BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE APPLICATION OF NEW MEXICO GAS COMPANY, INC. FOR APPROVAL OF ITS 2023-2025 ENERGY EFFICIENCY PROGRAM PURSUANT TO THE NEW MEXICO PUBLIC UTILITY AND ENERGY EFFICIENCY ACTS	**))))))**	**Case No. 22-00232-UT**

DIRECT TESTIMONY

ON BEHALF OF THE OFFICE OF THE ATTORNEY GENERAL

PART 2 – KENJI TAKAHASHI

NOVEMBER 30, 2022

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1. INTRODUCTION AND PURPOSE OF TESTIMONY

Q **Please state your name and occupation.**

A My name is Kenji Takahashi. I am a Senior Associate at Synapse Energy Economics, Inc. ("Synapse"). My business address is 485 Massachusetts Avenue, Suite 3, Cambridge, Massachusetts 02139.

Q **Please summarize your work experience and educational background.**

A At Synapse, I conduct economic, environmental, and policy analysis of energy system technologies, planning and regulations associated with both supply- and demand-side resources. Over the past 18 years, I have assessed the design, impact, and potential of energy efficiency and distributed energy resources policies and programs in over 40 jurisdictions across North America for a variety of clients. These include: environmental groups; municipal, state, and provincial governments; and federal agencies such as U.S. Environmental Protection Agency and U.S. Department of Energy.

Another area of my focus has been technological, resource, economic, and policy assessments of building decarbonization and its impact on gas system planning. I have assessed the potential of building decarbonization for several states including Massachusetts, Rhode Island, Vermont, New York, Maryland, and California and for several regions including the Northeast and the Southwest. For Massachusetts, I assessed the potential of natural gas demand savings measures and electrification measures as solutions to the gas moratorium placed by Berkshire Gas company, and I testified before the Massachusetts Department of Public Utilities on the matter. For the Southwest, I assisted the Southwest Energy

Efficiency Partnership (SWEEP) as the technical advisor for its analysis of the economics of residential building decarbonization back in 2018.

I hold a Master's in Urban Affairs and Public Policy with a concentration in Energy and Environmental Policy from the Biden School of Public Policy and Administration at the University of Delaware. I also recently completed the Massachusetts Institute of Technology's online program "Sustainable Infrastructure Systems: Planning and Operations."

A copy of my current resume is attached in Appendix A.

Q **On whose behalf are you testifying in this case?**

A I am testifying on behalf of the NMAG.

Q **Have you previously testified in regulatory proceedings in New Mexico?**

A No.

Q **Have you testified on a similar topic before a state or provincial commission in other jurisdictions?**

A Yes. I have testified regarding energy efficiency program assessments before the New Jersey Board of Public Utilities, the Massachusetts Department of Public Utilities, and the Ontario Energy Board.

Q **What is the purpose of your testimony in this proceeding?**

A NMAG retained Synapse to review the New Mexico Gas Company ("NMGC" or "Company") Application for approval of its 2023–2025 Energy Efficiency Program ("2023–2025 EEP") and provide recommendations to the New Mexico

Public Regulation Commission ("NMPRC" or "Commission"). To this end, I reviewed the 2023–2025 EEP and assessed whether it is in the interest of the residential and small business customers of NMGC and in the public interest of the state of New Mexico. The purpose of my testimony is to provide a summary of key issues with the 2023–2025 EEP and recommendations for improvement.

Q **How is this testimony structured?**

A My testimony is focused on gas-fueled water- and space-heating equipment investments, which I discuss in Section 2.

Q **What documents do you rely upon for your analysis, findings, and observations?**

A The sources for this testimony are the 2023–2025 EEP, annual reports summarizing 2019, 2020, and 2021 spending and performance, NMGC's 2020–2022 EEP, NMGC's responses to discovery requests, and my personal knowledge and experience with energy efficiency programs in other jurisdictions. I have submitted additional discovery to NMGC and I note topic areas throughout this testimony on which I have asked the Company additional questions. NMAG hopes to be granted leave to supplement this testimony based on the Company's responses.

2. Gas-Fueled Equipment Investments

Q **How much of the total proposed funding is allocated to gas-fueled water- and space-heating equipment replacements (including gas-fueled furnaces and**

boilers, gas-fueled storage water heaters, and gas-fueled tankless water heaters)?

The Company's 2023–2025 EEP provides incomplete information about the amount of funding dedicated to gas-fueled water- and space-heating equipment replacements in all programs. The Water Heating and Space Heating programs have a clear focus on these measures, so I focus my attention on these programs to start. The Water Heating program is focused on replacing gas-fueled water heaters with gas-fueled storage water heaters and gas-fueled tankless water heaters. The Space Heating program is focused on replacing gas-fueled heating systems with gas-fueled furnaces and boilers. Exhibit SLC-5 in the 2023–2025 EEP and the Company's benefit-cost model (Appendix B) break out the share of rebates dedicated to gas-fueled water- and space-heating equipment replacements within these two programs and the rebate costs.

The Company plans to provide 605 rebates for gas-fueled water-heating equipment replacements annually under the Water Heating program. The budget for these rebates is 51 percent of the total rebates for this program. If we apply this percentage to the average annual program budget of $1.2 million, the budget dedicated to water-heating equipment would be approximately $629,000.[1] The Company plans to provide 310 rebates for gas-fueled space-heating equipment replacements annually under the Space Heating program. The budget for these rebates is 47 percent of the total rebates for this program. Applying this percentage to the average annual program budget of $1.2 million, the budget dedicated to water-heating equipment would be approximately $550,000.[2]

[1] According to Exhibit SLC-5, the other measures include showerheads and gas-fueled dryers.
[2] According to Exhibit SLC-5, the other measures include smart thermostats, insulation, duct sealing, and furnace tune-ups.

Other programs such as the Income Qualified, Multi-Family, and Efficient Buildings programs may also include incentives for gas-fueled water- and space-heating equipment replacements. However, the Company does not provide a breakout of the measures and associated incentive amounts for these programs in Exhibit SLC-5 or the benefit-cost model (Appendix B). I am confirming the total number of rebates for water- and space-heating equipment annually and the total costs through discovery with NMGC. In the meantime, I estimate that NMGC proposes to invest *at least* $1.2 million annually in gas-fueled water- and space-heating equipment replacements out of its nearly $15 million budget, equivalent to 8 percent.

Q **Is the proposed funding for gas-fueled equipment appropriate?**

A No. The Company's proposal to support the installation of new gas-fueled equipment is not aligned with New Mexico's climate policy. In fact, I expect such a proposal is counter to the state's climate policies and would make it harder to achieve the state's greenhouse gas emissions (GHG) targets. This is because equipment incentives have the effect of locking existing customers into continued use of gas for several decades, which leads to continuing GHG emissions from the building sector. Also, customers who participate in the proposed programs will be exposed to further risks of high gas prices and price volatility, as discussed further along in my testimony.

Q **Please explain the state's greenhouse gas emissions reduction targets.**

A New Mexico Governor Michelle Lujan Grisham issued Executive Order 2019-003 "Executive Order on Addressing Climate Change and Energy Waste Prevention" in January 2019. This Executive order established a statewide GHG emission reduction target of at least 45 percent by 2030, based on 2005 levels.

According to the U.S. Energy Information Administration (EIA), gas consumption in the state increased by about 9 percent between 2005 and 2021.[3] Assuming the gas companies are equally responsible for achieving the GHG emissions reduction goal, the gas companies in the state need to reduce GHG emissions from their customers' gas use by 50 percent by 2030.

