EXH. JK-3T
DOCKET UG-230968
WITNESS: JASON KUZMA

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**DOCKET UG-230968**

PREFILED REBUTTAL TESTIMONY (NONCONFIDENTIAL) OF

JASON KUZMA

ON BEHALF OF PUGET SOUND ENERGY

SEPTEMBER 12, 2024

PUGET SOUND ENERGY

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PUGET SOUND ENERGY

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I. INTRODUCTION

Q. Are you the same Jason Kuzma who submitted Prefiled Direct Testimony on April 25, 2024, on behalf of Puget Sound Energy in this proceeding?

A. Yes. On April 25, 2024, I filed the Prefiled Direct Testimony of Jason Kuzma, Exhibit JK-1T, and one supporting exhibit (Exh. JK-2) thereto, on behalf of Puget Sound Energy ("PSE") in this proceeding.

Q. What is the purpose of your rebuttal testimony?

A. This prefiled rebuttal testimony does the following:

(i) addresses assertions raised by the Joint Environmental Advocates, which include Climate Solutions, NW Energy Coalition, and Washington Conservation Action (collectively, "JEA") regarding PSE's obligations as a gas supplier and as an owner of a covered facility under the Climate Commitment Act ("CCA");

(ii) provides an analysis that demonstrates that average daily temperatures at SeaTac International Airport over the course of a year is a nearly perfect predictor for volumes of natural gas sold and delivered to PSE's firm and interruptible customers and the greenhouse gas ("GHG") emissions associated with the combustion of such natural gas by such customers and the potential impact of such risks on PSE, and

(iii) suggests that the Washington Utilities and Transportation Commission ("Commission") may wish to consider modifications to PSE's Natural Gas Schedule 111 (Greenhouse Gas Emissions Cap and Invest Adjustment) to require certain reporting information required by the California Public Utilities Commission ("CPUC") for cost recovery of California Cap-and-Trade Program costs and revenues by California investor-owned natural gas utilities.

II. CCA COMPLIANCE RESPONSIBILITIES

Q. Does PSE dispute the assertion of JEA that the CCA "reflects legislators' practical understanding that compliance . . . will require covered entities to spend money to decarbonize"?[1]

A. No. The legislative intent of the CCA is to require covered entities, such as PSE, to purchase compliance instruments (subject to a cap on available compliance instruments that decreases each year) to create market forces that will encourage covered entities to invest in decarbonization efforts. PSE's understanding of the intent of the CCA appears to be consistent with the understanding of JEA.

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[1] McCloy, Exh. LM-1T at 8:12-13.

Q. Will the CCA encourage natural gas utilities, such as PSE, to "incur various expenses beyond simply purchasing allowances, such as investing in pilot studies, obtaining alternative fuels, spending on energy efficiency or weatherization methods . . ."?[2]

A. Yes. PSE agrees that the CCA will encourage natural gas utilities to make investments in decarbonization efforts, including the decarbonization methods mentioned in the testimony of JEA.

Q. Has PSE made investments in any of the decarbonization methods mentioned in the testimony of JEA?

A. Yes. PSE has made investments in the decarbonization methods mentioned in the testimony of JEA. PSE decarbonization actions include offering incentives for PSE customers to electrify, purchasing renewable natural gas, and operating a leak reduction program to reduce methane emissions and PSE is also exploring emerging technologies and clean fuels to help identify future decarbonization strategies. PSE recognizes that compliance with the CCA will require complex and multifaceted decarbonization efforts across many industries, including natural gas utilities. PSE is aware that a compliance strategy that relies exclusively upon the purchase of compliance instruments would be insufficient for PSE's natural gas operations.

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[2] McCloy, Exh. LM-1T at 9:6-9.

Q. Can PSE unilaterally engage in complex and multifaceted decarbonization efforts?

A. No. As a public service company, PSE has a legal obligation to provide nondiscriminatory, universal access to natural gas—a commodity that, when combusted, inherently emits greenhouse gas emissions. A tension exists between the public service obligations to sell natural gas imposed by law and statewide policy and goals to decarbonize, one that parties to this proceeding have failed to appreciate.

Q. Can you provide an example of parties to this proceeding failing to recognize the tension between PSE's public service obligations to sell natural gas imposed by law and statewide policy and goals to decarbonize?

A. Yes. For example, JEA criticizes PSE for its 2022 Integrated Resource Plan (the "2002 IRP") for including the sale of natural gas for the foreseeable future:

> PSE's 2022 Integrated Resource Plan (IRP) reveals that [PSE] intends to continue relying on fossil-derived fuels for the foreseeable future, primarily favoring natural gas. As illustrated in WG Exhibit-2, PSE's planned carbon emissions trajectory indicates that [PSE] aims to emit 4.1 million metric tons of carbon in its preferred portfolio by 2050, with natural gas operations accounting for 82% of Washington State's total carbon emission targets. PSE has yet to establish long-term plans to abate natural gas emissions, a decision that contradicts statewide goals and should not be condoned by the Commission.[3]

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[3] Gehrke, Exh. WG-1T at 19:11-18.

This testimony fails to acknowledge the legal requirements for integrated resource planning for gas companies in Washington. The Commission's rules expressly provide that the purpose of integrated resource plans is for natural gas companies to plan to meet system demand with the least cost of natural gas supply and conservation:

> Each natural gas utility regulated by the commission has the responsibility to meet system demand with the least cost mix of natural gas supply and conservation. In furtherance of that responsibility, each natural gas utility must develop an "integrated resource plan."[4]

Commission rules define the term "integrated resource plan" as

> a plan describing the mix of natural gas supply and conservation designated to meet current and future needs at the lowest reasonable cost to the utility and its ratepayers.[5]

Commission rules require integrated resource plans of gas companies to include the following:

- a range of forecasts of future natural gas demand in firm and interruptible markets for each customer class that examine the effect of economic forces on the consumption of natural gas and that address changes in the number, type and efficiency of natural gas end-uses;[6]
- an assessment of commercially available conservation, including load management, as well as an assessment of currently employed and new policies and programs needed to obtain the conservation improvements;[7]
- an assessment of conventional and commercially available nonconventional gas supplies; [8]

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[4] WAC 480-90-238(1).
[5] WAC 480-90-238(2)(a).
[6] WAC 480-90-238(3)(a).
[7] WAC 480-90-238(3)(b).
[8] WAC 480-90-238(3)(c).

- an assessment of opportunities for using company-owned or contracted storage;[9]

- an assessment of pipeline transmission capability and reliability and opportunities for additional pipeline transmission resources;[10]

- a comparative evaluation of the cost of natural gas purchasing strategies, storage options, delivery resources, and improvements in conservation using a consistent method to calculate cost-effectiveness;[11]

- the integration of the demand forecasts and resource evaluations into a long-range (e.g., at least ten years; longer if appropriate to the life of the resources considered) integrated resource plan describing the mix of resources that is designated to meet current and future needs at the lowest reasonable cost to the utility and its ratepayers;[12]

- a short-term plan outlining the specific actions to be taken by the utility in implementing the long-range integrated resource plan during the two years following submission,[13] and

- a report on the utility's progress towards implementing the recommendations contained in its previously filed plan.[14]

In short, the 2022 IRP complied with the Commission's regulations and planned to meet demand with resources available to PSE—a mix of natural gas supply and conservation designated to meet current and future needs at the lowest reasonable cost to PSE and its customers. PSE hears JEA's criticism that the 2022 IRP focused heavily on natural gas supply and insufficiently on complex and multifaceted decarbonization efforts, but the 2022 IRP needed to comply with

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[9] WAC 480-90-238(3)(d).
[10] WAC 480-90-238(3)(e).
[11] WAC 480-90-238(3)(f).
[12] WAC 480-90-238(3)(g).
[13] WAC 480-90-238(3)(h).
[14] WAC 480-90-238(3)(i).

rules promulgated by the Commission. Although the state may have recently established policies and goals to decarbonize and reduce greenhouse gas emissions, many regulations, processes, and programs reflect a different era, one in which the state encouraged the use of natural gas as an economic fuel for space and water heating.

Q. What does PSE suggest to harmonize the public service company obligations of gas companies with statewide decarbonization policies and goals?

A. Parties must work together to amend regulations and establish new processes and programs that allow gas companies to meet their public service obligations while contributing to statewide decarbonization policies and goals. For example, PSE agrees with JEA that PSE is "capable of structuring and implementing a decarbonization plan,"[15] but valuable time has been spent over the past year adjudicating a proposal that PSE bear costs associated with one of the very few compliance instruments—allowances—available for PSE to comply with the CCA. To date, PSE has had limited opportunity to structure and implement a decarbonization plan but already faces a proposal that assumes that PSE will fail at decarbonization plans that it has recently begun to structure.

PSE is not opposed to the work ahead, as evidenced by its support of legislation in the 2024 legislative session that would allow PSE to engage in a more holistic planning process through an integrated system plan. PSE asks that parties

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[15] McCloy, Exh. LCM-1T at 12:18-19.

recognize that PSE must simultaneously satisfy its public service obligations while working to establish decarbonization efforts for Commission approval. To be successful, however, interest parties will need to work in a collaborative—and not adversarial—environment.

III. COST RECOVERY

Q. Please describe Commission Staff's proposal in this proceeding.

A. Commission Staff recommends that the Commission

(i) adopt PSE's proposed risk-sharing mechanism, as revised by the modified earnings test proposed by Commission Staff, beginning January 1, 2025, and continuing through the rate-effective date of PSE next general rate case, and

(ii) eliminate the risk-sharing mechanism and include CCA compliance costs in PSE's base rate revenue requirement for natural gas operations in the next general rate case.[16]

Q. Does Commission Staff offer a rationale for the proposal to eliminate the risk-sharing mechanism and include CCA compliance costs in the base rate revenue requirement for natural gas operations in PSE's next general rate case?

A. Yes. Commission Staff offers the following recommendation:

> Without an assessment of the earnings risk the Company actually faces – i.e., without a detailed analysis of the risk that actual costs will be so much greater than the costs embedded in rates that it will have a material impact on the Company's earnings and ability to attract capital on reasonable terms – the Commission does not have

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[16] *See* McGuire, Exh. CRM-1T at 3:7-15.

> a basis for determining that the continued existence of PSE's schedule 111 is in the public interest.[17]

Q. Did Commission Staff conduct any analysis of the risk that CCA compliance costs would be "so much greater than the costs embedded in rates that it will have a material impact on [PSE's] earnings and ability to attract capital on reasonable terms"?[18]

A. No. PSE is unaware of any analysis conducted by Commission Staff of the risk that CCA compliance costs could exceed costs embedded in the base rate revenue requirement for natural gas operations. To be fair, the base rate revenue requirement for natural gas operations of PSE has never included CCA compliance costs, so any "detailed analysis" of actual CCA compliance costs to compliance costs embedded in the base rate revenue requirement for natural gas operations is not possible. Additionally, the Cap-and-Invest Program has only been in existence for just over eighteen months, and there is not a sufficient history of CCA allowance prices. Moreover, the CCA allowance prices over the first eighteen months have been volatile, reflecting the uncertainty inherent in a nascent regulatory program implemented under challenging circumstances and the shadow of a ballot initiative that seeks to eliminate the program.

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[17] McGuire, Exh. CRM-1T at 3:19 – 4:2.

[18] McGuire, Exh. CRM-1T at 3:22-4:1.

A. Analysis of Variability in Greenhouse Gas Emissions Associated With Deliveries of Natural Gas to PSE Customers

Q. Has PSE conducted an analysis of the variability in greenhouse gas emissions associated with deliveries of natural gas to PSE customers?

A. Yes. PSE conducted an analysis of the variability in greenhouse gas emissions associated with deliveries of natural gas to PSE customers. The analysis considers natural gas delivered to PSE customers, greenhouse gas emissions associated with such deliveries, average daily temperatures at SeaTac International Airport, and heating degree days (HDD65) over a seventeen year period beginning January 1, 2007, and ending December 31, 2023. Please see the First Exhibit to the Prefiled Rebuttal Testimony of Jason Kuzma, Exh. JK-4, for Direct (Scope I) and Indirect (Scope III) results of the analysis for calendar years 2015 through 2022, and please see the Second Exhibit to the Prefiled Rebuttal Testimony of Jason Kuzma, Exh. JK-5, for the full results of the analysis for calendar years 2007 through 2023.

Q. Why did PSE analyze the variability in greenhouse gas emissions associated with deliveries to PSE customers?

A. PSE's overall CCA compliance costs for natural gas operations included in Schedule 111 reflect the product of two variables:

(i) CCA allowance prices and

(ii) greenhouse gas emissions associated with natural gas volumes delivered to PSE customers.

Although there is not an extensive history of CCA allowance prices (and the existing history of CCA allowance prices reflects volatility inherent in an immature program subject to existential threat from a ballot initiative for regulatory appeal), there exists a history of natural gas deliveries from which one could conduct an analysis of variability in greenhouse gas emissions associated with deliveries of natural gas to PSE customers. Such an analysis could illustrate the impact of one variable (greenhouse gas emissions) on CCA costs and the potential impact of including CCA compliance costs in PSE's base rate revenue requirement for natural gas operations.

1. Sources of Greenhouse Gas Emissions Associated with PSE's Natural Gas Operations

Q. What types of greenhouse gas emissions arise from PSE's natural gas operations?

A. There are two significant sources of greenhouse gas emissions associated with PSE's natural gas operations:

(i) direct (Scope I) greenhouse gas emissions associated with PSE's natural gas distribution system, including carbon dioxide (CO_2) and methane (CH_4) emissions from equipment leaks, and

(ii) indirect (Scope III) greenhouse gas emissions associated with carbon dioxide (CO_2) emissions result from the combustion of natural gas by PSE's natural gas customers.

Q. Does PSE separately account for direct (Scope I) and indirect (Scope III) greenhouse gas emissions associated with PSE's natural gas operations?

A. Yes. PSE separately accounts for direct (Scope I) and indirect (Scope III) greenhouse gas emissions associated with PSE's natural gas operations in the Greenhouse Gas Inventory Reports that PSE provides in accordance with the Greenhouse Gas Reporting Program of the U.S. Environmental Protection Agency (EPA) and the greenhouse gas emissions reporting requirements of the Washington Department of Ecology under chapter 173-441.

a. <u>Direct (Scope I) Greenhouse Gas Emissions Associated with PSE's Natural Gas Operations</u>

Q. What sources result in direct (Scope I) greenhouse gas emissions associated with PSE's natural gas operations?

A. Direct (Scope I) greenhouse gas emissions from PSE's natural gas operations include fugitive emissions of carbon dioxide (CO_2) and methane (CH_4) from equipment leaks from connectors, block valves, control valves, pressure relief valves, orifice meters, regulators, and open-ended lines from metering and regulating and transmission-distribution transfer stations on PSE's natural gas distribution system.[19]

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[19] *See*, *e.g.*, Puget Sound Energy, *2019 Greenhouse Gas Inventory* at section 4.2.1.2, available at https://www.pse.com/-/media/PDFs/Greenhouse-Gas-Inventory/2019_Greenhouse_Inventory_Final_updated.pdf.

