Date Filed: November 4, 2026

Witness: **Juan-Pablo Velez**
Request from: **Connecticut Industrial Energy Consumers**

Question:

Provide an electronic copy of all Exhibits and workpapers associated with the Direct Testimony of Juan-Pablo Velez in native format. If the Exhibits and/or workpapers include one or more spreadsheets, provide such spreadsheets in native format with full access rights in one or more unlocked, working electronic files that are compatible with Microsoft Excel, with all data, formulas, and links intact.

Response:

Electronic copies of Exhibits to the Direct Testimony of Juan-Pablo were provided in the original filing as JPV-1 through JPV-4.

None of the charts and data contained in the testimony were generated with Excel. They were developed using Python, making Python the native format. Switchbox has elected to use Python to develop and run its own programs to manage datasets larger than Excel can manage and to complete more complicated analyses than Excel can perform. Python (https://www.python.org/about/) is an open-source programming language that is widely used by software engineers. All programs developed by Switchbox using Python and deployed in this case are documented, linked, and available for review as described below.

This response lists every figure, table and calculated number in the Direct Testimony of Juan-Pablo Velez (Docket No. 26-05-10) and links each one to the code that produced it. Figures, tables and numbers each have their own table, listed in the order they appear in the testimony.

- **Location** gives the page and line number in the testimony as filed. Items that appear more than once are listed once, with every place they appear.
- The second column gives the **figure or table title**, or for numbers, a short quote with the number in bold.
- **Where it's generated** links to the block of code that produces the item. Our analysis is written as notebooks: documents that explain each step in plain language next to the code that carries it out. Each link opens the exact lines on GitHub, frozen at the version used for the testimony (labeled ct_eversource_submission), so the links will keep pointing to the same code.

Where the work happens:

The table links to these notebooks:

- **Typical home's usage and bills** (representative_home.qmd): Monthly electricity use, bills and grid costs for the average fossil-fuel-heated home, before and after it installs a heat pump.
- **When the grid is under strain** (delivery_mc.qmd): Which hours of the year drive new grid costs, and how large those costs are.
- **Cost of new grid capacity** (marginal_costs.qmd): The cost of adding distribution and transmission capacity, drawn from the Company's filings.
- **Bill changes by heating fuel** (analysis.qmd): How many homes would see their bills rise or fall under each rate.
- **Fixed charge alternative** (incremental_fair_default.qmd): The fixed charge that would remove the overpayment if the volumetric rate were lowered instead.
- **Overpayment across all homes** (overpayment.qmd): How much each home that installs a heat pump would overpay for delivery under each rate.
- **Rate 6's 700 kWh threshold** (rate6_threshold.qmd): How the 700 kWh winter threshold sorts each home's usage into discounted and undiscounted blocks.
- **Spare grid capacity** (feeder_headroom.qmd): Each distribution feeder's peak demand compared with its capacity.
- **The testimony itself** (expert_testimony.qmd): The text of the testimony, including its tables and the filed Rate 1 charges it quotes.

The notebooks read results from Switchbox's rate simulation platform, which models each home's hourly electricity use, its bills under each rate, and the cost of serving it:

- **Hourly cost of new distribution capacity**: explanation, code.
- **Hourly cost of new bulk transmission capacity**: explanation, code.
- **Bill simulation for every modeled home**: code.
- **The rates we simulated** (Rate 1, Rate 6 and Rate HP): rate definitions.
- **How we derived Rate HP**: explanation, code.

Figures:

Location	Figure	Where it's generated
p. 8	Figure 1: Average monthly electricity consumption for simulated Eversource CT residential electric customers who heat with natural gas, heating oil, or propane.	representative_home.qmd_1324-1334
p. 9	Figure 2: Annual electric bill breakdown by component for fossil fuel-heated homes in Eversource CT's territory, before heat pump installation.	representative_home.qmd_1407-1417

Location	Figure	Where it's generated
p. 10	Figure 3: Average monthly electricity consumption for simulated Eversource residential electric customers, before (dark yellow: non-electric heating) and after (light yellow: electric heating) heat pump installation.	representative_home.qmd_1336-1346
p. 12	Figure 4: Annual electric bill breakdown by component for all Eversource fossil fuel-heated homes, before and after heat pump installation.	representative_home.qmd_1419-1429
p. 15	Figure 5: Hourly marginal distribution and sub-transmission capacity costs, CT Eversource, 2025.	delivery_mc.qmd_249-260
p. 16	Figure 6: Hourly marginal bulk transmission capacity costs, CT Eversource, 2025.	delivery_mc.qmd_234-245
p. 17	Figure 7: Average monthly electricity for simulated Eversource fossil fuel-heated homes before heat pump installation, with peak-hour usage highlighted. Peak hours are defined as hours where marginal T&D capacity cost exceeds 0.5¢/kWh, capturing 99% of total annual marginal cost.	representative_home.qmd_1145-1182
p. 18	Figure 8: Seasonal delivery marginal cost for all Eversource fossil fuel-heated homes before heat pump installation.	representative_home.qmd_1637-1648
p. 19	Figure 9: Average monthly electricity for all simulated Eversource fossil fuel-heated homes, before and after heat pump installation, with peak-hour usage highlighted. The darker red at the top of each bar is the new peak-hour demand added by the heat pump; the lighter red below it is peak-hour demand the home already had before the heat pump. Peak hours are defined as hours where marginal T&D capacity cost exceeds 0.5¢/kWh, capturing 99% of total annual marginal cost.	representative_home.qmd_1184-1282
p. 20	Figure 10: Seasonal delivery marginal cost for all Eversource fossil fuel-heated homes, before and after heat pump installation.	representative_home.qmd_1664-1676

