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Comments on Fuel Substitution Analysis Tool and Concerns that it Does Not Account for All Lifecycle Costs

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Additional submitted attachment is included below.

Mitsubishi Electric Comments on the Fuel Substitution Scenario Analysis Tool and Concerns that it Does Not Account for All Life-cycle Costs and Climate Impacts.

Submitted by Bruce Severance, Regulatory Compliance Engineer, March 13, 2020

INTRODUCTION

Mitsubishi Electric appreciates the Commission's efforts to mitigate the impacts of buildings on climate change and recognizes the importance of rapid mobilization strategies that produce measurable reductions in GHGs over the next thirty years as well as a broader transform California's economy to carbon free and carbon negative alternatives. On issues of climate mitigation strategies Mitsubishi Electric is an outspoken advocate. In June 2019, Mitsubishi Electric published "Environmental Sustainability Vision 2050" to clarify the company's stance on addressing long-term environmental issues. This corporate vision asserts that "The Mitsubishi Electric Group shall utilize diverse technological assets throughout wide-ranging business areas to solve various environmental issues, including climate change…" Mitsubishi Electric regards climate mitigation a primary mission and service to our customers, and in furtherance of the goals of the Paris Accords, we believe the climate science and consider it a moral responsibility to be reliable and consistent partners in the global climate mitigation efforts.

Although electrification of buildings is widely accepted as a lower carbon alternative to continued reliance on natural gas for heating, we also understand and embrace the social justice issues: the need to accurately assess the cost of fuel switching and the actual environmental benefits. For this reason we support the overall goal of having a Fuel Substitution Scenario Analysis Tool and appreciate the value of having such a tool for long term planning and policy making. However, it is critical that this tool encompass and include *all life-cycle cost impacts and carbon externalities* in order to assure an accurate long term assessment of GHG emissions and the corresponding policy impacts. It is also important to all parties that consumer cost estimates are accurate and appropriately peer reviewed by more than one impartial party. Contractor installation costs vary widely across the state as do actual energy savings to the consumer relative to climate zone variables. Finally, the need for improved contractor training and improved EPA 608 compliance should be assumed and integrated into the projected GHG reduction over time. Currently, there are

relatively poor recycling and reclamation practices nationally, and the early introduction of A2L*1 refrigerants in California in 2023 represents an opportunity for across-the-board advanced HVAC contractor training that should include improved quality installation practices to reduce system leaks as well as enhanced EPA 608 practices to reduce refrigerant leaks at time of service.

UNFACTORED LIFE-CYCLE COSTS

From the variables laid out in the February 27th GuideHouse presentation to the Commission on the Fuel Substitution Scenario Analysis Tool (TN#232239-2020022), it appears that methane leakage is only factored downstream from the meter, although there is significant leakage at these points in the gas infrastructure system, it entirely omits the impacts of point sources the Energy Commission has deemed to be "super-emitters" which we believe contribute far more significantly to climate change that current refrigerant emissions. Furthermore, the HVAC industry is largely embracing the need to reduce the GWP of refrigerants while the gas extraction industry and some distributors have largely resisted monitoring and repairing leaks and have embraced the Trump Administration's deregulation of this sector.

In September of 2019, AHRI, the manufacturers association and a number of AHRI member companies signed onto a memorandum of understanding that the industry would try to work toward a 2023 implementation of the <750GWP standard. Not all AHRI members signed up for this commitment in part because it is painfully challenging. Not only is the product development cycle challenging, the process will involve the kind of shift in technology that occur every two or three decades. Despite costly and challenging product development, we believe the HVAC industry as a whole is moving rapidly in this direction and that it is critical for them to do so to meet regulatory requirements as well as increased consumer demand for greener alternatives.

Where is the corresponding effort on the part of the fossil fuel industry to reduce their methane emissions and refining emissions and other climate impacts? In 2021, the Environmental Defense Fund (EDF) is scheduled to launch its methane satellite that will be able to pinpoint the size and location of methane leaks all over the globe. With this new technology, we will have a "bird's-eye" perspective and more complete data on the extent to which the gas extraction industry as well as the

gas distribution infrastructure needs to be reinvented. It is time for these climate impacts to be fully factored.

