

**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 603
Cross-Answer Testimony of Dr. Asa S. Hopkins
On Behalf of Sierra Club and NRDC**

February 26, 2024

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ASH-4 Synapse Rate and Bill Impact Model – Denver

1 **I. INTRODUCTION**

2 **Q Please state your name.**

3 **A** My name is Dr. Asa S. Hopkins.

4 **Q Are you the same Asa Hopkins that provided Answer Testimony in this**
5 **proceeding on January 22, 2024?**

6 **A** Yes.

7 **Q What is the purpose of your cross-answer testimony?**

8 **A** The purpose of my testimony is to present the results of using the rate and bill
9 analysis tool I presented in my Answer Testimony to calculate the rate and bill
10 impacts of two alternative portfolios presented in Answer testimony: the Colorado
11 Energy Office's ("CEO") proposal presented in the testimonies of Witness Hay
12 and Witness Ottesen, and the City and County of Denver's ("Denver") proposal
13 presented in the testimony of Witness Rogers.

14 **Q How is your testimony organized?**

15 **A** Section II of my testimony presents the results for rate and bill modeling of
16 CEO's proposal. Section III presents the results for rate and bill modeling of
17 Denver's proposal.

1 **II. RATE IMPACTS OF CEO’S PROPOSED PORTFOLIO**

2 **Q Please define what you mean by CEO’s Proposed Portfolio.**

3 **A I mean the proposal detailed in Hearing Exhibit 500, including Attachment KMH-**
4 **6, and Hearing Exhibit 501, with market transformation costs included.**

5 **Q Did CEO provide a rate and bill estimate for its proposed portfolio?**

6 **A Yes. Witness Hay provided some results in his answer testimony (Hearing Exhibit**
7 **500) and Attachment KMH-6. These results did not include the cost of the Market**
8 **Transformation portfolio. The differences between Witness Hay’s results and**
9 **mine reflect relatively small differences in the analysis methods used, such as**
10 **including the costs of the Market Transformation portfolio in my analysis.**

11 **Q How did you estimate the Market Transformation costs of CEO’s Proposed**
12 **Portfolio?**

13 **A Based on Witness Ottesen’s testimony (Hearing Exhibit 501), I included some**
14 **parts of the of the Market Transformation portfolio and excluded other pieces of**
15 **the Market Transformation portfolio. Specifically, I included the neighborhood**
16 **retrofit, hydrogen blending, advanced leak detection, and market innovation fund**

1 costs,¹ and excluded the Company's other proposals from the Market
2 Transformation budget. My understanding is that CEO proposes that other market
3 transformation activities would be either rejected or pursued inside the base clean
4 heat plan budget. I added a cost of \$2.4 million per year for five years (total of
5 \$12 million) for the Mead and Fort Lupton non-pipeline alternatives, to reflect the
6 recommendations related to these projects at pages 27-28 of Witness Ottesen's
7 testimony.

8 **Q How did you allocate the Market Transformation costs between electric and**
9 **gas ratepayers for the CEO case?**

10 **A** I assigned all costs for the hydrogen blending, advanced leak detection, and
11 market innovation fund to gas ratepayers, and split the costs of the neighborhood
12 retrofit and Mead and Fort Lupton non-pipeline alternatives evenly between
13 electric and gas ratepayers.

14 **Q Did you amortize market transformation costs for the CEO Proposed**
15 **Portfolio?**

16 **A** Yes, I amortized them over four years, as described by Witness Ottesen.

¹ CEO supports some concepts in the market innovation fund, but not others. Because PSCo did not provide individual budgets for the concepts, I have included the full market innovation fund budget in CEO's portfolio.

1 **Q Did you amortize other clean heat plan costs?**

2 **A Yes. To reflect Witness Hay’s proposal, I assumed the Additional DSM and**
3 Electrification costs would be amortized over four years.

4 **Q How did you develop your estimate of rate and bill impacts from CEO’s**
5 **Proposed Portfolio?**

6 **A I used my tool, inputting the values from Hearing Exhibit 500, Attachment KMH-**
7 6, with the changes described above. Attachment ASH-3 is this version of the
8 tool.

9 **Q What did your analysis find regarding the impact of CEO’s Proposed**
10 **Portfolio on the CHP rider paid by gas customers?**

11 **A I have replicated the analysis of the direct rate impact of the CHP rider provided**
12 in Witness Ihle’s Direct Testimony, specifically JWI-D-5: CHSGA Rate Impact
13 Analysis, but I performed this analysis on CEO’s Proposed Portfolio. See Table 1
14 below. I understand that CEO is proposing that there not be a standalone CHP
15 rider, but instead that the CHP costs be recovered through an existing rider. I have
16 retained the separation and the same name as in the Public Service Company of
17 Colorado’s (“the Company”) proposal for consistency and avoidance of
18 confusion.