Location	Figure	Where it's generated
p. 21	Figure 11: Peak demand as a percentage of rated capacity for every feeder on Eversource CT's distribution system, ranked from most to least utilized. The gray line marks 100% of rated capacity. Source: Eversource response to System Data Requirement No. 2.	feeder_headroom.qmd_251-332
p. 23	Figure 12: Change in annual T&D costs caused vs. T&D charges paid when a fossil fuel-heated home installs a heat pump under proposed Rate 1.	representative_home.qmd_1863-1924
p. 24	Figure 13: Annual delivery overpayment for all fossil fuel-heated CT Eversource homes switching to heat pumps, under proposed Rate 1.	overpayment.qmd_1251-1255
p. 36	Figure 14: Average annual energy bills for simulated Eversource-territory natural gas-heated homes, before and after heat pump installation. Electric and natural gas consumption from NREL ResStock, bills calculated using CAIRO model.	representative_home.qmd_974-992
p. 38	Figure 15: Change in total annual energy bill for natural gas-heated homes after switching to a heat pump, under CT Eversource's proposed Rate 1.	analysis.qmd_367-378
p. 39; p. 89	Figure 16: Average annual energy bills for simulated Eversource-territory natural gas-heated homes: before heat pumps, after heat pumps under Rate 1, and after heat pumps with incremental load charged at marginal cost. (also shown as Figure 35)	representative_home.qmd_2171-2211
p. 40; p. 56	Figure 17: Change in total annual energy bill for natural gas-heated CT Eversource homes switching to a heat pump, under Rate 1 vs. a fair rate that eliminates the overcharge. (also shown as Figure 25)	analysis.qmd_1282-1301
p. 42	Figure 18: Average annual energy bills for simulated Eversource-territory delivered fuel-heated homes, before and after heat pump installation. Electric and delivered fuel	representative_home.qmd_994-1012

Location	Figure	Where it's generated
	consumption from NREL ResStock, bills calculated using CAIRO model.	
p. 42	Figure 19: Change in total annual energy bill for delivered fuel-heated homes after switching to a heat pump, under CT Eversource's default rate.	analysis.qmd_380-391
p. 44; p. 90	Figure 20: Average annual energy bills for simulated Eversource-territory delivered fuel-heated homes: before heat pumps, after heat pumps under Rate 1, and after heat pumps with incremental load charged at marginal cost. (also shown as Figure 36)	representative_home.qmd_2226-2267
p. 45	Figure 21: Change in total annual energy bill for oil/propane-heated CT Eversource homes switching to a heat pump, under Rate 1 vs. a fair rate that eliminates the overcharge.	analysis.qmd_1303-1333
p. 48	Figure 22: Annual delivery overpayment for all fossil fuel-heated CT Eversource homes switching to heat pumps: proposed Rate 1 (top) vs. proposed Rate 6 (bottom).	overpayment.qmd_1257-1347
p. 49	Figure 23: Change in total annual energy bill for natural gas-heated CT Eversource homes switching to a heat pump, under Rate 1 vs. Rate 6 vs. a fair rate that eliminates the overcharge.	analysis.qmd_1335-1355
p. 51	Figure 24: Change in total annual energy bill for oil/propane-heated CT Eversource homes switching to a heat pump, under Rate 1 vs. Rate 6 vs. a fair rate that eliminates the overcharge.	analysis.qmd_1628-1649
p. 64	Figure 26: Annual delivery overpayment for all fossil fuel-heated CT Eversource homes switching to heat pumps: Rate 1 vs. Rate 6 vs. Rate 6 with Block 2 at marginal cost.	overpayment.qmd_1349-1476
p. 65	Figure 27: Change in total annual energy bill for natural gas-heated CT Eversource homes switching to a heat pump, under Rate 1 vs. Rate 6 vs. Rate 6 with Block 2 at marginal cost vs. a fair rate.	analysis.qmd_1697-1718

Location	Figure	Where it's generated
p. 66	Figure 28: Change in total annual energy bill for oil/propane-heated CT Eversource homes switching to a heat pump, under Rate 1 vs. Rate 6 vs. Rate 6 with Block 2 at marginal cost vs. a fair rate.	analysis.qmd_1720-1741
p. 70	Figure 29: Pre-heat-pump winter electricity use for delivered fuel homes, ranked by consumption. Dashed line at 700 kWh marks Rate 6's block threshold.	rate6_threshold.qmd_699-727
p. 71	Figure 30: How Rate 6's 700 kWh threshold classifies each delivered fuel home's load. Blue: HP load correctly in Block 2. Orange: HP load trapped in Block 1. Yellow: base load getting Block 2 windfall.	rate6_threshold.qmd_735-754
p. 72	Figure 31: Rate 6 threshold classification for delivered fuel homes, by income tercile. Low-income homes (left) bear more orange (trapped HP load); high-income homes (right) receive more yellow (windfall discount).	rate6_threshold.qmd_885-934
p. 76	Figure 32: How Rate 6's 700 kWh threshold classifies load for delivered fuel homes (left) vs. natural gas homes (right). Blue: HP load in Block 2 (discounted). Orange: HP load trapped in Block 1 (full rate). Yellow: base load getting Block 2 windfall.	rate6_threshold.qmd_1017-1052
p. 78	Figure 33: Current 700 kWh threshold (top) vs. a threshold set at the natural gas mean (bottom). Lowering the threshold helps natural gas homes (more blue, right column) but sends windfall discount to delivered fuel homes (more yellow, left column).	rate6_threshold.qmd_1126-1174
p. 88	Figure 34: Annual delivery overpayment for all fossil fuel-heated CT Eversource homes switching to heat pumps: Rate 1 vs. Rate 6 vs. Rate 6 (Block 2 at MC) vs. Rate HP.	overpayment.qmd_1478-1577
p. 91	Figure 37: Change in total annual energy bill for natural gas-heated CT Eversource homes switching to a heat pump, under Rate 1 vs. Rate HP.	analysis.qmd_896-910

