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21-05002

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Southwest Gas Corporation

SOUTHWEST GAS CORPORATION

November 12, 2021

Ms. Trisha Osborne
Assistant Commission Secretary
Public Utilities Commission of Nevada
1150 East William Street
Carson City, NV 89701-3109

Re: Docket No. 21-05002
Investigation Regarding Long-Term Planning for Natural Gas Utility Service in Nevada.

Dear Ms. Osborne:

Please accept for filing Reply Comments filed on behalf of Southwest Gas Corporation in the above-referenced docket.

Should you have any questions regarding this filing, please contact me at (702) 876-7045.

Respectfully submitted,

ShaLinda Creer
Regulation & Litigation

Enclosure

cc: Parties of Record

8360 S. Durango / Las Vegas, NV 89113
P.O. Box 98510 / Las Vegas, NV 89193-8510 / 702-364-3312
www.swgas.com

Catherine M. Mazzeo, Esq.
Nevada Bar No. 8179
Catherine.Mazzeo@swgas.com
Anthony R. Sassi, Esq.
Nevada Bar No. 12486
Anthony.Sassi@swgas.com
8360 South Durango Drive
Las Vegas, NV 89113
Telephone No. 702.364.3357
Facsimile No. 702.364.3446
Attorneys for Southwest Gas Corporation

BEFORE THE PUBLIC UTILITIES COMMISSION OF NEVADA

Investigation Regarding Long-Term Planning for Natural Gas Utility Service in Nevada	Docket No.: 21-05002

SOUTHWEST GAS CORPORATION'S PHASE 1 REPLY COMMENTS

Southwest Gas Corporation (Southwest Gas or Company) hereby provides the attached Phase 1 reply comments pursuant to the Procedural Order issued by the Public Utilities Commission of Nevada (Commission). Southwest Gas appreciates the continued opportunity to share information and further the dialogue as to the critical role natural gas plays in helping Nevada achieve its climate change and greenhouse gas (GHG) emission reduction goals.

Respectfully submitted this 12th day of November 2021.

SOUTHWEST GAS CORPORATION

Catherine M. Mazzeo
Nevada Bar No. 8179
Anthony R. Sassi
Nevada Bar No. 12486
8360 South Durango Drive
Las Vegas, NV 89113
Attorneys for Southwest Gas Corporation

CERTIFICATE OF SERVICE

I hereby certify that on the 12th day of November, 2021 and pursuant to NAC 703.610 of the rules and regulations of the Public Utilities Commission of Nevada, I caused to be served a copy of the foregoing SOUTHWEST GAS CORPORATION'S PHASE 1 REPLY COMMENTS by electronic mail, properly addressed, to the following:

Jesse Panoff, Assistant Staff Counsel
Public Utilities Commission of Nevada
1150 E. Williams Street
Carson City, NV 89701

Public Utilities Commission of Nevada
9075 W. Diablo Drive, Suite 250
Las Vegas, Nevada 89148

jpanoff@puc.nv.gov
pucn.sc@puc.nv.gov

Michael Saunders, Esq.
Bureau of Consumer Protection
100 N. Carson Street
Carson City, NV 89701

Bureau of Consumer Protection
8945 W. Russell Road, Suite 204
Las Vegas. NV 89148

msaunders@ag.nv.gov
bcpserv@ag.nv.gov

NV Energy
Michael Knox
6100 Neil Road
Reno, NV 89511
michael.knox@nvenergy.com

Advanced Energy Economy
Sarah Steinberg
1010 Vermont Ave NW, Suite 1050
Washington D.C. 20050
ssteinberg@aee.net
lrubinshen@aee.net

Rocky Mountain Institute
Rachel Golden
2490 Junction Pl., #200
Boulder, CO 80301
rgolden@rmi.org
sbillimoria@rmi.org
aalter@rmi.org

CHR
Matt Vespa
50 California St., Suite 500
San Francisco, CA 94111
mvespa@earthjustice.org
mdegasperi@earthjustice.org
aluna@earthjustice.org

Conservation Advocates
David Jenkins
PO Box 613
Oakton, VA 22124
djenkins@conservativestewards.org

