BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF COLORADO

IN THE MATTER OF THE	**)**	
APPLICATION OF PUBLIC SERVICE	**)**	
COMPANY OF COLORADO FOR	**)**	**PROCEEDING NO. 23A-0392EG**
APPROVAL OF ITS 2024-2028	**)**	
CLEAN HEAT PLAN	**)**	

HEARING EXHIBIT 601

Answer Testimony of Dr. Asa S. Hopkins

On Behalf of Sierra Club and NRDC

January 22, 2024

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I. INTRODUCTION AND QUALIFICATIONS

Q Please state your name, business address, and position.

A My name is Dr. Asa S. Hopkins. My business address is 485 Massachusetts Ave., Suite 3, Cambridge, Massachusetts 02139. I am a Vice President at Synapse Energy Economics, Inc. Among other work, I lead Synapse's consulting regarding the future of gas utilities, and I also work extensively in the related area of building decarbonization technology and policy.

Q Please describe Synapse Energy Economics.

A Synapse Energy Economics, Inc. ("Synapse") is a research and consulting firm specializing in energy industry regulation, planning, and analysis. Synapse works for a variety of clients, with an emphasis on consumer advocates, regulatory commissions, and environmental advocates.

Q Please describe your professional experience before beginning your current position at Synapse.

A Before joining Synapse in 2017, I was the Director of Energy Policy and Planning at the Vermont Public Service Department from 2011 to 2016. In that role, I was the director of regulated utility planning for the state's public advocate office and the director of the state energy office. I served on the Board of Directors of the

National Association of State Energy Officials. Prior to my work in Vermont, I was an AAAS Science and Technology Policy Fellow at the U.S. Department of Energy ("DOE"), where I worked in the Office of the Undersecretary for Science to develop the first DOE Quadrennial Technology Review. Prior to my time at the U.S. DOE, I was a postdoctoral fellow at Lawrence Berkeley National Laboratory, working on appliance energy efficiency standards. I earned my PhD and master's degrees in physics from the California Institute of Technology and my Bachelor of Science degree in physics from Haverford College. My resume is included as Attachment ASH-1.

Q Have you previously provided testimony before the Colorado Public Utilities Commission?

A No.

Q On whose behalf are you providing evidence in this case?

A I am testifying on behalf of the Sierra Club and the Natural Resources Defense Council ("NRDC") (collectively, "Conservation Coalition").

Q What is the purpose of your testimony?

A The purpose of my testimony is to present a tool that Synapse developed to conduct calculations regarding the rate and bill impacts of alternative Clean Heat

Plan ("CHP") proposals, such as the Pollution-Free Buildings Portfolio detailed in the Answer Testimony of Justin Brant (Hearing Exhibit 700). Witness Brant has used this tool to calculate the rate and bill impacts for his proposed alternative portfolio, which is presented in his testimony. I present results for the rate and bill impacts of the Amended Preferred Portfolio (as presented by the Public Service Company of Colorado ("the Company" or "PSCo") in Hearing Exhibit 102, Attachment DRA-7), incorporating adjustments to those results to reflect the perspective on total costs described in Witness Brant's Testimony.

Q How is your testimony organized?

A Section II of my testimony introduces the methods and assumptions I used for my rate calculations. Section III presents the results of my rate and bill calculations as applied to the Company's Amended Preferred Portfolio.

II. CALCULATION METHODS AND ASSUMPTIONS

Q Could you summarize the calculation methods you used to estimate rate impacts?

A Of course. I began my analysis by reviewing and adapting the rate impact tools presented by Witness Ihle in his testimony on behalf of the Company. Specifically, I used the spreadsheet models presented as Witness Ihle's workpapers entitled "CHP - Bill Impact – [Case Name] - 7-24-2023."

Q How did you use the "CHP - Bill Impact" workpapers?

A I made two types of changes to these workpapers to develop my estimates. First, I restructured the workpapers to aid the compatibility with the testimony of Witness Brant and make it easier for other parties in the proceeding to adjust assumptions within the tool. Next, I updated scenario definitions and assumptions to align with Hearing Exhibit 102, Attachment DRA-7 and Witness Brant's testimony. My tool built from these workpapers can be found in Attachment ASH-2.