Location	Figure	Where it's generated
p. 92	Figure 38: Change in total annual energy bill for delivered fuel-heated CT Eversource homes switching to a heat pump, under Rate 1 vs. Rate HP.	analysis.qmd_970-984

Tables:

Location	Table	Where it's generated
p. 46	Table 1: Rate 1 vs. Rate 6 distribution and transmission rates	expert_testimony.qmd_944-951
p. 53	Table 2: Rate 6 Block 2 distribution charge decomposition (Source: Exhibit CLP-RATES-6)	expert_testimony.qmd_1025-1031
p. 62	Table 3: Rate 6 Block 2 decomposition with marginal cost floor, including transmission	expert_testimony.qmd_1169-1176
p. 82	Table 4: Rate HP winter rates compared to Rate 1	expert_testimony.qmd_1449-1456

Numbers:

Location	Quote (number in bold)	Where it's generated
p. 5, line 15; p. 23, line 10 and footnote 19; p. 24, line 3; p. 38, line 12; p. 96, line 6	…electric customers with heat pumps are overcharged by an average of **$1,040** per year on distribution and transmission—far in excess…	representative_home.qmd_1439-1500
p. 5, line 20	as a direct result of being overcharged, only **57%** of CL&P's electricity customers that heat with fossil…	analysis.qmd_337-343
p. 6, line 9	…make it cheaper to heat with heat pumps than fossil fuels for **83%** of Connecticut households, thus eliminating a key obstacle to the…	analysis.qmd_962-968
p. 6, line 19; p. 85, line 11	…At present, we estimate that the winter Distribution Energy Charge should be **71%** lower than Rate 1's Distribution Energy Charge.	representative_home.qmd_1965-2159

Location	Quote (number in bold)	Where it's generated
p. 7, line 1	…At present, we estimate that the winter Transmission Service Rate should be **75%** lower than Rate 1's Transmission Service Rate.	representative_home.qmd_1965-2159
p. 8, line 1; p. 10, line 5	Residential customers that heat with fossil fuels consume an average of **7,211** kWh of electricity per year.	representative_home.qmd_622-699
p. 8, footnote 1; p. 37, line 15	Average monthly consumption was calculated from a sample of **3,539** residential buildings from NREL's 2024 ResStock residential building energy simulations…	analysis.qmd_211-229
p. 9, line 1; p. 12, line 2	On average, they pay a total of **$2,078** per year, broken down as follows:	representative_home.qmd_798-841
p. 9, line 2; p. 12, line 4	**$148** in fixed monthly customer charges,	representative_home.qmd_798-841
p. 9, line 3; p. 12, line 6	**$814** for distribution, collected by the Distribution Service Rate and its…	representative_home.qmd_798-841
p. 9, line 5; p. 12, line 7	**$364** for transmission, collected by the Transmission Charge under the Transmission…	representative_home.qmd_798-841
p. 9, line 7; p. 12, line 8	**$752** for generation, collected by the Generation Service Charge in Rate…	representative_home.qmd_798-841
p. 9, footnote 3; p. 83, footnote 74	…Docket No. 26-05-10) (Eversource 2026f) they total **-0.911** ¢/kWh.	expert_testimony.qmd_156-156
p. 10, line 4; p. 12, line 19; p. 25, line 21	On average, their electricity usage grows by **6,432** kWh per year (89%) after replacing their fossil heating system…	representative_home.qmd_622-699
p. 10, line 4	On average, their electricity usage grows by 6,432 kWh per year (**89%**) after replacing their fossil heating system with a heat pump,…	representative_home.qmd_622-699
p. 10, line 5	…replacing their fossil heating system with a heat pump, from 7,211 to **13,643** kWh per year.	representative_home.qmd_622-699
p. 10, line 5; p. 19, line 9; p. 25, line 22; p. 100, line 14	**97%** of this incremental usage occurs between October and April, due…	representative_home.qmd_1184-1282