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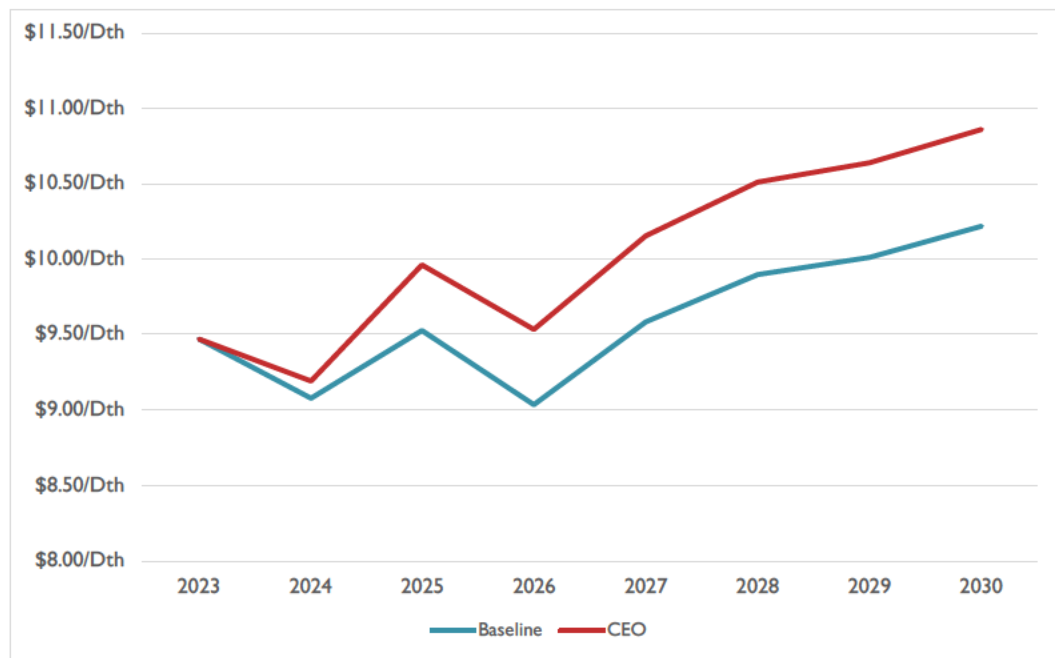
Table 1: Clean Heat Support Gas Adjustment Rate Impact Analysis of CEO's Proposed Portfolio

	2024	2025	2026	2027	2028	2029	2030
CHSGA Annual Costs							
Incremental Gas DSM - Amortized Costs	\$3,616,721	\$11,137,426	\$18,103,104	\$23,534,432	\$24,636,659	\$21,007,912	\$16,856,016
Certified Natural Gas	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Offsets	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Hydrogen	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Recovered Methane	\$13,176,523	\$49,524,931	\$49,524,931	\$49,524,931	\$49,524,931	\$49,524,931	\$49,524,931
Market Transformation Projects	\$0	\$0	\$0				
Market Transformation Fund	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total CHSGA Costs	\$16,793,244	\$60,662,357	\$67,628,035	\$73,059,363	\$74,161,590	\$70,532,843	\$66,380,947
Sales Volumes Adjusted for Decreases Associated with DSM & Electrification	143,051,726 Dth	140,165,309 Dth	135,154,659 Dth	128,415,412 Dth	120,774,276 Dth	111,442,522 Dth	103,201,089 Dth
Forecasted CHSGA Rate	\$0.12/Dth	\$0.43/Dth	\$0.50/Dth	\$0.57/Dth	\$0.61/Dth	\$0.63/Dth	\$0.64/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	\$9.19/Dth	\$9.96/Dth	\$9.54/Dth	\$10.16/Dth	\$10.51/Dth	\$10.64/Dth	\$10.86/Dth
CHSGA Rate Impact	+ 1.3%	+ 4.5%	+ 5.5%	+ 5.9%	+ 6.2%	+ 6.3%	+ 6.3%
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	\$0.75	\$2.77	\$3.20	\$3.64	\$3.93	\$4.05	\$4.12
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	\$1.36	\$5.02	\$5.80	\$6.60	\$7.12	\$7.34	\$7.46

2

1 CEO proposes recovering amortized DSM and recovered methane costs and some
2 market transformation costs from gas ratepayers. For CEO's Proposed Portfolio,
3 the resulting gas rate trajectory, which reflects the impact of the CHP rider only
4 (relative to the no-CHP case), can be found in Figure 1.