CRS
Cameron Dyer
550 W. Musser St., Suite 1
Carson City, NV 89703
cameron.dyer@westernresources.org

Served via United States Mail:

Mormon Women for Ethical Government
Paulette Stauffer Henriod
10779 Hobbiton Ave.
Las Vegas, NV 89135

Pollution Free Nevada
8540 S. Eastern Ave., Suite 200
Las Vegas, NV 89123

Chispa Nevada
Rudy Zamora
2275 C Renaissance Dr.
Las Vegas, NV 89119

Ceres
Jennifer Helfrich
369 Pine St., Suite 620
San Francisco, CA 94104

an employee of Southwest Gas Corporation

I. INTRODUCTION

For as opposed as the views may be on how best to reduce GHG emissions in Nevada, the responses to the Commission's questions in Phase One also reveal a significant amount of agreement amongst the interested parties. The responding parties generally agree that reducing GHG emissions is a critical objective and that cleaner energy resources will be the key to lowering emissions. They also agree that more research and investment is necessary to develop those clean energy technologies. Finally, they acknowledge that there are barriers, both now and in the future, that the State will need to overcome to decarbonize Nevada's energy systems.[1]

The differences between the opening comments from the local regulated utilities and the various single outcome focused advocacy groups, most of whom are from out of state, (collectively the Advocacy Groups) stem from a philosophical difference on how best to approach reducing GHG emissions and, perhaps, the purpose of this docket. For several of the Advocacy Groups, their analytic approach is to start with a conclusion and then work backwards to identify the challenges their preferred solution presents. Their starting point – their conclusion – is the belief that the direct-use of natural gas should be eliminated and building electrification is the sole path to reducing GHG emissions to near-zero levels in 2050, effectively ignoring the remaining economy-wide emission reduction challenges that remain.[2] They attempt to justify their conclusions through faulty assumptions and unsupported

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[1] *See e.g.*, Advanced Energy Economy Phase 1 Opening Comments [hereinafter Advanced Energy Economy] at 4

[2] *See Id.* at 2; Conservation Advocates Phase 1 Opening Comments [hereinafter Conservation Advocates] at 2; Pollution Free Nevada Phase 1 Opening Comments [hereinafter Pollution Free Nevada] at 1-2; Mormon Women for Ethical Government Phase 1 Opening Comments [hereinafter Mormon Women for Ethical Government] at 1; Ceres Phase 1 Opening Comments [hereinafter Ceres] at 2; Rocky Mountain Institute Phase 1 Opening Comments [hereinafter RMI] at 1.

conclusions, including that gas technology will not advance or that natural gas prices will soar in the future.[3]

Having definitively determined their ultimate destination, the Advocacy Groups pencil out the path to reach that point and identify some of the roadblocks and potholes on the journey that the Commission and the state will need to avoid. However, they offer very little in the way of reasonable, affordable solutions to overcoming those barriers. Among the challenges they identify are the cost of the transition, the need for significant infrastructure changes, technological advancement to replace natural gas effectively and efficiently, and, not the least of which, overcoming consumer preference for natural gas.[4] It appears they view this docket as an opportunity to declare Nevada's energy policy – something which neither the Legislature nor the Governor have done – and to begin discussing the challenges associated with implementing that policy,[5] including the cost of dramatic overhauls to Nevada's energy delivery infrastructures and Nevadans' end-use appliances.[6]

In contrast, Southwest Gas believes this docket is an opportunity to create a regulatory environment that encourages advancements in clean fuel technology and that supports economy-wide emissions reductions, while also placing equal importance on cost, reliability, and customer choice. The innovations that emerge from an inclusive, rather than exclusive, environment will dictate the best course to proceed and the solutions that are best for Nevadans. Any decisions the Commission does make aimed at reducing GHG emissions should remain technology neutral, i.e., not favoring one technology over another. Doing so maximizes the pathways to clean energy and increases the likelihood of reaching economy-

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[3] *See* Conservation Advocates at 2, 10-11, 79; Advanced Energy Economy at 6-8; Ceres at 2; CHR, Inc. Phase 1 Opening Comments [hereinafter CHR, Inc.] at 2, 10-13.
[4] Consumer Advocates at 22.
[5] Advanced Energy Economy at 5; Pollution Free Nevada at 1-2; Ceres at 4; RMI at 1.
[6] *See* Conservation Advocates at 36; Advanced Energy Economy at 2-3, 12.