Q How did you restructure Witness Ihle's workpapers?

A I created a common inputs page. This allows a user to change input values that alter the rate and bill impacts from a centralized place. This page refers to a static inputs page that contains the relevant inputs for the Company's and Mr. Brant's proposed portfolios (within the tool, these portfolios are referred to as "PSCo" and "SWEEP/CC," respectively). The equations used throughout the tool are either the same or functionally the same as those used in Witness Ihle's workpapers. This restructuring allowed for (1) better coordination with Witness Brant's testimony and (2) use of the tool by other parties to evaluate the bill and rate impacts of scenarios whose characteristics they can load into the inputs page, while maintaining the validity of the equations in Witness Ihle's workpapers.

To allow for analysis of proposals that include both expensed and amortized costs associated with electrification and DSM programs, I split the "Electrification" and

"Additional Gas DSM" lines in each of Witness Ihle's tables into two parts and treated their costs accordingly. I added the ability for a user of the tool to use separate amortization parameters for gas and electric costs. I added the ability to use a time-series of values for the difference between winter and summer peak (that is, the "headroom" for the transmission and generation system). Lastly, I combined the functionality of the rate impacts from the Average Rate Summary workpaper filed by the Company with the Bill Impacts workbook which was the basis for the tool.

Q Could you describe what you mean by updating scenario assumptions?

A Witness Brant testifies that the winter headroom for the transmission and generation systems are growing due to summer peaks increasing at a faster rate than winter peaks according to the Company's modeling in its most recent Electric Resource Plan. I updated the inputs and calculation used to project transmission and generation costs to reflect this testimony, for the scenario based on Witness Brant's testimony. For analysis of the Company's proposal, I have used the Company's assumptions regarding headroom. Note that the choice between Witness Brant's and the Company's headroom assumptions does not make a difference during the initial Clean Heat Plan period: Mr. Brant's proposed portfolio does not exhaust the headroom assumed by the Company until 2030, when it exceeds the Company's assumed headroom by about 98.5 MW but does not exceed Witness Brant's assumed headroom.

Q How did you integrate Witness Brant's proposal into your tool?

A I set up the tool to accommodate the structure and content of Witness Brant's Pollution-Free Buildings Portfolio proposal. The tool includes the input values for program costs and estimated impact on energy consumption that are submitted in Witness Brant's testimony (Hearing Exhibit 700). Witness Brant provides further clarification on the inputs and resulting rate and bill impacts in his testimony.

Q Does your tool allow its user to illuminate the potential impacts of changes in assumptions and clean heat program approaches?

A Yes, to some degree. The tool does not estimate the impact or effectiveness of programs, such as demand-side management or electrification programs, and the resulting changes in sales—the changes in sales expected from these programs need to be determined by the user and entered into the tool as inputs. The tool can show the impact of assumptions, such as the cost or avoided cost of utility capital investments or program funding approaches. For example, the tool allows the user to see that, using the Company's assumptions, the annual value of avoided gas system capital is about one quarter of the added annual cost of electric system capital in the Company's Amended Preferred Portfolio. (This ratio depends both on the assumed dollar value of changes in peak demand to the two utility systems, and on the changes in sales and peak loads that result from clean heat programs, all of which users can modify using the tool's input page.) The tool also allows

the user to evaluate the impact of program financing choices such as expensing versus amortizing program costs, or the parameters of amortization. For example, shortening the amortization time increases annual costs during the amortization period, while making that period shorter. As a result, when comparing rates in cases with two different amortization periods, relative rates are lower during the time between the end of the shorter amortization period the end of a longer one. Reducing the rate of return on amortized capital lowers costs.

III. RATE IMPACTS OF THE COMPANY'S PROPOSAL

Q Please define what you mean by the Company's Amended Preferred Portfolio.

A I mean the proposal detailed in Hearing Exhibit 115 and Hearing Exhibit 102, Attachment DRA-7, with certified natural gas and market transformation costs included.

Q How does your treatment of certified natural gas costs differ from the Company's treatment of those costs in DRA-7?