Q. How does PSE calculate and report direct (Scope I) greenhouse gas emissions associated with PSE's natural gas operations?

A. Pursuant to RCW 70A.15.2200 of the Washington Clear Air Act,[20] the Washington Department of Ecology adopted rules requiring mandatory greenhouse gas emissions reporting requirements for owners and operators of certain facilities that directly emit 10,000 metric tons or more per year of greenhouse gas emissions in Washington.[21] PSE filed its first reports under the mandatory greenhouse gas emissions rules of the Washington Department of Ecology began in 2013, for greenhouse gas emissions in 2012.

Q. What direct (Scope I) greenhouse gas emissions associated with PSE's natural gas operations has PSE reported to the Washington Department of Ecology?

A. Over the last eight reports made to the Washington Department of Ecology, the direct (Scope I) greenhouse gas emissions associated with PSE's natural gas operations have been in a range with a minimum of 58,610 $mtCO_2e$, a maximum of 66,913 $mtCO_2e$, and a mean of 62,033 $mtCO_2e$. Please see the First Exhibit to the Prefiled Rebuttal Testimony of Jason Kuzma, Exh. JK-4, at page 1, for the direct (Scope I) greenhouse gas emissions associated with PSE's natural gas

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[20] *See* Chapter 70A.15 RCW (Washington Clean Air Act).

[21] *See* Chapter 173-441 WAC (Reporting of Emissions of Greenhouse Gases).

operations that PSE has reported to the Washington Department of Ecology for calendar years 2015 through 2022.

b. Indirect (Scope III) Greenhouse Gas Emissions Associated with PSE's Natural Gas Operations

Q. What sources result in indirect (Scope III) greenhouse gas emissions associated with PSE's natural gas operations?

A. Indirect (Scope III) greenhouse gas emissions from PSE's natural gas operations are the greenhouse gas emissions emitted from the complete combustion or oxidation by PSE's customers of the natural gas supplied by PSE.[22]

Q. How does PSE calculate and report indirect (Scope III) greenhouse gas emissions associated with PSE's natural gas operations?

A. The Washington Department of Ecology greenhouse gas emissions reporting rules requires suppliers of natural gas, such as PSE, to report greenhouse gas emissions associated with the complete combustion or oxidation of natural gas delivered, sold, or imported in Washington:

> In addition to the CO_2 emissions specified under 40 C.F.R. § 98.402, all suppliers of natural gas covered in this section must separately report the CO_2, CO_2 from biomass-derived fuels, CH_4, N_2O, and CO_2e emissions from the complete combustion or oxidation of the annual volume of natural gas delivered, sold or imported in Washington state.[23]

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[22] *See, e.g.,* WAC 173-441-010 (providing that "[f]or suppliers, the [greenhouse gases] reported are the quantity that would be emitted from the complete combustion or oxidation of the products supplied.").

[23] WAC 173-441-122 (4)(a).

These greenhouse gas emissions resulting from the complete combustion or oxidation by PSE customers of natural gas delivered by PSE constitutes indirect (Scope III) greenhouse gas emissions of PSE.

Q. How does PSE calculate indirect (Scope III) greenhouse gas emissions of PSE customers associated with its customers' "complete combustion or oxidation of the annual volume of natural gas delivered, sold or imported in Washington state"?

A. The end-use combustion of natural gas by PSE customers in furnaces, boilers, water heaters, ranges, ovens, and other appliances produces carbon dioxide (CO^2) emissions. The combustion of one therm of natural gas results in 0.00529 metric tons of carbon dioxide equivalents ($mtCO_2e$), as calculated in Formula 1 below:[24]

Formula 1. Conversion Factor (Therms to $mtCO_2e$)

$$1\text{ therm} = \frac{0.1\text{ mmbtu}}{1\text{ therm}} \times \frac{14.43\text{ kg C}}{1\text{ mmbtu}} \times \frac{44\text{ kg CO}_2}{12\text{ kg C}} \times \frac{1\text{ metric ton}}{1{,}000\text{ kg}} = 0.00529\ \frac{\text{metric tons CO}_2}{\text{Therm}}$$

Accordingly, PSE can calculate the indirect (Scope III) greenhouse gas emissions of the natural gas delivered to PSE customers by multiplying the volume (therms)

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[24] International Panel on Climate Change, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, vol. 2 (Energy) (2006), available at https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html; U.S. Energy Information Administration, *Monthly Energy Review*, at Table A4: Approximate Heat Content of Natural Gas for End-Use Sector Consumption (Aug. 2024), available at https://www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf; U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*, at Annex 2 (Methodology for estimating CO_2 emissions from fossil fuel combustion), Table A-19 "C Content Coefficients by Year (MMT C/QBtu)" (2023), available at https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Annexes.pdf.

of natural gas delivered to PSE customers by a conversion factor of 0.00529 $mtCO_2e$ per therm.

Q. What indirect (Scope III) greenhouse gas emissions associated with PSE's natural gas operations has PSE reported to the Washington Department of Ecology?

A. Over the last eight reports made to the Washington Department of Ecology, the indirect (Scope III) greenhouse gas emissions associated with PSE's natural gas operations have been in a range with a minimum of 4,771,418 $mtCO_2e$, a maximum of 5,596,735 $mtCO_2e$, and a mean of 5,211,791 $mtCO_2e$. Please see the First Exhibit to the Prefiled Rebuttal Testimony of Jason Kuzma, Exh. JK-4, at page 2, for the indirect (Scope III) greenhouse gas emissions associated with PSE's natural gas operations that PSE has reported to the Washington Department of Ecology for calendar years 2015 through 2022.

c. Total Greenhouse Gas Emissions Associated with PSE's Natural Gas Operations

Q. What were the total greenhouse gas emissions associated with PSE's natural gas operations that PSE has reported to the Washington Department of Ecology for calendar years 2015 through 2022?

A. Over the last eight reports made to the Washington Department of Ecology, the total greenhouse gas emissions associated with PSE's natural gas operations have been in a range with a minimum of 4,830,129 $mtCO_2e$, a maximum of 5,663,648 $mtCO_2e$, and a mean of 5,273,825 $mtCO_2e$. Please see the First Exhibit to the Prefiled Rebuttal Testimony of Jason Kuzma, Exh. JK-4, at page 3, for the total greenhouse gas emissions associated with PSE's natural gas operations that PSE has reported to the Washington Department of Ecology for calendar years 2015 through 2022.

As shown on page 3 of the First Exhibit to the Prefiled Rebuttal Testimony of Jason Kuzma, Exh. JK-4, the vast majority of greenhouse gas emission associated with PSE's natural gas operations results from indirect (Scope III) greenhouse gas emissions associated with the complete combustion or oxidation by PSE customers of natural gas delivered by PSE. Over the eight-year report period, indirect (Scope III) greenhouse gas emissions accounted for an average of 98.88 percent of greenhouse gas emission associated with PSE's natural gas operations, and direct (Scope I) greenhouse gas emissions accounted for an average of 1.12 percent of greenhouse gas emission associated with PSE's natural gas operations.[25]

2. <u>A Very Strong Negative Correlation Exists Between Natural Gas Volumes Delivered by PSE and the Average Daily Temperatures at SeaTac International Airport</u>

Q. How did PSE begin an analysis of the variability in greenhouse gas emissions associated with natural gas deliveries to PSE customers?

A. PSE began its analysis of the variability in greenhouse gas emissions associated with natural gas deliveries to PSE customers by examining whether a statistical

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[25] *See* Kuzma, Exh. JK-4 at 3.

correlation exists (i) between natural gas volumes delivered to PSE customers and average daily temperatures at SeaTac International Airport and (ii) between greenhouse gas emissions associated with natural gas volumes delivered to PSE customers and average daily temperatures at SeaTac International Airport.

About 40 percent of natural gas volumes delivered in the U.S. is used in electric power production,[26] and the remaining 60 percent of natural gas volumes delivered in the U.S. is split between residential and commercial uses, such as heating and cooking, and industrial uses.[27] Given the extensive use of natural gas for space and water heating in northern climates, such as the Puget Sound, PSE examined the strength of the statistical correlation between natural gas volumes delivered by PSE and daily average temperature.

Q. What natural gas volumes did PSE include in its analysis?

A. PSE examined three sets of natural gas volumes in its analysis:

(i) natural gas volumes delivered to PSE's firm and interruptible sales customers;

(ii) natural gas volumes delivered to PSE's natural gas transportation customers, and

(iii) natural gas volumes delivered to PSE's firm and interruptible sales customers and natural gas transportation customers.

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[26] Although PSE does have emissions associated with the use of natural gas as a fuel for electric power production, those emissions are associated with electric operations and are not included in Schedule 111 or a subject in this proceeding.

[27] *See* U.S. Energy Information Administration, *Natural Gas Fuel Basics*, Alternative Fuels Data Center: Natural Gas Fuel Basics, available at afdc.energy.gov/fuels/natural-gas-basics.

Q. Why did PSE include natural gas volumes delivered to PSE's firm and interruptible sales customers in its analysis?

A. The inclusion of natural gas volumes delivered to PSE's firm and interruptible sales customers in the analysis was an easy and obvious inclusion. PSE directly sells natural gas molecules to these firm and interruptible sales customers, and PSE would, subject to certain exemptions under the CCA, be the gas supplier responsible for CCA compliance associated with the complete combustion and oxidation of natural gas by firm and interruptible end-use customers.

The natural gas volumes delivered to firm and interruptible sales customers included in the analysis are somewhat over-inclusive because some of these sales are associated with uses exempt from the Cap-and-Invest Program, such as (i) greenhouse gas emissions from watercraft supplied with natural gas in Washington for the portion of the natural gas fuel combusted outside of Washington[28] and (ii) greenhouse gas emissions from natural gas used at national security facilities, such as Joint Base Lewis-McChord.[29] Therefore, the natural gas volumes delivered to firm and interruptible sales customers included in PSE's analysis is greater than the volumes of natural gas deliveries for which PSE would have compliance responsibilities under the CCA. Nonetheless, these exempt uses represent a very small portion of the overall volumes of natural gas delivered by PSE to firm and interruptible natural gas sales customers and should not have a

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[28] *See* RCW 70A.65.080(7)(b).

[29] *See* RCW 70A.65.080(7)(f).

material impact on the overall magnitude of greenhouse gas emissions variations in the PSE analysis.

Q. Why did PSE include natural gas volumes delivered to PSE's transportation customers in its analysis?

A. Whereas the need to include natural gas volumes delivered to PSE's firm and interruptible sales customers in the analysis was an easy and obvious inclusion, the need to include natural gas volumes delivered to PSE's transportation customers is not. PSE does not make sales of natural gas molecules to its transportation customers. Instead, these transportation customers purchase directly from third parties, and PSE's solely responsibility is to distribute the natural gas volumes purchased by these customers from the interstate natural gas pipeline to the facilities of these customers. Accordingly, it may not be obvious that PSE would have compliance obligations under the CCA for natural gas deliveries to transportation customers.

Under the CCA, PSE has CCA compliance obligations for some—but not all—natural gas transportation customers. The CCA requires any entity that owns or operates a facility with greenhouse gas emissions that equal or exceed 25,000 $mtCO_2e$ in a year to comply directly with the CCA. Those PSE customers that take natural gas transportation service to facilities with greenhouse gas emissions that equal or exceed 25,000 $mtCO_2e$ per year would have direct compliance obligations under the CCA, and PSE would not have a CCA compliance obligations for natural gas volumes delivered to these facilities. PSE would, however, have CCA compliance obligations associated with natural gas transportation service to facilities that do not equal or exceed 25,000 $mtCO_2e$ per year—even those facilities of natural gas transportation customers with greenhouse gas emissions that equal or exceed 10,000 $mtCO_2e$ (but less than 25,000 $mtCO_2e$ per year) and have separate reporting obligations to the Washington Department of Ecology under the mandatory greenhouse gas reporting rules under the Washington Clean Air Act. Again, the natural gas volumes delivered to transportation customers included in PSE's analysis is greater than the volumes of natural gas delivered to transportation customers for which PSE would have compliance responsibilities under the CCA.

Q. Why did PSE include total natural gas volumes delivered to PSE customers in its analysis?

A. PSE included total natural gas volumes delivered to firm and interruptible sales customers and transportation customers to compare such results with the results for (i) firm and interruptible sales customers and (ii) transportation customers. This would allow an understanding of how, and if, natural gas deliveries to transportation customers could affect the overall correlation between greenhouse gas emissions associated with PSE's natural gas operations and daily average temperature. If the inclusion of natural gas deliveries to transportation customers were to have an immaterial impact on the correlation, then it may be preferable to examine the correlation for the total natural gas delivered by PSE. Conversely, if the inclusion of natural gas deliveries to transportation customers were to have a material impact on the correlation, then it may be preferable to examine the correlation for natural gas deliveries to PSE's firm and interruptible sales customers only.

Q. How did PSE calculate the correlation between volumes of natural gas delivered to average daily temperatures at SeaTac International Airport?

A. For each day of the period beginning January 1, 2007, and ending December 31, 2023, PSE used the Pearson correlation test to evaluate whether there exists a linear relationship between the following datasets:

- (i) volumes (in therms) of
  - (a) natural gas delivered to firm and interruptible sales customers,
  - (b) natural gas delivered to transportation customers, and
  - (c) natural gas delivered to firm and interruptible sales customers and transportation customers,

  and
- (ii) average daily temperatures[30] at SeaTac International Airport.

