to channel over 50 percent of Smart Grid project investments into disadvantaged communities, highly impacted communities, and vulnerable populations.

On April 6, 2023, PSE submitted a Grid Resilience grant application for the maximum possible award of $100 million. The portfolio of projects included in this proposal would have helped improve reliability of distribution circuits that have experienced higher frequency (or duration) of service disruption than the threshold Customer Minutes Interrupted metric. The projects would have also (i) replaced aging conductors that may cause reliability concerns in the near future and (ii) engaged in the proactive underground conversion of overhead lines to mitigate reliability concerns and improve resilience of our assets in high wildfire risk areas. PSE had planned to channel about 44 percent of Grid Resilience

project investments into disadvantaged communities, highly impacted communities, and vulnerable populations.

The competition for these grants was substantial, with over 700 applications received. On October 18, 2023, the U.S. Department of Energy released the list of 58 winning applications for the first round of Grid Flexibility and Grid Resilience grants.[15] Unfortunately, neither of PSE's proposals was among those selected.

There are two additional rounds of funding expected for similar grants, and PSE intends to pursue these opportunities. The U.S. Department of Energy issued the latest Funding Opportunity Announcement for Grid Flexibility and Grid Resilience grants on November 13, 2023,[16] with concept papers due on January 12, 2024 and full applications due on April 17, 2024. PSE submitted one concept paper as a primary applicant and is part of regional partnerships in four additional concept papers for the second round of GRIP funding.

Q. Can you describe the funding opportunities that PSE has pursued relating to hydroelectric efficiency?

A. Since 2014, PSE has applied for, and been awarded, incentive payments under the hydroelectric incentive program under Section 242 of the Energy Policy Act

[15] *See* Grid Deployment Office, Grid Resilience and Innovation Partnerships (GRIP) Program Projects, U.S. Department of Energy (Oct. 18 2023), https://www.energy.gov/gdo/grid-resilience-and-innovation-partnerships-grip-program-projects; *see also* U.S. Department of Energy, *Biden-Harris Administration Announces $3.5 Billion for Largest Ever Investment in America's Electric Grid, Deploying More Clean Energy, Lowering Costs, and Creating Union Jobs* (Oct. 18 2023), https://www.energy.gov/articles/biden-harris-administration-announces-35-billion-largest-ever-investment-americas-electric.

[16] *See* Grid Deployment Office, *Biden-Harris Administration Announces Up to $3.9 Billion to Modernize and Expand America's Power Grid*, U.S. Department of Energy (Nov. 14, 2023), https://www.energy.gov/gdo/articles/biden-harris-administration-announces-39-billion-modernize-and-expand-americas-power.

of 2005[17] for new generation sources developed on existing dams (the "242 Program"). The 242 Program is among the suite of hydroelectric incentives that received new or increased funding under the IIJA. The increase in funding for this program has greatly helped PSE, which received two incentive payments (for calendar years 2021 and 2022) for hydropower generated from the Lower Baker Unit 4. Specifically, the U.S. Department of Energy determined that PSE was eligible for payment on 38,211,401 kilowatt-hours (kWh) generated by Lower Baker Unit 4 in each of calendar years 2021 and 2022. At the rate of $0.02617/kWh, the U.S. Department of Energy determined that PSE's final incentive payment for power generated during calendar years 2021 and 2022 was $1,000,000 and $1,000,000, respectively. This amount represented an increase from incentive payments received by PSE in prior years. These benefits offset the operating budgets of the plant. Note that the availability of this incentive payment has varied by year and depends on approved funding and other factors, such as generation at the plant and how many other entities apply. Given this uncertainty, PSE currently conservatively forecasts receiving $250,000 in 2024 and 2025, respectively.

Q. Can you describe the opportunities that PSE has pursued related to funding a regional hydrogen hub?

A. PSE is a member of the Pacific Northwest Hydrogen Association ("PNWH2"), a consortium of public and private entities spanning Washington, Oregon, and

[17] Section 242 of the Energy Policy Act, Pub. L. No. 109-58, codified at 42 U.S.C. § 15881.

Montana working together to bring clean hydrogen power solutions that leverage the region's vast renewable energy resources to market.

On April 7, 2023, PNWH2 submitted a grant application to secure funding for a regional clean hydrogen hub. PSE is one of 17 companies that has projects proposed as part of the PNWH2 Hub. On October 13, 2023, the U.S. Department of Energy selected the PNWH2 Hub for award negotiations following a competitive nationwide process.[18] The PNWH2 Hub is eligible to receive up to $1 billion in federal funding over four development phases defined by the U.S. Department of Energy that span nine years.

The projects proposed in the PNWH2 Hub would drive economic opportunity across all demographics, creating or supporting more than 10,000 good-paying jobs and stronger energy security to improve the lives and futures of people throughout the region. The PNWH2 Hub's vision and projects were developed with leadership from tribes, unions, industry, and many others and will help deliver a shared vision of clean and equitable energy systems in the Pacific Northwest.