A I have included certified natural gas costs in the annual program costs in the tool. Witness Brant provides an explanation for this choice in his testimony, Hearing Exhibit 700.

Q How does your treatment of market transformation costs differ from the Company's treatment of those costs in DRA-7?

A I have included market transformation costs in the annual program costs in the tool. The costs of market transformation for the Company's Amended Preferred Portfolio come from the Company's workpaper "CHP – Bill impact – Clean Heat Plus – 7-24-2023". It was necessary to reference that workpaper because these costs were neither updated nor included in DRA-7 (which does not include a bill analysis of the Amended Preferred Portfolio). The costs of market transformation for Witness Brant's proposal come from his testimony, Hearing Exhibit 700).

Q What are the annual program costs used in your analysis of the Company's Amended Proposal?

A See Table 1 below. The source for these costs is Hearing Exhibit 102, Attachment DRA-7 and the Company's workpaper "CHP – Bill Impact – Clean Heat Plus – 7-24-2023" (for the market transformation portfolio costs).

Table 1: The Company's Amended Preferred Portfolio Annual Program Costs 2023-2030 (2023 $Millions)

Measure Bin	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Additional Gas DSM	*15.6*	*15.4*	*16.2*	*16.8*	*17.1*	*16.7*	*10.0*
Electrification	*19.9*	*35.0*	*57.7*	*83.9*	*106.2*	*129.3*	*147.2*
Certified Natural Gas	-	-	*2.4*	*4.6*	*6.2*	*7.1*	*7.1*
~~Offsets~~	~~*2.3*~~	~~*4.2*~~	~~*6.7*~~	~~*8.7*~~	~~*9.3*~~	~~*9.6*~~	~~*9.9*~~
Hydrogen	-	-	-	*5.7*	*20.1*	*36.7*	*46.2*
Recovered Methane	*13.2*	*80.9*	*89.2*	*89.2*	*89.2*	*89.2*	*86.0*
Market Transformation	*14.8*	*21.8*	*14.4*	*7.8*	*6.4*	-	-
Total	***63.5***	***153.1***	***179.9***	***208.0***	***245.2***	***279.0***	***296.5***

Q What are the gas throughput values used in your analysis of the Company's Amended Proposal?

A See Table 2 below. I have chosen to combine "certified natural gas" and "natural gas" on one line for simplicity. The source for these values is Hearing Exhibit 102, Attachment DRA-7.

Table 2: The Company's Amended Preferred Portfolio Gas Throughput at Year End (Dth/Year)

Measure Bin	2024	2025	2026	2027	2028	2029	2030
~~Certified Natural Gas~~	-	~~*20,000*~~	~~*35,735,961*~~	~~*71,168,913*~~	~~*100,421,249*~~	~~*117,265,928*~~	~~*116,868,077*~~
Recovered Methane	*512,512*	*2,192,289*	*2,821,289*	*2,821,289*	*2,821,289*	*2,821,289*	*2,794,161*
Hydrogen	-	-	-	*669,890*	*1,725,658*	*2,874,623*	*3,711,888*
~~Natural Gas~~	~~*143,765,072*~~	~~*141,209,572*~~	~~*102,864,378*~~	~~*63,512,319*~~	~~*29,340,084*~~	~~*5,774,062*~~	~~*323,923*~~
Natural Gas (Amended)	*143,765,072*	*141,229,572*	*138,600,339*	*134,681,232*	*129,761,333*	*123,039,990*	*117,192,000*
Electrification	*953,398*	*2,560,518*	*4,821,358*	*7,722,923*	*11,275,095*	*15,475,724*	*20,143,816*
Additional DSM	*793,610*	*1,580,705*	*2,385,751*	*3,202,626*	*4,024,134*	*4,843,069*	*5,517,510*

Q Did the Company provide a rate and bill estimate for its Amended Preferred Portfolio?

A No, but I have used the tool I developed to produce such an estimate.

Q How did you develop your estimate of rate and bill impacts from the Company's Amended Preferred Portfolio?

A I used my tool, inputting the values from Hearing Exhibit 102, Attachment DRA-7 Amended Preferred Portfolio, with the changes described above.