5 **Figure 1: CHP Rider Only - Natural Gas Average Rates – CEO's Proposed**
6 **Portfolio**

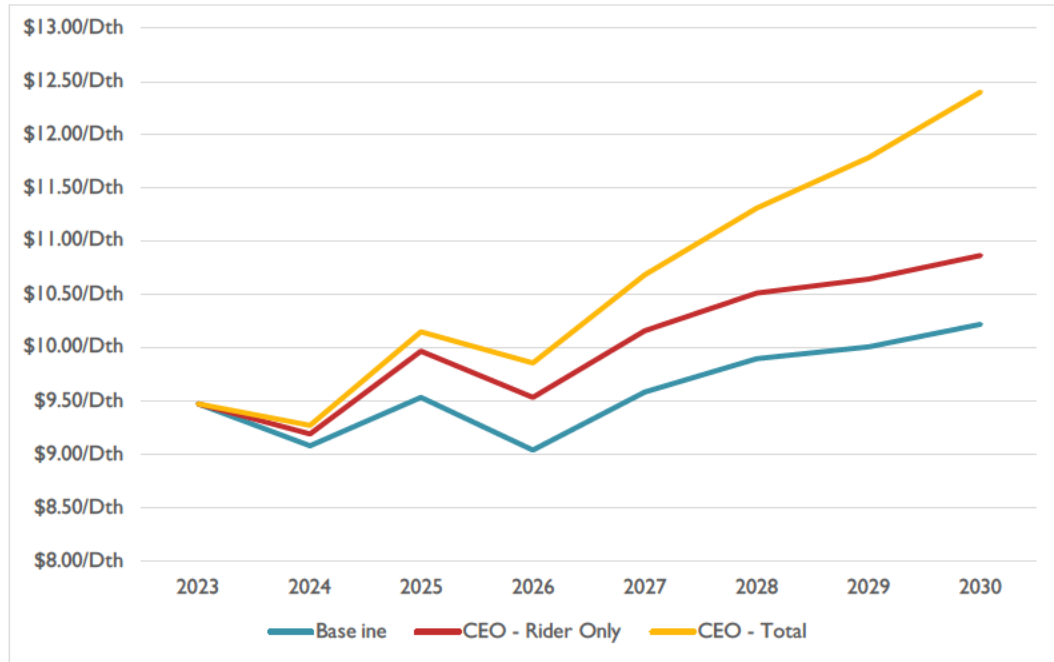


7

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

9 **A** Yes, I did. Using the same methods as Witness Ihle, I have produced an updated
10 equivalent of Figure JW1-D-8, showing that reductions in gas throughput result in
11 further gradual increases in gas rates. Figure 2, below, shows the overall impact
12 on gas rates of both the CHP rider and changes in sales under the CEO's Proposed
13 Portfolio.

1 **Figure 2: CEO's Proposed Portfolio Average Rate Analysis - Natural Gas**



2

3 **Q What did your analysis find regarding the impact of the CEO's Proposed**
4 **Portfolio on the CHP rider paid by electric customers?**

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

7 See Table 2.

1

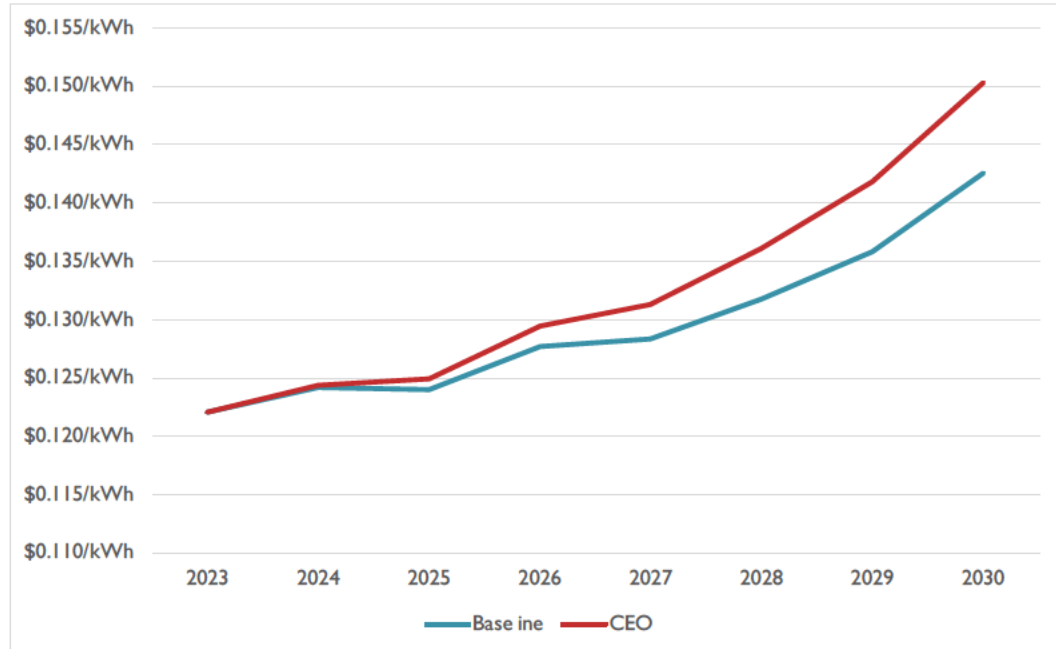
Table 2: Clean Heat Support Electric Adjustment Rate Impact Analysis for CEO's Proposed Portfolio