Q. What is the Pearson correlation test?

A. The Pearson correlation test examines the concordance in variation between two variables (here, the volumes of natural gas delivered on a given day and the

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[30] The average daily temperature (in degrees Fahrenheit) for a day is the arithmetic average of the maximum and minimum temperature for that day. *See* National Oceanic and Atmospheric Administration, *Local Climatological Data (LCD) Dataset Documentation*, National Centers for Environmental Information, available at www.ncei.noaa.gov/pub/data/cdo/documentation/LCD_documentation.pdf.

average daily temperature on that day). The Pearson's correlation coefficient (r) measures the intensity and the direction of the correlation between two variables if there exists a linear relationship between them. Mathematically, the Pearson's correlation coefficient is the covariance of two variables divided by the product of their standard deviation:

Formula 2. Pearson's Correlation Coefficient

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 (y_i - \bar{y})^2}},$$

where:

- x_i and y_i are the data points, and
- $\bar{x}$ is the mean of the x-values and $\bar{y}$ is the mean of the y-values.[31]

The resulting Pearson's correlation coefficient varies between -1 and +1, with a negative sign indicating a negative correlation and a positive sign indicating a positive correlation. The following chart[32] provides an interpretation of the intensity of the correlation, with a positive one (+1) indicating a perfect positive correlation, a negative one (-1) indicating a perfect negative correlation, and zero (0) indicating no correlation:

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[31] *See*, *e.g.*, Sarah Thomas, *Understanding the Pearson Correlation Coefficient*, *Outlier* (Apr. 11, 2023), available at https://articles.outlier.org/pearson-correlation-coefficient; Brian M. Adams, *et al.*, *Dakota, A Multilevel Parallel Object-Oriented Framework for Design Optimization, Parameter Estimation, Uncertainty Quantification, and Sensitivity Analysis: Version 6.16 User's Manual* , Sandia National Laboratories (May 2022), available at https://www.sandia.gov/app/uploads/sites/241/2023/03/Users-6.16.0.pdf.

[32] *See*, *e.g.*, Spyridon N. Papageorgiou, *On correlation coefficients and their interpretation*, Journal of Orthodontics vol. 49(3) 359–361 (2022) (citing James D, Evans, *Straightforward Statistics for the Behavioral Sciences,* Brooks/Cole Pub. Co. (1996)).

Table 1. Interpretation of Pearson's Correlation Coefficient

Positive Correlations	Negative Correlations	Intensity of Correlation
$0 < r < 0.2$	$-0.2 < r < 0$	very weak
$0.2 < r < 0.4$	$-0.4 < r < -0.2$	Weak
$0.4 < r < 0.6$	$-0.6 < r < -0.4$	moderate
$0.6 < r < 0.8$	$-0.8 < r < -0.6$	Strong
$0.8 < r < 1.0$	$-1.0 < r < -0.8$	very strong

a. A Very Strong (Nearly Perfect) Negative Correlation Exists Between (i) Daily Volumes of Natural Gas Delivered to Firm and Interruptible Sales Customers and (ii) Average Daily Temperatures at SeaTac International Airport

Q. What were the Pearson's correlation coefficients for the correlation between daily volumes of natural gas delivered to firm and interruptible sales customers and average daily temperatures at SeaTac International Airport?

A. The Pearson's correlation coefficients indicate a very strong (nearly perfect) negative correlation between the daily volumes of natural gas delivered to firm and interruptible sales customers and average daily temperatures at SeaTac International Airport for each year of the seventeen year period (2007-2023) examined.[33] Table 2 below provides the Pearson's correlation coefficient for these data.

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[33] *See* Kuzma, Exh. JK-5 at 3-19.

Table 2. Correlation Between (i) Daily Volumes (Therms) of Natural Gas Deliveries to Firm and Interruptible Customers and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value
2007	-0.9514
2008	-0.9510
2009	-0.9402
2010	-0.9241
2011	-0.9599
2012	-0.9480
2013	-0.9526
2014	-0.9368
2015	-0.9242

Year	*r*-value
2016	-0.9317
2017	-0.9474
2018	-0.9365
2019	-0.9564
2020	-0.9386
2021	-0.9272
2022	-0.9413
2023	-0.9486

As illustrated in Table 2 above, the Pearson's correlation coefficient for each of the seventeen years was less than -0.9, indicating a very strong negative correlation between daily volumes of natural gas delivered to firm and interruptible sales customers and average daily temperatures at SeaTac International Airport. In other words, as temperatures at SeaTac International Airport increased, the volumes of natural gas delivered by PSE to firm and interruptible sales customers decreased. Conversely, as temperatures at SeaTac International Airport decreased, the volumes of natural gas delivered by PSE to firm and interruptible sales customers increased.

Q. Is there any way to illustrate this very strong negative correlation?

A. Yes. PSE also examined the distribution of daily volumes of natural gas delivered to firm and interruptible sales customers by month for each year of the seventeen year period (2007-2023) examined.[34] The graph on page 223 of Exh. JK-5 illustrates the variability in daily volumes of natural gas delivered to firm and interruptible sales customers by month.

Q. How should one interpret this graph on page 223?

A. The following provides a key of sorts for the interpretation of the graph on page 223 of Exh. JK-5:

(i) **Black Solid Line Near Top** – The black solid line near the top of the graph represents the daily maximum volume of natural gas delivered to firm and interruptible sales customers by month during the seventeen year period (2007-2023).

(ii) **White Dashed Line in Middle** –The white dashed line in the middle of the dark blue band represents the mean daily volume of natural gas delivered to firm and interruptible sales customers by month.

(iii) **Dark Blue Band** –The dark blue band in which the white dashed line is located represents one standard deviation above and below the mean daily volume of natural gas delivered to firm and interruptible sales customers by month – about 68 percent of all data points should fall within this dark blue band.

(iv) **Medium Blue Bands Above and Below the Dark Blue Band** –The two medium blue bands located above and below the dark blue band represent two standard deviations above and below the mean daily volume of natural gas delivered to firm and interruptible sales customers by month – about 95 percent of all data points should fall within the dark and medium blue bands.

(v) **Light Blue Bands Above and Below the Upper and Lower Medium Blue Bands** –The two light blue bands

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[34] *See* Kuzma, Exh. JK-5 at 223-24.

located above and below the upper and lower medium blue bands represent three standard deviations above and below the mean daily volume of natural gas delivered to firm and interruptible sales customers by month – about 99.5 percent of all data points should fall within the light blue, medium blue, and dark blue bands.

(vi) **Lower Solid Black Line** –The lower solid black line on the graph represents the daily minimum volume of natural gas delivered to firm and interruptible sales customers by month.

Q. What does the graph on page 223 of Exh. JK-5 illustrate?

A. The graph on page 223 of Exh. JK-5 illustrates great variability in the daily volume of natural gas delivered to firm and interruptible sales customers during the coldest months each year (e.g., December and January) and significant compression and low variability in the daily volume of natural gas delivered to firm and interruptible sales customers during the warmest months each year (e.g., July and August).

Table 3 below provides the maximum, mean, minimum and standard deviation for daily volumes of natural gas delivered to firm and interruptible sales customers by month over the seventeen year period (2007-2023) examined.

Table 3. Maximum, Mean, Minimum and Standard Deviation of Daily Volumes of Natural Gas (in Therms) Delivered to Firm and Interruptible Sales Customers by Month[35]
(2007-2023)

Month	Minimum	Mean	Maximum	Std. Deviation
January	2,060,490	4,369,107	7,310,490	917,175
February	2,202,680	4,175,445	7,618,060	991,062

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[35] Kuzma, Exh. JK-5 at 224.

Table 3. Maximum, Mean, Minimum and Standard Deviation of Daily Volumes of Natural Gas (in Therms) Delivered to Firm and Interruptible Sales Customers by Month[35]

(2007-2023)

Month	Minimum	Mean	Maximum	Std. Deviation
March	1,549,370	3,424,287	5,588,590	780,856
April	984,510	2,525,341	4,573,010	726,557
May	860,150	1,564,474	3,186,170	480,180
June	630,330	1,153,139	2,369,800	275,498
July	616,810	878,257	1,263,630	100,134
August	638,530	859,383	1,284,740	90,068
September	707,050	1,092,248	2,342,130	269,762
October	945,390	2,142,710	4,770,370	673,487
November	1,575,170	3,514,790	7,505,370	959,698
December	2,177,970	4,478,438	8,305,560	1,016,042

As shown in Table 3 above, the colder months of November through February have large ranges between minimum and maximum volumes of natural gas deliveries, with standard deviations of over 1,000,000 therms. In contrast, the summer months of June through September have small ranges between minimum and maximum volumes of natural gas deliveries, with standard deviations that are a third to a tenth of their counterparts in the winter months. Together, this data illustrate (i) higher daily volumes (and higher variability therein) in colder months and (ii) lower daily volumes (and lower variability therein) in warmer months.

Q. Did PSE consider the distribution of monthly volumes of natural gas delivered to firm and interruptible sales customers by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of monthly volumes of natural gas delivered to firm and interruptible sales customers by month for each year of the seventeen year period (2007-2023) examined.[36] The graph on page 249 of Exh. JK-5 illustrates the variability in monthly volumes of natural gas delivered to firm and interruptible sales customers by month.

Table 4 below provides the maximum, mean, minimum and standard deviation for monthly volumes of natural gas delivered to firm and interruptible sales customers by month over the seventeen year period (2007-2023) examined.

Table 4. Maximum, Mean, Minimum and Standard Deviation of Monthly Volumes of Natural Gas (in Therms) Delivered to Firm and Interruptible Sales Customers by Month
(2007-2023)[37]

Month	Minimum	Mean	Maximum	Std. Deviation
January	102,109,700	135,442,312	164,386,330	14,463,012
February	85,540,120	117,894,929	156,622,050	17,860,077
March	80,801,760	105,951,475	122,529,430	11,893,147
April	52,225,970	75,760,237	94,148,770	11,180,135
May	38,904,080	48,498,685	65,018,760	7,423,356
June	27,361,310	34,594,172	44,851,120	4,459,906
July	23,969,040	27,225,965	44,851,120	1,641,879
August	24,599,030	26,640,866	29,533,540	1,340,204
September	28,357,940	32,767,429	29,616,680	2,939,109
October	46,315,080	66,424,016	39,291,790	9,874,411

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[36] *See* Kuzma, Exh. JK-5 at 249-50.
[37] *Id*. at 250.

Table 4. Maximum, Mean, Minimum and Standard Deviation of Monthly Volumes of Natural Gas (in Therms) Delivered to Firm and Interruptible Sales Customers by Month
(2007-2023)[37]

Month	Minimum	Mean	Maximum	Std. Deviation
November	81,512,200	105,443,700	86,633,310	12,480,809
December	119,045,840	138,831,572	133,440,360	13,757,580

The variability in monthly volumes of natural gas delivered to firm and interruptible sales customers shown on page 249 of Exh. JK-5 demonstrates the same strong negative correlation between monthly volumes of natural gas delivered to firm and interruptible sales customers and average daily temperatures at SeaTac International Airport, with (i) higher monthly volumes (and higher variability therein) in colder months and (ii) lower monthly volumes (and lower variability therein) in warmer months.

Q. Did PSE consider the distribution of annual volumes of natural gas delivered to firm and interruptible sales customers over the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of annual volumes of natural gas delivered to firm and interruptible sales customers over the seventeen year period (2007-2023) examined.[38] The graph on page 251 of Exh. JK-5 illustrates the variability in annual volumes of natural gas delivered to firm and interruptible sales customers over the period. Annual volumes of natural gas delivered to firm and interruptible sales customers over the seventeen year period ranged from a

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[38] *See* Kuzma, Exh. JK-5 at 251.

low of 799,273,040 therms per year to a high of 1,007,092,910 therms per year, with a mean of 915,475,360 therms per year and a standard deviation of 58,774,368 therms per year. These data demonstrate the variability in annual volumes of natural gas delivered to firm and sales interruptible sales customers from year to year.

b. A Moderate-to-Strong Negative Correlation Exists Between (i) Daily Volumes of Natural Gas Delivered to Transportation Customers and (ii) Average Daily Temperatures at SeaTac International Airport

Q. What were the Pearson's correlation coefficients for the correlation between daily volumes of natural gas delivered to transportation customers and average daily temperatures at SeaTac International Airport?

A. The Pearson's correlation coefficients indicate a moderate-to-strong negative correlation between the daily volumes of natural gas delivered to PSE's transportation customers and average daily temperatures at SeaTac International Airport for each year of the seventeen year period (2007-2023) examined.[39] Table 5 below provides the Pearson's correlation coefficient for these data.

Table 5. Correlation Between (i) Daily Volumes (Therms) of Natural Gas Deliveries to Transportation Customers and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value	Year	*r*-value
2007	-0.6351	2016	-0.5502
2008	-0.6778	2017	-0.5833

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[39] *See* Kuzma, Exh. JK-5 at 21-37.

Table 5. Correlation Between (i) Daily Volumes (Therms) of Natural Gas Deliveries to Transportation Customers and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value
2009	-0.4753
2010	-0.3975
2011	-0.6218
2012	-0.6866
2013	-0.6611
2014	-0.6547
2015	-0.5911

Year	*r*-value
2018	-0.5530
2019	-0.5192
2020	-0.5225
2021	-0.5966
2022	-0.6565
2023	-0.6730

As illustrated in Table 5 above, the Pearson’s correlation coefficient for each of the seventeen years fell within a range between -0.3975 and -0.6866, indicating a moderate-to-strong negative correlation between daily volumes of natural gas delivered to transportation customers and average daily temperatures at SeaTac International Airport. Although a negative correlation exists between daily volumes of natural gas delivered by PSE to transportation customers and daily average temperatures, the negative correlation is not as strong as the correlation that exists for firm and interruptible sales customers. This weaker negative correlation reflects the nature of use of natural gas use by transportation customers, which use natural gas predominantly for large industrial and commercial processes and operations. These large industrial and commercial processes and operations do not vary with temperature to the degree that the use of natural gas for space and water heating does, and their usage would likely show a stronger correlation to business cycles than average daily temperatures.

Q. Did PSE also examine the distribution of daily volumes of natural gas delivered to transportation customers by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of daily volumes of natural gas delivered to transportation customers by month for each year of the seventeen year period (2007-2023) examined.[40] The graph on page 226 of Exh. JK-5 illustrates the variability in daily volumes of natural gas delivered to transportation customers by month.[41] This graph on page 226 of Exh. JK-5 illustrates less variability in the daily volumes of natural gas delivered to transportation customers than the similar graph on page 223 for daily volumes of natural gas delivered to firm and interruptible sales customers. The range and variability in the daily volumes of natural gas delivered to transportation customers remain relatively constant throughout the month of the years, with slightly more volumes in the coldest months of the year (November through February) and slightly less volumes in the warmest months of the year (June through September).

Table 6 below provides the maximum, mean, minimum and standard deviation for daily volumes of natural gas delivered to transportation customers by month over the seventeen year period (2007-2023) examined.

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[40] *See* Kuzma, Exh. JK-5 at 226-27.

[41] The graph on page 226 of Exh. JK-5 follows the same format as the graph on page 223 of Exh. JK-5, and the key to interpretation discussed with respect to the graph on page 223 of Exh. JK-5 would similarly apply to the graph on page 226 of Exh. JK-5.