wide near-zero emissions. This docket also presents an opportunity to discuss and address some of the regulatory hurdles that may impede technological advancement. For example, the cost effectiveness tests used to evaluate potential energy efficiency projects should be modified to factor in the broader environmental benefits of investing in these initiatives. Southwest Gas respectfully suggests that this docket ultimately is an opportunity to discuss the regulatory framework necessary to allow utilities to explore potential pathways to reducing economy-wide emissions and to smoothly integrate those innovations as they become viable.

II. REPLY COMMENTS

A. Nevada Has Not Declared Any Energy Policies or Chosen a Path to Decarbonization.

Most, if not all, of the Advocacy Groups point to the 2020 Nevada Climate Strategy (Strategy) to incorrectly intimate, or even outright claim, that Nevada's climate policy requires transitioning away from natural gas.[7] While the Strategy suggests transitioning away from natural gas as one path to reduce GHG emissions, it stops far short of declaring this the policy of the State or concluding that transitioning away from natural gas is the only way to achieve near-zero levels of GHG emissions by 2050. To the contrary, the Strategy goes to great lengths to make clear that it is not making any policy declarations or even suggesting the best path to decarbonizing. The Strategy states, repeatedly, that it is only intended to be an analytic tool to aid policy makers in the future.[8] It is intended to demonstrate to policy makers how they might analyze potential paths to decarbonization. The Nevada Climate Initiative developed the analytic framework and then put it to use in the Strategy to review some, but not all, of the potential paths to decarbonization.[9]

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[7] RMI at 3 (calling the Strategy "Nevada's own Climate Plan"); Conservation Advocates at 2.
[8] *See e.g.*, 2020 Nevada Climate Strategy at 1, 5, 9, 12, 14, 15, 51, 52.
[9] *Id.* at 52.

Members of the Climate Initiative Leadership Team, who were responsible for drafting the Strategy, have echoed and re-enforced that the Strategy does not dictate policy to the Legislature, local governments, or state regulators.[10] They reaffirm that the purpose of the Strategy is to evaluate "a suite of different policies … that *could* be implemented in our state."[11] Kristen Averyt, the State's Climate Policy Coordinator and a member of the leadership team,[12] confirmed that "[t]he Strategy did not make specific recommendations about policies that should or should not be implemented."[13] The Strategy makes "suggestions," but those suggestions do not hold the force of law.[14] She also emphasized that the Strategy is not designed to tell people what to do or not do nor does the Strategy even recommend any specific steps.[15]

To that end, the Legislature considered a few of the policies outlined in the Strategy in the 2021 Legislative Session. One of these proposed policies that would have set the state on the path of transitioning away from residential and commercial use of natural gas was repudiated by the Legislature, providing further clarification that the Legislature is responsible for deciding which policies in the Strategy to implement and which ones to reject.[16]

The Strategy, and its drafters, also recognize that there are more pathways that have yet to be examined. The Strategy contemplated 17 possible policies to reduce emissions in

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[10] *See* Nevada Independent, *Nevada climate strategy outlines framework to phase out natural gas, electrify transportation*, December 7, 2020. https://thenevadaindependent.com/article/nevada-climate-strategy-outlines-framework-to-phase-out-natural-gas-electrify-transportation

[11] KNPR, *Nevada Outlines Strategy to Combat Climate Change*, December 4, 2020. https://knpr.org/knpr/2020-12/nevada-outlines-strategy-combat-climate-change

[12] On November 9, 2021, Governor Sisolak named Ms. Averyt the State's Senior Climate Advisor

[13] Prepared testimony of Kristen Averyt on Assembly Bill 349, before the Assembly Grown and Infrastructure Committee, March 30, 2021. Available at https://www.leg.state.nv.us/App/NELIS/REL/81st2021/ExhibitDocument/OpenExhibitDocument?exhibitId=51621&fileDownloadName=0330_AB349_Averyt.K_test.pdf