	2024	2025	2026	2027	2028	2029	2030
CHSEA Annual Costs (\$millions)							
Beneficial Electrification - Amortized Costs	\$7,614,094	\$26,743,120	\$54,320,451	\$92,660,600	\$139,570,425	\$200,380,959	\$266,555,710
Total CHSGA Costs	\$7,614,094	\$26,743,120	\$54,320,451	\$92,660,600	\$139,570,425	\$200,380,959	\$266,555,710
Sales Volumes Adjusted for Changes Associated with DSM & Electrification							
	29,453,724,157 kWh	30,075,666,576 kWh	30,796,003,619 kWh	31,538,025,457 kWh	32,500,840,489 kWh	33,358,885,928 kWh	34,269,632,348 kWh
Forecasted CHSEA Rate	\$0.00026/kWh	\$0.00089/kWh	\$0.00176/kWh	\$0.00294/kWh	\$0.00429/kWh	\$0.00601/kWh	\$0.00778/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	\$0.12441/kWh	\$0.12492/kWh	\$0.12942/kWh	\$0.13129/kWh	\$0.13608/kWh	\$0.14182/kWh	\$0.15035/kWh
CHSEA Rate Impact	+ 0.2%	+ 0.7%	+ 1.4%	+ 2.3%	+ 3.3%	+ 4.4%	+ 5.5%
Average Monthly Residential Usage	606 kWh	606 kWh	606 kWh	606 kWh	606 kWh	606 kWh	606 kWh
Impact To Average Monthly Residential Bill	\$0.16	\$0.54	\$1.07	\$1.78	\$2.60	\$3.64	\$4.71

2

1 For CEO's Proposed Portfolio, the electric rate trajectory from the CHP rider
2 alone, relative to the no-CHP case, can be found in Figure 3.

3 **Figure 3: CHP Rider Only - Electric Average Rates – CEO's Proposed**
4 **Portfolio**

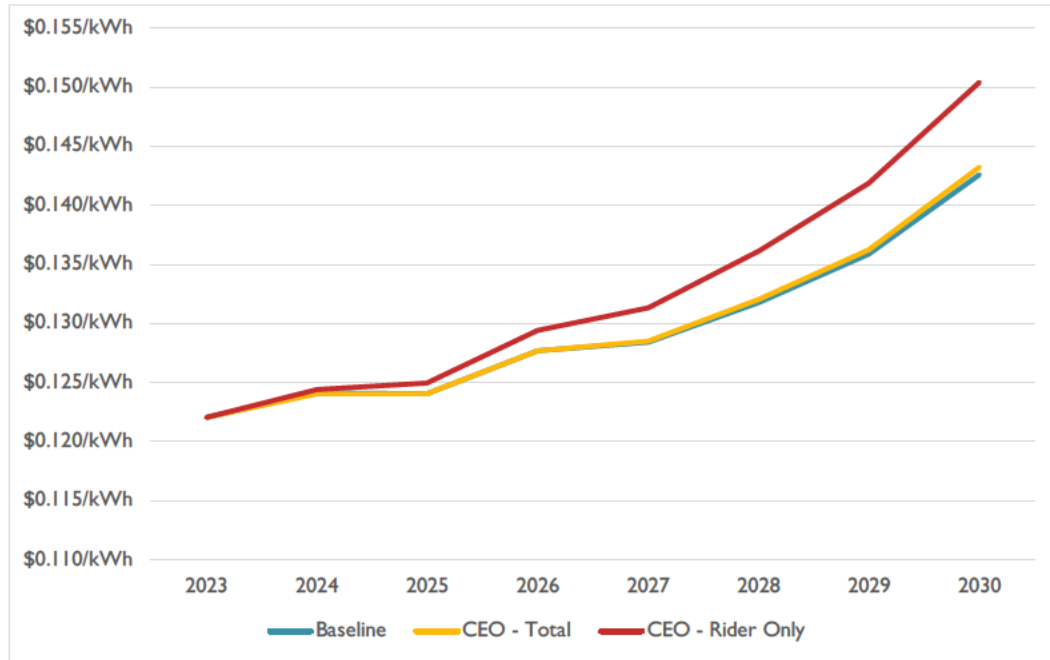


5

6 **Q Did you consider the effects of changes in sales on average electric rates?**