Q What did your analysis find regarding the impact of the Company's Amended Preferred Portfolio on the CHP rider paid by gas customers?

A I have replicated the analysis of the direct rate impact of the CHP rider provided in Witness Ihle's Direct Testimony, specifically JWI-D-5: CHSGA Rate Impact Analysis, but I performed this analysis on the Amended Preferred Portfolio instead of the original Clean Heat Plus portfolio analyzed in Witness Ihle's testimony. For this analysis, I maintained all of the Company's assumptions around the mechanism and customers for cost recovery. See Table 3 below.

Table 3: Clean Heat Support Gas Adjustment Rate Impact Analysis of Amended Preferred Portfolio

	2024	2025	2026	2027	2028	2029	2030
CHSGA Annual Costs							
Incremental Gas DSM - Amortized Costs	$995,020	$2,939,543	$4,857,237	$6,797,867	$8,726,602	$10,577,768	$11,905,093
Certified Natural Gas	$0	$0	$2,400,000	$4,600,000	$6,200,000	$7,100,000	$7,100,000
Offsets	$0	$0	$0	$0	$0	$0	$0
Hydrogen	$0	$0	$0	$5,700,000	$20,100,000	$36,700,000	$46,200,000
Recovered Methane	$13,200,000	$80,900,000	$89,200,000	$89,200,000	$89,200,000	$89,200,000	$86,000,000
Market Transformation Projects	$14,800,000	$21,800,000	$14,350,000	$7,750,000	$6,350,000	$0	$0
Market Transformation Fund	$0	$0	$0	$0	$0	$0	$0
Total CHSGA Costs	$28,995,020	$105,639,543	$110,807,237	$114,047,867	$130,576,602	$143,577,768	$151,205,093
Sales Volumes Adjusted for Decreases Associated with DSM & Electrification	143,829,097 Dth	142,308,372 Dth	139,218,141 Dth	134,878,924 Dth	129,924,793 Dth	123,262,414 Dth	117,134,563 Dth
Forecasted CHSGA Rate	$0.20/Dth	$0.74/Dth	$0.80/Dth	$0.85/Dth	$1.01/Dth	$1.16/Dth	$1.29/Dth
Baseline Average Rate Forecast	$9.07/Dth	$9.53/Dth	$9.04/Dth	$9.59/Dth	$9.90/Dth	$10.01/Dth	$10.22/Dth
Average Rate With CHSGA	$9.28/Dth	$10.27/Dth	$9.83/Dth	$10.43/Dth	$10.90/Dth	$11.17/Dth	$11.51/Dth
CHSGA Rate Impact	+ 2.2%	+ 7.8%	+ 8.8%	+ 8.8%	+ 10.2%	+ 11.6%	+ 12.6%
Average Monthly Residential Usage	6.4 Dth	6.4 Dth	6.4 Dth	6.4 Dth	6.4 Dth	6.4 Dth	6.4 Dth

Impact To Average Monthly Residential Bill	$1.29	$4.75	$5.09	$5.41	$6.43	$7.45	$8.26
Average Residential Usage - Winter Only	11.6 Dth	11.6 Dth	11.6 Dth	11.6 Dth	11.6 Dth	11.6 Dth	11.6 Dth
Impact To Average Monthly Residential Bill	$2.34	$8.61	$9.23	$9.81	$11.66	$13.51	$14.97