Specifically, PSE is pursuing capital funding for a hydrogen-fueled peaker plant through the PNWH2 application for a hydrogen hub. If a hub were awarded to the region, PSE would be in a position to build, own, and operate a zero-carbon dispatchable electric generating facility that helps provide a stable source of clean

[18] *See* Office of Clean Energy Demonstrations, Regional Clean Hydrogen Hubs Selections for Award Negotiations, U.S. Department of Energy (Oct. 13, 2023), https://www.energy.gov/oced/regional-clean-hydrogen-hubs-selections-award-negotiations.

energy for PSE customers. PSE chose to pursue this opportunity to help address resource adequacy challenges and future CETA requirements noted in the Prefiled Direct Testimony of Josh Jacobs, Exh. JJJ-1T and to benefit from the overall strength of the public-private team that was assembled to pursue a hub.

Q. How has PSE incorporated energy equity into the IIJA project selection process?

A. Each application that PSE has pursued has required the development of detailed community benefit plans. In selecting projects to include in these applications, PSE considered location of projects and how to benefit disadvantaged communities, as defined by the Justice40 Initiative.[19] Projects selected were, in many cases, part of PSE's five-year plans. However, PSE sought to select projects where IIJA funding would provide increased benefit, such as accelerations to project timelines in order to improve service or enable new benefits, such as DER expansion, in disadvantaged communities.

PSE shared the project proposals submitted for funding under the IIJA with PSE's Equity Advisory Group to receive feedback on the approach. PSE incorporated suggestions of the Equity Advisory Group into the final applications. The Equity Advisory Group also submitted letters of support for PSE's grant applications.

[19] *See*, *e.g.*, Office of Energy Justice and Equity, Justice40 Initiative, U.S. Department of Energy, https://www.energy.gov/justice/justice40-initiative.

Q. What funding opportunities from the IIJA did PSE not pursue and why?

A. PSE did not pursue grant opportunities for middle mile broadband, energy efficiency, electric vehicles, and certain sections of the hydroelectric fleet incentives:

- **Middle Mile Broadband**. Upon evaluation, the middle mile broadband grant opportunity was not well-aligned with PSE's regulated business model or strategic focus.
- **Energy Efficiency**. PSE was not eligible to be a direct recipient of energy efficiency grants.
- **Electric Vehicles**. PSE was not eligible to be a direct recipient of electric vehicle grants; however, PSE is working to support community partners, such as school districts in PSE's service area, pursuing electric vehicle grants under the IIJA by providing letters of support and technical assistance
- **Hydroelectric Efficiency**. PSE evaluated hydroelectric efficiency grants under section 243 for Upper Baker Unit 2 but decided not to pursue them because PSE was too far along in the redesign of the unit to qualify for the incentives.

PSE also evaluated the hydroelectric fleet funding opportunity under the dam safety category (section 247) for the Upper Baker Spillway project. PSE filed a letter of intent with the U.S. Department of Energy in June 2023. However, due to heavy competition for these funds, the U.S. Department of Energy indicated that it would prioritize the applications based on the following three criteria:

- Dam safety condition classification;
- Hazard potential classification; and

- Potential to increase resiliency to future hydrologic conditions.

After consideration of the scoring criteria, PSE concluded that the Upper Baker Spillway project would rank relatively low, particularly due to the large number of facilities that have a lower Dam Safety Condition Classification than the Upper Baker facility. Thus, PSE decided not to pursue the grant further.

Q. What offsetting/rate mitigation opportunities is PSE pursuing from the IRA?

A. The IRA contains approximately $370 billion in renewable energy investment tax credits and advanced energy economy support. These renewable energy investment tax credits will make the development and acquisition of renewable and nonemitting electric generation resources more affordable for PSE and its customers. Among other things, the IRA helps create a level playing field for the development of renewable energy resources. When PSE develops and builds its own renewable energy resources, it is PSE's customers who own and derive the long-term benefit of those resources. Accordingly, PSE's customers receive the full benefit of the investment tax credits, receive the credit for generating and using the renewable energy resource, and receive the benefit of lower rates when excess renewable energy can be marketed to other areas. Please see the Prefiled Direct Testimony of Matthew R. Marcelia, Exh. MRM-1T, for details on how PSE plans to leverage the investment tax credits available under the IRA and how these benefits will flow back to PSE customers.

Q. How is PSE planning to leverage Home Efficiency and Electrification Rebates available through the IRA to help customers?

A. In July 2023, the U.S. Department of Energy released guidance (program requirements and the application instructions) on the Home Efficiency and Electrification Rebates grant program, a year after approval of the IRA. PSE has closely monitored this development and is in the process of assessing how program activities align with the requirements outlined by the U.S. Department of Energy. For example, home efficiency audit requirements outlined by the agency are extensive, and PSE will be working with the state to assess the most effective deployment of the audits in order to seek efficiency rebates. PSE will also seek clarity on how to qualify its electrification assessments. PSE is currently running home electrification assessments as part of its Targeted Electrification Pilot and is exploring how this program may qualify within IRA electrification rebates program requirements.