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

1 **Figure 4: CEO's Proposed Portfolio Average Rate Analysis - Electricity**



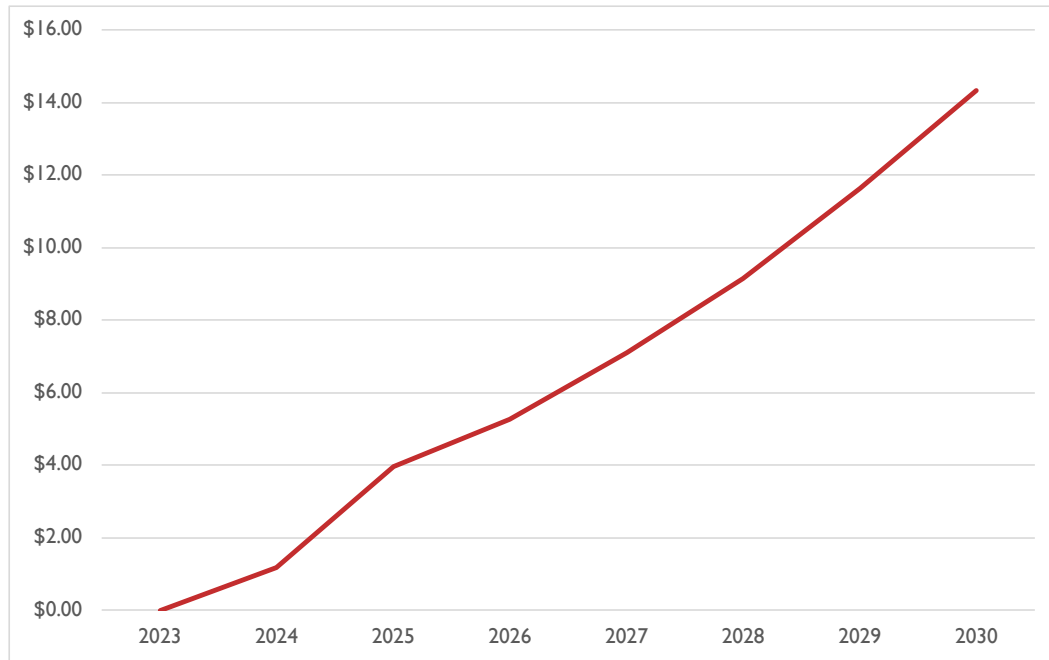
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3 **Q Did you quantify the average monthly bill impact for a typical electric and**
4 **gas combined customer?**

5 **A** Yes, I did. Figure 5 shows the updated version of Figure JWI-D-10 for CEO's
6 Proposed Portfolio.

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Figure 5. Impact to Average Monthly Bill For Combined Electric & Natural Gas Residential Customer – CEO’s Proposed Portfolio



3

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III. RATE IMPACTS OF DENVER’S PROPOSED PORTFOLIO

5

Q Please define what you mean by Denver’s Proposed Portfolio.

6

A I mean the proposal detailed in Hearing Exhibit 1800 (the Answer Testimony of

7

Witness Rogers), with market transformation costs included.

8

Q Did Denver provide a rate and bill estimate for its proposed portfolio?

9

A No.

1 **Q Did Denver provide annual budgets for its proposed portfolio?**

2 **A**No, it did not.

3 **Q How did you estimate the annual budgets for Denver’s proposed portfolio?**

4 **A**I started with the costs of the Company’s Emissions Target portfolio, then
5 removed costs associated with any programs other than additional demand side
6 management (DSM) and electrification. I then scaled the budget associated with
7 electrification up by a factor of about 1.322. I calculated this factor from the ratio
8 of emissions reductions in Denver’s proposed electrification portfolio (1,991,444
9 tons) and the electrification portion of the Company’s Emissions Target portfolio
10 (1,505,899 tons). These values are from Table JNR-2.

11 **Q Did you adjust the results of the electrification programs in the same way?**

12 **A**Yes. I scaled up the number of participating buildings in electrification programs
13 and the resulting reduction in pipeline gas sales by the same factor.

14 **Q How did you check this method?**

15 **A**Using this method, I estimate the average annual cost of Denver’s portfolio
16 between 2024 and 2030 is \$249 million per year, which agrees with the value
17 presented by Witness Rogers in Table JNR-2. Denver staff were also able to
18 review the analysis and verify that the costs produced using this method align
19 with their analysis.

1 **Q How did you estimate the Market Transformation costs of Denver’s**
2 **Proposed Portfolio?**

3 **A** Based on Witness Rogers’s testimony (Hearing Exhibit 1800), I included some
4 parts of the Market Transformation portfolio and excluded other pieces of the
5 Company’s proposed Market Transformation portfolio. Specifically, I included
6 the neighborhood retrofit, all-electric new construction, Boulder Pearl Street Mall
7 NPA, Aurora F-3 reinforcement NPA, and market innovation fund costs, and
8 excluded the Company’s other proposals from the Market Transformation budget.