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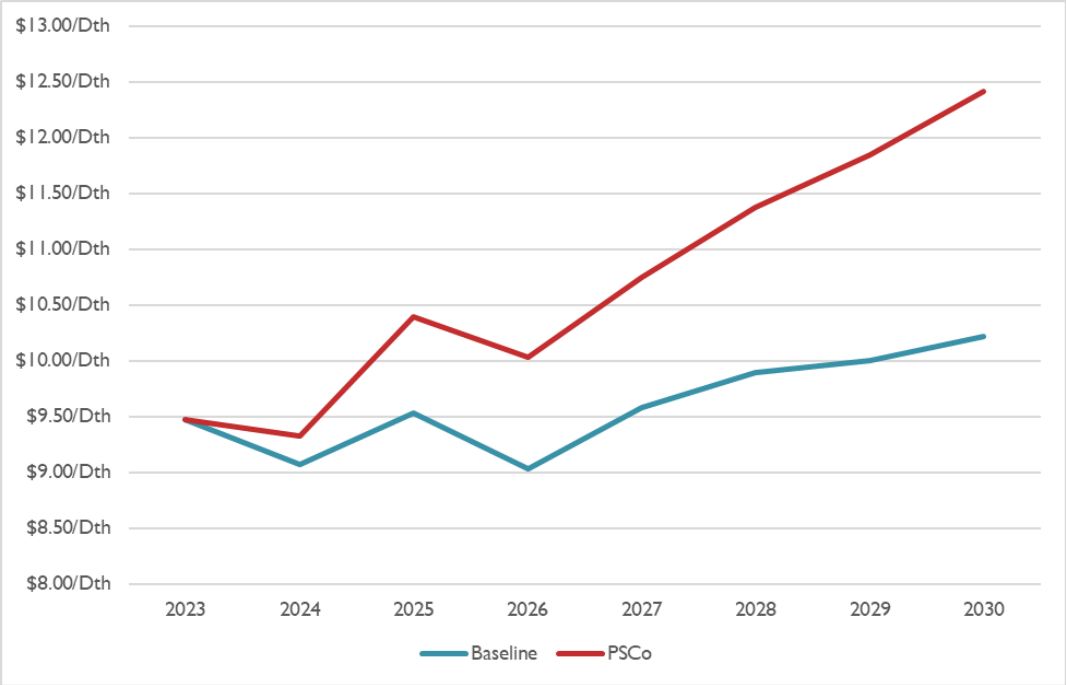
The Company proposes recovering amortized DSM costs and CNG and market transformation costs from gas ratepayers. For the Company's Amended Preferred Portfolio, the resulting gas rate trajectory, which reflects the impact of the CHP rider only (relative to the no-CHP case), can be found in Figure 1.

Figure 1: CHP Rider Only - Natural Gas Average Rates – Amended Preferred Portfolio

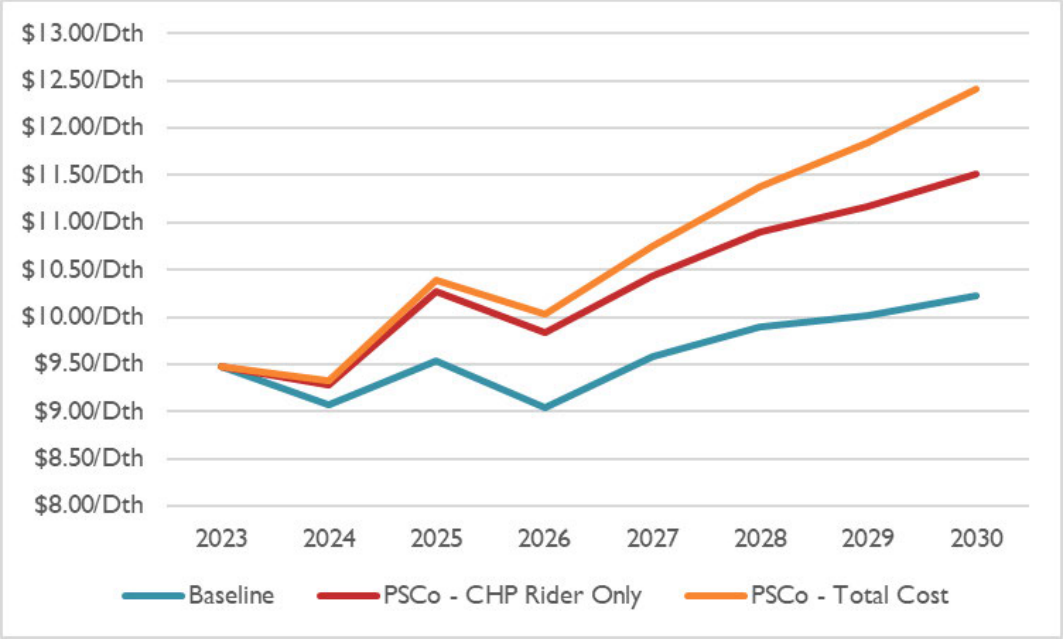


Q Did you consider the effects of changes in sales on average gas rates?