Location	Quote (number in bold)	Where it's generated
p. 11, footnote 5	Because only **34%** of the Company's fossil-fuel-heated customers currently…	representative_home.qmd_1290-1316
p. 12, line 2	…fuels install a heat pump, their average annual electricity bill rises by **$1,736** (84%), from $2,078 to a total of $3,815 per year.	representative_home.qmd_798-841
p. 12, line 2	…install a heat pump, their average annual electricity bill rises by $1,736 (**84%**), from $2,078 to a total of $3,815 per year.	representative_home.qmd_798-841
p. 12, line 2	…electricity bill rises by $1,736 (84%), from $2,078 to a total of **$3,815** per year.	representative_home.qmd_798-841
p. 12, line 6	Distribution increases by **$726** (89%) per year, from $814 to $1,540	representative_home.qmd_798-841
p. 12, line 6	Distribution increases by $726 (**89%**) per year, from $814 to $1,540	representative_home.qmd_798-841
p. 12, line 6	Distribution increases by $726 (89%) per year, from $814 to **$1,540**	representative_home.qmd_798-841
p. 12, line 7; p. 61, line 6	Transmission increases by **$325** (89%) per year, from $364 to $689	representative_home.qmd_798-841
p. 12, line 7	Transmission increases by $325 (**89%**) per year, from $364 to $689	representative_home.qmd_798-841
p. 12, line 7	Transmission increases by $325 (89%) per year, from $364 to **$689**	representative_home.qmd_798-841
p. 12, line 8; p. 13, line 5	Generation increases by **$686** (91%) per year, from $752 to $1,438 The question my…	representative_home.qmd_798-841
p. 12, line 8	Generation increases by $686 (**91%**) per year, from $752 to $1,438 The question my testimony…	representative_home.qmd_798-841
p. 12, line 8	Generation increases by $686 (91%) per year, from $752 to **$1,438** The question my testimony addresses is whether all of these…	representative_home.qmd_798-841
p. 14, line 16	…start from the Company's system-wide marginal upstream distribution cost of **$20.17**/kW-year, grossed up for secondary losses to…	marginal_costs.qmd_54-81
p. 14, lines 16 and 19	…of $20.17/kW-year, grossed up for secondary losses to **$21.22**/kW-year.	marginal_costs.qmd_54-81

Location	Quote (number in bold)	Where it's generated
p. 14, line 19	…I placed these $/kWh-year values on the **2025** calendar and scaled them so the year totals…	marginal_costs.qmd_54-81
p. 17, line 1; p. 18, line 3; p. 19, line 2	In total, these customers consume an average of **1,599** kWh during peak hours—just 22% of their total…	representative_home.qmd_1145-1182
p. 17, line 2	…customers consume an average of 1,599 kWh during peak hours—just **22%** of their total annual usage.	representative_home.qmd_1145-1182
p. 17, line 2	As Figure 7shows, **100%** of this peak hour usage occurs during the summer.	representative_home.qmd_1145-1182
p. 17, line 5	On average, each peak-hour kWh causes approximately **2.1¢** of new distribution costs and 5.3¢ of new…	delivery_mc.qmd_197-219
p. 17, line 5	…kWh causes approximately 2.1¢ of new distribution costs and **5.3¢** of new transmission costs.	delivery_mc.qmd_197-219
p. 17, footnote 10	distribution ranges from **0.6¢** to 6.3¢, and transmission from 0.5¢ to…	delivery_mc.qmd_197-219
p. 17, footnote 10	distribution ranges from 0.6¢ to **6.3¢**, and transmission from 0.5¢ to 19.6¢.	delivery_mc.qmd_197-219
p. 17, footnote 10	distribution ranges from 0.6¢ to 6.3¢, and transmission from **0.5¢** to 19.6¢.	delivery_mc.qmd_197-219
p. 17, footnote 10	…from 0.6¢ to 6.3¢, and transmission from 0.5¢ to **19.6¢**.	delivery_mc.qmd_197-219
p. 18, line 4	…by the average fossil fuel-heated customer cause a total of **$28** in new distribution costs and $95 in new transmission costs,…	representative_home.qmd_1439-1500
p. 18, line 4	…customer cause a total of $28 in new distribution costs and **$95** in new transmission costs, per year.	representative_home.qmd_1439-1500
p. 18, lines 5 and 8; p. 19, line 3	…As Figure 8 shows, this combined marginal T&D cost of **$123** is caused entirely by peak hour usage during the summer.	representative_home.qmd_1439-1500
p. 19, line 7; p. 20, lines 2 and 3	That amounts to just **114** additional peak-hour kWh per year, on average.	representative_home.qmd_1184-1282

Location	Quote (number in bold)	Where it's generated
p. 20, line 2	…only 114 coincide with peak hours (shown in red)—less than **1.8%** of the total.	representative_home.qmd_1184-1282
p. 20, line 7	**$133**, up from $123.	representative_home.qmd_1551-1576
p. 20, line 7	$133, up from **$123**.	representative_home.qmd_1551-1576
p. 20, line 8; p. 23, line 2	Their incremental marginal T&D cost is therefore just **$10** per year, on average.	representative_home.qmd_1551-1576
p. 21, line 5	Of the **918** feeders with loading data, only 2 feeders—0.2%…	feeder_headroom.qmd_336-365
p. 21, line 5	Of the 918 feeders with loading data, only **2** feeders—0.2% —have peak demand that exceeds their…	feeder_headroom.qmd_336-365
p. 21, line 5	Of the 918 feeders with loading data, only 2 feeders—**0.2%** —have peak demand that exceeds their rated capacity.	feeder_headroom.qmd_336-365
p. 21, line 6	Those feeders serve just **4,903** customers, or 0.4% of the Company's 1,218,177 customers on feeders…	feeder_headroom.qmd_336-365
p. 21, line 6	Those feeders serve just 4,903 customers, or **0.4%** of the Company's 1,218,177 customers on feeders with data.	feeder_headroom.qmd_336-365
p. 21, line 7	Those feeders serve just 4,903 customers, or 0.4% of the Company's **1,218,177** customers on feeders with data.	feeder_headroom.qmd_336-365
p. 21, line 7	The median feeder operates at just **49%** of capacity, meaning the typical feeder has 51% headroom even…	feeder_headroom.qmd_336-365
p. 21, line 8	…feeder operates at just 49% of capacity, meaning the typical feeder has **51%** headroom even at its annual peak.	feeder_headroom.qmd_336-365
p. 23, line 4; p. 28, line 14	…Yet under proposed Rate 1, their distribution and transmission charges increase by **$1,051** per year—roughly 102 times the new…	representative_home.qmd_798-841
p. 23, line 4	…their distribution and transmission charges increase by $1,051 per year—roughly **102** times the new T&D costs they actually cause.	representative_home.qmd_798-841