[14] KNPR, *Nevada Outlines Strategy to Combat Climate Change*, December 4, 2020. https://knpr.org/knpr/2020-12/nevada-outlines-strategy-combat-climate-change

[15] *Id.*

[16] Assembly Bill 380, 2021 Nevada Legislature, https://www.leg.state.nv.us/Session/81st2021/Bills/AB/AB380.pdf

various sectors across Nevada. But, because of limitations on time and resources combined with the impact of the COVID-19 pandemic, the Climate Initiative Leadership Team was unable to complete a comprehensive review of all possible policy options.[17] The Strategy acknowledges that it is a "living document," that more work is necessary, and that other policies still need to be analyzed.[18] David Bobzien, another member of the Initiative leadership team and the Director of the Governor's Office of Energy, acknowledged that "renewable natural gas was not considered in the State Climate Policy" because of a belief that Southwest Gas would not be pursuing RNG until 2035.[19] He also acknowledged that the Climate Initiative does "see some opportunity with green hydrogen" and that it looks forward to working with Southwest Gas on exploring hydrogen in direct-use applications.[20] Yet, the Strategy did not analyze the possibility of RNG, or any other alternative, as a way to achieve economy-wide emission reductions.[21]

Moreover, the Advocacy Groups incorrectly cite SB 254 as creating a mandate that the state lower GHG emissions to zero by 2050. Rather, SB 254 directs the Department of Conservation and Natural Resources to issue a report that includes, among other things, a list of policies that "*could* achieve reductions in projected greenhouse gas emissions" and the amount of GHG reductions necessary to reach certain emissions levels.[22] Unlike NRS 704.7821, which sets out the schedule by which electric utility providers must incorporate certain percentages of renewable energy into their energy portfolios, SB 254 does not impose any specific steps or timelines for the state or its regulated utilities. SB 254 does not

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[17] 2020 Nevada Climate Strategy at 52.
[18] *Id.*
[19] Testimony of David Bobzien on Assembly Bill 380 before the Assembly Committee on Growth and Infrastructure, April 6, 2021. Available at https://www.leg.state.nv.us/Session/81st2021/Minutes/Assembly/GI/Final/777.pdf.
[20] *Id.*
[21] *See generally*, 2020 Nevada Climate Strategy.
[22] NRS 445B.360(2).

announce any specific policies, nor does it delegate authority to do so. The Legislature left the path to achieving economy-wide GHG emission reductions open.

B. Research and Development Should Determine the Best Path to Achieving Economy-Wide GHG Emission Reductions.

The Legislature wisely refrained from defining any energy policies that would eliminate pathways to decarbonization or that would inhibit innovation in the state's energy systems. Among the many reasons not to declare an energy policy prematurely are that no one can predict how technology will advance nor is it possible to anticipate all the consequences of prematurely determining Nevada's energy future.

1. A Current Lack of Viability Provides No Reason to Eliminate a Potential Solution.

Likely, the interested parties would agree with the general principal that there will be drastic technological advancements between now and 2050. Additionally, many, if not all, of the Advocacy Groups would acknowledge that technological advancement in electric technologies is necessary to reach their goal, and that as of today, it is not feasible to eliminate natural gas use.[23] They rely on an underlying, unproven assumption that electric technology will advance enough to eventually replace the gas infrastructure.[24] They even rely on these potential advancements to claim that electricity costs will slide down the cost curve.[25]

Yet, the Advocacy Groups simultaneously dismiss natural gas and the gas infrastructure as tools to decarbonize Nevada's energy supply based on an underlying and unproven belief that there will be insufficient technological advancement in gas technology.[26] They encourage investment in electric technologies on the one hand but dismiss the

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[23] *See* Advanced Energy Economy at 9.
[24] *Id.* at 4.
[25] *Id.* at 4, 8; Ceres at 2.
[26] Advanced Energy Economy at 6; Ceres at 4.

emerging clean fuel technologies on the other.[27] They conclude that clean fuel technology prices will never materialize, or if it does that it will never slide down the cost curve.[28] However, they assume electric technology will do both.[29] Even though the Legislature has not made any policy determinations that favor any specific technologies over others, the Advocacy Groups ask the Commission to do so. They encourage the Commission to eliminate any space for clean energy technology innovation, and some even caution the Commission to take the bold action of not allowing any investment in gas infrastructure and technologies[30] – essentially declaring an energy policy prematurely, which the Legislature specifically chose not to do. So, while the Advocacy Groups ask for patience and faith with respect to electric generation technologies, they are unwilling to extend the same patience or faith to clean fuel technologies.