A Yes, I did. Using the same methods as Witness Ihle, I have produced an updated equivalent of Figure JWI-D-8, showing that reductions in gas throughput result in further gradual increases in gas rates. Figure 2, below, shows the overall impact

on gas rates of both the CHP rider and changes in sales under the Company's Amended Preferred Portfolio.

Figure 2: Amended Preferred Portfolio Average Rate Analysis - Natural Gas



Q What did your analysis find regarding the impact of the Company's Amended Preferred Portfolio on the CHP rider paid by electric customers?

A I have replicated the analysis of direct CHP rider rate impact provided in Witness Ihle's Direct Testimony, specifically JWI-D-6: CHSEA Rate Impact Analysis. See Table 4.

Table 4: Clean Heat Support Electric Adjustment Rate Impact Analysis for Preferred Portfolio

	2024	2025	2026	2027	2028	2029	2030
CHSEA Annual Costs ($millions)							
Beneficial Electrification - Amortized Costs	$1,269,288	$4,729,203	$10,484,838	$19,164,808	$30,640,910	$44,613,565	$60,706,787
Total CHSGA Costs	$1,269,288	$4,729,203	$10,484,838	$19,164,808	$30,640,910	$44,613,565	$60,706,787
Sales Volumes Adjusted for Changes Associated with DSM & Electrification	29,385,815,249 kWh	29,893,285,301 kWh	30,452,694,031 kWh	30,988,281,461 kWh	31,711,125,617 kWh	32,330,268,436 kWh	33,060,794,983 kWh
Forecasted CHSEA Rate	$0.00004 /kWh	$0.00016 /kWh	$0.00034 /kWh	$0.00062 /kWh	$0.00097 /kWh	$0.00138 /kWh	$0.00184 /kWh
Baseline Average Rate Forecast	$0.12415 /kWh	$0.12403 /kWh	$0.12766 /kWh	$0.12835 /kWh	$0.13178 /kWh	$0.13582 /kWh	$0.14257 /kWh
Average Rate With CHSEA	$0.12419 /kWh	$0.12419 /kWh	$0.12800 /kWh	$0.12897 /kWh	$0.13275 /kWh	$0.13720 /kWh	$0.14441 /kWh
CHSEA Rate Impact	+ 0.0%	+ 0.1%	+ 0.3%	+ 0.5%	+ 0.7%	+ 1.0%	+ 1.3%

Average Monthly Residential Usage	606 kWh	606 kWh	606 kWh	606 kWh	606 kWh	606 kWh	606 kWh
Impact To Average Monthly Residential Bill	$0.03	$0.10	$0.21	$0.37	$0.59	$0.84	$1.11

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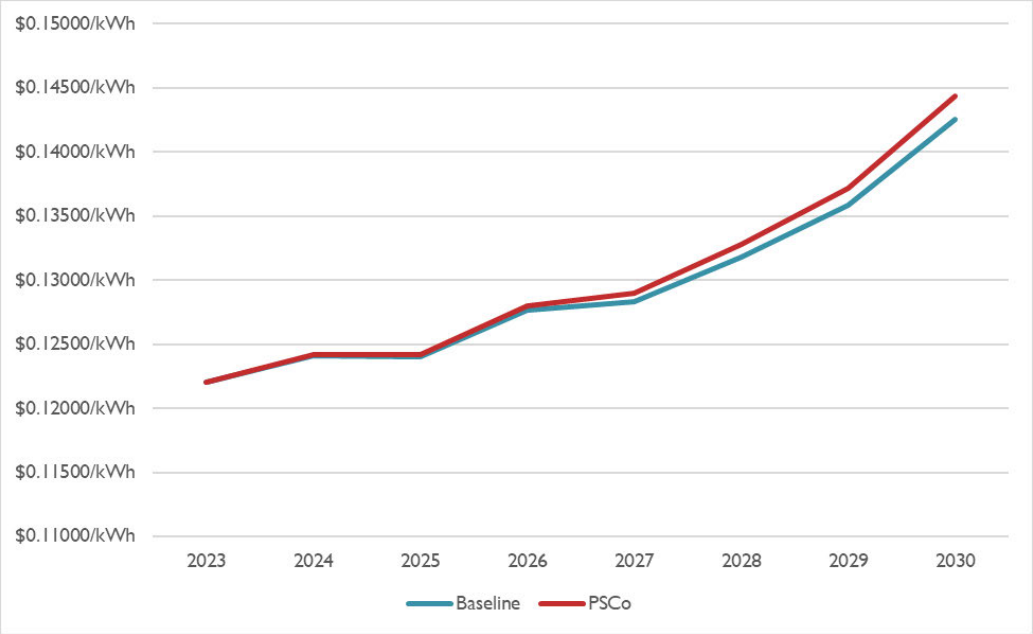
For the Company's Amended Preferred Portfolio, the electric rate trajectory from the CHP rider alone, relative to the no-CHP case, can be found in Figure 3.