Q **Please elaborate on how the Company's proposed gas-fueled water- and space-heating replacement investments in the 2023–2025 EEP hinders achievement of the state's greenhouse gas emissions reduction goals.**

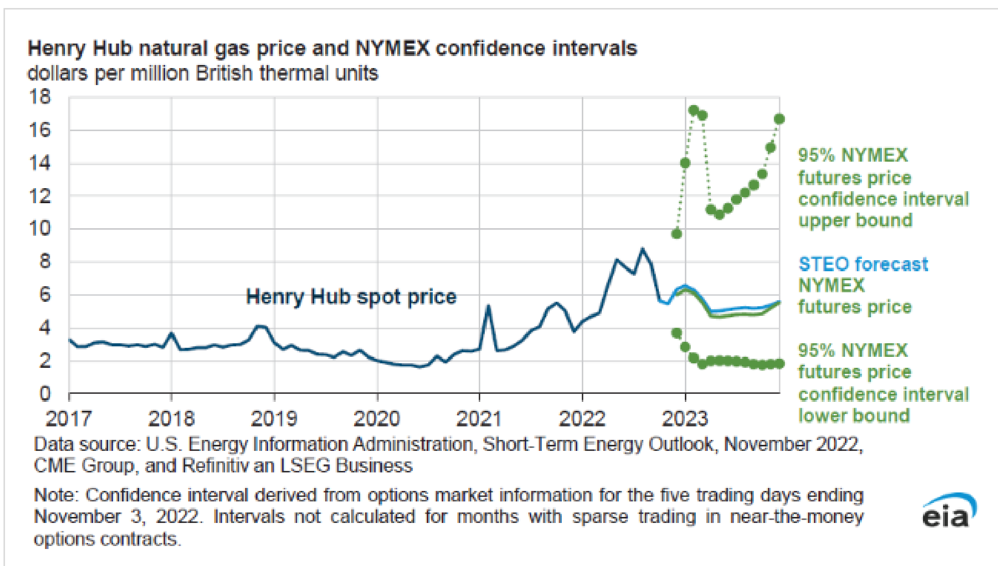
A Space- and water-heating systems have long measure lives. The Company assumes that water heaters last 15 to 20 years and furnaces and boilers last 18 to 20 years. These long measure lives suggest that once customers install new gas-fueled water- and space-heating systems using the Company's rebates, these systems will be in use for the next 15 years or more. For many customers, utilities are trusted voices regarding building equipment choices, and regulatory approval of their programs implies that customers can trust that the utility's programs are consistent with state policy. Instead of being consistent with policy, these incentives will make it more difficult for New Mexico to achieve its 2030 GHG emission reduction goal because they will lock in some GHG emissions for a long period of time. A shift in investments from more polluting options to less polluting options during this three-year plan cycle would better enable New Mexico to achieve its 2030 GHG emission reduction goal.

[3] EIA. "Natural Gas Consumption by End Use." Available at: https://www.eia.gov/dnav/ng/ng_cons_sum_dcu_SNM_a.htm

Q Please elaborate on how the Company's proposed 2023–2025 EEP gas-fueled water- and space-heating equipment replacement incentives will expose customers to further risks of high gas prices and price volatility.

A Gas prices have increased dramatically over the past few years globally and in the United States, primarily due to global gas supply constraints that were triggered by substantially reduced gas supply from Russia to the European market. Figure 1 shows the EIA's Short-Term Energy Outlook (STEO), which includes historical gas prices since 2017 along with STEO's gas forecast and NYMEX futures gas prices through 2024.

Figure 1. Historical and Projected Natural Gas Prices and NYMEX Future Gas Prices

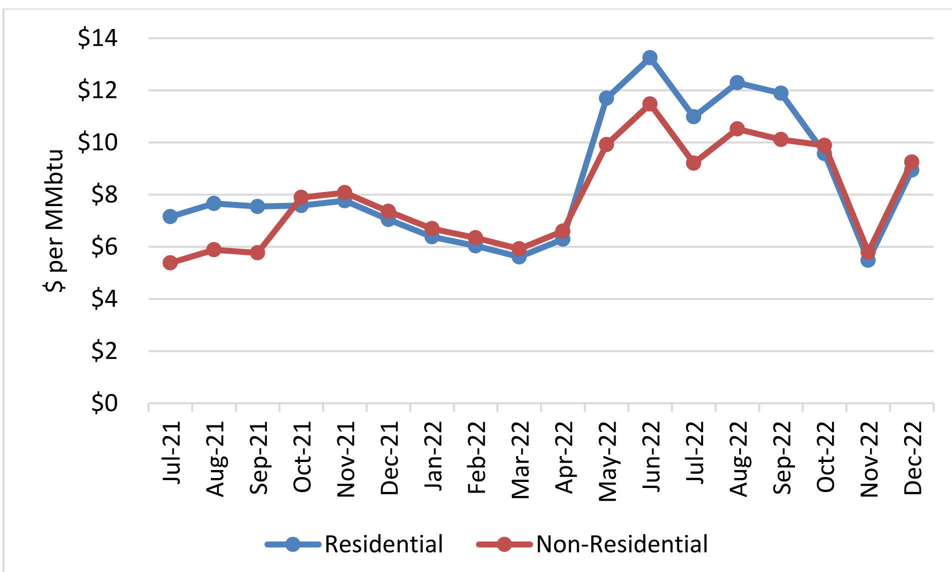


Source: U.S. Energy Information Administration. 2022. Short-Term Energy Outlook. page 7. Available at: https://www.eia.gov/outlooks/steo/pdf/steo_full.pdf.

This figure shows that historical gas commodity prices at Henry Hub were between $2 and $4 per million British thermal units (MMBtu) from 2017 through 2020. Gas prices started to increase from the beginning of 2021 to as high as $8 per MMBtu in mid-2022, approximately 3 to 4 times higher than the previous levels. During this time, prices were more volatile as well. Gas prices declined slightly in the fall of 2022 but are still around $6 per MMBtu. While EIA's short-term price forecasts (shown as STEO forecast in the figure) and NYMEX futures prices are slightly lower than the current gas prices, they are still substantially higher than levels seen in the last half-decade.

These price increases are affecting all households and businesses using gas in New Mexico. Figure 2 presents monthly gas commodity prices for residential and non-residential customers served by the New Mexico Gas Company since July 2021. The price trends are similar to the prices at Henry Hub presented above.

Figure 2. Gas Commodity Prices for New Mexico Gas Company's Customers



Source: New Mexico Gas Company. "Cost of Gas." Available at: *<u>https://www.nmgco.com/en/cost_of_gas</u>*

As shown in **Figure 2** above gas commodity prices roughly tripled in 2022 when compared to 2020. Given that NMGC gas distribution and transmission costs (which are not affected by the fluctuations in gas commodity prices) are about $2.3 per MMBtu, I estimate that all-in gas prices including commodity prices and transmission and distribution charges may have doubled since 2020. This implies that gas bills are now roughly twice what they used to be.

According to EIA, the average residential customer in NMGC's jurisdiction paid $420 for natural gas in 2020 and $575 in 2021.[4] These estimates include monthly customer charges. NMGC customer charges are currently $12 per month for residential customers, or $144 per year.[5] Assuming the same customer charges for 2020 and 2021, the annual gas costs excluding customer bills would have been $276 in 2020 and $431 in 2021. Further assuming that the annual gas costs in 2022 excluding customer charges would be twice as high as the costs in 2020 (or $552), the total annual gas bill including the customer charges would be about $696 ($552 + $144), representing about 66 percent increase from the bills in 2020. While more efficient gas-fueled equipment will reduce the exposure to such gas price hikes and volatility, this savings is smaller than it could be. For example, an efficient gas-fueled furnace is typically about 95 percent efficient while a standard gas-fueled furnace may be about 80 percent efficient. The energy savings from the efficient gas-fueled furnace is about 16 percent relative to the standard gas-fueled furnace. This means that a consumer who purchases an efficient gas-fueled furnace will be still exposed to most of the high gas prices and price volatility.