In addition to IRA-based home rebate grants, the State of Washington is expected to allocate CCA funds in the amount of $80 million for home electrification and appliance rebate programs. Washington State Department of Commerce issued a Request for Information that highlighted intentions to utilize these funds, and PSE's response included advice on program deployment specific to these home electrification rebate programs.

To leverage federal and state funding for home efficiency and electrification rebates, PSE will align its efficiency and electrification projects with its residential conservation programs, which include:

- Efficiency Boost (which offers higher rebates on energy-efficient upgrades to income-qualified customers);
- Home Weatherization Assistance (which connects income-qualified customers to local agencies for a free whole-home efficiency upgrade);
- Increased incentives for Multifamily New Construction and Retrofit (which provides rebates to offset the cost of in-unit and common area upgrades that improve energy efficiency);
- Electric space heat rebates;
- Water heating system rebates;
- Weatherization rebates; and
- Rebates and programs associated with PSE's Targeted Electrification Pilot.

Q. What support has PSE provided to its community partners to help them pursue funding opportunities from the IIJA and the IRA for which they may be eligible?

A. PSE has provided letters of support to various community partners that have sought funding from the IIJA, including the following:

1. La Conner School District – U.S. Environmental Protection Agency Clean School Bus grant;
2. Highline School District – U.S. Environmental Protection Agency Clean School Bus grant;

3. North Kitsap School District – U.S. Environmental Protection Agency Clean School Bus grant;

4. Issaquah School District – U.S. Environmental Protection Agency Clean School Bus grant;

5. Port Gamble S'Klallam Tribes – Energy Transitions Initiatives Partnership Project (ETIPP);

6. Northwest Seaport Alliance (NWSA) – U.S. Department of Transportation's Charging and Fueling Infrastructure Discretionary Grant Opportunity FY2022 and FY2023, for a project titled "Catalyzing Zero-Emission Drayage Trucking Infrastructure & Opportunities in the Seattle-Tacoma Region";

7. Sandia National Laboratories – U.S. Department of Energy, Office of Clean Energy Demonstrations' "Collaborative Alignment for Critical Technology Industries" funding for a project titled "National Consortium for the Advancement of LDES Technologies";

8. King County Metro electrification;

9. University of Washington-Bothell charging stations;

10. Sound Transit's Federal Transit Administration request;

11. Washington Department of Commerce "Solar for All" application to the U.S. Environmental Protection Agency;

12. The Nisqually Indian Tribe's "Solar for All" application to the U.S. Environmental Protection Agency; and

13. PSE signed a letter of support as a member company of the Electric Utilities of the West Coast Transit Corridor Initiative (WCCTCI) to support the application of the states of California, Oregon, and Washington to the U.S. Department of Transportation's Charging and Fueling Infrastructure Discretionary Grant Opportunity FY 2022 and FY 2023 for the West Coast Truck Charging and Fueling Corridor Project.

Q. How is PSE working with state agencies, like the Washington State Department of Commerce, on IIJA and IRA funds that are distributed through the state agencies?

A. The Washington State Department of Commerce ("Commerce") issued a Request for Information ("RFI") in September of 2023 to officially gather recommendations and insights from market participants and stakeholders (e.g., utilities, building owners, public agencies, advocacy organizations, equipment distributors, contractors, etc.) regarding twenty-four energy programs that use IIJA/IRA and other funds. PSE responded to this RFI to provide Commerce with advice on co-deployment with PSE programs and program priorities, where appropriate.

Other actions PSE has taken include active participation in Commerce-established roundtable and public listening sessions as well as targeted comment opportunities that Commerce has provided to the public on home efficiency and electrification rebate programs. PSE will continue to work with Commerce to provide market and program insights and expertise and expects funds to begin flowing in mid-to-late 2024, according to Commerce-communicated timelines. PSE expects Commerce programs will ultimately deploy both federal funds as well as state budget funds (from revenues from the CCA auctions, for example).

C. Other Federal and State Funding Opportunities

Q. Which other federal and state funding opportunities has PSE pursued?

A. PSE has applied for grants through the state's Clean Energy Fund for the following projects:

- **Grid Modernization Projects**. PSE applied for, and was awarded, a $200,000 grid modernization grant through the Clean Energy Fund. PSE will use the funding to perform a feasibility study evaluating the use of storage and other technologies to increase distribution system hosting capacity in the Kittitas County region so that PSE can provide an opportunity for more customer solar adoption. The phase 1 application was approved, and PSE submitted phase 2 of the application on September 21, 2023. PSE was selected for a funding award on December 20, 2023.

- **Clean Energy Research, Development and Demonstration**. PSE has applied for a $1,000,000 grant to pursue a metal hydride hydrogen storage pilot project that would enable PSE to test a hydrogen storage option that can be deployed safely.

In addition, PSE has also applied for funding through the Washington State EV Charging Program, which is offering, in the first round of funding, $64 million in incentives to install Level 2 and DC fast chargers throughout the state, with a goal of directing 40 percent of funding into overburdened and vulnerable communities. PSE was the lead applicant for two multifamily projects within this program and a partner applicant on over 100 other proposed projects. For a full list of public funding opportunities that PSE is actively tracking and evaluating, please see the Third Exhibit to the Prefiled Direct Testimony of John Mannetti, Exh. JM-4.