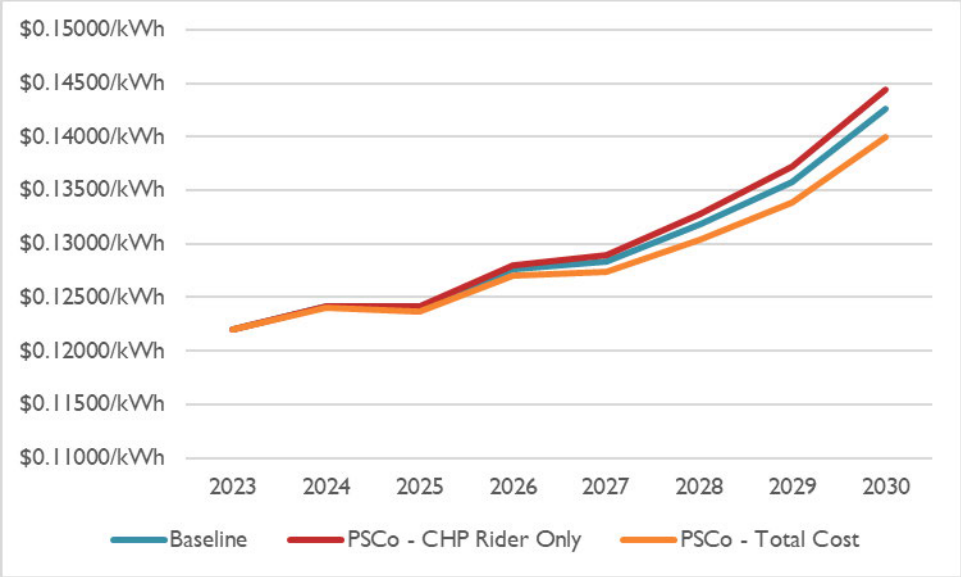
Figure 3: CHP Rider Only - Electric Average Rates – Amended Preferred Portfolio



Q Did you consider the effects of changes in sales on average gas rates?

A Yes, I did. Using the same methods as Witness Ihle, I have produced an updated equivalent of Figure JWI-D-9 which shows that, for the Company's Amended Preferred Portfolio, increases in electric throughput result in gradual decreases in electric rates relative to the no-CHP baseline. This reduction is large enough to offset the increase in rates from the CHSEA. See Figure 4.