[4] U.S. EIA. 2022. "Natural Gas Annual Respondent Query System (EIA-176 Data through 2021)" Report: 176 Type of Operations and Sector Items. Available at: https://www.eia.gov/naturalgas/ngqs/#?report=RP4&year1=2018&year2=2021&company=Name

[5] New Mexico Gas Company. 2020. Fourth Revised Rate No. 10. Canceling Third Revised Rate No. 10 – Residential Service. Available at: https://www.nmgco.com/userfiles/files/Rate%20No.%2010%20PDF%20Residential%20Services.pdf.

Q **Is there a better alternative to gas-fueled water-heating and space-heating equipment?**

A Yes. A better alternative to gas-fueled equipment for water and space heating is electric heat pumps and heat pump water heaters. Electric heat pumps have superior energy efficiency over any other type of heating systems and offer the potential to fully decarbonize water- and space-heating end uses in buildings. Heat pumps can also provide space cooling. Heat pumps are cost-effective relative to gas-fueled heating systems in both new and existing buildings. With the current high gas prices and electric prices that have increased to a lesser extent than gas prices,[6] heat pumps are now even more cost-effective.

Q **Please elaborate on the performance of electric heat pumps.**

A On average, efficiencies of electric heat pumps including electric heat pump water heaters typically exceed 250 percent (also expressed as coefficient of performance or COP greater than 2.5). Heat pumps can achieve this level of high performance because they move heat from one place to another using a vapor-compression refrigerant cycle, instead of combustion. While heat pump performance for space heating declines as the temperature declines, heat pumps designed for cold climates (often called cold climate heat pumps) are now widely available in the market and can comfortably and efficiently heat space at temperatures that are significantly below zero. For example, one field study from Vermont observed that cold climate heat pumps achieved 160 percent efficiency at 5°F and operated

[6] U.S. EIA. "Average retail price of electricity, monthly" for New Mexico, available at: https://www.eia.gov/electricity/data/browser/#/topic/7?agg=0,1&geo=00000000001&endsec=vg&freq=M&start=200101&end=202208&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0.

at above 100 percent efficiency even below -20°F.[7] Heat pump water heater performance is not dependent on the outside temperature.

All the counties in New Mexico have a design temperature above 0°F.[8] (The design temperature represents the lowest temperature recommended for consideration when designing the size of a heating system.) This means that cold climate heat pumps can fully replace gas-fueled water- and space-heating systems without any technical issues across New Mexico and reduce 100 percent of gas consumption for these end uses. On the other hand, an efficient gas-fueled furnace would only save about 16 percent of the gas consumption.

Q **Please elaborate on how heat pumps can fully decarbonize space and water heating end uses.**

A Heat pumps will enable the building sector to fully decarbonize water and space heating end uses when the grid is powered by 100 percent clean energy in the state. It is notable that a 2022 study conducted by the Southwest Energy Efficiency Partnership (SWEEP) estimated that heat pumps for space heating installed today in New Mexico are expected to reduce the emissions relative to gas by 58 to 64 percent over the life of the heat pumps. This analysis considers (a) projected grid emission rates for New Mexico based on the National Renewable

[7] Walczyk, J. 2017. *Evaluation of Cold Climate Heat Pumps in Vermont*. Prepared by The Cadmus Group, LLC for the Vermont Public Service Department. Available at: https://publicservice.vermont.gov/sites/dps/files/documents/Energy_Efficiency/Reports/Evaluation%20of%20Cold%20Climate%20Heat%20Pumps%20in%20Vermont.pdf.

[8] U.S. EPA. *ENERGY STAR Certified Homes County-Level Design Temperature Reference Guide*. Available at: https://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/County%20Level%20Design%20Temperature%20Reference%20Guide%20-%202015-06-24.pdf.

Energy Laboratory's (NREL) Cambium model and (b) a conservative methane leak rate from natural gas systems.[9]

Q **Please discuss the economics of heat pumps relative to gas-fueled water- and space-heating equipment.**

A The 2022 SWEEP study also estimated the cost-effectiveness of heat pumps relative to gas-fueled furnaces for new construction and existing residential buildings in warmer cities and colder cities in a few Southwestern states, including New Mexico. Table 1 presents SWEEP's analysis for the warmer cities. The operating costs for heat pumps are generally lower than the operating costs of gas-fueled furnaces. Even with the incremental installation cost of a heat pump, heat pumps have better lifecycle economics in three cities on a life-cycle cost basis, ranging from $252 savings for a new home in Las Vegas, Nevada to $1,055 savings for an existing home in Tucson, Arizona. In Las Cruces, the life cycle costs of heat pumps are more than gas-fueled furnaces (by $435 to $472). The primary reason for the unfavorable economics of heat pumps for Las Cruces is a combination of (a) a relatively higher electricity-to-gas price ratio among the selected cities and (b) the highest heating demand among the selected cities. While SWEEP finds that it is cheaper to operate a heat pump in Las Cruces than to use a gas-fueled furnace, the operating savings are not enough to overcome an upfront cost premium.

[9] SWEEP. 2022. *Benefits of heat pumps for Southwest homes*. Table 8 on page 22 and Table 9 on page 23. Available at: https://swenergy.org/pubs/southwest-heat-pump-study-2022.

Table 1. SWEEP's Analysis of the Economics Heat Pumps in Warmer Southwestern Cities

City and Scenario	Gas-Fueled Furnace	Heat Pump	Heat Pump Incremental Installation Costs ($)	Total Incremental Life-Cycle Costs
	NPV of Heating Costs ($)	NPV of Heating Costs ($)		
New Home				
Phoenix, AZ	$3,221	$1,914	$1,000	($306)
Tucson, AZ	$4,883	$3,022	$1,000	($861)
Las Vegas, NV	$3,694	$2,441	$1,000	($252)
Las Cruces, NM	$4,591	$4,026	$1,000	$435
Retrofit of Existing Home				
Phoenix, AZ	$3,726	$2,256	$1,000	($469)
Tucson, AZ	$5,502	$3,448	$1,000	($1,055)
Las Vegas, NV	$4,239	$2,823	$1,000	($416)
Las Cruces, NM	$5,154	$4,626	$1,000	$472

Source: SWEEP. 2022. Benefits of heat pumps for Southwest homes. Table 10.

Table 2 summarizes SWEEP's analysis of the economics of heat pumps in two cities in New Mexico. As shown in this table, the economics are worse for Albuquerque than for Las Cruces. This is partly because SWEEP assumes a cold climate heat pump, which is more expensive, for Albuquerque and other colder cities. The operating cost savings of the heat pump again cannot overcome this higher upfront cost.

Table 2. SWEEP's Analysis of the Economics Heat Pumps in Two Cities in New Mexico

City and Scenario	Gas-Fueled Furnace	Heat Pump	Heat Pump Incremental Installation Costs ($)	Total Incremental Life-Cycle Costs
	NPV of Heating Costs ($)	NPV of Heating Costs ($)		
New Home				
Las Cruces, NM	$4,591	$4,026	$1,000	$435
Albuquerque, NM	$7,107	$6,595	$3,200	$2,688
Retrofit of Existing Home				
Las Cruces, NM	$5,154	$4,626	$1,000	$472
Albuquerque, NM	$7,960	$7,772	$1,800	$1,591

Source: SWEEP. 2022. Benefits of heat pumps for Southwest homes. Table 10 and 11.

Q **What gas prices were used in the SWEEP analysis?**

A The SWEEP study used gas prices of about $0.93 per therm for Albuquerque and $0.80 for Las Cruces.