Location	Quote (number in bold)	Where it's generated
p. 23, line 10 and footnote 19	…by an average of $1,040 a year—an amount equal to **44%** of their entire post-heat-pump…	representative_home.qmd_1439-1500
p. 23, footnote 19	$1,040 overcharge ÷ **$2,377** total post-heat-pump T&D bill…	representative_home.qmd_1439-1500
p. 28, line 16	…costs they were causing after switching to heat pumps—**$10** per year —not only would the cost-causation…	representative_home.qmd_1439-1500
p. 28, line 20	…have established, heat pump customers are actually overpaying for T&D by **$1,040**, and this overpayment contributes directly to a cross-subsidy…	representative_home.qmd_798-841
p. 32, line 6	…because the discount stays so far above that floor, Rate 6 leaves **76%** of the existing cross-subsidy running in the other…	overpayment.qmd_694-774
p. 35, line 16; p. 91, line 11	Approximately **34%** of the Company's residential customers heat with natural gas.	analysis.qmd_234-253
p. 36, line 3; p. 39, line 7	…total annual energy bill—electricity plus natural gas—change from **$3,257** before the heat pump to $3,745 after, an increase of…	representative_home.qmd_871-972
p. 36, line 3	…plus natural gas—change from $3,257 before the heat pump to **$3,745** after, an increase of $488 per year.	representative_home.qmd_871-972
p. 36, line 3; p. 39, line 2; p. 89, line 7	…from $3,257 before the heat pump to $3,745 after, an increase of **$488** per year.	representative_home.qmd_871-972
p. 36, line 6	…cooking.) But due to the overpayment problem documented in Section III, the **$877** increase in transmission and distribution bills more than offsets the…	representative_home.qmd_798-841
p. 37, line 15	…homes from the Company's territory—3,539 buildings, representing the Company's approximately **1,212,521** residential electricity customers.	analysis.qmd_211-229
p. 38, line 1; p. 40, line 12; p. 49, line 11;	Under current rates, only **13%** of the Company's residential electricity customers that heat with natural…	analysis.qmd_281-296

Location	Quote (number in bold)	Where it's generated
p. 65, line 4; p. 91, line 6		
p. 38, lines 10 and 11	…natural gas-heated customer installing a heat pump is overcharged approximately **$865** per year in transmission and distribution costs—they pay…	representative_home.qmd_1439-1500
p. 39, lines 3 and 8; p. 89, line 6	…overcharge were removed, their total annual energy bill would actually decrease by **$377** after making the switch, as shown by Figure 35.	representative_home.qmd_2171-2211
p. 39, line 8	…annual energy bill would fall from $3,257 with a gas furnace to **$2,880** with a heat pump—a savings of $377 per…	representative_home.qmd_2171-2211
p. 41, line 1	…a heat pump, and those who save would save an average of **$134** per year.	analysis.qmd_281-296
p. 41, line 2; p. 50, line 3; p. 56, line 1; p. 65, line 7	Under a fair rate that eliminates the overcharge for every customer, **86%** would save, and they would save an average of $487…	analysis.qmd_1228-1280
p. 41, line 2	…every customer, 86% would save, and they would save an average of **$487** per year.	analysis.qmd_1228-1280
p. 41, line 9	Approximately **46%** of the Company's residential customers heat with delivered fuels like…	analysis.qmd_234-253
p. 41, line 15; p. 43, line 19	…fuel-heated customer sees its total annual energy bill decrease from **$5,212** to $4,595 after installing heat pumps under Rate 1, a…	representative_home.qmd_871-972
p. 41, line 15	…customer sees its total annual energy bill decrease from $5,212 to **$4,595** after installing heat pumps under Rate 1, a net decrease…	representative_home.qmd_871-972
p. 41, line 16; p. 43, line 20	…$4,595 after installing heat pumps under Rate 1, a net decrease of **$618** per year.	representative_home.qmd_871-972
p. 43, line 4; p. 45, line 1; p. 51, line 1; p. 66, line 7; p. 92, line 8	**90%** of delivered fuel-heated households would see their total…	analysis.qmd_320-335