9 **Q How did you allocate the costs between electric and gas ratepayers for the**
10 **Denver case?**

11 **A** Following Witness Rogers’s testimony, I assigned all programmatic costs to gas
12 ratepayers.

13 **Q How did you develop your estimate of rate and bill impacts of Denver’s**
14 **Proposed Portfolio?**

15 **A** I used my tool, inputting the values from Hearing Exhibit 1800, with the
16 assumptions described above. Attachment ASH-4 is this version of the tool.

1 **Q What did your analysis find regarding the impact of Denver’s Proposed**
2 **Portfolio on the CHP rider paid by gas customers?**

3 **A I have replicated the analysis of the direct rate impact of the CHP rider provided**
4 in Witness Ihle’s Direct Testimony, specifically JWI-D-5: CHSGA Rate Impact
5 Analysis, but I performed this analysis on Denver’s Proposed Portfolio. See Table
6 3 below.

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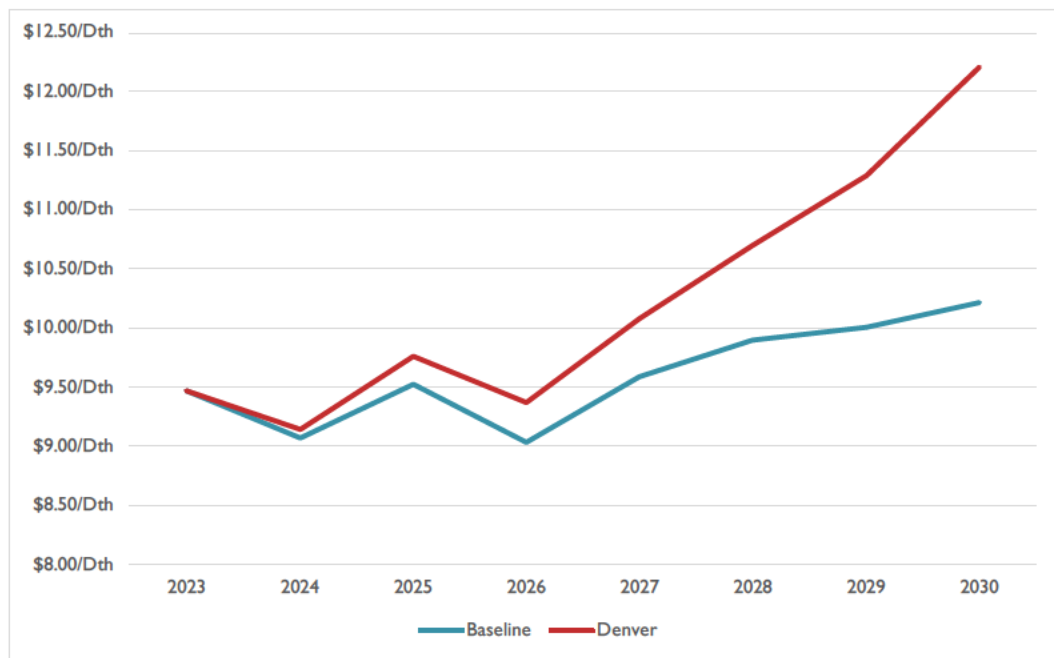
Table 3: Clean Heat Support Gas Adjustment Rate Impact Analysis of Denver’s Proposed Portfolio

	2024	2025	2026	2027	2028	2029	2030
CHSGA Annual Costs							
Incremental Gas DSM - Amortized Costs	\$4,949,090	\$16,930,821	\$33,593,022	\$56,529,039	\$87,710,119	\$131,703,892	\$183,041,842
Certified Natural Gas	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Offsets	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Hydrogen	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Recovered Methane	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Market Transformation Projects	\$4,550,000	\$14,950,000	\$11,200,000	\$5,100,000	\$3,700,000	\$0	\$0
Market Transformation Fund	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total CHSGA Costs	\$9,499,090	\$31,880,821	\$44,793,022	\$61,629,039	\$91,410,119	\$131,703,892	\$183,041,842
Sales Volumes Adjusted for Decreases Associated with DSM & Electrification							
	142,483,031 Dth	138,637,979 Dth	132,279,166 Dth	123,810,077 Dth	114,100,285 Dth	102,494,906 Dth	92,054,916 Dth
Forecasted CHSGA Rate	\$0.07/Dth	\$0.23/Dth	\$0.34/Dth	\$0.50/Dth	\$0.80/Dth	\$1.28/Dth	\$1.99/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	\$9.14/Dth	\$9.76/Dth	\$9.37/Dth	\$10.08/Dth	\$10.70/Dth	\$11.29/Dth	\$12.21/Dth
CHSGA Rate Impact	+ 0.7%	+ 2.4%	+ 3.7%	+ 5.2%	+ 8.1%	+ 12.8%	+ 19.5%
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	\$0.43	\$1.47	\$2.17	\$3.19	\$5.13	\$8.22	\$12.73
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	\$0.77	\$2.67	\$3.93	\$5.77	\$9.29	\$14.91	\$23.07

2

1 Denver proposes recovering all expensed and amortized costs from gas
2 ratepayers. For Denver's Proposed Portfolio, the resulting gas rate trajectory,
3 which reflects the impact of the CHP rider only (relative to the no-CHP case), can
4 be found in Figure 6.