Table 6. Maximum, Mean, Minimum and Standard Deviation of Daily Volumes of Natural Gas (in Therms) Delivered to Transportation Customers by Month[42] (2007-2023)

Month	Minimum	Mean	Maximum	Std. Deviation
January	396,950	642,840	856,880	77,813
February	430,130	655,228	896,490	83,503
March	414,240	640,807	837,630	76,647
April	320,090	594,139	813,660	81,323
May	291,920	548,175	721,330	86,547
June	338,300	529,378	733,070	71,222
July	295,100	507,676	684,250	77,197
August	315,050	520,345	693,280	72,458
September	268,620	535,441	742,370	83,225
October	280,680	584,062	758,680	81,574
November	342,110	602,291	796,940	91,215
December	317,000	631,353	918,900	105,156

As shown in Table 6 above, the range of daily volumes of natural gas delivered to transportation customers by month represented a difference between maximums and minimums of between 378,230 therms (August) and 601,900 therms (December), with slightly higher ranges in the winter months and slightly lower ranges in the summer months. Similarly, the monthly standard deviations range between 71,222 therms (June) to 105,156 therms (December). These standard deviations illustrate some seasonal variation but nothing like the monthly standard deviations for daily volumes of natural gas delivered to firm and interruptible sales customers, which had standard deviations in the winter months that were ten times larger than standard deviations in the summer months.

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[42] Kuzma, Exh. JK-5 at 227.

Together, these data illustrate (i) some increase in daily volumes (and some increased variability therein) of natural gas delivered to transportation customers in colder months and (ii) some decrease in daily volumes (and some decreased variability therein) of natural gas delivered to firm and interruptible sales customers in warmer months. Overall, the seasonal change is not as pronounced for deliveries of daily volumes of natural gas delivered to transportation customers as it was for deliveries of daily volumes of natural gas delivered to firm and interruptible sales customers.

Q. Did PSE consider the distribution of monthly volumes of natural gas delivered to transportation customers by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of monthly volumes of natural gas delivered to transportation customers by month for each year of the seventeen year period (2007-2023) examined.[43] The graph on page 253 of Exh. JK-5 illustrates the variability in monthly volumes of natural gas delivered to transportation customers by month.

Table 7 below provides the maximum, mean, minimum and standard deviation for monthly volumes of natural gas delivered to transportation by month over the seventeen year period (2007-2023) examined.

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[43] *See* Kuzma, Exh. JK-5 at 253-54.

Table 7. Maximum, Mean, Minimum and Standard Deviation of Monthly Volumes of Natural Gas (in Therms) Delivered to Transportation Customers by Month (2007-2023)[44]

Month	Minimum	Mean	Maximum	Std. Deviation
January	18,486,960	19,928,036	21,649,550	1,051,779
February	16,071,400	18,500,561	21,231,410	1,436,921
March	18,320,000	19,827,336	22,156,450	1,168,615
April	13,734,590	17,824,160	19,599,500	1,346,971
May	13,888,770	16,993,410	18,759,150	1,279,843
June	13,897,740	15,881,327	17,492,200	1,026,667
July	14,138,600	15,737,969	17,659,830	1,135,846
August	13,762,470	16,130,695	18,250,460	1,181,360
September	12,612,640	16,063,226	17,563,280	1,204,843
October	15,273,310	18,105,936	20,008,050	1,386,083
November	15,686,460	18,068,731	20,226,870	1,175,274
December	16,141,420	19,571,955	22,787,170	1,175,274

The variability in monthly volumes of natural gas delivered to transportation customers shown on page 253 of Exh. JK-5 and in Table 7 above demonstrates some seasonal variability in monthly volumes of natural gas delivered to transportation customers, with (i) slightly higher volumes (and variability therein) in colder months and (ii) slightly lower volumes (and variability therein) in warmer months.

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[44] *Id*. at 254.

Q. Did PSE consider the distribution of annual volumes of natural gas delivered to transportation customers over the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of annual volumes of natural gas delivered to transportation customers over the seventeen year period (2007-2023) examined.[45] The graph on page 255 of Exh. JK-5 illustrates the variability in annual volumes of natural gas delivered to transportation customers over the period. Annual volumes of natural gas delivered to transportation customers over the seventeen year period ranged from a low of 189,186,870 therms per year to a high of 231,587,360 therms per year, with a mean of 212,633,342 therms per year and a standard deviation of 10,855,848 therms per year. These data demonstrate the relatively moderate variability in annual volumes of natural gas delivered to transportation customers from year to year.

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[45] *See* Kuzma, Exh. JK-5 at 251.

c. A Very Strong (Nearly Perfect) Negative Correlation Between (i) Daily Volumes of Natural Gas Delivered to All (Firm and Interruptible Sales and Transportation) Customers and (ii) Average Daily Temperatures at SeaTac International Airport

Q. What were the Pearson's correlation coefficients for the correlation between daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) and average daily temperatures at SeaTac International Airport?

A. The Pearson's correlation coefficients indicate a very strong (nearly perfect) negative correlation between the total daily volumes of natural gas delivered (firm and interruptible sales customers and transportation customers) and average daily temperatures at SeaTac International Airport for each year of the seventeen year period (2007-2023) examined.[46] Table 8 below provides the Pearson's correlation coefficient for these data.

Table 8. Correlation Between (i) Daily Volumes (Therms) of Natural Gas Deliveries to Total Customers (Firm and Interruptible Customers and Transportation Customers) and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value
2007	-0.9507
2008	-0.9505
2009	-0.9387
2010	-0.9245
2011	-0.9611
2012	-0.9487

Year	*r*-value
2016	-0.9300
2017	-0.9468
2018	-0.9347
2019	-0.9532
2020	-0.9334
2021	-0.9269

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[46] *See* Kuzma, Exh. JK-5 at 39-55.

Table 8. Correlation Between (i) Daily Volumes (Therms) of Natural Gas Deliveries to Total Customers (Firm and Interruptible Customers and Transportation Customers) and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value	Year	*r*-value
2013	-0.9536	2022	-0.9415
2014	-0.9359	2023	-0.9493
2015	-0.9260		

As illustrated in Table 8 above, the Pearson's correlation coefficient for each of the seventeen years was less than -0.9, indicating a very strong negative correlation between daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) and average daily temperatures at SeaTac International Airport. In fact, the Pearson's correlation coefficients in Table 8 (total deliveries to firm and interruptible sales customers and transportation customers) are very similar to the Pearson's correlation coefficients in Table 2 (deliveries to firm and interruptible sales customers).

Table 9 below provides the differences between the Pearson's correlation coefficients in Table 8 (total deliveries to firm and interruptible sales customers and transportation customers) are very similar to the Pearson's correlation coefficients in Table 2 (deliveries to firm and interruptible sales customers).

Table 9. Differences Between the Pearson's Correlation Coefficients in Table 8 and the Pearson's Correlation Coefficients in Table 2

Year	Difference in *r*-value
2007	0.0007
2008	0.0005
2009	0.0015
2010	-0.0004
2011	-0.0012
2012	-0.0007
2013	-0.0010
2014	0.0009
2015	-0.0018
2016	0.0017
2017	0.0006
2018	0.0018
2019	0.0032
2020	0.0052
2021	0.0003
2022	-0.0002
2023	-0.0007

The differences in *r*-value in Table 9 above range from a low of -0.0018 and a high of 0.0052, suggesting a very minimal impact due to the inclusion of volumes of natural gas delivered to PSE's transportation customers (Table 5) with the volumes of natural gas delivered to PSE's firm and interruptible sales customers (Table 2) in arriving at Pearson's correlation coefficients for all natural gas deliveries to PSE customers (Table 9). This suggests that the less strong negative Pearson's correlation coefficients in Table 5 (deliveries to transportation customers) have a relatively immaterial impact.

Q. Did PSE also examine the distribution of daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month for each year of the seventeen year period (2007-2023) examined.[47] Similar to the graph on page 223 of Exh. JK-3 for deliveries to firm and interruptible sales customers, the graph on page 229 of Exh. JK-5[48] illustrates great variability in the daily volume of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) during the coldest months each year (*i.e.*, December and January) and significant compression and low variability in the daily volume of natural gas delivered to (firm and interruptible sales customers and transportation customers) during the warmest months each year (*i.e.*, July and August).

Table 10 below provides the maximum, mean, minimum and standard deviation for daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month over the seventeen year period (2007-2023) examined.

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[47] *See* Kuzma, Exh. JK-5 at 229-30.

[48] The graph on page 229 of Exh. JK-5 follows the same format as the graph on page 223 of Exh. JK-5, and the key to interpretation discussed with respect to the graph on page 223 of Exh. JK-5 would similarly apply to the graph on page 229 of Exh. JK-5.

Table 10. Maximum, Mean, Minimum and Standard Deviation of Daily Volumes of Natural Gas (in Therms) Delivered to Total Customers (Firm and Interruptible Sales Customers and Transportation Customers) by Month[49]

(2007-2023)

Month	Minimum	Mean	Maximum	Std. Deviation
January	2,546,120	5,011,947	8,149,470	956,159
February	2,794,630	4,830,674	8,455,990	1,040,880
March	2,118,360	4,065,095	6,426,220	811,448
April	1,544,660	3,119,480	5,343,480	765,890
May	1,160,780	2,112,648	3,855,190	518,010
June	1,039,970	1,682,517	2,935,230	289,768
July	932,250	1,385,933	1,832,310	133,999
August	1,011,970	1,379,728	1,884,440	120,628
September	1,097,770	1,627,688	3,035,360	302,421
October	1,437,990	2,726,773	5,519,110	706,439
November	2,071,270	4,117,081	8,221,390	1,003,573
December	2,724,630	5,109,791	9,027,210	1,061,103

As shown in Table 10 above, the colder months of November through February have large ranges between minimum and maximum volumes of natural gas deliveries, with standard deviations of over 1,000,000 therms. In contrast, the summer months of June through September have small ranges between minimum and maximum volumes of natural gas deliveries, with standard deviations that are a third to a tenth of their counterparts in the winter months. Together, these data illustrate (i) higher daily volumes (and higher variability therein) of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) in colder months and (ii) lower daily volumes (and

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[49] Kuzma, Exh. JK-5 at 230.

lower variability therein) of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) in warmer months.

Q. Did PSE consider the distribution of monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month for each year of the seventeen year period (2007-2023) examined.[50] The graph on page 257 of Exh. JK-5 illustrates the variability in monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) customers by month.

Table 11 below provides the maximum, mean, minimum and standard deviation for monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) over the seventeen year period (2007-2023) examined.

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[50] *See* Kuzma, Exh. JK-5 at 257-58.

Table 11. Maximum, Mean, Minimum and Standard Deviation of Monthly Volumes of Natural Gas (in Therms) Delivered to Total Customers (Firm and Interruptible Sales Customers and Transportation Customers) by Month (2007-2023)[51]

Month	Minimum	Mean	Maximum	Std. Deviation
January	120,607,160	155,370,348	186,035,880	15,058,631
February	103,148,480	136,395,489	177,853,460	18,700,857
March	100,564,150	125,778,811	140,849,430	12,022,496
April	69,707,430	93,584,397	113,520,200	11,775,234
May	56,125,760	65,492,095	82,893,230	7,791,064
June	42,492,180	50,475,499	60,189,720	4,292,880
July	40,003,310	42,963,935	45,339,130	1,583,126
August	39,759,660	42,771,561	44,201,040	1,300,935
September	43,672,920	48,830,655	52,806,080	2,890,509
October	63,113,250	84,529,953	106,147,430	10,559,461
November	98,809,280	123,512,431	151,905,310	13,054,058
December	138,347,280	158,403,528	181,414,280	14,692,729

The variability in monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) shown on page 257 of Exh. JK-5 demonstrates the same strong negative correlation between monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) and average daily temperatures at SeaTac International Airport, with (i) higher volumes (and higher variability therein) in colder months and (ii) lower volumes (and variability therein) in warmer months.

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[51] *Id*. at 257.

Q. Did PSE consider the distribution of annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) over the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) over the seventeen year period (2007-2023) examined.[52] The graph on page 259 of Exh. JK-5 illustrates the variability in annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) over the period. Annual volumes of natural gas delivered to firm and interruptible sales customers over the seventeen year period ranged from a low of 1,017,015,390 therms per year to a high of 1,214,342,820 therms per year, with a mean of 1,128,108,702 therms per year and a standard deviation of 58,399,542 therms per year. These data demonstrate the variability in annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) from year to year.

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[52] *See* Kuzma, Exh. JK-5 at 259.

3. A Very Strong Negative Correlation Exists Between (i) Greenhouse Gas Emissions Associated with Natural Gas Volumes Delivered by PSE and (ii) Average Daily Temperatures at SeaTac International Airport

a. A Very Strong (Nearly Perfect) Negative Correlation Exists Between (i) Greenhouse Gas Emissions Associated with Daily Volumes of Natural Gas Delivered to Firm and Interruptible Sales Customers and (ii) Average Daily Temperatures at SeaTac International Airport

Q. Did PSE calculate Pearson's correlation coefficients for the correlation between greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers and average daily temperatures at SeaTac International Airport?

A. Yes. PSE calculated the Pearson's correlation coefficients for greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers and average daily temperatures at SeaTac International Airport. The Pearson's correlation coefficients indicate a very strong (nearly perfect) negative correlation between greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers and average daily temperatures at SeaTac International Airport for each year of the seventeen year period (2007-2023) examined.[53] Table 12 below provides the Pearson's correlation coefficient for these data.

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[53] *See* Kuzma, Exh. JK-5 at 113-29.

Table 12. Correlation Between (i) Greenhouse Gas Emissions (mtCO₂e) Associated with Daily Deliveries of Natural Gas to Firm and Interruptible Sales Customers and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value
2007	-0.95147
2008	-0.9510
2009	-0.9402
2010	-0.9241
2011	-0.9599
2012	-0.9480
2013	-0.9526
2014	-0.9368
2015	-0.9242
2016	-0.9317
2017	-0.9474
2018	-0.9365
2019	-0.9564
2020	-0.9386
2021	-0.9272
2022	-0.9413
2023	-0.9486

As illustrated in Table 12 above, the Pearson's correlation coefficient for each of the seventeen years was less than -0.9, indicating a very strong negative correlation between greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers and average daily temperatures at SeaTac International Airport. In other words, as temperatures at SeaTac International Airport increased, the greenhouse gas emissions associated with volumes of natural gas delivered by PSE to firm and interruptible sales customers decreased by a similar magnitude. Conversely, as temperatures at SeaTac International Airport decreased, the greenhouse gas emissions associated with volumes of natural gas delivered by PSE to firm and interruptible sales customers increased by a similar magnitude.