Q. Is PSE pursuing any loans through the U.S. Department of Energy Loan Programs Office?

A. PSE is assessing the applicability of the U.S. Department of Energy Loan Programs Office's ("LPO") Title 17 Clean Energy Financing Program for funding planned projects. Under the Title 17 Clean Energy Financing Program, the LPO can provide federal financing for projects located in the United States that support clean energy deployment and energy infrastructure reinvestment to reduce greenhouse gas emissions and air pollution.

Q. How is PSE assessing the applicability of the Title 17 Clean Energy Financing Program for funding planned projects?

A. PSE is reviewing the Title 17 Clean Energy Financing Program requirements and project eligibility requirements to determine if one or more projects are a good candidate for this funding opportunity. As part of this evaluation, PSE is in conversations with the LPO regarding project funding applicability.

Q. When will PSE be applying for a Title 17 Clean Energy Financing Program loan and how long does the application process take?

A. Due to the complexity of the Title 17 Clean Energy Financing Program requirements, it will take some time to understand if this is a viable solution for low-cost funding for the company and our customers. If PSE has eligible projects, according to the LPO, the application process through conditional commitment commonly takes up to a year.

V. PSE IS ACTIVELY CONSIDERING EMERGING TECHNOLOGIES IN THE CLEAN ENERGY SPACE

Q. What are PSE's clean energy capacity needs for 2030 and 2045?

A. PSE projects that demand for electricity will increase over the next two decades. Moreover, the transition to clean energy means that reliable, dispatchable sources of energy that have traditionally provided baseload power, such as coal and natural gas, will no longer be available. Replacement of these resources with intermittent renewable resources requires substantial additional capacity to balance the intermittent nature of these renewable resources.

PSE's 2023 Electric Progress Report identified the need to acquire almost 7,000 MW of nameplate renewable resources by 2030 and 15,000 MW of nameplate renewable resources by 2045.[20] To put this into perspective, PSE's current generating capacity including owned and contracted resources is around 6,500 MW of nameplate capacity. In other words, PSE will likely need to more than double its existing nameplate capacity to meet the 2030 goal of CETA and more than triple its existing nameplate capacity to meet the 2045 goal of CETA.

Q. What is PSE's vision/strategy for meeting these capacity needs?

A. In the 2023 Electric Progress Report, PSE laid out its vision for meeting its clean energy capacity needs in 2030 and 2045. The plan illustrated that significant investment in intermittent renewable resources, combined with energy storage,

[20] For a copy of the 2023 Electric Progress Report, please see the Second Exhibit to the Prefiled Direct Testimony of Josh Jacobs, Exh. JJJ-3.

and demand response, will shape the foundation of PSE's future energy system. PSE also assumes that other technologies will emerge over the coming fifteen years that will help PSE maintain a reliable system while meeting the state's policy goals. Having a diverse set of resources is especially critical for meeting customer needs at times of peak demand, such as a cold winter day or a summer heat wave.

PSE believes that no single technology solution will be the sole solution for a clean energy future, which is why PSE is taking an "all of the above" approach, including pragmatic and diversified engagement with others in the region to take concrete steps to move multiple technologies forward. PSE works to identify future resources to maintain the reliability and affordability that customers expect as PSE works with others in the region to create a cleaner and more equitable energy system.

Q. What emerging technologies is PSE exploring to meet future capacity needs?

A. As stated above, given PSE's significant capacity needs and the lack of existing carbon-free dispatchable and baseload capacity resources, PSE has cast a wide net to explore emerging technologies that can help fill this capacity gap. This prefiled direct testimony discusses PSE's exploration of three emerging technologies: (i) clean hydrogen technologies, (ii) small modular nuclear reactors, and (iii) long-duration energy storage technologies.

A. Clean Hydrogen Technologies

Q. Is PSE exploring clean hydrogen technologies?

A. Yes. PSE is currently exploring clean hydrogen technologies and how such technologies can help decarbonize PSE's energy operations and meet decarbonization goals of PSE customers. Specifically, PSE is considering the use of clean hydrogen as a fuel for combustion turbine peaking plants. When used as a fuel for power generation, the combustion of clean hydrogen in a turbine does not produce carbon dioxide emissions.

Q. How has PSE been involved in the effort of the Pacific Northwest Hydrogen Association to develop a hydrogen hub?

A. As discussed above in Section IV.B of this prefiled direct testimony, PSE is a member of the Pacific Northwest Hydrogen Association ("PNWH2"). PSE is pursuing capital funding for a hydrogen-fueled peaker plant through the PNWH2 Hub application. If successful, PSE will be in position to build, own, and operate a zero-carbon electric generating facility to balance and firm intermittent renewable resources. The peaker that PSE is developing also includes a storage tank for renewable diesel, a backup fuel, in the event that the plant must operate during periods in which clean hydrogen is unavailable. This project would serve as a catalyst not only for the regional hydrogen economy, but also for the transition of PSE's existing natural gas-fueled thermal fleet to zero carbon fuels, including clean hydrogen, by 2045.