The Comparative Readiness of Electrification Strategies Versus Hydrogen and RNG

It is critical the Fuel Substitution Scenario Analysis Tool fully factor not only externalities, but also actual projected cost of alternative fuels development such as renewable natural gas (RNG) and hydrogen, both of which may play a significant role in the state's decarbonization strategies, but which have attracted comparatively lower levels of investment on the part of the fossil fuel industry as a whole. By contrast, low-GWP technologies for electrification of HVAC and hot water systems are going to be turnkey within 3 years. For this reason, it is critical that long term projections of decarbonization scenarios include accurate and realistic projections of the cost of alternative fuel technology development and their infrastructure costs, which inevitably result in increased NG fuel costs in the near term. The current state of low-cost NG supplies is based upon a boom in so-called "fracking" technologies, at the expense of shallow investment in long-term low-carbon alternatives. Similarly, any projected decarbonization scenarios that rely on RNG to supply more than 20% of the projected 2030 or 2050 gas demand, should also factor additional CO2 emissions and costs required to transport RNG compost materials from outside of California. Obviously, the further these bulky raw materials are transported, the net CO2 benefits diminish proportionally.

Although corporate secrecy is a necessary part of any business when it comes to product design, there is no doubt that many, if not all, HVAC manufacturers are engaged in aggressive product development to address concerns around high GWP refrigerants. Given CARB's stated timelines, the need for prudent business planning, and the drive to remain competitive requires this. The refrigerant chemical companies are also aggressively working on lower GWP alternatives. There is a sort of Marshal Plan being implemented. And there is also no question that national and international stakeholders are already developing codes and standards to implement CARB's 2023 <750GWP targets. There is some question as to whether all manufacturers and their suppliers will be ready to meet the 2023 timeline, and only time will tell, but it is very clear that the wheels of industry and standards development at multiple levels are already in motion. The HVAC and water heating industries are likely to "hit the ground running" with advanced heat pump technologies.

The objectives laid out by SB350 call for decarbonization of the California economy by 2050 and Governor Brown's executive order pushed that goal up to 2045. If we assume that decarbonization in practical terms means electrification of the residential market, (and perhaps some industrial segments), conversion of 10 million homes in 25 years translates into 400,000 homes per year, a truly monumental objective. We assume that residential electrification will be the only viable decarbonization alternative because the hydrogen and RNG (renewable natural gas) alternatives proposed by gas advocates do not seem to be economically viable as long as there is limited investment and no economies of scale. We believe that the strategy for keeping utility rates low and balancing supply and demand on the grid in the process must include a cost-effective alternative to solar, namely offshore wind as an alternative to solar plus utility scale batteries, and hopefully with a hydrogen infrastructure to support storage. Utility scale batteries have their own lifecycle impacts unless alternatives to lithium technology are developed for stationary applications. Given the status of these many technologies that play into the climate change solution, we see electrification of the residential market to be an inevitable part of the solution.

Most independent researchers agree that electrification of the residential market is the only practical way to decarbonize that segment of the building stock. This is because the hydrogen and RNG alternatives presented by gas industry advocates do not appear to be attracting investment, and consequently, may be decades away. Renewable natural gas (RNG) is a promising technology, and statewide production targets should be established. But the economics of this alternative seem less promising. George Minter of SoCal Gas has presented publicly at a joint CEC-CPUC event in 2018 that there is only sufficient biomass in California to provide about 25% of the RNG gas demand in 2050 even after factoring improvements in efficiency. His solution was to import biomass from neighboring states, which increases the carbon footprint due to transport, and deprives our neighboring states of their own biomass supply. Hydrogen from power to gas electrolysis is also proposed as a viable solution and it may be. SoCal Gas has committed to a prototype development project with UC Irvine in an effort to fulfill their promise to be the "greenest gas company in the U.S.". We support such efforts and feel they deserve a level of government support provided they produce tangible results.

However, the current economic forecasts put the cost of that hydrogen at about five times the cost of electrification alternatives, and the fossil fuel industry has not invested heavily in this alternative.

There are also serious questions about the safety of injecting hydrogen, a very "thin" molecule, into the aging gas infrastructure as a blend with NG or RNG, as this will be likely to promote greater leakage and there is cause for safety concerns given prior accidents. There has been very little scientific or regulatory discourse on these points. From these concerns, there is a general consensus among objective, and independent researchers that hydrogen should it become more cost effective, should be reserved for high-heat industrial processes and heavy transport such as trucking and aviation, which will require new investment in those distribution infrastructures. There is some need for gas interests to both invest more heavily in these alternative technology development programs, as well as clearly asses the shifting demands, opportunities and the logical progression of market transformation with a degree of flexibility. It is highly likely that gas suppliers will find their greatest opportunities for business growth in these industrial and transportation sectors.

It is also critical that any Fuel Substitution Scenario Analysis Tool factor the demand from these competing market segments into their long term scenario projections. If the gas industry is motivated and successful in using the prosperity of today to build the bridge to better tomorrow, the higher near term costs of RNG and hydrogen production will be likely to shift demand to the high-heat industrial applications and heavy transport segments that will require such fuels. As economies of scale allow hydrogen to apply to broader markets, it is more likely to first be used as a storage medium at electrical generation plants before it is injected into the residential gas pipeline infrastructure. Again, it is our hope the hydrogen will become an essential component of the decarbonization strategy and that it achieves broad success, but we nevertheless believe there is a logical order to the manner in which it will be distributed to meet the demands of emerging markets. These factors must be fully considered and integrated into the Fuel Substitution Scenario Analysis Tool.