5 **Figure 6: CHP Rider Only - Natural Gas Average Rates – Denver's Proposed**
6 **Portfolio**

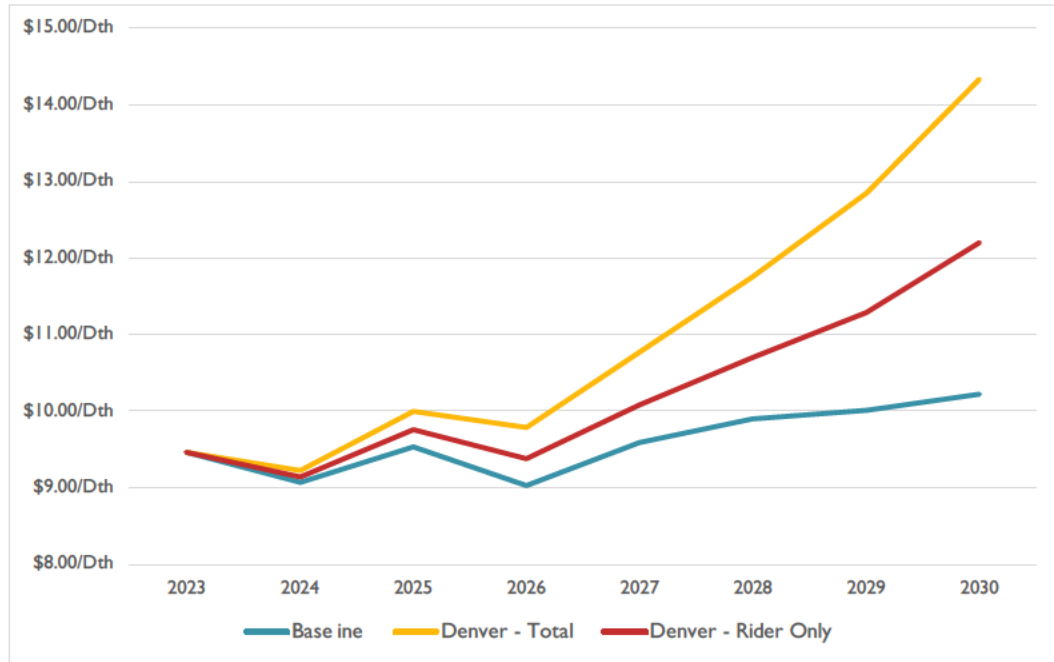


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8 **Q Did you consider the effects of changes in sales on average gas rates?**

9 **A** Yes, I did. Using the same methods as Witness Ihle, I have produced an updated
10 equivalent of Figure JW1-D-8, showing that reductions in gas throughput result in
11 further gradual increases in gas rates. Figure 7, below, shows the overall impact
12 on gas rates of both the CHP rider and changes in sales under the Denver's
13 Proposed Portfolio.

1 **Figure 7: Denver's Proposed Portfolio Average Rate Analysis - Natural Gas**



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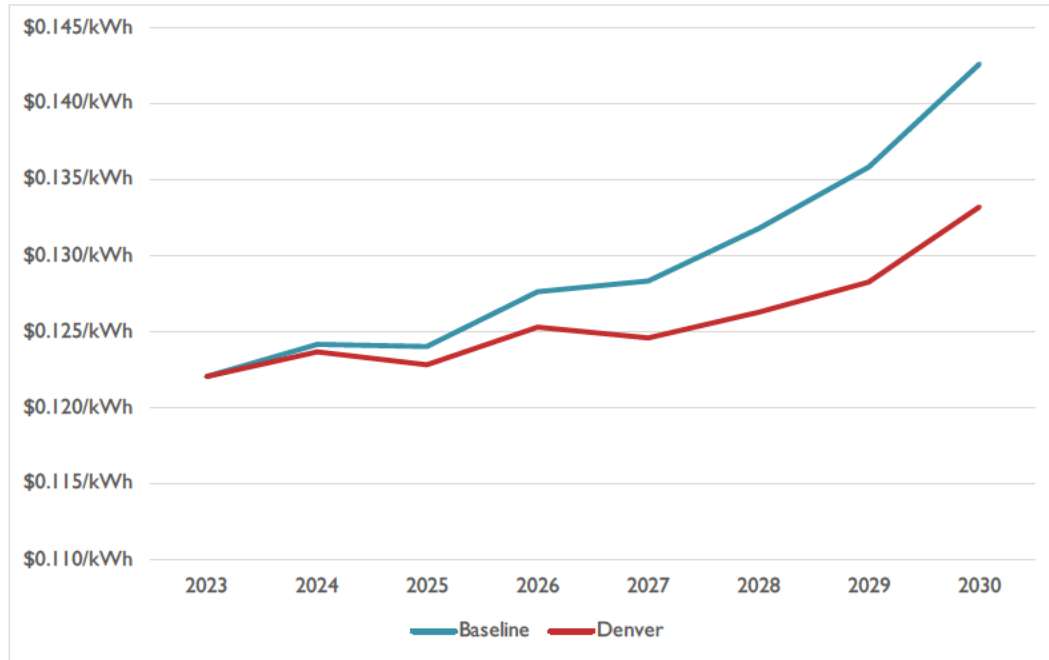
3 **Q What did your analysis find regarding the impact of the Denver's Proposed**
4 **Portfolio on the CHP rider paid by electric customers?**