Q **How would today's higher gas prices impact these results?**

A One major sensitivity factor that could change the economics of heat pumps is energy prices, in particular gas prices. As shown in Figure 2, the gas prices for this year are already substantially higher than last year's prices, which I expect to be closer to the prices used in the SWEEP study as the study was published in early this year. On average, the gas commodity price increase in this year is about 32 percent relative to last year's prices, using the available gas price data between July to December in 2021 and 2022 as presented in Figure 2. Including gas transmission and distribution charges, I estimate that the gas cost increase is about 25 percent relative to last year. Since 2021, residential electricity prices only modestly increased at about 4 percent on average, according to EIA.[10] I used these cost escalation factors and recalculated the economics of heat pumps for the two New Mexico cities in Table 3 as an illustrative analysis. This analysis shows that heat pumps would become an economical choice for consumers in all cases except one new construction case in Albuquerque. The lifetime cost savings are about $67 to $630 for the three cases with better heat pump economics. For the new construction case in Albuquerque, heat pumps are about $1,175 more expensive over their lifetimes. However, it is important to note that this analysis excludes the cost of avoiding new gas pipelines for a new home (which is about $5,100 based on the SWEEP 2022 study) as well as monthly gas fixed charges. Furthermore, the federal government will start to provide generous incentives for heat pumps under a few programs supported by the Inflation Reduction Act ("IRA"), starting in 2023, to advance building decarbonization. All households who purchase heat pumps can receive up to $2,000 as tax credits and income-qualified households can receive a total of $8,000 as rebates in a separate program.[11] Consumers will be better off installing heat pumps with these incentives, even before accounting for the increased natural gas prices.

[10] U.S. EIA. "Average retail price of electricity, monthly" for New Mexico, available at: https://www.eia.gov/electricity/data/browser/#/topic/7?agg=0,1&geo=00000000001&endsec=vg&freq=M&start=200101&end=202208&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0.
[11] Ungar, L., Nadel, S. 2022. *Home Energy Upgrade Incentives: Programs in the Inflation Reduction Act and Other Recent Federal Laws*. American Council for an Energy-Efficient Economy. Available at: https://www.aceee.org/policy-brief/2022/09/home-energy-upgrade-incentives-programs-inflation-reduction-act-and-other.

Table 3 Analysis of the Economics Heat Pumps in Two Cities in New Mexico, adjusted for Increased Gas and Electricity Prices

City and Scenario	Gas-Fueled Furnace	Heat Pump	Heat Pump Incremental Installation costs ($)	Total Incremental Life-cycle Costs
	NPV of Heating Costs ($)	NPV of Heating Costs ($)		
New Home				
Las Cruces, NM	$5,739	$4,187	$1,000	($552)
Albuquerque, NM	$8,884	$6,859	$3,200	$1,175
Retrofit of Existing Home				
Las Cruces, NM	$6,443	$4,811	$1,000	($631)
Albuquerque, NM	$9,950	$8,083	$1,800	($67)

Gas prices could decline over the upcoming year, but the available industry price projections such as the EIA and NYMEX futures prices indicate that the prices are likely to remain high, as shown in Figure 1. Finally, it is important to note that future gas transmission and distribution prices could increase substantially in the long-term if gas companies need to reduce their gas sales to meet the state's GHG reduction mandates. I will discuss this issue in more detail later in this testimony.

Q How do the customer economics of heat pump water heaters compare with those of heat pumps for space heating?

A The SWEEP 2022 study also estimated the economics of heat pump water heaters against gas-fueled water heaters. The study found that heat pump water heaters are $380 to $440 more expensive on a lifecycle basis.[12] However, assuming higher gas prices, as discussed for heat pumps for space heating, I expect that the economics of heat pump water heaters would be comparable to gas-fueled water heaters. As an example,SWEEP estimates the lifetime operating costs of a gas-fueled water heater and a heat pump water heater in Albuquerque are $1,257 and

[12] SWEEP. 2022. Table 14.

$733 respectively and the incremental cost of a heat pump is $900. The operating cost savings of this heat pump water heater is $524 with the current gas price assumed in the SWEEP study. If the overall gas and electricity costs are increased by 25 percent and 4 percent, respectively, as I assumed in my analysis of heat pumps for space heating above, the total lifetime operating costs will increase to about $1,571 for a gas water heater and $762 for a heat pump water heater. This will increase the operating cost savings for a heat pump water heater to $838 ($1,571 - $733). As a result, the total lifecycle cost of a heat pump water heater will be just $90 more expensive than a gas water heater.

However, it is important to note that even without assuming higher gas prices, heat pump water heaters will become an economic choice for numerous consumers starting next year because of the generous incentives that will become available because of the Inflation Reduction Act (IRA). The IRA provides incentives for heat pump water heaters. All households can receive up to $2,000 as a tax credit and income-qualified households can receive an incentive of $1,750 as a rebate.[13]

Q **The price projections you've shown go out only a few years, much shorter than the lifetime of new space- and water-heating equipment. What insights would you share with customers and the Commission regarding longer-term gas rates?**

A In the long term, there is a high likelihood that gas rates gradually increase over time to a much higher level than we are experiencing this year. As a growing number of customers use heat pumps instead of traditional gas-fueled equipment—due to federal, state, and local policies and the advancement of the

[13] Ungar, L., Nadel, S. 2022.

heat pump market—gas companies will have to raise their gas rates in order to recover their fixed costs over a smaller volume of sales. If New Mexico gas customers were to reduce their gas use by 45 percent by 2030 relative to the 2005 level (which means a 50 percent reduction from today's level as I discussed at the beginning of this section above) in line with state GHG policy, NMGC and the other gas companies in the state would need to double the distribution portion of gas rates to recover the same revenue requirement.

A recent Synapse study conducted for the Maryland Office of People's Counsel analyzed the potential impact of gas prices and bills for consumers in a few building decarbonization scenarios meeting the state's GHG reduction mandates.[14] The study found that average gas bills could roughly double for residential customers by 2035 and increase by 4 to 8 times by 2050, largely driven by declining gas sales and an increasing amount of expensive low-carbon gaseous fuels (e.g., biomethane and synthetic natural gas) to meet the state's GHG reduction mandates.

Q **How do you estimate electrification measures would perform on the Utility Cost Test, from the gas utility perspective?**

A Electrification is likely to be a very cost-effective measure based on the UCT. A utility offering a comparable incentive for a gas-fueled furnace and a heat pump could achieve much greater gas savings because the electric equipment would reduce most, if not all, of the building's space-heating gas use. The resulting

[14] Synapse Energy Economics. 2022. *Climate Policy for Maryland's Gas Utilities: Financial Implications.* Prepared for Maryland Office of People's Counsel. Available at: https://opc.maryland.gov/Gas-Rates-Climate-Report.

utility cost per therm of savings would be much lower because of the much greater gas savings. Similar UCT impacts would be observed for water heating.

Q **Is the UCT the right test to use when considering fuel-switching measures?**

A The UCT has some value in this case, but it would be better to use a more comprehensive cost-effectiveness test that considers the cost of increased electricity consumption. While New Mexico has not adopted such a test, I recommend that the Commission require use of a fuel-agnostic test when considering coordinated gas and electric efficiency programs.

Q **How would you recommend the Company address the issues you raised regarding gas-fueled water- and space-heating equipment replacement incentives for the Company's 2023–2025 EEP?**

A The Commission should direct the Company to shift the funding for gas-fueled water and space heating equipment to weatherization and other non-gas equipment measures (e.g., smart thermostats, low flow showerheads) for all customers except income-qualified customers. This recommendation applies to gas equipment for new and existing homes and buildings in the following programs: Water Heating, Space Heating, Multifamily (except low-income customers targeted under this program), and Efficient Buildings. I further recommend that the Commission direct the Company to spend the next year incorporating electric heat pumps and electric heat pump water heaters as gas and GHG emissions savings measures into its 2024 and 2025 revised EEPs with a goal of launching the new offering a year from now at the latest.

Q **Do you know any other jurisdictions where gas companies or other entities eliminated incentives for gas equipment and/or started offering incentives for electric heat pumps as fuel switching measures from gas heating end-uses?**

A Yes. the District of Columbia's Sustainable Energy Utility (DCSEU), a jurisdiction-wide energy efficiency program administrator, recently decided to discontinue gas equipment incentives to support the District's building decarbonization initiative. The DCSEU shifted the funding to support electric heat pump incentives.[15] All the gas investor-owned utilities in Massachusetts started offering incentives for electric heat pumps in their 2022-2024 EEPs.[16] Vermont Gas Systems (VGS), a regulated gas company in Vermont, has been promoting heat pumps since 2021 to be compatible with the state's GHG reduction mandates.[17]

Q **Does this conclude your testimony?**

A Yes.