The Comparative Life-Cycle Impacts of Near Term Methane and HFC Leaks

For those who would argue that the current generation of refrigerants cause greater degradation to the climate crisis than gas heating alternatives we would counter with these important points:

1) We would agree with NRDC's cited evidence that fugitive refrigerant leaks on packaged systems have about 10% of the lifecycle impacts of their gas equipment counterparts. Our

own research indicates lower lifecycle impacts. We also agree that given the HVAC industry's near term commitment to lower GWP refrigerants, these lifecycle impacts are going to continue to go down.

2) Environmental Defense Fund (EDF) has recently estimated that fugitive methane leaks from well sites and the gas pipeline infrastructure is as high 60% higher nationally than previously reported to the USEPA.*[2] The International Energy Agency (IEA) estimates the gas industry can cut worldwide emissions by 75% in the near term—and that up to two-thirds of those reductions can be realized at zero net cost because costs are balanced by increased production and profits.*[3]
3) In 2015 a CPUC report*[4] confirmed with "greater accuracy than ever before"*[5] that California natural gas utilities are letting "huge amounts of their product escape into the atmosphere – about 6.6 billion cubic feet in 2015", a total higher than the previous year's Aliso Canyon Disaster.*[5]
4) If this is the case, these methane leaks, with a short term GWP of 85, are a far greater concern than refrigerants, and their recovery is offset by increased profits.*[6] The launch of EDF's methane satellite in 2021 will confirm fugitive methane emissions with high accuracy.
5) By contrast, the HVAC industry is already moving quickly to phase-in lower GWP refrigerants by 2023 and significant investment in these planet saving alternatives are already being made. One must ask, where is the corresponding level of investment from the fossil fuel industry in hydrogen and RNG? To date there is little published about how serious their planning and commitment to these alternative technologies may actually be.*[7]

The Projected Cost of Climate Externalities on California Households

There is an underlying awareness among stakeholders of the potential climate impacts to Californians, but there has yet to be a clear and comprehensive assessment by independent research agencies on these projected costs to California households. Avoided climate impact costs are not insignificant, as we have learned from recent fires, and loss of human life. The National Climate Assessment 4 released in 2018 included for the first time a state by state climate impact assessment, and the projected picture for California is dark: a 90% reduction in agricultural productivity by 2100, rising sea levels, damage to ports, bridges and other transport infrastructures, loss of property

due to flooding and fires. On the basis of this data we have *conservatively* calculated the associated increase in cost of housing, insurance and cost of living across multiple categories for consumers to be in the range of $4000 per year by the 2040 time period*[8] (See Climate Impact Costs to California Households also submitted to this docket on 3-13-20). Although we recognize that this assessment of impacts to California households needs to be thoroughly peer-reviewed, if not independently conducted by disinvested agencies, all of these costs and the corollary consumer protection considerations appear to be excluded from the near and long term cost trade-off variables included in the Fuel Substitution Scenario Analysis Tool, and the implications of this omission are significant. Future policy by the CEC and the CPUC are very likely going to be shaped, or at least influenced by this modeling tool. If such externalities are omitted from an assessment of net present value to California households, policy will tilt in favor of gas industry solutions that do not currently offer zero-carbon alternatives.

Policy Impacts of an Inaccurate Scenario Analysis Tool and Recommendations

Given the above background, we would propose the Fuel Substitution Scenario Analysis Tool may offer an inaccurate projection of both societal and consumer benefits unless it fully integrates both the cost of consumer climate impacts as well as both short term and long term GWP impacts of methane extraction, refining and distribution. It is also essential to assess the "decarbonization readiness" of the competing industrial interests. The consequence of inaccuracy or omission of any of these categories is more than significant. It can misdirect policy makers toward partial solutions, and redirect incentives and government support for the most promising alternatives during the very critical 20 year period in which climate scientists agree we must turn the direction of our industrial development and past reliance on carbon-based fuels on a dime. The future of our economy and quality of life depend upon our success in accomplishing these very monumental tasks. Accurate modeling and projection of scenarios and business planning has never been more critical to the future of the planet. And we believe that what is accomplished in California, almost definitively becomes the model of what is done elsewhere. It is critical to get this right, and for this reason we make the following recommendations:

1) Factor the GHG impacts of all methane leaks industry wide and including gas extraction, flaring practices, storage facility leaks (such as Aliso Canyon) and all "super-emitter" sites.