Location	Quote (number in bold)	Where it's generated
p. 43, line 19	…bill would fall from $5,212 with an oil or propane furnace to **$3,426** with a heat pump—a savings of $1,786 (34%)…	representative_home.qmd_2226-2267
p. 43, line 20; p. 90, line 6	…propane furnace to $3,426 with a heat pump—a savings of **$1,786** (34%) per year, compared to savings of only $618 (12%)…	representative_home.qmd_2226-2267
p. 43, line 20; p. 44, line 1; p. 90, line 6	…furnace to $3,426 with a heat pump—a savings of $1,786 (**34%**) per year, compared to savings of only $618 (12%) under…	representative_home.qmd_2226-2267
p. 43, line 20; p. 44, line 2	…savings of $1,786 (34%) per year, compared to savings of only $618 (**12%**) under Rate 1.	representative_home.qmd_871-972
p. 45, line 2	…customers would save, and those who save would save an average of **$712** per year.	analysis.qmd_320-335
p. 45, line 2; p. 51, line 3; p. 66, line 7	Under a fair rate that eliminates the overcharge, **100%** would save, and they would save an average of $1,798…	analysis.qmd_1537-1579
p. 45, line 3	…the overcharge, 100% would save, and they would save an average of **$1,798** per year.	analysis.qmd_1537-1579
p. 45, line 15	Under the Company's proposed Rate 1, **87%** of natural gas-heated customers would see their total…	analysis.qmd_281-296
p. 48, line 2; p. 63, line 10	…fossil fuel-heated customer switching to a heat pump is overcharged **$1,040** per year in delivery costs; if Rate 6 were offered…	overpayment.qmd_694-774
p. 48, line 3; p. 86, line 10	…were offered to all natural gas-customers, that overcharge falls to **$787**—still a substantial surcharge above the customer's incremental marginal cost.	overpayment.qmd_694-774
p. 48, line 4; p. 63, line 11	In other words, Rate 6 eliminates only **24%** of the average annual overpayment I documented in Section III.	overpayment.qmd_694-774
p. 50, line 1; p. 65, line 5	Under Rate 6, **17%** of natural gas-heated customers would save—only…	analysis.qmd_1199-1221
p. 50, line 1	…17% of natural gas-heated customers would save—only a **4%** point improvement over Rate 1, and still leaving the vast…	analysis.qmd_1199-1221

Location	Quote (number in bold)	Where it's generated
p. 50, line 4	…of natural gas-heated customers would save by switching—a **73%** point improvement over Rate 1, and a complete transformation of…	analysis.qmd_1228-1280
p. 50, line 7	…the average natural gas-heated customer's annual bill would increase by **$463** after switching; under a fair rate, it would decrease by $402.	analysis.qmd_281-296
p. 50, line 8	…increase by $463 after switching; under a fair rate, it would decrease by **$402**.	analysis.qmd_1228-1280
p. 50, lines 9 and 11	…overcharged, we would expect the average customer's bill outcome to improve by **$865** compared to Rate 1.	analysis.qmd_1228-1280
p. 50, line 10	Under Rate 6, the average annual bill would still increase, by **$306**—an improvement of just $156 over Rate 1, or…	analysis.qmd_1199-1221
p. 50, line 11	…annual bill would still increase, by $306—an improvement of just **$156** over Rate 1, or less than a fifth of that…	analysis.qmd_1199-1221
p. 51, line 2; p. 66, line 7	Under Rate 6, **94%** would save—a 3% point improvement.	analysis.qmd_1537-1579
p. 51, line 2	Under Rate 6, 94% would save—a **3%** point improvement.	analysis.qmd_1537-1579
p. 51, line 7; p. 67, line 2	Under proposed Rate 1, the average delivered fuel customer saves **$628** per year after switching; under a fair rate, they would…	analysis.qmd_320-335
p. 51, line 8; p. 67, line 1	…$628 per year after switching; under a fair rate, they would save **$1,796**.	analysis.qmd_1537-1579
p. 51, lines 9 and 11	…would expect their post-heat-pump savings to increase by **$1,169**, on average.	analysis.qmd_1537-1579
p. 51, line 10; p. 67, line 3	Under Rate 6, they would save **$952**—an improvement of $324 over Rate 1, or roughly…	analysis.qmd_1537-1579
p. 51, line 10	Under Rate 6, they would save $952—an improvement of **$324** over Rate 1, or roughly a quarter of the $1,169 bill…	analysis.qmd_1537-1579
p. 61, line 6	they only cause an average of **$8** in incremental marginal transmission costs, but they are charged $325…	representative_home.qmd_1439-1500

Location	Quote (number in bold)	Where it's generated
p. 61, line 7	…$325 extra a year for transmission, leading to a transmission overcharge of **$317** (as shown in Section III Figure 12).	representative_home.qmd_798-841
p. 63, line 13; p. 86, line 12	…distribution facilities all set at marginal cost, the average overpayment falls to **$195**, eliminating 81% of the Rate 1 overcharge.	overpayment.qmd_694-774
p. 63, line 14	…all set at marginal cost, the average overpayment falls to $195, eliminating **81%** of the Rate 1 overcharge.	overpayment.qmd_694-774
p. 65, line 6	Under the modified Rate 6, **46%** would save.	analysis.qmd_1199-1221
p. 65, line 7; p. 67, line 8	The modified Rate 6 closes **45%** of the gap between Rate 1 and the fair rate…	analysis.qmd_1228-1280
p. 65, line 8	…in share of customers who save; Rate 6 as proposed closes only **5%**.	analysis.qmd_1228-1280
p. 66, line 7	90% under Rate 1, 94% under Rate 6, **95%** under the modified Rate 6, and 100% under a fair…	analysis.qmd_1603-1626
p. 67, line 2	Under Rate 1, the average customer captures only **35%** of those savings ($628).	analysis.qmd_320-335
p. 67, line 3	Under Rate 6, that rises to **53%** ($952).	analysis.qmd_1537-1579
p. 67, lines 3 and 7	Under the modified Rate 6, **92%** ($1,660).	analysis.qmd_1603-1626
p. 67, line 3	Under the modified Rate 6, 92% (**$1,660**).	analysis.qmd_1603-1626
p. 68, line 21	…6, the first 700 kWh is billed at the Block 1 rate (**13.6** ¢/kWh) and only the last 200 kWh gets…	rate6_threshold.qmd_1178-1347
p. 68, line 21	…and only the last 200 kWh gets the Block 2 rate (**11.7** ¢/kWh).	rate6_threshold.qmd_1178-1347
p. 69, line 9; p. 74, line 14	Home A receives **1.9** ¢/kWh of discount on only 40% of its…	rate6_threshold.qmd_1178-1347
p. 70, line 1; p. 75, line 21	The average monthly winter base load for these customers is **671** kWh per month, which matches the 700 kWh threshold well.	rate6_threshold.qmd_1178-1347
p. 70, line 4	…(The lines in the chart would need to be largely parallel.) Only **22%** of delivered fuel homes have a base load between 600…	rate6_threshold.qmd_1178-1347