[15] DCSEU. 2021. 2021 Annual Report. page 17. Available at: https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/DCSEU-AnnualReport-Final-11.30.2021.pdf.

[16] D.P.U. 21-129, NSTAR Electric Company d/b/a Eversource Energy's response to Information Request AG-Common 1-2, November 19, 2021, available at: fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/14215601

[17] Hood, M. et al. 2022. "The Gas Utility of the Future is Here, and It Looks Like This." Proceedings of the 2022 ACEEE Summer Study of Energy Efficiency in Buildings. Available at: https://www.aceee.org/sites/default/files/pdfs/ssb/20220810191634048_17d392a3-2631-4b57-a395-a63dcc001c97.pdf

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AFFIRMATION (IN LIEU OF AFFIDAVIT)

OF KENJI TAKAHASHI

In compliance with the Temporary NMPRC Electronic Filing Policy of March 20, 2020, and under Rule 1-011(B) NMRA of the New Mexico Rules of Procedures for the District Courts, I, Kenji Takahashi, hereby file this testimony on behalf of the New Mexico Attorney General and state as follows:

I hereby affirm in writing under penalty of perjury under the laws of the State of New Mexico that the statements contained in the foregoing Testimony of Kenji Takahashi on behalf of the Office of Attorney General are true and correct to the best of my knowledge, information, and belief.

I further declare under penalty of perjury that the foregoing is true and correct.

Executed on November 30, 2022.

Kenji Takahashi (electronically signed)
Expert Witness on Behalf of the New Mexico Attorney General
485 Massachusetts Avenue, Suite 3
Cambridge, MA 02139

Appendix A: Resume of Kenji Takahashi

Kenji Takahashi, Senior Associate

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc, Cambridge, MA. *Senior Associate, 2015–present; Associate*, 2004–2015.

Analyzes technologies, policies, and regulations associated with supply- and demand-side energy resources. Assesses the performance, costs, and potential of energy efficiency measures, renewable energy resources, and building decarbonization and electrification measures. Examines economic and environmental implications of clean energy policies and programs associated with energy efficiency, demand response, distributed generation, and renewable energy. Analyzes ratemaking issues such as standby rates and time of use rates for distributed generation, and decoupling rate mechanisms for energy efficiency measures. Investigates electricity and natural gas market price trends and fluctuations. Prepares expert testimony and reports for regulatory proceedings.

Center for Energy and Environmental Policy, University of Delaware, Newark, DE. *Research Associate*, 2002 – 2004.

Researched the market potential of distributed resources under different electric distribution rate designs (report prepared for Conectiv Power Delivery Company). Investigated the potential of the Clean Development Mechanisms (CDM) in Asian developing countries and the Japanese government's policy for CDM. Contributed to a market penetration study for photovoltaic technologies in comparison with the predicted oil production from the oil reservoirs in the Arctic National Wildlife Refuge (report prepared for Astropower, Inc.). Analyzed the installation of PV and generation-set options for the Assateague Beach Coastal Guard Station at the Assateague Island National Seashore in Maryland (report prepared for the U.S. National Park Service).

Delaware Division of Public Advocate, Wilmington, DE. *Research Intern*, 2003.

Researched and wrote reports on states' policies regarding (1) energy efficiency/load management programs in order to identify cost-effective programs for implementation in Delaware; (2) electric standard offer service/default service (rate designs) for those who do not choose alternative suppliers under the deregulation process; (3) electric universal service and system benefit charges for protecting consumers from risks associated with electricity restructuring; and (4) Contributions and Advances-in-Aid-of-Construction for water supply extensions.

Resources for the Future, Washington DC. *Research Intern*, 2002.

Investigated current and planned wind power capacity for the United States. Analyzed the EPA and EIA market models to estimate technical and economic potential of wind power in the United States.

Researched the status of renewable energy supply in Japan's electricity sector for the Economic and Social Research Institute, Cabinet Office, Government of Japan.

Citizens' Alliance for Saving the Atmosphere and the Earth (CASA), Osaka, Japan. *Volunteer and Researcher*, 1999 – 2001.

Worked as a newsletter writer, editor, and event organizer. Wrote a report on the first experimental biomass energy facility in Japan and the photovoltaic system at Yagi Junior High School in Kyoto, Japan. Participated in a research project to investigate renewable energy potential and policies in Japan. Wrote a report on problems of nuclear power plants affecting communities in Fukui prefecture, Japan.

EDUCATION

University of Delaware, **Center for Energy and Environmental Policy, Joseph R. Biden, Jr School of Public Policy and Administration**, Newark, DE
Master of Arts in Urban Affairs and Public Policy with a focus on Energy and Environmental Policy, 2003. Master's thesis: *Policies to Support Distributed Resources under Different Electricity Restructuring Models*. Courses in energy economics, energy and environmental policy, electricity policy and planning, political economy of environment, solar electric technology, cost-benefit and decision-making analyses, and geographic information system.

Kansai University, Osaka, Japan
Bachelor of Arts in Law with a concentration in Public Administration, 2000.

AWARDS AND SCHOLARSHIPS

- Director's Citation, Joseph R. Biden, Jr School of Public Policy and Administration, University of Delaware. May 2003.
- NEC scholarship for an environmental education leader-training program funded by one of the leading Japanese computer companies, NEC. November 2000.

ADDITIONAL SKILLS

Software: MS Office, Minitab, Analytica, IMPLAN, AVoided Emissions and geneRation Tool (AVERT), CO–Benefits Risk Assessment (COBRA), RETScreen, BEopt™, REM/Rate™
Language: Japanese, Cantonese, and Spanish

OTHER RELEVENT WORK

- Currently assessing Puget Sound Energy's Energize Eastside project proposal on behalf of the City of Newcastle. The focus of this assessment is on (a) the reasonableness of the utility's historical loads and load forecasts including energy efficiency, demand response, and distributed energy resources; and (b) whether there is a need to build new transmission infrastructure as proposed under the company's Energize Eastside project proposal.

- Assisted NYSERDA with developing (a) a database of renewable heating and cooling (RH&C) technologies, (b) an Excel-based tool to analyze benefits and costs of RH&C, and (c) a state RH&C Policy Framework titled "Renewable Heating and Cooling Policy Framework: Options to Advance Industry Growth and Markets in New York."
- Assisted U.S. EPA with its analysis for and preparation for technical support documents on energy efficiency associated with U.S. EPA's Clean Power Plan under 111(d) regulation
- Assisted New Jersey Division of Rate Counsel with reviewing and commenting on various energy related proposals and documents in New Jersey including utility and the state energy efficiency programs and the state's energy plans. 2009 to present.
- Assisted Nova Scotia Utility and Review Board with a review of energy efficiency potential and integrated resource planning for Nova Scotia Power's jurisdiction. 2013
- Assisted the Hawaii Division of Consumer Advocacy in proceedings to develop and review IRPs for three electric companies and to review the state's energy efficiency programs. 2012 to 2014.
- Assisted the Arkansas Public Service Commission staff with (a) reviewing and assessing utility integrated resource planning and energy efficiency program proposals and (b) drafting regulatory orders on comprehensive energy efficiency program designs and reporting methods. 2012 to 2013.
- Assessed on behalf of Sierra Club energy efficiency and demand response potential estimates by the Cadmus Group for Puget Sound Energy, September 2012.
- Assumed a general contractor role for renovating an existing multi-family house into an ultra-low energy use house equipped with state-of-art energy efficiency measures (such as R-7 windows, R-70 roof insulation, a 95 percent efficient energy recovery ventilation system, cold climate heat pumps) and a 5 kW solar photovoltaic system. December 2012.
- Assessed on behalf of Sierra Club energy efficiency goals proposed in the Los Angeles Department of Water and Power's 2010 integrated resource plan.
- Assisted Nova Scotia Utility and Review Board with developing Community Based Feed-In Tariffs (COMFITs) for five different technologies: small wind projects, medium-sized wind projects, small hydro, small tidal, and biomass CHP projects. April 2011.
- Analyzed existing deep energy retrofit (DER) project data and analyzed potential energy savings from model partial DER projects (e.g., attic, above-grade wall, windows, basement wall) using REM/Rate building energy software and Synapse's own spreadsheet building energy model developed for this research project. The results from the analysis were used to project energy savings from and to set incentive levels for partial DER projects as part of National Grid's 2013-2015 efficiency program filing.