Q. Did PSE examine the distribution of greenhouse gas emissions associated with daily volumes of natural gas delivered by PSE to firm and interruptible sales customers by month for each year of the seventeen year period (2007-2023) examined

A. Yes. PSE examined the distribution of greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers by month for each year of the seventeen year period (2007-2023) examined.[54] The graph on page 233 of Exh. JK-5 illustrates great variability in greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers during the coldest months each year (e.g., December and January) and significant compression and low variability in greenhouse gas emissions associated with daily volume of natural gas delivered to firm and interruptible sales customers during the warmest months each year (e.g., July and August).[55]

Table 13 below provides the maximum, mean, minimum and standard deviation greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers by month over the seventeen year period (2007-2023) examined.

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[54] *See* Kuzma, Exh. JK-5 at 233-234.

[55] The graph on page 233 of Exh. JK-5 follows the same format as the graph on page 223 of Exh. JK-5, and the key to interpretation discussed with respect to the graph on page 223 of Exh. JK-5 would similarly apply to the graph on page 233 of Exh. JK-5.

Table 13. Maximum, Mean, Minimum and Standard Deviation of Greenhouse Gas Emissions (mtCO$_2$e) Associated With Daily Volumes of Natural Gas Delivered to Firm and Interruptible Sales Customers by Month[56]
(2007-2023)

Month	Minimum	Mean	Maximum	Std. Deviation
January	10,900	23,113	38,672	4,852
February	11,652	22,088	40,300	5,243
March	8,196	18,114	29,564	4,131
April	5,208	13,359	24,191	3,843
May	4,550	8,276	16,855	2,540
June	3,334	6,100	12,536	1,457
July	3,263	4,646	6,685	530
August	3,378	4,546	6,796	476
September	3,740	5,778	12,390	1,427
October	5,001	11,335	25,235	3,563
November	8,333	18,593	39,703	5,077
December	11,521	23,691	43,936	5,375

As shown in Table 13 above, the colder months of November through February have large ranges between minimum and maximum daily greenhouse gas emissions associated with natural gas deliveries to firm and interruptible customers, with standard deviations of over 5,000 mtCO$_2$e per day. In contrast, the summer months of June through September have small ranges between minimum and maximum daily greenhouse gas emissions associated with natural gas deliveries to firm and interruptible customers, with standard deviations that are a third to a tenth of those in the winter months. Together, these data illustrate (i) higher greenhouse gas emissions (and higher variability therein) associated

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[56] Kuzma, Exh. JK-5 at 234.

with daily volumes of natural gas delivered to firm and interruptible sales customers in colder months and (ii) lower greenhouse gas emissions (and lower variability therein) associated with daily volumes of natural gas delivered to firm and interruptible sales customers in warmer months.

Q. Did PSE consider the distribution of greenhouse gas emissions associated with monthly volumes of natural gas delivered to firm and interruptible sales customers by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of greenhouse gas emissions associated with monthly volumes of natural gas delivered to firm and interruptible sales customers by month for each year of the seventeen year period (2007-2023) examined.[57] The graph on page 262 of Exh. JK-5 illustrates the variability in greenhouse gas emissions associated with monthly volumes of natural gas delivered to firm and interruptible sales customers by month.

Table 14 below provides the maximum, mean, minimum and standard deviation for greenhouse gas emissions associated with monthly volumes of natural gas delivered to firm and interruptible sales customers by month over the seventeen year period (2007-2023) examined.

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[57] *See* Kuzma, Exh. JK-5 at 262-63.

Table 14. Maximum, Mean, Minimum and Standard Deviation of Greenhouse Gas Emissions (mtCO$_2$e) Associated with Monthly Volumes of Natural Gas Delivered to Firm and Interruptible Sales Customers by Month (2007-2023)[58]

Month	Minimum	Mean	Maximum	Std. Deviation
January	540,160	716,490	869,604	76,509
February	452,507	623,664	828,531	94,480
March	427,441	560,483	648,181	62,915
April	276,275	400,772	498,047	59,143
May	205,803	256,558	343,949	39,270
June	144,741	183,003	237,262	23,593
July	126,796	144,025	156,232	8,686
August	130,129	140,930	156,672	7,090
September	150,014	173,340	207,854	15,548
October	245,007	351,383	458,290	52,236
November	431,200	557,797	705,900	66,023
December	629,752	734,419	851,832	72,778

The variability in greenhouse gas emissions associated with monthly volumes of natural gas delivered to firm and interruptible sales customers shown on page 262 of Exh. JK-5 demonstrates the same strong negative correlation between greenhouse gas emissions and temperature, with (i) higher greenhouse gas emissions (and higher variability therein) associated with monthly volumes of natural gas delivered to firm and interruptible sales customers in colder months and (ii) lower greenhouse gas emissions (and lower variability therein) associated with monthly volumes of natural gas delivered to firm and interruptible sales customers in warmer months.

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[58] *Id*. at 263.

Q. Did PSE consider the distribution of greenhouse gas emissions associated with annual volumes of natural gas delivered to firm and interruptible sales customers over the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of greenhouse gas emissions associated with annual volumes of natural gas delivered to firm and interruptible sales customers over the seventeen year period (2007-2023) examined.[59] The graph on page 264 of Exh. JK-5 illustrates the variability of greenhouse gas emissions associated with annual volumes of natural gas delivered to firm and interruptible sales customers over the period. Greenhouse gas emissions associated with annual volumes of natural gas delivered to firm and interruptible sales customers over the seventeen year period ranged from a low of 4,228,154 mtCO_2e per year to a high of 5,327,521 mtCO_2e per year, with a mean of 4,842,865 mtCO_2e per year and a standard deviation of 310,916 mtCO_2e per year. These data demonstrate the variability in greenhouse gas emissions associated with annual volumes of natural gas delivered to firm and sales interruptible sales customers from year to year.

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[59] *See* Kuzma, Exh. JK-5 at 264.

b. A Moderate-to-Strong Negative Correlation Exists Between (i) Greenhouse Gas Emissions Associated with Daily Volumes of Natural Gas Delivered to Transportation Customers and (ii) Average Daily Temperatures at SeaTac International Airport

Q. What were the Pearson's correlation coefficients for the correlation between greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers and average daily temperatures at SeaTac International Airport?

A. The Pearson's correlation coefficients indicate a moderate-to-strong negative correlation between the greenhouse gas emissions associated with daily volumes of natural gas delivered to PSE's transportation customers and average daily temperatures at SeaTac International Airport for each year of the seventeen year period (2007-2023) examined.[60] Table 15 below provides the Pearson's correlation coefficient for these data.

Table 15. Correlation Between (i) Greenhouse Gas Emissions (mtCO$_2$e) Associated with Daily Deliveries of Natural Gas to Transportation Customers and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value	Year	*r*-value
2007	-0.6351	2016	-0.5502
2008	-0.6778	2017	-0.5833
2009	-0.4753	2018	-0.5530
2010	-0.3975	2019	-0.5192
2011	-0.6218	2020	-0.5225
2012	-0.6866	2021	-0.5966

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[60] *See* Kuzma, Exh. JK-5 at 131-47.

Table 15. Correlation Between (i) Greenhouse Gas Emissions ($mtCO_2e$) Associated with Daily Deliveries of Natural Gas to Transportation Customers and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value
2013	-0.6611
2014	-0.6547
2015	-0.5911
2022	-0.6565
2023	-0.6730

As illustrated in Table 15 above, the Pearson's correlation coefficient for each of the seventeen years fell within a range between -0.3975 and -0.6866, indicating a moderate-to-strong negative correlation between greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers and average daily temperatures at SeaTac International Airport. Although a negative correlation exists between greenhouse gas emissions associated with daily volumes of natural gas delivered by PSE to transportation customers and daily average temperatures, the negative correlation is not as strong as the correlation that exists greenhouse gas emissions associated with daily volumes of natural gas delivered by PSE to firm and interruptible sales customers.

Q. Did PSE also examine the distribution of greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers by month for each year of the seventeen year period (2007-2023) examined.[61] The graph on page 236 of Exh. JK-5 illustrates the variability of greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers by month.[62] This graph on page 236 of Exh. JK-5 illustrates much less variability in greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers than the similar graph on page 226 for greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers. The range and variability in greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers remain relatively constant throughout the month of the years, with slightly more greenhouse gas emissions in the coldest months of the year (November through February) and slightly less greenhouse gas emissions in the warmest months of the year (June through September).

Table 16 below provides the maximum, mean, minimum and standard deviation for greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers by month over the seventeen year period (2007-2023) examined.

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[61] *See* Kuzma, Exh. JK-5 at 236-37.

[62] The graph on page 236 of Exh. JK-5 follows the same format as the graph on page 223 of Exh. JK-5, and the key to interpretation discussed with respect to the graph on page 223 of Exh. JK-5 would similarly apply to the graph on page 236 of Exh. JK-5.

Table 16. Maximum, Mean, Minimum and Standard Deviation of Greenhouse Gas Emissions ($mtCO_2e$) Associated with Natural Gas Delivered to Transportation Customers by Month[63] (2007-2023)

Month	Minimum	Mean	Maximum	Std. Deviation
January	2,100	3,401	4,533	412
February	2,275	3,466	4,742	442
March	2,191	3,390	4,431	405
April	1,693	3,143	4,304	430
May	1,544	2,900	3,816	458
June	1,790	2,800	3,878	377
July	1,561	2,686	3,620	408
August	1,667	2,753	3,667	383
September	1,421	2,832	3,927	440
October	1,485	3,090	4,013	432
November	1,810	3,186	4,216	483
December	1,677	3,340	4,861	556

As shown in Table 16 above, the range of daily volumes of natural gas delivered to transportation customers by month represented a difference between maximums and minimums of between 2,000 $mtCO_2e$ (August) and 3,184 $mtCO_2e$ (December), with slightly higher ranges in the winter months and slightly lower ranges in the summer months. Similarly, the monthly standard deviations range between 377 $mtCO_2e$ (June) to 556 $mtCO_2e$ (December). These standard deviations illustrate some seasonal variation but nothing like the monthly standard deviations for greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers, which had standard

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[63] Kuzma, Exh. JK-5 at 237.

deviations in the winter months that were ten times larger than standard deviations in the summer months.

Together, these data illustrate (i) some increase in greenhouse gas emissions (and variability therein) associated with volumes of daily volumes of natural gas delivered to transportation customers in the colder months and (ii) some decrease in greenhouse gas emissions (and variability therein) associated with volumes of daily volumes of natural gas delivered to transportation customers in the warmer months. Overall, the seasonal change is not as pronounced for greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers as it was for greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers.

Q. Did PSE consider the distribution of greenhouse gas emissions associated with monthly volumes of natural gas delivered to transportation customers by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of greenhouse gas emissions associated with monthly volumes of natural gas delivered to transportation customers by month for each year of the seventeen year period (2007-2023) examined.[64] The graph on page 266 of Exh. JK-5 illustrates the variability of greenhouse gas emissions associated with monthly volumes of natural gas delivered to transportation customers by month.

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[64] *See* Kuzma, Exh. JK-5 at 266-67.

Table 17 below provides the maximum, mean, minimum and standard deviation for greenhouse gas emissions associated with monthly volumes of natural gas delivered to transportation by month over the seventeen year period (2007-2023) examined.

Table 17. Maximum, Mean, Minimum and Standard Deviation for Greenhouse Gas Emissions (mtCO^{2}e) Associated with Monthly Volumes of Natural Gas Delivered to Transportation Customers by Month (2007-2023)[65]

Month	Minimum	Mean	Maximum	Std. Deviation
January	97,796	105,419	114,526	5,564
February	85,018	97,868	112,314	7,601
March	96,913	104,887	117,208	6,182
April	72,656	94,290	103,681	7,125
May	73,472	89,895	99,236	6,770
June	73,519	84,012	92,534	5,431
July	74,793	83,254	93,421	6,009
August	72,803	85,331	96,545	6,249
September	66,721	84,974	92,910	6,374
October	80,796	95,780	105,843	7,332
November	82,981	95,584	107,000	6,217
December	85,388	103,536	120,544	8,719

The variability of greenhouse gas emissions associated with monthly volumes of natural gas delivered to transportation customers shown on page 266 of Exh. JK-5 and in Table 17 above demonstrates some seasonal variability, with slightly higher greenhouse gas emissions associated with deliveries to transportation

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[65] *Id*. at 254.

customers in colder months and lower greenhouse gas emissions associated with deliveries to transportation customers in warmer months.

Q. Did PSE consider the distribution of greenhouse gas emissions associated with annual volumes of natural gas delivered to transportation customers over the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of greenhouse gas emissions associated with annual volumes of natural gas delivered to transportation customers over the seventeen year period (2007-2023) examined.[66] The graph on page 268 of Exh. JK-5 illustrates the variability of greenhouse gas emissions associated with annual volumes of natural gas delivered to transportation customers over the period. Greenhouse gas emissions associated with annual volumes of natural gas delivered to transportation customers over the seventeen year period ranged from a low of 1,000,799 $mtCO_2e$ per year to a high of 1,225,097 $mtCO_2e$ per year, with a mean of 1,124,830 $mtCO_2e$ per year and a standard deviation of 57,427 $mtCO_2e$ per year. These data demonstrate the relatively moderate variability in greenhouse gas emissions associated with annual volumes of natural gas delivered to transportation customers from year to year.

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[66] *See* Kuzma, Exh. JK-5 at 268.

c. A Very Strong (Nearly Perfect) Negative Correlation Exists Between (i) Greenhouse Gas Emissions Associated with Daily Volumes of Natural Gas Delivered to Total Customers (Firm and Interruptible Sales and Transportation) and (ii) Average Daily Temperatures at SeaTac International Airport

Q. What were the Pearson's correlation coefficients for the correlation between greenhouse gas emissions associated with daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) and average daily temperatures at SeaTac International Airport?

A. The Pearson's correlation coefficients indicate a very strong (nearly perfect) negative correlation between greenhouse gas emissions associated with total daily volumes of natural gas delivered (firm and interruptible sales customers and transportation customers) and average daily temperatures at SeaTac International Airport for each year of the seventeen year period (2007-2023) examined.[67] Table 18 below provides the Pearson's correlation coefficient for these data.