2) Factor gas refining CO2 impacts and gas line pressurization energy just as you factor emissions at generation plants.
3) Factor HVAC industry commitments to near term GWP reduction and project a schedule of continued market penetration of these lower GWP alternatives for both HVAC and water heating.
4) Factor the decarbonization-readiness of the competing industrial interests and base future market transformation on the level of investment committed by the competing electrification and gas interests toward decarbonization technologies.
5) Factor an "advanced training" requirement for participating HVAC contractors that will be necessitated by the introduction of A2L refrigerants and increase quality installation and reduce industry-wide leakage over the coming ten years.
6) Factor improved EPA 608 training and reduced refrigerant leakage over time that will result from advanced training necessitated by the introduction of A2L refrigerants.
7) Factor improved delivered efficiency of HVAC and refrigeration systems. In the case of residential HVAC, there can and should be a 30% to 40% increase in system efficiency due to better system sizing, proper duct design and improved commissioning methods. NIST and ACEEE studies show that there is significant room for improved contractor QI practices nationally and that on average installed system efficiency is only 56% to 58% of the rated equipment efficiency due primarily to duct and refrigerant leaks.*[9]
8) Factor regional differences in HVAC contractor burdened labor rates and system replacement costs.
9) Finally, it is essential that the cost of climate impacts on California Households be full factored, even if very conservatively, but based on independent science that has been peer-reviewed by non-industry interests, such as research from EDF, NRDC, UCS, the IPCC and the National Climate Assessment (NCA4).

In conclusion, we would emphasize our support of accurate industry and climate impacts on California households. Accurate assessment of externalities and consumer cost analyses are critical to be able to focus and direct policy to decarbonize the California economy with minimal hardship, and no additional cost to the consumer.

In our assessment, the cost of replacing a traditional gas furnace with a split DX system is equal and energy savings are highest in high-cooling load climates, so any strategy to electrify the residential market should focus where the consumer benefits are greatest, so that there is a significant ROI and high levels of consumer satisfaction.

Thank you for the opportunity to comment on this critical policy issue.

Respectfully submitted,

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FOOTNOTES:

*1 A2L refrigerants are <750GWP mildly flammable replacements for current generation of HFC refrigerants (Category A1)

*2 Assessment of Methane Gas Emissions from the US Oil and Gas Supply Chain, *Science* 13 Jul 2018: Vol. 361, Issue 6398, pp. 186-188, DOI: 10.1126/science.aar7204 Link: https://science.sciencemag.org/content/361/6398/186

*3 New Study Finds U.S. Oil and Gas Methane Emissions Are 60 Percent Higher Than EPA Reports, EDF Newsletter, June 21, 2018 Link: https://www.edf.org/media/new-study-finds-us-oil-and-gas-methane-emissions-are-60-percent-higher-epa-reports-0

*4 Order Instituting Rulemaking to Adopt Rules and Procedures Governing Commission-Regulated Natural Gas Pipelines and Facilities to Reduce Natural Gas Leakage Consistent with Senate Bill 1371, CPUC Rulemaking 15-01-008, Filed January 15, 2015, Link: http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M172/K518/172518969.PDF

*5 REPORT: CA Utilities Are Leaking Lots of Gas – but There's a Way to Stop It, EDF Newsletter, Amanda Johnson, March 1, 2017, Link: http://blogs.edf.org/energyexchange/2017/03/01/report-ca-utilities-are-leaking-lots-of-gas-but-theres-a-way-to-stop-it/

*6 Untapped Potential: Reducing Global Methane Emissions from Oil and Natural Gas Systems, Rhodium Group, Kate Larsen, Michael Delgado and Peter Marsters, April 2015, Link: https://rhg.com/research/untapped-potential-reducing-global-methane-emissions-from-oil-and-natural-gas-systems/

*7 Oil companies are thinking about a low-carbon future, but aren't making big investments in it yet, by Lewis Fulton, University of California, Davis and Daniel Sperling, University of California, Davis, Dec. 2019, (https://green-technology.org/magazinenews/oil-companies-are-thinking-about-a-low-carbon-future)

*8 Climate Change Cost Impacts no California Households, Comments submitted to the CEC and CPUC based on NCA4, UCS research, and many other independent sources, by Bruce Severance for Mitsubishi Electric, January 2019, Submitted to both CEC Docket #19-IEPR-06 and CPUC Docket #R.19-01-011 on Aug. 8, 2019

*9 Sensitivity Analysis of Installation Faults on Heat Pump Performance, NIST Technical Note 1848, Piotr A. Domanski, Hugh I. Henderson and W. Vance Payne, September 2014. Link: https://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1848.pdf