- Assisted several states, including Alaska, Colorado, Florida, Maryland, Massachusetts, and South Carolina with developing and analyzing their state climate change action plans; evaluated costs and benefits of demand and supply-side policy options, including quantifying expected greenhouse emission reductions. 2007 to 2010.
- Arranged meetings for Union Fenosa/Gas Natural, a Spanish electric and gas company, with Japanese and Korean organizations to study energy efficiency technologies, programs and policies in those countries; Visited Japanese organizations with the delegates of Union Fenosa, provided them technical and translation assistance on energy efficiency in Japan. July 26 to July 31, 2009.

PUBLICATIONS

Wilson, R., I. Addleton, K. Takahashi, J. Litynski. 2021. *Clean, Affordable, and Reliable: A Plan for Duke Energy's Future in the Carolinas*. Synapse Energy Economics for North Carolina Sustainable Energy Association, Carolinas Clean Energy Business Alliance, Southern Alliance for Clean Energy, Natural Resources Defense Council and the Sierra Club.

Hopkins, A. S., A. Napoleon, K. Takahashi. 2021. *A Framework for Long-Term Gas Utility Planning in Colorado*. Synapse Energy Economics for the Colorado Energy Office.

Kallay, J., A. Napoleon, K. Takahashi, E. Sinclair, T. Woolf. 2021. *Opportunities for Evergy Kansas to Address Energy Equity Within its Integrated Resource Plan and Other Planning Processes*. Synapse Energy Economics for Union of Concerned Scientists.

Takahashi, K., T. Woolf, B. Havumaki, D. White, D. Goldberg, S. Kwok, A. Takasugi. 2021. *Missed Opportunities: The Impacts of Recent Policies on Energy Efficiency Programs in Midwestern States.* Synapse Energy Economics for the Midwest Energy Efficiency Alliance.

Takahashi, K., E. Sinclair, A. Napoleon, A.S. Hopkins, D. Goldberg. 2021. *Evaluation of EnergyWise Low-Income Energy Efficiency Program in Mississippi – Program Performance, Design, and Implications for Low-Income Efficiency Programs*. Synapse Energy Economics for Sierra Club and Gulf Coast Community Foundation.

Wilson, R., I. Addleton, K. Takahashi, J. Litynski. 2021. *Clean, Affordable, and Reliable – A Plan for Duke Energy's Future in the Carolinas*. Synapse Energy Economics for North Carolina Sustainable Energy Association, Carolinas Clean Energy Business Alliance, Southern Alliance for Clean Energy, Natural Resources Defense Council and the Sierra Club.

Eash-Gates, P., K. Takahashi, D. Goldberg, A.S. Hopkins, S. Kwok. 2021. *Boston Building Emissions Performance Standard: Technical Methods Overview.* Synapse Energy Economics for the City of Boston.

Shipley, J., Hopkins, A., Takahashi, K., & Farnsworth, D. 2021. *Renovating regulation to electrify buildings: A guide for the handy regulator*. Regulatory Assistance Project.

Goldberg, D., J. Frost, D. Hurley, K. Takahashi. 2020. *New England Electrification Load Forecast*. Synapse Energy Economics for E4TheFuture.

Lane, C., K. Takahashi. 2020. *Rate and Bill Impact Analysis of Rhode Island Natural Gas Energy Efficiency Programs*. Synapse Energy Economics for National Grid.

Takahashi, K., A. S. Hopkins, D. White, S. Kwok, N. Garner. 2020. *Assessment of National Grid's Long-Term Capacity Report – Natural gas capacity needs and alternatives*. Synapse Energy Economics for the Eastern Environmental Law Center.

Takahashi, K., J. Frost, D. Goldberg, A. S. Hopkins, K. Nishio, K. Nakano. 2020. *Survey of U.S. State and Local Building Decarbonization Policies and Programs.* Presented at the 2020 ACEEE Summer Study of Energy Efficiency in Buildings.

Hopkins, A. S., A. Napoleon, K. Takahashi. 2020. *Gas Regulation for a Decarbonized New York: Recommendations for Updating New York Gas Utility Regulation.* Synapse Energy Economics for Natural Resources Defense Council.

Takahashi, K., A. Napoleon. 2020. *Synapse Comments on EfficiencyOne Performance Alignment Study - M09096.* Questions and comments regarding the EfficiencyOne Performance Alignment Study filed on April 21, 2020. Synapse Energy Economics for the Nova Scotia Utility and Review Board.

Napoleon, A., J. Kallay, K. Takahashi. 2020. *Utility Energy Efficiency and Building Electrification Portfolios Through 2025: A Brief on the New York Public Service Commission's Recent Order.* Synapse Energy Economics for the Natural Resources Defense Council.

Hopkins, A. S., K. Takahashi, Nadel, S. 2020. "Keep warm and carry on: Electrification and efficiency meet the 'polar vortex'." Proceedings of the 2020 ACEEE Summer Study of Energy Efficiency in Buildings.

Kallay, J., A. Hopkins, J. Frost, A. Napoleon, K. Takahashi, J. Slason, G. Freeman, D. Grover, B. Swanson. 2019. *Net Zero Energy Roadmap for the City of Burlington, Vermont.* Synapse Energy Economics and Resource Systems Group for Burlington Electric Department.

White, D., K. Takahashi, M. Whited, S. Kwok, D. Bhandari. 2019. *Memphis and Tennessee Valley Authority: Risk Analysis of Future TVA Rates for Memphis.* Synapse Energy Economics for Friends of the Earth.

Napoleon, A., T. Woolf, K. Takahashi, J. Kallay, B. Havumaki. 2019. *Comments in the New York Public Service Commission Case 18-M-0084: In the Matter of a Comprehensive Energy Efficiency Initiative.* Comments related to NY Utilities report regarding energy efficiency budgets and targets, collaboration, heat pump technology, and low- and moderate-income customers and requests for approval. Synapse Energy Economics on behalf of Natural Resources Defense Council.

Havumaki, B., J. Kallay, K. Takahashi, T. Woolf. 2019. *All-Electric Solid Oxide Fuel Cells as an Energy Efficiency Measure.* Synapse Energy Economics for Bloom Energy.

Takahashi, K., B. Havumaki, J. Kallay, T. Woolf. 2019. *Bloom Fuel Cells: A Cost-Effectiveness Brief.* Synapse Energy Economics for Bloom Energy.

Camp, E., B. Fagan, J. Frost, D. Glick, A. Hopkins, A. Napoleon, N. Peluso, K. Takahashi, D. White, R. Wilson, T. Woolf. (2019). *Phase 2 Report on Muskrat Falls Project Rate Mitigation: Newfoundland and Labrador Hydro Rate Mitigation Approaches: Options for Cost Savings and Revenue Opportunities through Export Market Sales, Energy Efficiency, In-Province Electrification and Rate Design Approaches After In-Service of the Muskrat Falls Project*. Synapse Energy Economics for Board of Commissioners of Public Utilities, Province of Newfoundland and Labrador.

Napoleon, A., D. Goldberg, K. Takahashi, T. Woolf. 2019. *An Assessment of Prince Edward Island Energy Corporations' 2018 - 2021 Energy Efficiency and Conservation Plan.* Synapse Energy Economics for Carr, Stevenson and MacKay as Counsel to the Island Regulatory and Appeals Commission.