Table 18. Correlation Between (i) Greenhouse Gas Emissions (mtCO₂e) Associated with Daily Deliveries of Natural Gas to Total Customers (Firm and Interruptible Sales Customers and Transportation Customers) and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value
2007	-0.9507
2008	-0.9505
2009	-0.9387
2010	-0.9245
2016	-0.9300
2017	-0.9468
2018	-0.9347
2019	-0.9532

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[67] *See* Kuzma, Exh. JK-5 at 149-65.

Table 18. Correlation Between (i) Greenhouse Gas Emissions (mtCO$_2$e) Associated with Daily Deliveries of Natural Gas to Total Customers (Firm and Interruptible Sales Customers and Transportation Customers) and (ii) Average Daily Temperatures (°F) at SeaTac International Airport

Year	*r*-value
2011	-0.9611
2012	-0.9487
2013	-0.9536
2014	-0.9359
2015	-0.9260
2020	-0.9334
2021	-0.9269
2022	-0.9415
2023	-0.9493

As illustrated in Table 18 above, the Pearson's correlation coefficient for each of the seventeen years was less than -0.9, indicating a very strong negative correlation between greenhouse gas emissions associated with daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) and average daily temperatures at SeaTac International Airport. In fact, the Pearson's correlation coefficients in Table 18 (greenhouse gas emissions associated with daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers)) are very similar to the Pearson's correlation coefficients in Table 12 (greenhouse gas emissions associated with daily volumes of natural gas delivered to firm and interruptible sales customers).

Table 19 below provides the differences between the Pearson's correlation coefficients in Table 18 (greenhouse gas emissions associated with daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers)) are very similar to the Pearson's correlation coefficients in Table 12 (greenhouse gas emissions associated with daily volumes of natural gas to firm and interruptible sales customers).

Table 19. Differences Between the Pearson's Correlation Coefficients in Table 18 and the Pearson's Correlation Coefficients in Table 12

Year	Difference in *r*-value
2007	0.0007
2008	0.0005
2009	0.0015
2010	-0.0004
2011	-0.0012
2012	-0.0007
2013	-0.0010
2014	0.0009
2015	-0.0018
2016	0.0017
2017	0.0006
2018	0.0018
2019	0.0032
2020	0.0052
2021	0.0003
2022	-0.0002
2023	-0.0007

The differences in *r*-value in Table 19 above range from a low of -0.0018 and a high of 0.0052, suggesting a very minimal impact due to the inclusion of greenhouse gas emissions associated with daily volumes of natural gas delivered to PSE's transportation customers (Table 15) with the greenhouse gas emissions associated with daily volumes of natural gas delivered to PSE's firm and interruptible sales customers (Table 12) in arriving at Pearson's correlation coefficients for greenhouse gas emissions associated with daily volumes of natural gas delivered to total customers (Table 19). This suggests that the less strong negative Pearson's correlation coefficients in Table 15 (greenhouse gas emissions associated with daily volumes of natural gas delivered to transportation customers) have a small but relatively immaterial impact.

Q. Did PSE also examine the distribution of greenhouse gas emissions associated with daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of greenhouse gas emissions associated with daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month for each year of the seventeen year period (2007-2023) examined.[68] Similar to the graph on page 233 of Exh. JK-3 for greenhouse gas emissions associated with volumes of natural gas delivered to firm and interruptible sales customers, the graph on page 229 of Exh. JK-5[69] illustrates great variability in the greenhouse gas emissions associated with volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) during the coldest months each year (*i.e.*., December and January) and significant compression and little variability in greenhouse gas emissions associated with volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) during the warmest months (*i.e.*, July and August).

Table 20 below provides the maximum, mean, minimum and standard deviation for greenhouse gas emissions associated with volumes of natural gas delivered to

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[68] *See* Kuzma, Exh. JK-5 at 239-40.

[69] The graph on page 239 of Exh. JK-5 follows the same format as the graph on page 223 of Exh. JK-5, and the key to interpretation discussed with respect to the graph on page 223 of Exh. JK-5 would similarly apply to the graph on page 239 of Exh. JK-5.

total customers (firm and interruptible sales customers and transportation customers) by month over the seventeen year period (2007-2023) examined.

Table 20. Maximum, Mean, Minimum and Standard Deviation of Daily Volumes of Natural Gas (in Therms) Delivered to Total Customers (Firm and Interruptible Sales Customers and Transportation Customers) by Month[70] (2007-2023)

Month	Minimum	Mean	Maximum	Std. Deviation
January	13,469	26,513	43,111	5,058
February	14,784	25,554	44,732	5,506
March	11,206	21,504	33,995	4,293
April	8,171	16,502	28,267	4,052
May	6,141	11,176	20,394	2,740
June	5,501	8,901	15,527	1,533
July	4,932	7,332	9,693	709
August	5,353	7,299	9,969	638
September	5,807	8,610	16,057	1,600
October	7,607	14,425	29,196	3,737
November	10,957	21,779	43,491	5,309
December	14,413	27,031	47,754	5,613

As shown in Table 20 above, the colder months of November through February have large ranges between minimum and maximum greenhouse gas emissions associated with daily volumes of natural gas deliveries, with standard deviations of over 5,000 mtCO_2e. In contrast, the summer months of June through September have small ranges between minimum and maximum greenhouse gas emissions associated with daily volumes of natural gas deliveries, with standard deviations that are a third to a ninth of the winter months. Together, these data

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[70] Kuzma, Exh. JK-5 at 230.

illustrate (i) higher greenhouse gas emissions (and higher variability therein) associated with daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) in the colder months and (ii) lower greenhouse gas emissions (and low variability therein) associated with daily volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) in the warmer months.

Q. Did PSE consider the distribution of greenhouse gas emissions associated with monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month for each year of the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of greenhouse gas emissions associated with monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month for each year of the seventeen year period (2007-2023) examined.[71] The graph on page 270 of Exh. JK-5 illustrates the variability in greenhouse gas emissions associated with monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) by month.

Table 21 below provides the maximum, mean, minimum and standard deviation for greenhouse gas emissions associated with monthly volumes of natural gas

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[71] *See* Kuzma, Exh. JK-5 at 270-71.

delivered to total customers (firm and interruptible sales customers and transportation customers) over the seventeen year period (2007-2023) examined.

Table 21. Maximum, Mean, Minimum and Standard Deviation of Greenhouse Gas Emissions (mtCO2e) Associated with Monthly Volumes of Natural Gas Delivered to Total Customers (Firm and Interruptible Sales Customers and Transportation Customers) by Month (2007-2023)[72]

Month	Minimum	Mean	Maximum	Std. Deviation
January	638,012	821,909	984,130	79,660
February	545,655	721,532	940,845	98,928
March	531,984	665,370	745,093	63,599
April	368,752	495,061	600,522	62,291
May	296,905	346,453	438,505	41,215
June	224,784	267,015	318,404	22,709
July	211,618	227,279	239,844	8,375
August	210,329	226,262	233,824	6,882
September	231,030	258,314	279,344	15,291
October	333,869	447,163	561,520	55,860
November	522,701	653,381	803,579	69,056
December	731,857	837,955	959,682	77,725

The variability in greenhouse gas emissions associated with monthly volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) shown on page 270 of Exh. JK-5 demonstrates the same strong negative correlation between greenhouse gas emissions and temperature, with higher greenhouse gas emissions (and variability therein) in colder months and lower greenhouse gas emissions (and variability therein) in warmer months.

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[72] *Id*. at 271.

Q. Did PSE consider the distribution of greenhouse gas emissions associated with annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) over the seventeen year period (2007-2023) examined?

A. Yes. PSE also examined the distribution of greenhouse gas emissions associated with annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) over the seventeen year period (2007-2023) examined.[73] The graph on page 272 of Exh. JK-5 illustrates the variability in greenhouse gas emissions associated with annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) over the period. Greenhouse gas emissions associated with annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) over the seventeen year period ranged from a low of 5,380,011 mtCO_2e per year to a high of 6,423,874 mtCO_2e per year, with a mean of 5,967,695 mtCO_2e per year and a standard deviation of 308,934 mtCO^2e per year. These data demonstrate the variability in greenhouse gas emissions associated with annual volumes of natural gas delivered to total customers (firm and interruptible sales customers and transportation customers) from year to year.

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[73] *See* Kuzma, Exh. JK-5 at 272.

Q. Please summarize this analysis.

A. The analysis presented in this section and in Exhibit JK-5 demonstrates that average daily temperatures at SeaTac International Airport over the course of a year is a nearly perfect predictor for volumes of natural gas sold and delivered to PSE’s firm and interruptible customers and the greenhouse gas emissions associated with the combustion of such natural gas by such customers. Although a negative correlation exists between volumes (in therms) and greenhouse gas emissions (in $mtCO_2e$) associated with deliveries to transportation customers and average daily temperatures at SeaTac International Airport, the correlation is not as direct as it is for deliveries to PSE’s sales customers. Overall, however, the analysis demonstrates that there is a near perfect negative correlation between average daily temperatures at SeaTac International Airport and annual greenhouse gas emissions associated with PSE’s obligations as a gas supplier under the Cap-and-Trade Program. Average daily temperature is a factor well beyond the control of PSE and the Commission.

B. Potential Impact of Commission Staff's Recommendation to Eliminate Schedule 111 and Include CCA Compliance Costs in PSE's Base Rate Revenue Requirement for Natural Gas Operations

Q. What does the foregoing analysis of variability in greenhouse gas emissions associated with deliveries of natural gas to PSE customers suggest with respect to the potential impact of Commission Staff's recommendation to eliminate Schedule 111 and include CCA compliance costs in PSE's natural gas base rate revenue requirement for natural gas operations as of the rate-effective date of PSE's next general rate proceeding?

A. The foregoing the analysis of variability in greenhouse gas emissions associated with deliveries of natural gas to PSE customers suggests that Commission Staff's recommendation to eliminate the risk-sharing mechanism and include CCA compliance costs in PSE's base rate revenue requirement for natural gas operations could have a substantial and material impact on PSE's financial operations from normal variations in temperature.

As mentioned previously, PSE's overall CCA compliance costs for natural gas operations included in Schedule 111 reflect the product of two variables:

(i) CCA allowance prices and

(ii) greenhouse gas emissions associated with natural gas volumes delivered to PSE customers.

If the Commission were to adopt Commission Staff's recommendation and include CCA compliance costs in PSE's base rate revenue requirement, then the Commission would presumably forecast both (i) a CCA allowance price for a rate period and (ii) greenhouse gas emissions associated with natural gas volumes delivered to PSE customers.

Currently, it is very difficult, if not impossible, to develop any reliable forecast of CCA allowance prices. As discussed previously, CCA allowance prices over the first eighteen months of the CCA have been extremely volatile. The volatility in CCA allowance prices is unlikely to dissipate in the foreseeable future. If voters elect to repeal the CCA by ballot initiative in November, then there will be no future CCA allowance prices for the auction in the fourth quarter of 2024 or thereafter. Conversely, if voters elect not to repeal the CCA by ballot initiative in November, then CCA allowance prices are likely to spike from the current depressed allowance prices as demand for allowances, which is currently depressed by the overhang of possible repeal of the program, will increase dramatically, and covered entities who elected to buy few, if any, CCA allowances in calendar year 2024 will need to purchase allowances to meet compliance.

If the Commission were to project greenhouse gas emissions associated with natural gas volumes delivered to PSE customers for calculating CCA compliance costs for inclusion in the PSE base rate revenue requirement for natural gas operations, it would be highly likely that the Commission would use some form of historical average of greenhouse gas emissions associated with natural gas volumes delivered to PSE customers.

As demonstrated in the analysis conducted by PSE, there is a very strong (near perfect) correlation between greenhouse gas emissions associated with volumes of natural gas delivered to PSE customers and average daily temperatures at SeaTac International Airport. Variations in average daily temperatures at SeaTac International Airport would result in significant variations in greenhouse gas emissions associated with deliveries of natural gas to PSE customers. If the Commission were to use a historical mean of greenhouse gas emissions associated with volumes of natural gas delivered to customers, then normal variations in temperature could result in PSE over-recoveries of CCA compliance costs in colder than normal years and under-recoveries of CCA compliance costs in warmer than normal years. This would be true without regard to any variation between the CCA allowance cost used by the Commission to calculate CCA compliance costs for inclusion in the PSE base rate revenue requirement for natural gas operations and the actual CCA compliance costs during the rate period.

Q. Please provide an example of this potential impact of including CCA compliance costs in the PSE base rate revenue requirement for natural gas operations.

A. Assume for example that the Commission were to seek to include CCA compliance costs for calendar year 2025 in the PSE base rate revenue requirement for natural gas operations under consideration in Dockets UE-240004, *et al.* Assume further that the Commission were to project that CCA allowance prices for calendar year 2025 would be at or around a CCA Tier 1 allowance price of $60 per allowance.[74] Finally, assume that the Commission were to assume greenhouse gas emission associated with deliveries to natural gas customers in calendar year 2025 would be equal to historical mean greenhouse gas emissions of 4,842,865 mtCO$_2$e associated with annual volumes of natural gas delivered to firm and interruptible sales customers over the 2007-2023 period.[75] (Note that the historical mean for deliveries to firm and intermittent sales customers is significantly lower than the indirect (Scope III) greenhouse gas emissions reported by PSE to the Washington Department of Ecology for all but one of the past eight years,[76] but the use of this value would eliminate the possibility of double-counting greenhouse gas emissions of PSE transportation customers who must comply directly with CCA.) Thus, the Commission would assume, for purposes of establishing the PSE base rate revenue requirement for natural gas operations, that PSE would need 4,842,865 allowances for compliance in calendar year 2025 (one allowance equals one mtCO$_2$e of greenhouse gas emissions).

In calendar year 2024, PSE will receive 4,167,601 no-cost CCA allowances from the Washington Department of Ecology.[77] By law, PSE must consign 75 percent of these no-cost CCA allowances at auction in calendar year 2025[78] and use the

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[74] The Tier 1 price for CCA allowances in 2024 is $56.16, and a Tier 1 price for CCA allowances in 2025 of $60 would be slightly less than the Tier 1 price of $56.16 in 2024 multiplied by the annual statutory increase of 5 percent plus an inflationary adjustment of 2 percent ($56.16 × 1.07 = $60.09).

[75] *See* Exh. JK-5 at 264.

[76] *See* Exh. JK-4 at 3.

[77] See Washington Department of Ecology, *Allowance Allocation to Natural Gas Utilities for the First Compliance Period*, Publication No. 23-02-074 (June 2023), available at https://apps.ecology.wa.gov/publications/documents/2302074.pdf.

[78] See WAC 173-446-300(2)(b)(ii)(C).

proceeds from these allowances for the benefit of customers, as determined by the Commission. After the minimum consignment of 3,125,701 no-cost allowances to auction,[79] there would remain 1,041,900 no-cost allowances that PSE could potentially use for compliance in calendar year 2025.