Q. Is PSE participating in other efforts to consider the use of clean hydrogen as an energy source?

A. Yes. In addition to the PNWH2 Hub, PSE is also participating in trade organizations and regional alliances, including the Renewable Hydrogen Alliance, HyReady through Pacific Northwest National Laboratory, and the Green Hydrogen Coalition.

Q. What are some barriers to commercializing and deploying hydrogen?

A. There are currently several barriers to commercialization and deployment of clean hydrogen as fuel for power generation, including initial costs and scaling of solutions, availability of renewable power to produce clean hydrogen at competitive rates, and electrical transmission capacity. Additionally, there is no large-scale geologic storage or pipeline capacity in Washington to facilitate the movement of hydrogen between suppliers and offtakers. Production tax credits and investment tax credits made available in the Inflation Reduction Act improve the economics of clean hydrogen as a fuel source for power generation, however recent guidance issued by the U.S. Department of the Treasury and Internal Revenue Service on the application of IRA tax credits for hydrogen production in section 45V of the Internal Revenue Code may make those tax credits difficult to obtain. There also continue to be challenges around the public perceptions of hydrogen, including safety concerns and arguments about hydrogen's proper role in decarbonizing the economy.

B. Small Modular Nuclear Reactors

Q. Is PSE exploring small modular nuclear reactor technologies?

A. Yes. PSE is exploring small modular nuclear ("SMR") reactor technologies. Nuclear energy already generates a large percentage of electricity in the U.S. and has accounted for between 19 percent and 20 percent of the total annual U.S. electricity generation from calendar years 1990 through 2021.[21] In Washington, the Columbia Generating Station in Richland, Washington, provides nearly ten percent of the state's energy.[22]

In recent years, there have been significant improvements in advanced reactors that seek to address some of the concerns associated with cost, size, and safety of existing commercial reactors, such as the Columbia Generating Station:

> Advanced reactors are often referred to as "Generation IV" nuclear technologies, with existing commercial reactors constituting "Generation III" or, for the most recently constructed reactors, "Generation III+." Major categories of advanced reactors include advanced water-cooled reactors, which would make safety, efficiency, and other improvements over existing commercial reactors; gas-cooled reactors, which could use graphite as a neutron moderator or have no moderator; liquid metal-cooled reactors, which would be cooled by liquid sodium or other metals and have no moderator; molten salt reactors, which would use liquid fuel; and fusion reactors, which would release energy through the combination of light atomic nuclei rather than the splitting (fission) of heavy nuclei such as uranium. Most of these concepts have been studied, but relatively few have advanced to

[21] U.S. Energy Information Administration, *U.S. Nuclear Industry* (Aug. 24, 2023), https://ww.eia.gov/energyexplained/nuclear/us-nuclear-industry.php.

[22] Energy Northwest, *Nuclear Energy*, https://www.energy-northwest.com/energy101/energysources/Pages/Nuclear.aspx.

> commercial-scale demonstration, and such demonstrations in the United States took place decades ago.[23]

In light of PSE's significant capacity needs and the need for a CETA-compliant baseload resource to replace coal in our portfolio, PSE has engaged in regional discussions around small modular reactors. Small modular reactors are advanced nuclear reactors that have a power capacity of up to 300 MW per unit, which is about one-third of the generating capacity of traditional nuclear power reactors, and can produce carbon-free electricity.[24] Many of the benefits of SMRs are inherently linked to the nature of their design:

> Many of the benefits of SMRs are inherently linked to the nature of their design – small and modular. Given their smaller footprint, SMRs can be sited on locations not suitable for larger nuclear power plants. Prefabricated units of SMRs can be manufactured and then shipped and installed on site, making them more affordable to build than large power reactors, which are often custom designed for a particular location, sometimes leading to construction delays. SMRs offer savings in cost and construction time, and they can be deployed incrementally to match increasing energy demand.[25]

If small modular reactors could advance beyond commercial-scale demonstration and become available for commercial use in the U.S., they could play a critical role in integrating intermittent renewable resources, like wind and solar, and provide a critical reliability benefit to the grid.

[23] Congressional Research Service, *Advanced Nuclear Reactors: Technology Overview and Current Issues*, Summary (Feb. 17, 2023), https://crsreports.congress.gov/product/pdf/R/R45706.

[24] *See* International Atomic Energy Agency, *What Are Small Modular Reactors (SMRs)?* (Sept. 13, 2023), www.iaea.org/newscenter/news/what-are-small-modular-reactors-smrs.

[25] *Id*.

Q. Is PSE evaluating any specific small modular nuclear reactor projects?

A. Yes. As part of an "all of the above" approach to meeting clean energy and capacity needs, PSE is investing $10 million with Energy Northwest to support early project development activities for the first phase of a small modular nuclear reactor facility in exchange for future energy and capacity generated as part of these projects.