Location	Quote (number in bold)	Where it's generated
p. 70, line 6	…gray line in Figure 29.) The middle 80% of homes range from **179** to 1,173 kWh—a sixfold spread.	rate6_threshold.qmd_1178 -1347
p. 70, line 6	…in Figure 29.) The middle 80% of homes range from 179 to **1,173** kWh —a sixfold spread.	rate6_threshold.qmd_1178 -1347
p. 71, line 4	Discount leakage (orange) affects **67%** of delivered fuel homes—their base load is below…	rate6_threshold.qmd_1178 -1347
p. 71, line 6	Among those homes, the median amount of leaked HP load is **169** kWh per month.	rate6_threshold.qmd_1178 -1347
p. 71, line 7	Windfall discount (yellow) affects **49%**—their base load is above 700 kWh, so some…	rate6_threshold.qmd_1178 -1347
p. 71, line 9	Among those homes, the median windfall is **167** kWh per month.	rate6_threshold.qmd_1178 -1347
p. 71, line 12	…homes, base load and income are positively correlated (weighted Pearson r = **0.44**).	rate6_threshold.qmd_1178 -1347
p. 72, line 4	Among low-income delivered fuel homes, **88%** experience discount leakage—their base load is below 700…	rate6_threshold.qmd_1178 -1347
p. 72, lines 5 and 12	Only **23%** receive a windfall.	rate6_threshold.qmd_1178 -1347
p. 72, line 6	only **50%** experience discount leakage (and the leakage is smaller, as a…	rate6_threshold.qmd_1178 -1347
p. 72, line 7	…the leakage is smaller, as a share of their incremental load) while **68%** receive a windfall on pre-existing base load.	rate6_threshold.qmd_1178 -1347
p. 72, line 10; p. 73, lines 6, 7, and 10; p. 77, lines 13 and 17	…discount is designed to reduce every customer's incremental heat pump bill by **14.1%**, because it lowers the price charged for each of those…	rate6_threshold.qmd_1178 -1347
p. 72, line 11	…the price charged for each of those kWh by 14.1%—from **13.570** ¢/kWh to 11.656 ¢/kWh.	rate6_threshold.qmd_1178 -1347
p. 72, line 11	…of those kWh by 14.1%—from 13.570 ¢/kWh to **11.656** ¢/kWh.	rate6_threshold.qmd_1178 -1347

Location	Quote (number in bold)	Where it's generated
p. 72, line 12; p. 73, line 9	…delivered fuel homes see their incremental HP bills reduced by only **8.0%** on average (even after including the 23% of…	rate6_threshold.qmd_1178-1347
p. 72, line 13; p. 73, line 10	…homes that receive a windfall.) High-income homes see a **15.9%** reduction in their incremental HP bills, on average—more…	rate6_threshold.qmd_1178-1347
p. 73, line 9	…—8.0% for the lowest-income third of delivered fuel homes, **13.8%** for the middle third, and 15.9% for the…	rate6_threshold.qmd_1178-1347
p. 74, line 10 and footnotes 69 and 70; p. 75, footnote 71	…I showed above, the threshold systematically gives low-income homes only **57%** of their intended savings, while high-income homes get…	rate6_threshold.qmd_1178-1347
p. 74, line 10 and footnote 70; p. 75, footnote 71	…only 57% of their intended savings, while high-income homes get **112%**.	rate6_threshold.qmd_1178-1347
p. 74, line 14 and footnote 70; p. 75, footnote 71	…as proposed, the Block 2 discount is 1.9 ¢/kWh, or **14%** of the Block 1 rate.	rate6_threshold.qmd_1178-1347
p. 74, line 15	…above, low-income homes see an effective bill reduction of only **8%**, while high-income homes see 16%—a 8…	rate6_threshold.qmd_1178-1347
p. 74, line 16	…effective bill reduction of only 8%, while high-income homes see **16%**—a 8 percentage-point gap, driven entirely by…	rate6_threshold.qmd_1178-1347
p. 74, line 16 and footnote 70; p. 75, footnote 71	…of only 8%, while high-income homes see 16%—a **8** percentage-point gap, driven entirely by the threshold's inability…	rate6_threshold.qmd_1178-1347
p. 74, footnote 70; p. 75, lines 3 and 4 and footnote 71	…of their intended savings, so their effective bill reduction is 57% × **72%** = 41%.	rate6_threshold.qmd_1178-1347
p. 74, footnote 70; p. 75, line	…intended savings, so their effective bill reduction is 57% × 72% = **41%**.	rate6_threshold.qmd_1178-1347