Now, assume that the Commission were to offset the projected 4,842,865 allowances needed for compliance by the 1,041,900 remaining no-cost allowances. If the Commission were to do so, then the Commission would project CCA compliance costs of $228,056,900 (as demonstrated in Table 22 below using the projected CCA allowance price of $60 per allowance assumed earlier) and include this cost in the PSE base rate revenue requirement for natural gas operations.

Table 22. Hypothetical Projected CCA Compliance Costs to Include in PSE Base Rate Revenue Requirement for Natural Gas Operations

Projected allowances needed for 2025 compliance:	4,842,865 allowances
Remaining no-cost allowances after consignment of minimum:	– 1,041,900 allowances
Projected allowances PSE must acquire for 2025 compliance:	3,800,965 allowances
Projected CCA allowance price of $60 per allowance:	× $60 per allowance
CCA compliance costs to include in base rate revenue requirement:	$228,057,900

Now, assume that the daily average temperatures at SeaTac International Airport were colder than normal in calendar year 2025, resulting in higher volumes of gas deliveries to PSE customers and higher associated greenhouse gas emissions of 5,153,781 $mtCO_2e$, which is one standard deviation (310,916 $mtCO_2e$) higher

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[79] The product of 4,167,601 no-cost allowances multiplied by 75 percent is 3,125,700.75, which, rounded up to the nearest whole allowance, is 3,125,701 no-cost allowances.

than the historical mean used for establishing base rates.[80] Under this scenario, PSE would need to acquire 310,916 more allowances than projected in the base rate revenue requirement, resulting an under-recovery of over $18.5 million of CCA compliance costs:

Table 23. Hypothetical Under-Recovery of CCA Compliance Costs Due to One Standard Deviation in Greenhouse Gas Emissions Associated with Colder than Normal Daily Average Temperatures at SeaTac International Airport

Additional allowances that PSE must acquire for compliance:	310,916 allowances
CCA allowance price of $60 per allowance:	× $60 per allowance
PSE under-recovery of CCA compliance costs:	$18,654,960

This under-recovery of over $18.65 million of CCA compliance costs in Table 23 is due solely to lower than normal average daily temperatures and does not factor any variation in projected and actual CCA allowance prices.

Q. Could the Commission mitigate emissions forecast risk by requiring that the CCA compliance costs be recovered volumetrically in the PSE base rate revenue requirement for natural gas operations?

A. It is possible that the Commission could mitigate emissions forecast risk by requiring that the CCA compliance costs be recovered volumetrically in the PSE base rate revenue requirement for natural gas operations, but the forecast risk associated with CCA allowance prices would remain. Neither the Commission nor PSE can reliably forecast the CCA allowance settlement prices with any degree of accuracy. For example, allowance settlement prices over the first six

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[80] *See* Exh. JK-5 at 264.

auctions have ranged from a low of $25.76 per allowance to a high of $63.03 per allowance, as shown in Figure 1 below.

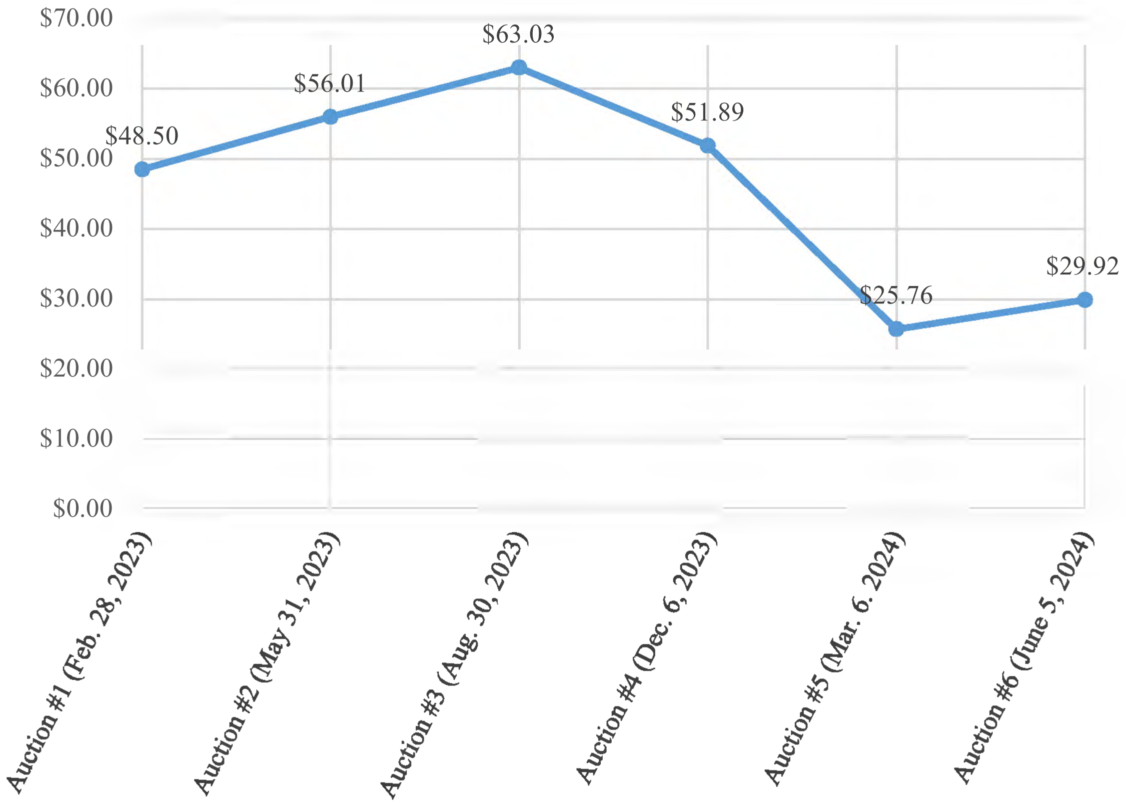
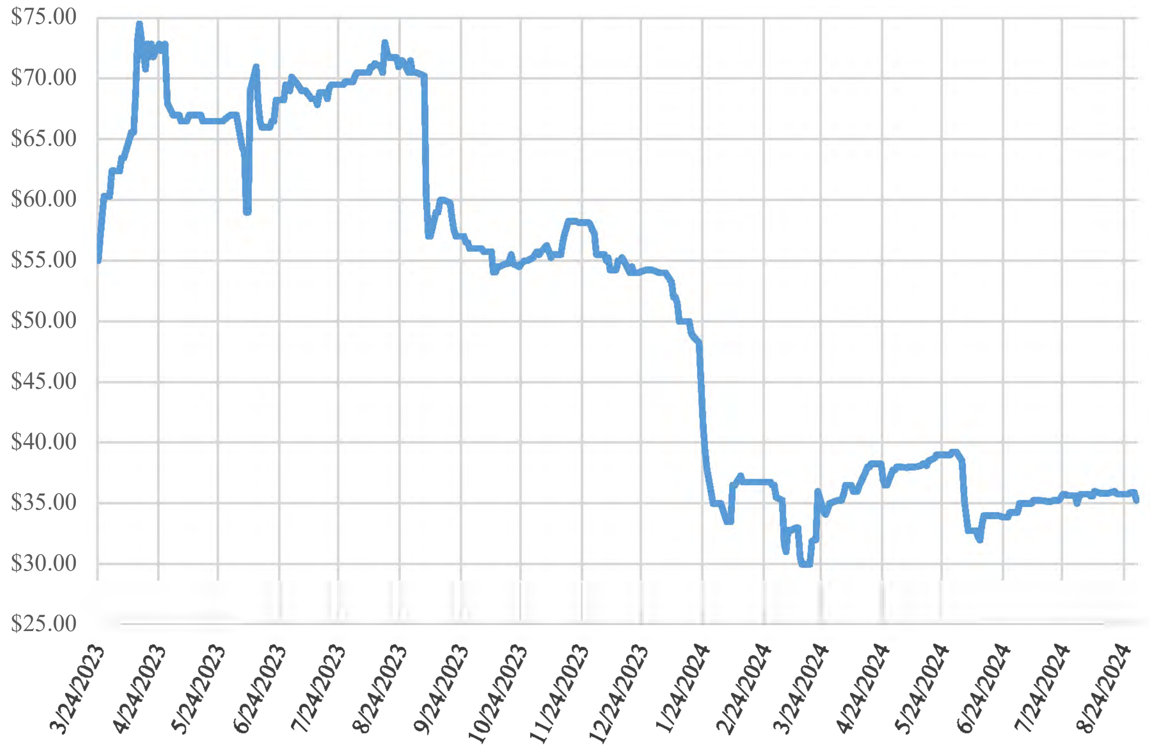


Figure 1. CCA Allowance Settlement Prices
(Auctions #1 through #6)

Moreover, allowance prices (vintage 2024) on the secondary market have been very volatile and have ranged from a low of $30.00 per allowance to a high of $74.52 per allowance, as shown in Figure 2 below.

Figure 2. CCA Allowance (Vintage 2024) Prices on Secondary Markets
(through August 30, 2024)



Q. What would be the result of a hypothetical similar to that above except that projected and actual greenhouse gas emissions were held constant but the actual allowance price were higher than the projected allowance priced used to establish the base rate revenue requirement for natural gas operations?

A. If actual greenhouse gas emissions in calendar year 2025 were 4,842,865 mtCO$_2$e (*i.e.*, equal to projected greenhouse gas emissions used to establish the base rate revenue requirement for natural gas operations in the hypothetical), but actual CCA allowance prices were ten percent higher than the projected CCA allowance priced used to set rates (*i.e.*, actual price of $66 per allowance compared to $60 per allowance), then the result would be an under-recovery of over $22.8 million of CCA compliance costs:

Table 24. Hypothetical Under-Recovery of CCA Compliance Costs Due to Actual CCA Allowance Prices Being Ten Percent Higher Than Projected CCA Allowance Prices Assumed to Establish Base Rate Revenue Requirement for Natural Gas Operations

Projected allowances needed for 2025 compliance:	4,842,865 allowances
Remaining no-cost allowances after consignment of minimum:	– 1,041,900 allowances
Actual allowances PSE must acquire for 2025 compliance:	3,800,965 allowances
Actual average CCA allowance price of $66 per allowance:	× $66 per allowance
Actual cost to acquire allowances for 2025 compliance:	$250,863,690
CCA compliance costs included in base rate revenue requirement:	– $228,057,900
Under-recovery of CCA compliance costs:	$22,805,790

This under-recovery of over $22.8 million of CCA compliance costs in Table 24 is due solely to actual CCA allowance prices that are ten percent higher than the projected CCA allowance prices used to establish the PSE base rate revenue requirement for natural gas operations and does not factor any variation in projected and actual greenhouse gas emissions. The large under-recoveries in the hypotheticals presented in Tables 23 and 24 reflect the variation in but one of the two variables of CCA cost compliance. The covariance of the two variables would result in higher or lower under-recoveries, depending on the variation in the variable.

Q. Could the variation in variable discussed in the hypotheticals result in the over-recovery of CCA compliance costs?

A. Yes. The variation in variables addressed in the hypotheticals in Tables 23 and 24 would result in the over-recovery of CCA compliance costs of the same magnitude if variation in variables were reversed.

For example, if the daily average temperatures at SeaTac International Airport were warmer than normal in calendar year 2025, resulting in lower volumes of gas deliveries to PSE customers and lower associated greenhouse gas emissions of 4,531,948 mtCO$_2$e, which is one standard deviation (310,916 mtCO$_2$e) lower than the historical mean used for establishing base rates.[81] Under this scenario, PSE would not need to acquire 310,916 allowances included in the base rate revenue requirement, resulting an over-recovery of over $18.65 million of CCA compliance costs:

Table 25. Hypothetical Over-Recovery of CCA Compliance Costs Due to One Standard Deviation in Greenhouse Gas Emissions Associated with Warmer than Normal Daily Average Temperatures at SeaTac International Airport

Allowances in rates but not needed for actual compliance:	(310,916 allowances)
CCA allowance price of $60 per allowance:	× $60 per allowance
PSE over-recovery of CCA compliance costs:	($18,654,960)

This over-recovery of over $18.65 million of CCA compliance costs in Table 25 is due solely to higher than normal average daily temperatures and does not factor any variation in projected and actual CCA allowance prices.

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[81] *See* Exh. JK-5 at 264.

Additionally, if actual greenhouse gas emissions in calendar year 2025 were 4,842,865 mtCO$_2$e (*i.e.*, equal to projected greenhouse gas emissions used to establish the base rate revenue requirement for natural gas operations in the hypothetical), but actual CCA allowance prices were ten percent lower than the projected CCA allowance priced used to set rates (*i.e.*, actual price of $54 per allowance compared to $60 per allowance), then the result would be an over-recovery of over $22.8 million of CCA compliance costs:

Table 26. Hypothetical Under-Recovery of CCA Compliance Costs Due to Actual CCA Allowance Prices Being Ten Percent Higher Than Projected CCA Allowance Prices Assumed to Establish Base Rate Revenue Requirement for Natural Gas Operations

Projected allowances needed for 2025 compliance:	4,842,865 allowances
Remaining no-cost allowances after consignment of minimum:	– 1,041,900 allowances
Actual allowances PSE must acquire for 2025 compliance:	3,800,965 allowances
Actual average CCA allowance price of $66 per allowance:	× $54 per allowance
Actual cost to acquire allowances for 2025 compliance:	$205,252,110
CCA compliance costs included in base rate revenue requirement:	– $228,057,900
Under-recovery of CCA compliance costs:	($22,805,790)

This over-recovery of over $22.8 million of CCA compliance costs in Table 26 is due solely to actual CCA allowance prices that are ten percent lower than the projected CCA allowance prices used to establish the PSE base rate revenue requirement for natural gas operations and does not factor any variation in projected and actual greenhouse gas emissions.

Q. What do these hypotheticals demonstrate?

A. These hypotheticals demonstrate that the inclusion of CCA compliance costs in the PSE base rate revenue requirement for natural gas operations would result in significant over- and under-recoveries due to circumstances outside the control of PSE and the Commission. Small changes in large numbers have large results. Normal variations in average daily temperatures increase or decrease greenhouse gas emissions associated with volumes of natural gas deliveries to PSE customers, thereby resulting in under- or over-recoveries of CCA compliance costs in the tens of millions of dollars. Similarly, errors in forecasts in emissions or allowance prices can lead to tens of millions of dollars of under- or over-recoveries of CCA compliance costs.