Q. Is PSE seeking cost recovery of this $10 million investment?

A. No. PSE is not seeking cost recovery of this $10 million investment in Energy Northwest to support early project development activities for the first phase of a small modular nuclear reactor facility.

C. Grid-Scale Long Duration Energy Storage Technologies

Q. Is PSE considering grid-scale long duration energy storage technologies?

A. Yes. PSE is currently considering a number of grid-scale long duration energy storage technologies. PSE is working with both internal and external parties, such as the Electric Power Research Institute, to understand the chemistries behind the technologies and how PSE could operationalize the storage capabilities of such technologies.

PSE is a member of the National Consortium for the Advancement of LDES Technologies, which Sandia National Laboratories formed in partnership with Argonne National Laboratory, Idaho National Laboratory, the National

Renewable Energy Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory. PSE is one of 87 entities to join the consortium, which seeks to "enable, facilitate, and coalesce collaborative efforts between public and private entities to address the core issues facing long duration energy storage commercialization, including investor confidence, market planning, interconnection, standardization, safety, economic evaluation, and more."[26]

Q. How will long duration energy storage help mitigate PSE's clean energy capacity needs?

A. LDES technologies can help maintain a continuous and reliable supply of clean energy in the absence of baseload resources like coal and natural gas. An LDES battery can store energy produced by intermittent renewable resources, like wind and solar, for use when the sun is not shining and the wind is not blowing.

As discussed further in Section VI below, Form Energy's iron-air technology can dispatch at full nameplate capacity for up to 100 hours.[27] For reference, PSE typically maintains about 56 hours of distillate back-up at existing peaker plants, and more common grid-scale battery energy storage systems generally have durations of four hours or less:

> By the end of 2022 about 9 GW of energy storage had been added to the U.S. grid since 2010, adding to the roughly 23 GW of pumped storage hydropower (PSH) installed before that. Of the

[26] U.S. Department of Energy Office of Technology Transitions, *DOE Announces over $15 Million towards Two Projects to Support Industry Engagement and Alignment for Clean Energy Solutions* (Sept. 7, 2023), https://www.energy.gov/technologytransitions/articles/doe-announces-over-15-million-towards-two-projects-support-industry.

[27] *See id*.

> new storage capacity, more than 90% has a duration of 4 hours or less, and in the last few years, Li-ion batteries have provided about 99% of new capacity.[28]

Therefore, Form Energy's iron-air technology offers the potential for a much longer firm energy duration than that of lithium-ion batteries. A longer duration would enable PSE to maintain reliability over a much longer duration or during times of limited generation from intermittent renewable resources during peak events.

Q. What are some barriers to the commercialization of LDES technologies?

A. LDES technologies are only just starting to be developed and deployed, and there are many types (over 100) of LDES technologies under development. The lack of operational history is the most significant current barrier to commercialization of LDES technologies. Without historical operational data from comparable utilities or companies, it is difficult for utilities, such as PSE, to anticipate, plan, and prepare to operate LDES technologies. The significant leap from current grid-scale lithium-ion battery energy storage systems to LDES technologies will take time, and utilities must develop a technological understanding of how best to deploy LDES technologies as grid-scale devices.

[28] Paul Denholm, et al., *Moving Beyond 4-Hour Li-Ion Batteries: Challenges and Opportunities for Long(er)-Duration Energy Storage*, National Renewable Energy Laboratory, at v (Sept. 2023), https://www.nrel.gov/docs/fy23osti/85878.pdf.

VI. PSE'S PROPOSED LONG-DURATION ENERGY STORAGE PILOT

A. Overview

Q. What is PSE proposing for a long-duration energy storage pilot?

A. PSE is proposing to install a 10 MW iron-air battery technology developed by Form Energy (the "LDES Pilot"). Form Energy's iron-air battery technology can discharge for a duration of 100 hours.[29] PSE projects that the proposed LDES Pilot would go into service by the end of calendar year 2026.

Q. Please describe PSE's proposed LDES Pilot.

A. PSE is proposing installation of a 10 MW/1000 MWh iron-air battery from Form Energy. The battery features a 100-hour duration discharge, which far exceeds other battery storage technologies, including grid-scale lithium-ion batteries. PSE is currently analyzing siting options that will maximize project benefits under the clean energy investment tax credits ("ITC"), thereby providing positive customer benefits while allowing PSE to evaluate the capacity benefits of this new resource type.

This 100-hour duration would allow PSE to discharge the LDES battery during winter peaking and summer peaking events when intermittent resources, such as wind and solar renewable resources, may not be generating. Form Energy has developed the operating characteristics of this iron-air battery to resemble those of a combustion turbine peaking plant. If this LDES Pilot proves successful, PSE

[29] *See* Form Energy, *Battery Technology*, https://formenergy.com/technology/battery-technology/.

could consider deploying similar LDES systems in 100 MW increments, fulfilling PSE's need for CETA-compliant dispatchable capacity.