Location	Quote (number in bold)	Where it's generated
5 and footnote 71		
p. 74, footnote 70; p. 75, line 5 and footnote 71	…homes capture 112%, so theirs is 112% × 72% = **81%**.	rate6_threshold.qmd_1178-1347
p. 74, footnote 70; p. 75, line 6 and footnote 71	…an 8 percentage-point gap under a 14% discount produce a **40** percentage-point gap under a 72% discount.	rate6_threshold.qmd_1178-1347
p. 75, line 3	…and transmission all set at marginal cost—the discount grows to **13.4** ¢/kWh, or 72% of the Block 1 rate.	rate6_threshold.qmd_1178-1347
p. 75, line 19	…average pre-HP winter base load for natural gas homes is **441** kWh per month—nearly 230 kWh below the 700…	rate6_threshold.qmd_1178-1347
p. 75, line 20	…load for natural gas homes is 441 kWh per month—nearly **230** kWh below the 700 kWh threshold.	rate6_threshold.qmd_1178-1347
p. 77, line 2	For the median delivered fuel home, it is **94%**.	rate6_threshold.qmd_1178-1347
p. 77, line 6	…lower-income homes.) For the median natural gas home, however, only **55%** of incremental HP load receives the discount—the threshold…	rate6_threshold.qmd_1178-1347
p. 77, line 7	And **23%** of natural gas homes—nearly 1 in 4…	rate6_threshold.qmd_1178-1347
p. 77, line 9	Among delivered fuel homes, only **7%** fare that poorly.	rate6_threshold.qmd_1178-1347
p. 77, line 15	…these customers would see their incremental heat pump bill reduced by only **7.7%**, on average—roughly half of the intended discount.	rate6_threshold.qmd_1178-1347
p. 77, line 16	The typical delivered fuel home, by contrast, would see a **13.3%** reduction, on average, much closer to the intended 14.1% bill…	rate6_threshold.qmd_1178-1347

Location	Quote (number in bold)	Where it's generated
p. 78, line 3	…shows the current 700 kWh threshold; the bottom row lowers it to **441** kWh—the natural gas mean base load.	rate6_threshold.qmd_1178-1347
p. 78, line 5	Their capture rate rises from **59%** to 86%.	rate6_threshold.qmd_1178-1347
p. 78, line 5	Their capture rate rises from 59% to **86%**.	rate6_threshold.qmd_1178-1347
p. 78, line 6	**73%** of delivered fuel homes now receive a windfall (yellow), and…	rate6_threshold.qmd_1178-1347
p. 79, line 1	…homes now receive a windfall (yellow), and their capture rate balloons to **113%**—meaning the delivered fuel population as a whole receives…	rate6_threshold.qmd_1178-1347
p. 85, lines 14 and 17	…Company's fossil-heated customers installs a heat pump, they cause only **$10** in incremental marginal T&D cost per year, on…	representative_home.qmd_1439-1500
p. 86, line 14	…the mean overpayment is **$-1**.	overpayment.qmd_694-774
p. 88, line 2	However, **61%** of fossil fuel customers are within $200 of zero.	overpayment.qmd_694-774
p. 88, line 4	…natural gas customers are almost as likely to be underpaying as overpaying (**53%** overpay, vs. 47% of oil/propane customers), and LMI…	overpayment.qmd_694-774
p. 88, line 4	…are almost as likely to be underpaying as overpaying (53% overpay, vs. **47%** of oil/propane customers), and LMI customers see a…	overpayment.qmd_694-774
p. 88, line 5	…of oil/propane customers), and LMI customers see a similar balance (**52%** overpay, vs. 49% of non-LMI customers).	overpayment.qmd_694-774
p. 88, line 5	…customers), and LMI customers see a similar balance (52% overpay, vs. **49%** of non-LMI customers).	overpayment.qmd_694-774
p. 88, line 17	…household's total annual energy bill under Rate HP would be **$865** (23%) less than if they switched to a heat pump…	representative_home.qmd_2171-2211

Location	Quote (number in bold)	Where it's generated
p. 88, line 17	…household's total annual energy bill under Rate HP would be $865 (**23%**) less than if they switched to a heat pump under…	representative_home.qmd_2171-2211
p. 89, line 6	…natural gas-heated household in the Company's territory could save $377 (**12%**) per year by switching their gas heating system to a…	representative_home.qmd_2171-2211
p. 90, line 3; p. 92, line 9	…bill after switching to a heat pump under Rate HP would be **$1,169** (25%) less than if they switched to a heat pump…	representative_home.qmd_2226-2267
p. 90, line 3	…after switching to a heat pump under Rate HP would be $1,169 (**25%**) less than if they switched to a heat pump under…	representative_home.qmd_2226-2267
p. 91, line 8; p. 92, line 1	Under Rate HP, **83%** would save by switching, and those that still see a…	analysis.qmd_1581-1601
p. 91, line 9	…switching, and those that still see a bill increase would lose only **$144** on average.	analysis.qmd_1581-1601
p. 92, line 1	…Rate HP, 83% would save—and the median saver would cut **$275** per year from their energy bills.	analysis.qmd_1581-1601
p. 92, line 8	90% would save, with median annual savings of **$512**.	analysis.qmd_320-335
p. 92, line 8	Under Rate HP, **99%** would save—and their average savings grow by an…	analysis.qmd_936-960
p. 97, line 12	…Rate 1, the monthly fixed charge would then have to rise from **$12.36** to $121.49—an increase of $109.13 per month.	incremental_fair_default.qmd_268-298
p. 97, line 12; p. 98, line 1	…the monthly fixed charge would then have to rise from $12.36 to **$121.49**—an increase of $109.13 per month.	incremental_fair_default.qmd_268-298
p. 97, line 13	…then have to rise from $12.36 to $121.49—an increase of **$109.13** per month.	incremental_fair_default.qmd_268-298