Camp, E., B. Fagan, J. Frost, D. Glick, A. Hopkins, A. Napoleon, N. Peluso, K. Takahashi, D. White, R. Wilson, T. Woolf. 2018. *Phase 1 Findings on Muskrat Falls Project Rate Mitigation.* Synapse Energy Economics for Board of Commissioners of Public Utilities, Province of Newfoundland and Labrador.

Hopkins, A. S., K. Takahashi, D. Glick, M. Whited. 2018. *Decarbonization of Heating Energy Use in California Buildings: Technology, Markets, Impacts, and Policy Solutions*. Synapse Energy Economics for the Natural Resources Defense Council.

Hopkins, A. S., K. Takahashi, L. David. 2018. *Challenges and Opportunities for Deep Decarbonization through Strategic Electrification under the Utility Regulatory Structures of the Northeast*. Proceedings of the 2018 ACEEE Summer Study on Energy Efficiency in Buildings, August 12, 2018.

Hall, J., J. Kallay, A. Napoleon, K. Takahashi, M. Whited. *Locational and Temporal Value of Energy Efficiency and other DERs to Transmission and Distribution Systems*. Proceedings of the 2018 ACEEE Summer Study on Energy Efficiency in Buildings, August 12, 2018.

White, D., K. Takahashi, A. Napoleon, T. Woolf. 2018. *Value of Energy Efficiency in New York: Assessment of the Range of Benefits of Energy Efficiency Programs*. Synapse Energy Economics for Natural Resources Defense Council.

Woolf, T., A. Hopkins, M. Whited, K. Takahashi, A. Napoleon. 2018. *Review of New Brunswick Power's 2018/2019 Rate Case Application.* In the Matter of the New Brunswick Power Corporation and Section 103(1) of the Electricity Act Matter No. 375. Synapse Energy Economics for the New Brunswick Energy and Utilities Board Staff.

Hopkins, A. S., K. Takahashi. 2017. *Alternatives to Building a New Mt. Vernon Substation in Washington, DC*. Synapse Energy Economics for the District of Columbia Department of Energy and Environment.

Hopkins, A.S., A. Horowitz, P. Knight, K. Takahashi, T. Comings, P. Kreycik, N. Veilleux, J. Koo. 2017. *Northeast Regional Assessment of Strategic Electrification.* Synapse Energy Economics and Meister Consulting Group for the Northeast Energy Efficiency Partnerships.

Takahashi, K., A. Allison, D. White. 2017. *Renewable Heating and Cooling Policy Framework: Options to Advance Industry Growth and Markets in New York*. Prepared for the New York State Energy Research and Development Authority.

Sierra Club. 2017. *Sierra Club Comments on Portland General Electric Company 2016 Integrated Resource Plan*. Submitted to the Public Utility Commission of Oregon, January 24, 2017.

Cook, R., J. Koo, N. Veilleux, K. Takahashi, E. Malone, T. Comings, A. Allison, F. Barclay, L. Beer. 2017. *Rhode Island Renewable Thermal Market Development Strategy*. Meister Consultants Group and Synapse Energy Economics for Rhode Island Office of Energy Resources.

Takahashi, K, T. Woolf, J. Kallay, E. Malone, A. Napoleon, M. Whited. 2016. *Starting Energy Efficiency Off on the Right Foot–Regulatory Policies to Support Successful Program Planning and Design.* Synapse Energy Economics for Prince Edward Island Regulatory & Appeals Commission.

Woolf, T., M. Whited, P. Knight, T. Vitolo, K. Takahashi. 2016. *Show Me the Numbers: A Framework for Balanced Distributed Solar Policies*. Synapse Energy Economics for Consumers Union.

Fisher, J., P. Luckow, A. Horowitz, T. Comings, A. Allison, E.A. Stanton, S. Jackson, K. Takahashi. 2016. *Michigan Compliance Assessment for the Clean Power Plan: MPSC/MDEQ EPA 111(d) Impact Analysis*. Prepared for Michigan Public Service Commission, Michigan Department of Environmental Quality, and Michigan Agency for Energy.

Woolf, T., A. Napoleon, P. Luckow, W. Ong, K. Takahashi. 2016. *Aiming Higher: Realizing the Full Potential of Cost-Effective Energy Efficiency in New York.* Synapse Energy Economics for Natural Resources Defense Council, E4TheFuture, CLEAResult, Lime Energy, Association for Energy Affordability, and Alliance for Clean Energy New York.

Napoleon, A., K. Takahashi, J. Kallay, T. Woolf. 2016. "Evaluation, Measurement, and Verification in Virginia." Synapse Energy Economics for Clean Energy Solutions Inc., Virginia Energy Efficiency Council, and Virginia Department of Mines, Minerals and Energy.

Stanton, E. A., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. R. Santen, K. Takahashi. 2016. *The RGGI Opportunity 2.0: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate Targets.* Synapse Energy Economics for Sierra Club, Pace Energy and Climate Center, and Chesapeake Climate Action Network.

Stanton, E. A., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. R. Santen, K. Takahashi. 2016. *The RGGI Opportunity: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate Targets.* Synapse Energy Economics for Sierra Club, Pace Energy and Climate Center, and Chesapeake Climate Action Network.

Kallay, J., K. Takahashi, A. Napoleon, T. Woolf. 2015. *Fair, Abundant, and Low-Cost: A Handbook for Using Energy Efficiency in Clean Power Plan Compliance.* Synapse Energy Economics for the Energy Foundation.

Woolf, T., K. Takahashi, E. Malone, A. Napoleon, J. Kallay. 2015. *Ontario Gas Demand-Side Management 2016-2020 Plan Review.* Synapse Energy Economics for the Ontario Energy Board.

Biewald, B., J. Daniel, J. Fisher, P. Luckow, A. Napoleon, N. R. Santen, K. Takahashi. 2015. *Air Emissions Displacement by Energy Efficiency and Renewable Energy.* Synapse Energy Economics.

Takahashi, K. 2015. "Boost Appliance Efficiency Standards." Ed. John Shenot. In *Implementing EPA's Clean Power Plan: A Menu of Options.* National Associate of Clean Air Agencies.

Takahashi, K., A. Napoleon. 2015. "Pursue Behavioral Efficiency Programs." Ed. John Shenot. In *Implementing EPA's Clean Power Plan: A Menu of Options.* National Associate of Clean Air Agencies.

Takahashi, K., J. Fisher, T. Vitolo, N. R. Santen. 2015. *Review of TVA's Draft 2015 Integrated Resource Plan*. Synapse Energy Economics for Sierra Club.

Comings, T., S. Jackson, K. Takahashi. 2015. *Comments on Indianapolis Power & Light Company's 2014 Integrated Resource Plan*. Synapse Energy Economics for the Sierra Club.

Stanton, E. A., P. Knight, J. Daniel, B. Fagan, D. Hurley, J. Kallay, E. Karaca, G. Keith, E. Malone, W. Ong, P. Peterson, L. Silvestrini, K. Takahashi, R. Wilson. 2015. *Massachusetts Low Gas Demand Analysis: Final Report.* Synapse Energy Economics for the Massachusetts Department of Energy Resources.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Calculating Alabama's 111(d) Target*. Synapse Energy Economics for the Southern Environmental Law Center.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Calculating Georgia's 111(d) Target*. Synapse Energy Economics for the Southern Environmental Law Center.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Alternate Scenarios for 111(d) Implementation in North Carolina*. Synapse Energy Economics for the Southern Environmental Law Center.

Stanton, E. A., P. Knight, J. Daniel, B. Fagan, D. Hurley, J. Kallay, G. Keith, E. Malone, P. Peterson, L. Silverstrini, K. Takahashi. 2014. *Feasibility Study for Low Gas Demand Analysis.* Synapse Energy Economics for the Massachusetts Department of Energy Resources.