Q. Please describe the technology PSE selected for the LDES Pilot.

A. Form Energy's LDES system is based on iron-air technology. The chemistry of this technology utilizes a reverse rusting process that allows for a much longer duration than that of lithium ion or flow battery technologies. Form Energy's LDES technology can charge continuously for days and discharge for upwards of 100 hours. The abundance of iron worldwide, as opposed to lithium, helps decrease material and cost risk, thereby allowing for a much smoother supply chain process. Form Energy further reduces supply chain risk by using off-the-shelf components in its battery equipment. The iron-air chemistry is also composed of a non-flammable aqueous electrolyte meaning that there is no risk of thermal runaway and no heavy metals required with this technology.

Q. Why is PSE introducing the proposed LDES Pilot as part of this proceeding?

A. Both the region and PSE have a growing need for carbon-free dispatchable capacity resources to provide balancing and ancillary services for intermittent renewable resources, such as solar and wind, to comply with CETA and similar requirements of other states. PSE has a need to learn about LDES technologies through first-hand deployment of these systems on PSE's grid. The experience and learning gained by PSE from the proposed LDES Pilot will help prove out

LDES use cases and costs, which will inform future resource planning and acquisition decisions.

PSE and Form Energy can build and deploy the LDES Pilot assets by 2026, which is sooner than other types of carbon-free dispatchable capacity evaluated by PSE. Additionally, the primary battery material—iron—is an affordable and abundantly available commodity that, if successful, could demonstrate the promise of the Form Energy LDES technology as a cost-effective carbon-free dispatchable capacity resource.

Q. How would PSE's proposed LDES Pilot benefit customers?

A. PSE intends to use the proposed LDES Pilot for several use cases.

On the generation side, PSE will leverage the long duration capacity of the proposed LDES Pilot to supplement system peak management. Optimizing market conditions, PSE will test capacity in two scenarios: (1) the use of capacity a few hours per day over many days, and (2) the use of capacity for three to four consecutive days. PSE will learn from and assess the 100-hour duration of the technology in each use case to understand the value in each use case.

Additionally, PSE will test capacity planning and qualifying capacity of the proposed LDES Pilot. In both trading and capacity planning, PSE's load office will be able to use the LDES system for ancillary services as a contingency reserve obligation.

Q. What research did PSE conduct to understand the Form Energy LDES technology?

A. PSE partnered with Electric Power Research Institute to understand LDES technologies in general and the Form Energy iron-air LDES technology in particular. PSE also contracted with Black and Veatch, an outside consultant, to perform technology evaluation in the development of the 2025 Integrated Resource Plan. PSE's internal subject matter experts worked with these organizations to understand the potential value of LDES technologies and evaluated numerous battery technologies, including LDES technologies.

Q. Does Form Energy have other pilot projects in progress?

A. Yes. Form Energy has a number of publicly announced pilot projects under development. Form Energy has contracted with each of Georgia Power, Great River Energy, Dominion Energy, Xcel Energy, and the California Energy Commission on LDES projects ranging from five to fifteen MWs.

Q. Will the iron-air LDES technology selected by PSE align with existing technologies and control systems?

A. Yes. The Form Energy LDES technology will complement a number of batteries and microgrids currently under deployment by PSE. Leveraging existing information and operational technology requirements, asset management practices, and internal operational standards for distributed as well, as front-of-the-meter batteries, PSE has a process and framework for how to operationalize

the LDES Pilot. Further learning will enhance PSE's understanding of battery interaction on the market as well as ancillary services with the load office. Through this pilot, PSE hopes to further develop its knowledge of how this technology can support existing technologies on the system.

Q. How does PSE plan to engage the community and consider equity while developing the LDES Pilot?

A. PSE is in the process of site selection for the LDES Pilot. Through this process, PSE is committed to a robust community engagement process that involves 1) providing an opportunity to participate in the project planning and development and 2) listening to ideas and feedback to ensure the project benefits our customers, including PSE's vulnerable populations and highly impacted communities. PSE will work with its public engagement and policy teams to approach interested parties and communities in a methodical, equitable, and inclusive process.

Q. Did PSE engage with its management/executive team on the proposed LDES Pilot?

A. Yes. The Energy Management Committee approved the proposed LDES Pilot on January 4, 2024. Please see the Fourth Exhibit to the Prefiled Direct Testimony of John Mannetti, Exh. JM-5C, for the presentation to the Energy Management Committee on January 4, 2024. PSE entered into a memorandum of understanding ("MOU") with Form Energy to further develop the LDES Pilot on

January 4, 2024. Please see the Fifth Exhibit to the Prefiled Direct Testimony of John Mannetti, Exh. JM-6C for the MOU between PSE and Form Energy. Additionally, PSE management approved a Corporate Spending Authorization ("CSA") form for the LDES Pilot in PSE's capital plan. Please see the Sixth Exhibit to the Prefiled Direct Testimony of John Mannetti Exh. JM-7C for the Corporate Spending Authorization for the Long Duration Energy Storage Pilot.