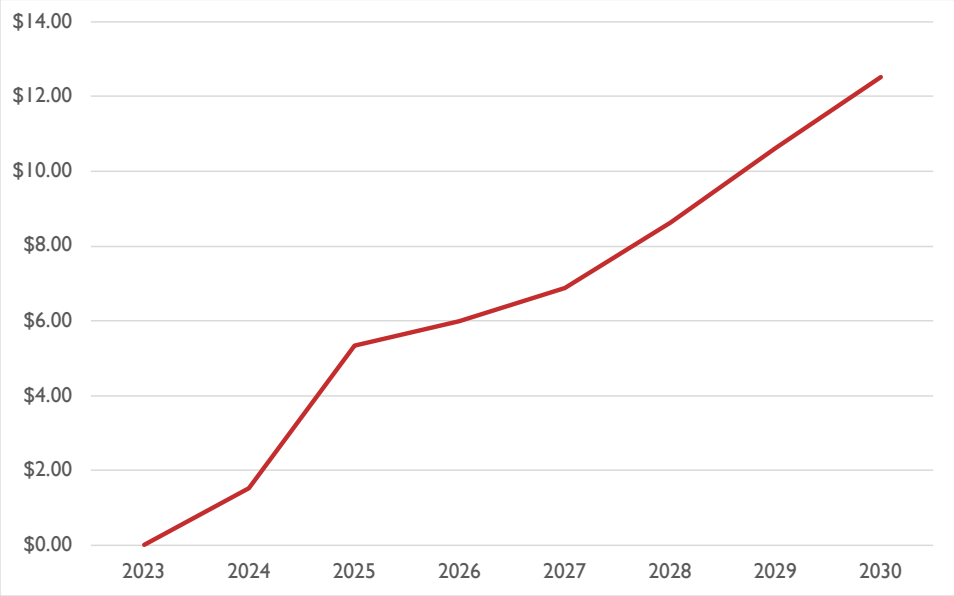
Figure 4: Amended Preferred Portfolio Average Rate Analysis - Electricity



Q Did you quantify the average monthly bill impact for a typical electric and gas combined customer?

A Yes, I did. Figure 5 shows the updated version of Figure JWI-D-10 for the Company's Amended Preferred Portfolio.

Figure 5. Impact to Average Monthly Bill For Combined Electric & Natural Gas Residential Customer – Amended Preferred Portfolio



Q How do the rate and bill impacts of the Company's Amended Preferred Portfolio compare with the rate and bill impacts for the Company's original Clean Heat Plus proposal?

A The rate and bill impacts of the Company's Amended Preferred Portfolio are very similar to the Company's original Clean Heat Plus proposal. For example, Witness Ihle's workpapers estimate an overall gas rate impact of 15.7 percent in 2028, whereas I calculate the Amended Preferred Portfolio would have an overall gas rate impact of 14.9 percent in that year. Electric rates would be 1.0 percent lower in both cases. This is consistent with what we expect given the small changes in portfolio costs between the original Clean Heat Plus proposal and the

Amended Preferred Portfolio with CNG and market transformation costs included.

Q Did Witness Brant analyze any further changes to scenario assumptions for the Company's Amended Preferred Portfolio?

A Yes. In his proposed alternative portfolio, Witness Brant makes certain changes to the way portfolio costs are divided between gas and electric customers and how they are amortized over time, which are described in his testimony. In order to perform an apples-to-apples comparison between Witness Brant's proposed alternative portfolio and the Company's Amended Preferred Portfolio, Witness Brant applied these same changes to cost allocation and recovery to the Amended Preferred Portfolio, again as described in his testimony. I incorporated these changes to the Amended Preferred Portfolio into an alternative scenario coded into my rate impacts tool, Attachment ASH-2. In this alternative version of the APP scenario, the tool codes the changes described in Mr. Brant's testimony. Otherwise, the values and calculations in this scenario are the same as in the baseline Amended Preferred Portfolio case. Witness Brant presents the results for this scenario in his testimony.

Q Does this conclude your testimony?

A Yes, it does.

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF COLORADO

IN THE MATTER OF THE APPLICATION OF PUBLIC SERVICE COMPANY OF COLORADO FOR APPROVAL OF ITS 2024-2028 CLEAN HEAT PLAN	**)**	**PROCEEDING NO. 23A-0392EG**

AFFIDAVIT OF ASA S. HOPKINS

I, Asa S. Hopkins, state that the Answer Testimony of Asa S. Hopkins, Hearing Exhibit 601 (and all attachments thereto) in the above-captioned matter, was prepared by me or under my supervision and control and that it is true and correct to the best of my knowledge and belief and would be the same if given orally under oath.

/s/ *Asa S. Hopkins*
Asa S. Hopkins

Dated January 22, 2024