5 **A** Denver proposes that there be no CHP rider for electric customers, so there is no
6 direct impact on electric rates.

7 **Q Did you consider the effects of changes in sales on average electric rates?**

8 **A** Yes, I did. Using the same methods as Witness Ihle, I have produced an updated
9 equivalent of Figure JWI-D-9 which shows that, for Denver's Proposed Portfolio,
10 increases in electric throughput result in gradual decreases in electric rates relative
11 to the no-CHP baseline. See Figure 8.

1 **Figure 8: Denver's Proposed Portfolio Average Rate Analysis - Electricity**



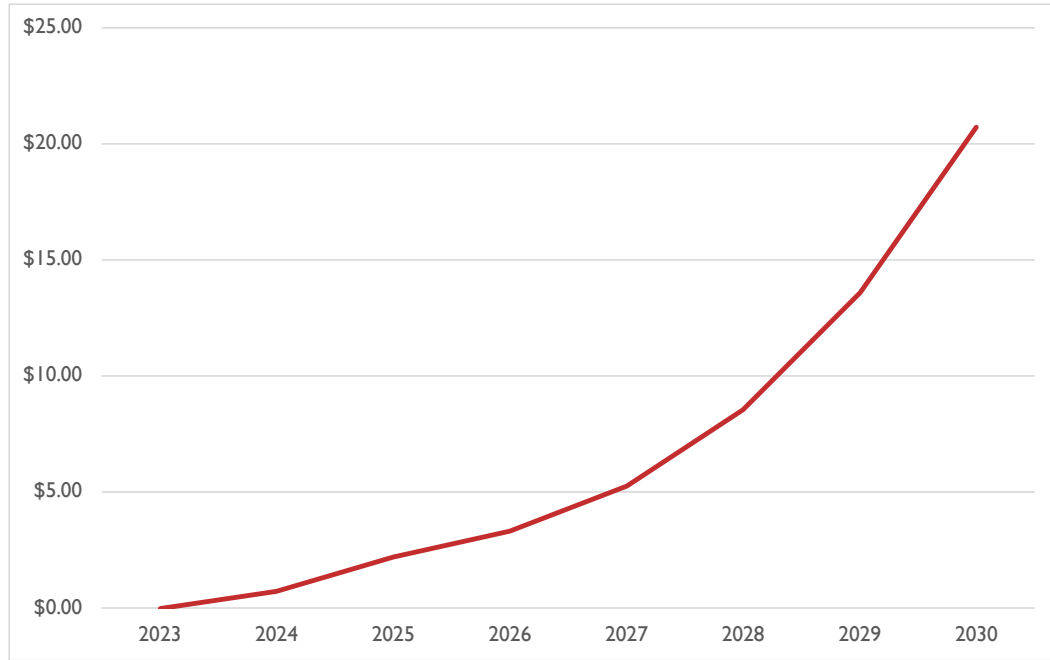
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3 **Q Did you quantify the average monthly bill impact for a typical electric and**
4 **gas combined customer?**

5 **A** Yes, I did. Figure 9 shows the updated version of Figure JWI-D-10 for Denver's
6 Proposed Portfolio.

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Figure 9. Impact to Average Monthly Bill For Combined Electric & Natural Gas Residential Customer – Denver’s Proposed Portfolio



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4 **Q Does this conclude your testimony?**

5 **A** Yes, it does.

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**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)**

AFFIDAVIT OF DR. ASA HOPKINS

I, Dr. Asa Hopkins, state that the Cross-Answer Testimony of Dr. Asa Hopkins, Hearing Exhibit 603 (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 Hopkins

Asa Hopkins

Dated February 26, 2024