Notably, in arguing for avoiding investment in clean fuel technology, the Conservation Advocates assume that there will be a limitation on future supplies of low-carbon fuel sources, claiming that "many sectors will likely end up competing for resources to decarbonize."[31] This assumption presumes that there will be no significant increases in availability of, nor decreases in the cost of, electrolyzer technology, other hydrogen-production technology, or other forms of carbon-free synthetic fuel. This highlights the problems with the modeling they rely on to reach their conclusions, particularly when attempting to model over a decades-long period. The modeled pathways are only able to model based upon technologies currently available, rely on cost curve assumptions, and imperfect and often incorrect assumptions. The result is the highly questionable conclusion that technological competition for the

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[27] Conservation Advocates at 2; Advanced Energy Economy at 6-8; Ceres at 2; CHR, Inc. at 2, 10-13.
[28] Conservation Advocates at 10-11.
[29] Advanced Energy Economy at 9.
[30] *Id.*; Conservation Advocates at 2; Ceres at 2; CHR, Inc. at 2-3, 10-13; RMI at 2.
[31] Conservation Advocates at 2.

presumed limited resources should be eliminated and that electric technologies should be supported over clean fuel technologies.[32]

The Advocacy Groups also fail to acknowledge that the existing natural gas infrastructure remains a vital tool in decarbonizing the energy systems and driving emission reductions across all economy sectors of the State, including electric generation. While the Advocacy Groups may attempt to downplay the future of clean fuel technology, clean fuel and natural gas technology will not remain stagnant. If supported, clean fuels and the gas infrastructure will benefit from technological innovation and the costs of clean fuel and gas technologies will decrease over time. This has been demonstrated over the past 10-15 years through the shale revolution and increased reliance on natural gas to displace higher carbon intensive fuels for power generation, and the dramatic reduction in GHG emissions across the United States, including Nevada. Whether additional advancements come in the form of negative carbon intensity renewable gas, low and zero carbon hydrogen, or synthetic natural gas, exciting opportunities exist to further reduce the carbon intensity of Nevada's fuels while relying on a proven, built infrastructure. Pursuing these opportunities mitigates the inequities and impacts on low-income and historically underserved communities, an issue the Advocacy Groups acknowledge but have no clear solution for. Indeed, as discussed in the Company's Phase 1 Opening Comments, simplistic policies limiting use of natural gas will result in significant stranded assets and overbearing costs, particularly for low-income customers. This is a zero-sum matter, costs borne by Nevada's economy will ultimately trickle down to all goods and services disproportionally impacting vulnerable communities.

[32] In reaching their conclusion that electric technologies will emerge and should be supported, and clean fuel technologies will not, it appears they applied different assumptions to two types of technologies.

2. Some of the Research the Advocacy Groups Rely Upon Omits Relevant Information or Relies on Faulty Assumptions.

Because the Advocacy Groups predetermined their conclusions, they provide information and studies that support the singular outcome they hope to achieve. However, the conclusions to be drawn from those studies come into doubt either because they fail to consider all relevant factors, because they rely on flawed assumptions, or both.

Indoor Air Quality

Many of the Advocacy Groups claim that indoor natural gas usage is linked to adverse health effects.[33] Typically, groups making these claims rely on one of two reports, reports that conducted no independent study, but rather relies on a review of published literature to make questionable assumptions and incorrect comparisons of data to support a flawed conclusion.[34] A technical analysis performed by Catalyst Environmental Solutions of one these reports, which was conducted by UCLA (UCLA report) points out some of the flaws of the report. The analysis shows that had the indoor air modeling used in the UCLA report made the correct comparisons, it would have concluded that there are no adverse health impacts from indoor use of natural gas appliances.[35] The technical analysis also identifies several other issues with the UCLA report, including that indoor air quality is more a function of what is being cooked, rather than the fuel used for cooking; that the report depends upon a sequential series of assumptions, some of which are unsupported by the literature relied