Q. Did PSE consider alternative technologies?

A. Yes. PSE has considered and continues to research a number of other emerging technologies. In the space of LDES specifically, PSE is unaware of any alternatives in the battery space that have a duration of longer than twelve hours. This puts the technology developed by Form Energy in a unique position to address longer peak events.

B. Implementation Strategy for the Proposed LDES Pilot

Q. Please explain PSE's implementation strategy for the proposed LDES Pilot.

A. In calendar year 2024, PSE and Form Energy will work together on technical due diligence, site identification, and selection of system size and configuration. PSE and Form Energy will also finalize necessary contracts for the proposed LDES Pilot.

In calendar year 2025, PSE and Form Energy will engage in (i) project design, (ii) permitting, (iii) community engagement to assess the equity implications of specific locations, and (iv) engineering, procurement, and construction activities.

In calendar year 2026, construction will begin, factory acceptance tests will be performed, and the LDES system will be delivered to the selected site.

Q. Will PSE manage the engineering, procurement, and construction activities for the proposed LDES Pilot?

A. No. Form Energy brings experience and expertise in LDES projects to the proposed LDES pilot. This experience and expertise includes the ability to contract with Form Energy's engineering, procurement, and construction team. PSE anticipates learning from Form Energy through implementation of the proposed LDES Pilot rather than managing the engineering, procurement, and construction work. In other words, PSE will be relying on the experience and expertise of Form Energy, while also gaining a better understanding of the technicalities of LDES systems.

Q. Please describe what PSE anticipates may be included in the Evaluation, Measurement, and Verification process.

A. PSE will use the proposed LDES Pilot to evaluate the technological readiness for full-scale utilization and deployment of LDES systems. PSE aims to learn and optimize how and when to dispatch LDES systems. For example, PSE will seek to understand how to utilize the technology for system peak reduction and ancillary

services, such as voltage support and frequency response. Learning how and when PSE can most effectively dispatch LDES systems will help determine the value of future deployments of LDES systems at scale.

C. Cost Recovery for the Proposed LDES Pilot

Q. What is PSE's projected capital budget for the LDES Pilot?

A. PSE's projected capital budget for the LDES Pilot is [redacted], with the LDES Pilot achieving operations in calendar year 2026.

Table 4. Projected Capital Budget for the LDES Pilot

Calendar Year	Projected Capital Expense
Calendar Year 2024	[redacted]
Calendar Year 2025	[redacted]
Calendar Year 2026	[redacted]
[redacted]	[redacted]

Table 4 above reflects only the capital expenditures and does not reflect financing costs, in the form of allowance for funds used during construction ("AFUDC") and construction work in progress ("CWIP"). Table 5 below reflects the projected amounts associated with the LDES Pilot that would be placed in rate base.

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Table 5. Projected Amounts to be Added to Rate Base for the LDES Pilot

Year	Beginnning CWIP	Capital Expenditures	AFUDC	Closing	Ending CWIP
2023					
2024					
2025					
2026					

Q. What is the projected operations and maintenance budget for the LDES Pilot after it becomes operational in 2026?

A. PSE projects an annual operations and maintenance budget for the LDES Pilot of approximately $200,000 (not including the cost of electricity to charge) or about $2,845,000 total over a 15-year period.

Q. How does PSE expect to recover the costs of the proposed LDES Pilot?

A. PSE proposes to recover the [redacted] reflected in Table 5 above in base rates during the multiyear rate plan period. PSE has included these costs in the filed rate plan as part of this proceeding.

PSE will also apply for clean energy investment tax credits under Section 48E of the tax code, 26 U.S.C. § 48E, for the proposed LDES pilot. The LDES Pilot should qualify for ITCs of 40 or 50 percent of the qualified investment, depending on siting of the pilot. The LDES Pilot would be eligible for the ITC of 50 percent of the qualified investment if sited in an energy community and 40 percent of the qualified investment if not sited in an energy community.

Please see the Prefiled Direct Testimony of Matthew R. Marcelia, Exh. MRM-1T, for a discussion of how PSE is evaluating and applying investment tax credits.

Q. Is LDES technology currently a cost-effective solution? If not, what would it take for LDES technology to be cost-effective?

A. No. Currently, LDES technology is not a cost-effective solution. PSE is testing the Form Energy LDES technology in the pilot to understand how and when to operationalize LDES technology once it becomes more cost-effective. PSE is optimistic that once scaled, LDES technology may be a cost-effective capacity resource.

The levelized cost of capacity for PSE's LDES pilot is estimated to be $[redacted] per kilowatt-year. However, PSE projects that the levelized cost of capacity of the Form Energy LDES technology at scale could be as low as $129 per kilowatt-year, which would compare favorably with the projected levelized cost of capacity of a biodiesel peaker at $176/KW-year. By contrast, the cost of multiple lithium-ion batteries to equal the duration of one Form Energy LDES battery would be significantly higher.

Please see the Fifth Exhibit to the Prefiled Direct Testimony of John Mannetti, Exh. JM-8, for a comparison of levelized costs of energy of capacity technologies considered by PSE.

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VII. CONCLUSION

Q. Does that conclude your prefiled direct testimony?

A. Yes, it does.