IV. COST RECOVERY FOR NATURAL GAS UTILITIES UNDER THE CALIFORNIA CAP-AND-TRADE PROGRAM

Q. When did the California Cap-and-Trade Program start?

A. In 2006, the California legislature passed Assembly Bill 32 ("AB 32")—the California Global Warming Solutions Act of 2006—granting the California Air Resources Board ("CARB" or "ARB") authority to regulate greenhouse gas emissions to achieve California's climate goals.[82] Pursuant to this established authority, CARB adopted California's landmark carbon Cap-and-Trade Program in December 2011.[83]

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[82] California Global Warming Solutions Act of 2006, Cal. Health & Safety Code § 38500 *et seq*.

[83] Cal. Code. Reg., Title 17, Subchapter 10, Article 5, Sections 95800 *et seq*.

The California Cap-and-Trade Program was the first full marketplace of industries for greenhouse gas emissions as a commodity in the United States, and the second in the world after the European Union's Emissions Trading Scheme.[84] Electric utilities became covered entities under the California Cap-and-Trade Program in the first compliance period, effective January 1, 2013. Natural gas utilities became covered entities under the California Cap-ad-Trade Program in the second compliance period, effective January 1, 2015.

Q. What are compliance periods for natural gas utilities subject to the California Cap-and-Trade Program?

A. Except for the first compliance period, compliance periods under the California Cap-and-Trade Program are three years. The first compliance period covered calendar years 2013 and 2014, during which time natural gas suppliers had no compliance obligation. [85] The second compliance period included calendar years 2015 through 2017. The third compliance period included calendar years 2018 through 2020. The fourth compliance period included calendar years 2021 through 2023. The California Cap-and-Trade Program is currently in its fifth compliance period, which includes calendar years 2024 through 2026.[86]

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[84] *See*, *e.g.*, Barbara Grady, *Experts Debate Economic Side Effects of California's Cap and Trade Program*, Earth Island Journal (Nov. 16, 2012)*, available at* https://www.earthisland.org/journal/index.php/articles/entry/experts_debate_side_effects_of_CA_cap_and_trade.

[85] *See In re Order Instituting Rulemaking to Address Natural Gas Distribution Utility Cost and Revenue Issues Associated with Greenhouse Gas Emissions*, Cal. Pub. Utls. Comm'n Decision 14-12-040 at 5 (Dec. 18, 2014), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M143/K633/143633560.PDF.

[86] *See* Cal. Code Regs. tit. 17 § 95840.

Q. Is it relevant to consider how the CPUC has addressed recovery of compliance cost for natural gas utilities under the California Cap-and-Trade Program?

A. Yes. The California Cap-and-Trade Program is the only other state-wide cap-and-trade program in the United States. Natural gas utilities have been operating under the California Cap-and-Trade Program for nearly a decade, with natural gas utilities complying in the most recent three of the four completed compliance periods. As discussed in the Prefiled Rebuttal Testimony of Jamie L. Martin, Exh. JLM-1T, the Commission must consider utilities of commensurate risks when establishing returns for utilities in Washington, and the California utilities are the only other utilities in the U.S. with risks of a similar program. Furthermore, in designing the Washington Cap-and-Invest Program, the Washington legislature leveraged the Global Warming Solutions Act of 2006 for key elements, including similar auction and offset mechanisms. Additionally, the state of California and the province of Québec are in discussions with the state of Washington regarding the possible linkage of the Washington Cap-and-Invest Program with the California and Québec cap-and-trade programs.[87]

The CPUC has consistent ratemaking standards and mechanisms on cost forecasting, cost recovery, purchasing limits, consignment and proposed forecast revenue requirements, as well as compliance reporting for obligations of utilities

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[87] Washington Department of Ecology, *California, Québec and Washington Agree to Explore Linkage*, Department of Ecology News Release (Mar. 20, 2024), available at https://ecology.wa.gov/about-us/who-we-are/news/2024-news-stories/mar-20-shared-carbon-market.

under the California Cap-and-Trade Program. Understanding these mechanism and processes established in the following orders by the CPUC is therefore imperative to understand implementation of the California Cap-and-Trade Program with respect to utilities:

- For the California natural gas investor-owned utilities, the CPUC adopted standards in Decision 14-12-040 (December 18, 2014),[88] Decision 15-10-032 (October 22, 2015),[89] and Decision 18-03-017 (March 22, 2018).[90]
- For the California electric investor-owned utilities, the CPUC adopted standards in Decision 12-12-033 (December 20, 2012), as amended and revised in a multitude of subsequent orders all available at the CPUC's Cap-and-Trade Decision-Making webpage.[91]

Q. Please describe the Cap-and-Trade Program compliance accounting process as approved by the CPUC for investor-owned natural gas utilities in California.

A. In Decision 14-12-040, the CPUC approved a settlement that authorized each California investor-owned natural gas utility to establish a two-way balancing account to track and record

(i) costs incurred to comply with the utility's indirect (Scope III) obligations as a gas supplier and direct

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[88] CPUC Decision 14-12-040, *supra* note 85.

[89] *In re Order Instituting Rulemaking to Address Natural Gas Distribution Utility Cost and Revenue Issues Associated with Greenhouse Gas Emissions*, Cal. Pub. Utls. Comm'n Decision 15-10-032 (Oct. 22, 2015), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M155/K330/155330024.PDF, as corrected by Cal. Pub. Utls. Comm'n Decision 16-01-028 (Jan. 19, 2016), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M157/K860/157860785.PDF.

[90] *In re Order Instituting Rulemaking to Address Natural Gas Distribution Utility Cost and Revenue Issues Associated with Greenhouse Gas Emissions*, Cal. Pub. Utls. Comm'n Decision 18-03-017 (Mar. 22, 2018), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M212/K370/212370733.PDF.

[91] California Public Utilities Commission, *CPUC Cap-and-Trade Decision-Making*, available at https://www.cpuc.ca.gov/industries-and-topics/natural-gas/greenhouse-gas-cap-and-trade-program/cpuc-proceedings-and-documents-related-to-ghg-cap-and-trade..

> (Scope I) obligations as an owner of covered facilities under the Cap-and-Trade Program and
>
> (ii) revenues received from consignment of no-cost allowances for auction under the Cap-and-Trade Program.

The CPUC expressly found the following with respect to cost recovery for California investor-owned natural gas utilities under the Cap-and-Trade Program:

> It is reasonable to approve the Settling Parties' request to establish two-way balancing accounts to track and record costs incurred to comply with the ARB natural gas supplier Cap-and-Trade program and company facility (e.g. gas compressor station) GHG compliance costs, as well as the revenues received from consignment of natural gas supplier allowances for auction under the ARB program is reasonable.[92]

In Decision 15-10-032, the CPUC established the processes for cost recovery of compliance costs and consignment allowance revenues of California investor-owned natural gas utilities. The CPUC expressly authorized each natural gas utility to forecast and reconcile Cap-and-Trade Program compliance costs and allowance revenues in balancing accounts to be amortized in core and noncore cast transportation rates beginning on January 1 of the following year:

> Each natural gas utility has an existing advice letter process in which it annually projects the year-end balances in various balancing accounts to be amortized in core and noncore gas transportation rates on January 1 of the following year. We authorize each utility to forecast and reconcile its natural gas GHG compliance costs and allowance proceeds as part of this existing true-up advice letter process. PG&E, SoCalGas, and SDG&E [Pacific Gas and Electric Company, Southern California Gas Company, and San Diego Gas and Electric Company] currently file: (1) a Tier 2 advice letter in October or November and (2) a Tier 1 advice letter at the end of December that updates the data in the October/November advice

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[92] Decision 14-12-040 at 18.

> letter. PG&E, SoCalGas and SDG&E should include their GHG forecasts into both of these advice letters.[93]

Q. Did the CPUC require investor-owned natural gas utilities to include information that would allow the agency to examine the prudence of the Cap-and-Trade Program compliance costs and revenues included in the balancing account?

A. Yes. Decision 15-10-032 expressly required natural gas utilities to include in their annual advice letters a narrative summary of Cap-and-Trade Program compliance costs and revenues completed in the year, including deviations from projections for such year filed in prior advice letters, and projecting compliance costs and revenues for the upcoming year:

> For all utilities, the annual advice letters should contain a new section related to GHG costs and allowance proceeds. This section of the advice letters should include (1) a narrative summary describing activities completed in the current year, including any deviations from what was forecasted for the current year, and projecting activities in the forecast year and (2) the completed tables (provided in Appendix A [to Decision 15-10-032]) to show the current year's recorded costs and proceeds and the next year's forecast costs and proceeds. For example, in fall of 2015, each utility should forecast its 2016 costs and proceeds, and also record the 2015 costs and proceeds it expects by the end of 2015.[94]

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[93] Decision 15-10-032 at 18-19.

[94] Decision 15-10-032 at 19.

Q. How did the CPUC address initial cost recovery associated with the implementation of the Cap-and-Trade Program by natural gas utilities?

A. Decision 18-03-017 required that the California natural gas utilities net the 2015, 2016, and 2017 (the second cap-and-trade compliance period) compliance costs from available allowance proceeds from respective years:

> Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas & Electric Company and Southwest Gas Company must calculate the total actual greenhouse gas End User and Lost and Unaccounted For gas compliance costs for 2015, 2016 and 2017, including interest, and net those costs against total available greenhouse gas proceeds for 2015, 2016 and 2017, including interest. Available greenhouse gas proceeds are those remaining after accounting for administrative costs included in the utilities' Greenhouse Gas Memorandum Accounts. Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas & Electric Company and Southwest Gas Company must calculate the accrued actual greenhouse gas costs and proceeds for the years 2015, 2016 and 2017 using the calculations, methodologies and procedures adopted in Decision 15-10-032.
>
> In the event that netted 2015-2017 greenhouse gas compliance costs exceed netted 2015-2017 greenhouse gas proceeds, Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas & Electric Company and Southwest Gas Company must amortize remaining greenhouse gas costs for the 2015-2017 time period over a 12-month period beginning when 2018 greenhouse gas compliance costs first appear in rates. Net greenhouse compliance costs, should they exist, must be included in base transportation rates as directed in Decision 15-10-032.
>
> In the event that netted 2015-2017 greenhouse gas proceeds exceed netted 2015-2017 greenhouse gas compliance costs, Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas & Electric Company and Southwest Gas Company must distribute remaining proceeds with the 2018 California Climate Credit.[95]

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[95] Decision 18-03-017 at 53-54.

Decision 18-03-017 also required the California natural gas utilities to begin recovery of the forecasted 2018 compliance costs (the first year of the third compliance period) over an 18-month amortization period from July 1, 2018:

> Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas & Electric Company and Southwest Gas Company must include 2018 greenhouse gas compliance costs in rates beginning July 1, 2018. Greenhouse gas compliance costs for 2018 must be amortized over eighteen months. In the event that disposition of the Tier 2 Advice Letters ordered in Ordering Paragraph 9 results in a delay in the inclusion of greenhouse gas costs in rates and/or the distribution of the 2018 California Climate Credit, inclusion of greenhouse gas costs and/or distribution of the California Climate Credit shall occur in the first month after final disposition of the Tier 2 Advice Letters.[96]

Following 2018, California's natural gas utilities would follow the annual cost recovery mechanism of the cap-and-trade compliance costs (through the companies' existing Annual Gas True-Up: Consolidated Gas Rate Update proceedings[97]) outlined in Decision 15-10-032.

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[96] Decision 18-03-017 at 54-55.

[97] *See, e*.g., Pacific Gas and Electric's 2024 Annual Gas True-Up: Consolidated Gas Rate Update, available at: https://www.pge.com/tariffs/assets/pdf/adviceletter/GAS_4845-G.pdf.

Q. Did the CPUC provide any guidance to California investor-owned natural gas utilities regarding how they could address forecast Cap-and-Trade Program costs and revenues subject to confidentiality restrictions under the Cap-and-Trade Program rules of the California Air Resources Board?

A. Yes. The CPUC expressly recognized that the overall forecast obligation in an advice letter for a natural gas utility would be publicly available, the natural gas utilities could separately forecast their compliance obligation based on confidential internal forecasts:

> The utilities should calculate their GHG compliance instrument procurement limit each year though the annual advice letters. The formula to calculate the procurement limit was approved in D.14-12-040. Utilities should use the annual GHG allowance consignment percentages specified in this instant decision to calculate their procurement limits. Providing the procurement limit in the advice letter provides administrative simplicity as the advice letter will include similar information about a utility's forecast compliance obligation. Whereas the forecast compliance obligation for the purposes of ratemaking can be based on publicly-available data, utilities may separately forecast their compliance obligation using confidential internal forecasts, and "net remaining natural gas compliance obligation to date." Therefore, procurement limits shall be provided confidentially, consistent with the Confidentiality Protocols initially approved in D.14-10-033 and adopted herein.[98]

Q. Is the cost recovery process adopted by the CPUC in Decisions 14-12-040, 15-10-032, and 18-03-017 similar to PSE's Schedule 111 process?

A. Yes. PSE forecasts and tracks Cap-and-Invest Program compliance costs and proceeds in accounting accounts that are similar to balancing accounts required by the California investor-owned natural gas utilities. PSE then reconciles projected

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[98] Decision 15-10-032 at 22.

and annual Cap-and-Invest Program compliance costs and proceeds through a Schedule 111 annual tariff filing. This is similar to the annual forecast and conciliation process described by the CPUC in Decision 15-10-032. Furthermore, Schedule 111 filings are subject to prudency review by the Commission and interested parties, which is similar to the review process that the CPUC undertakes in the fourth quarter of each year.

Q. Could the approach for cost recovery of Cap-and-Trade Program costs and revenues adopted by the CPUC be useful in if adopted by the Commission to address concerns of parties in this proceeding regarding compliance costs, transparency, and risk?

A. Yes. Although there are many similarities between the approach adopted by the CPUC and PSE's Schedule 111, there remain some key differences. For example, the CPUC requires natural gas utilities to include in their annual advice letters a narrative summary of Cap-and-Trade Program compliance costs and revenues completed in the year, including deviations from projections for such year filed in prior advice letters, and projecting compliance costs and revenues for the upcoming year.

The Commission could similarly require an approach that would require PSE to provide a narrative description of Cap-and-Trade Program costs and revenues over the year and how actual costs deviated from projected costs. The narrative discussion of PSE's activities in calendar year 2023 provided in the Prefiled

Direct Testimony of Tricia L. Fischer, Exh. TLF-1CT, and supporting exhibits thereto, could serve as an example of a narrative compiled and filed for compliance in the fourth quarter of the year.

V. CONCLUSION

Q. Does that conclude this prefiled rebuttal testimony?

A. Yes.