Takahashi, K., T. Comings, A. Napoleon. 2014. *Maximizing Public Benefit through Energy Efficiency Investments.* Synapse Energy Economics for Sierra Club.

Vitolo, T., J. Fisher, K. Takahashi. 2014. *TVA's Use of Dispatchability Metrics in Its Scorecard.* Synapse Energy Economics for Sierra Club.

Comings, T., S. Fields, K. Takahashi, G. Keith. 2014. *Employment Effects of Clean Energy Investments in Montana.* Synapse Energy Economics for Montana Environmental Information Center and Sierra Club.

Keith, G., S. Jackson, J. Daniel, K. Takahashi. 2014. *Idaho's Electricity Sources: Current Sources and Future Potential.* Synapse Energy Economics for the Idaho Conservation League.

Malone, E. T. Woolf, K. Takahashi, S. Fields. 2013. "Appendix D: Energy Efficiency Cost-Effectiveness Tests." *Readying Michigan to Make Good Energy Decisions: Energy Efficiency*. Synapse Energy Economics for the Council of Michigan Foundations.

Takahashi, K. et al. 2013. *Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in U.S. Cities*. Proceeding of the 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'13), September 12, 2013.

Comings, T., K. Takahashi, G. Keith. 2013. *Employment Effects of Investing in Select Electricity Resources in Washington State.* Synapse Energy Economics for Sierra Club.

Woolf, T., E. Malone, J. Kallay, K. Takahashi. 2013. *Energy Efficiency Cost-Effectiveness Screening in the Northeast and Mid-Atlantic States.* Synapse Energy Economics for Northeast Energy Efficiency Partnerships, Inc. (NEEP).

Stanton, E. A., T. Comings, K. Takahashi, P. Knight, T. Vitolo, E. Hausman. 2013. *Economic Impacts of the NRDC Carbon Standard.* Synapse Energy Economics for the Natural Resources Defense Council (NRDC).

Woolf, T., W. Steinhurst, E. Malone, K. Takahashi. 2012. *Energy Efficiency Cost-Effectiveness Screening: How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs.* Synapse Energy Economics for Regulatory Assistance Project and Vermont Housing Conservation Board.

Woolf, T., M. Whited, T. Vitolo, K. Takahashi, D. White. 2012. *Indian Point Energy Center Replacement Analysis: A Plan for Replacing the Nuclear Plant with Clean, Sustainable, Energy Resources.* Synapse Energy Economics for National Resources Defense Council and Riverkeeper.

Keith, G., T. Woolf, K. Takahashi. 2012. *A Clean Electricity Vision for Long Island: Supplying 100% of Long Island's Electricity Needs with Renewable Power.* Synapse Energy Economics for Renewable Energy Long Island.

Fisher, J., K. Takahashi. 2012. *TVA Coal in Crisis: Using Energy Efficiency to Replace TVA's Highly Non-Economic Coal Units*. Synapse Energy Economics for Sierra Club.

Woolf, T., E. Malone, K. Takahashi, W. Steinhurst. 2012. *Best Practices in Energy Efficiency Program Screening: How to Ensure that the Value of Energy Efficiency is Properly Accounted For*. Synapse Energy Economics for National Home Performance Council.

Takahashi, K., W. Steinhurst. 2012. A Preliminary Analysis of Energy Impacts from Partial Deep Energy Retrofit Projects in National Grid's Jurisdiction. Synapse Energy Economics for National Grid, USA.

Synapse Energy Economics. 2012. *Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in US Cities.* Prepared for a HVAC manufacture company.

Hornby, R., D. White, T. Vitolo, T. Comings, K. Takahashi. 2012. *Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky*. Synapse Energy Economics for Mountain Association for Community Economic Development and The Kentucky Sustainable Energy Alliance.

Keith, G., B. Biewald, E. Hausman, K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2011. *Toward a Sustainable Future for the US Power Sector: Beyond Business as Usual 2011.* Synapse Energy Economics for Civil Society Institute.

Synapse Energy Economics. 2011. *Electricity Scenario Analysis for the Vermont Comprehensive Energy Plan 2011.* Prepared for Vermont Department of Public Service.

Bourgeois, T., D. Hall, W. Steinhurst, K. Takahashi. 2011. *Deployment of Distributed Generation for Grid Support and Distribution System Infrastructure: A Summary Analysis of DG Benefits and Case Studies*. Pace Energy and Climate Center and Synapse Energy Economics for New York State Energy Research and Development Authority (NYSERDA).

Peterson, P., V. Sabodash, K. Takahashi. 2010. *Demand Side Resource Potential: A Review of Global Energy Partners' Report for Midwest ISO.* Synapse Energy Economics for Project for Sustainable FERC Energy Policy.

Keith, G., B. Biewald, E. Hausman, K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2010. *Beyond Business as Usual: Investigating a Future Without Coal and Nuclear Power in the US.* Synapse Energy Economics for Civil Society Institute.

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James, C., K. Takahashi, W. Steinhurst. 2009. *North Dakota Energy Efficiency Potential Study Report.* Synapse Energy Economics for Plains Justice.

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Hornby, R., C. Salamone, S. Perry, D. White, K. Takahashi. 2008. *Advanced Metering Infrastructure-Implications for Residential Customers in New Jersey*. Synapse Energy Economics for New Jersey Division of the Ratepayer Advocate.

Hornby, R., C. James, K. Takahashi, D. White. 2008. *Increasing Demand Response in Maine.* Synapse Energy Economics for the Maine Public Utilities Commission.

Hausman, E., R. Fagan, D. White, K. Takahashi, A. Napoleon. 2007. *LMP Electricity Markets: Market Operations, Market Power, and Value for Consumer.* Synapse Energy Economics for the American Public Power Association.

Zalcman, F., K. Takahashi, G. Keith, W. Steinhurst. 2006. *A Comprehensive Process Evaluation of Early Experience under New York's Pilot Program for Integration of Distributed Generation in Utility System Planning.* Synapse Energy Economics and Pace Law School Energy Project for New York State Energy Research and Development Authority (NYSERDA).

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Steinhurst, W., A. Napoleon, K. Takahashi. 2006. *Energy in the Northern Forest Region: A Situation Analysis*. Synapse Energy Economics for Northern Forest Center and The North Country Council.

Synapse Energy Economics. *Ensuring Delaware's Energy Future: A Response to Executive Order Number 82*. Technical assistance for Delaware Cabinet Committee on Energy.

Hausman, E., K. Takahashi, D. Schlissel, B. Biewald. 2006. *The Proposed Broadwater LNG Import Terminal - An Analysis and Assessment of Alternatives*. Prepared for Connecticut Fund for the Environment and Save the Sound.

Synapse Energy Economics. 2006. *The Glebe Mountain Wind Energy Project: Assessment of Project Benefits for Vermont and the New England Region*. Prepared for Glebe Mountain Wind Energy, LLC.

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Johnston, L., K. Takahashi, F. Weston, and C. Murray. 2005. *Rate Structures for Customers with Onsite Generation: Practice and Innovation*. Synapse Energy Economics and Regulatory Assistance Projects for National Renewable Energy Laboratory.

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- Energy Measure Verification Workshop (sponsored by Massachusetts Department of Energy Resources), September 2013.
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Resume updated January 2022

Appendix B: NMGC 2023-2025 EEP Benefit-Cost Model

Please find an electronic version only (in Excel) attached.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE APPLICATION OF NEW MEXICO GAS COMPANY, INC. FOR APPROVAL OF ITS 2023-2025 ENERGY EFFICIENCY PROGRAM PURSUANT TO THE NEW MEXICO PUBLIC UTILITY AND ENERGY EFFICIENCY ACTS	))))))	**Case No. 22-00232-UT**

CERTIFICATE OF SERVICE

I CERTIFY that on this date I sent, via email to the parties and individuals listed below, a true and correct copy of the **OAG's Direct Testimony:**

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