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[33] Ceres at 2; RMI at 4; Chispa Nevada Phase 1 Opening Comments at 2; Mormon Women for Ethical Government at 1; CHR, Inc. at 9; Pollution Free Nevada at 3

[34] *Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California*, UCLA at 12 (April 2020); *Issues that Render the Sierra Club/UCLA Study of Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California Not Useful for Decision-Making Purposes*, Catalyst Environmental Solutions (Oct. 2021), available at https://www.calrest.org/sites/main/files/file-attachments/ucla_study_-_natural_gas_stoves_-_tormey_critical_review.pdf. Attached hereto as Exhibit A.

[35] *Issues that Render the Sierra Club/UCLA Study of Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California Not Useful for Decision-Making Purposes*, Catalyst Environmental Solutions (Oct. 2021), available at https://www.calrest.org/sites/main/files/file-attachments/ucla_study_-_natural_gas_stoves_-_tormey_critical_review.pdf

upon; and that the report makes numerous statements that are simply not supported by the data provided or the references cited.[36] The other report produced by the Rocky Mountain Institute, which many of the Advocacy Groups rely on, suffers from many of the same flaws.

Electrification Pathways

Similarly, the studies some of the Advocacy Groups rely on to conclude that electrification is affordable suffer from the same errors that undermine their usefulness. The Conservation Advocates and others rely on modeled pathways to claim that electrifying buildings is a way to reduce GHG emissions "at a *reasonable* cost and risk."[37] Yet, they do not consider potential pathways that include clean fuels or the existing gas infrastructure nor do their models determine the most affordable and least risky pathway.[38] This is indicative of an approach that pre-determines a destination and tries to find a non-offensive path to that destination.

Additionally, because the analysis works backwards from their predetermined conclusion, the drafters of the pathways rely on assumptions that present unrealistic conclusions to dispense with required and meaningful up-front analysis of all possible pathways. As an example, the report cited by Conservation Advocates supports that electrification of end use markets is affordable when compared to natural gas. However, this conclusion is derived from the unsupported assumption that natural gas prices are in the $40 to $50 per Mcf range, or approximately 10 times higher than the actual cost of natural gas today.[39] Not only is this significantly higher than current prices for conventional natural gas, but utilities can also currently purchase RNG at a cost of $15/Mcf. Any analysis that

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[36] *Id.*
[37] Conservation Advocates at 7-8.
[38] *Id.*
[39] *Pathways and Policies to Achieve Nevada's Climate Goals: An Emissions, Equity, and Economic Analysis*, Evolved Energy, GridLab, NRDC, Sierra Club, at 25 (October 2020).

determines electrification is affordable in the context of gas prices in the range of $50/Mcf serves little purpose in determining pathways that are affordable for Nevadans.

3. Before Locking Nevada into an Electric Future, the Technology Must Demonstrate that Electrification is Sustainable, Cost Effective and Can Actually Achieve the Goal of Reducing GHG Emissions.

After dismissing natural gas and the natural gas infrastructure as a potential avenue to decarbonization simply because the necessary technological advancements are not guaranteed, the Advocacy Groups acknowledge, if only tacitly, that the infrastructure and technology to support full electrification does not exist today.[40] Even though there is similarly no guarantee that renewable electric generation technology will develop, they would nevertheless lock Nevada into an electric future.[41] While the Advocacy Groups may be willing to trade away an energy infrastructure that provides reliability, resiliency, affordability, and respects consumer choice simply because it might not fully decarbonize without investment in new technologies and innovation, Nevada must take a more prudent approach. Before committing to a single speculative solution, at the sake of all others, that solution must be uncontroverted with respect to its ability to deliver the outcomes desired. Full electrification has not done that.

a. Aggressive Electrification Has Not Demonstrated That It Will Reduce Emissions.

Another point on which all interested parties would seemingly agree is that Nevada cannot simply delay reducing GHG emissions and certainly cannot increase emissions. Nevada must continue to reduce GHG emissions now and build on those reductions over the next three decades. Yet, the push to increase electrification of end-use applications as

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[40] *See e.g.*, Advanced Energy Economy at 2, 8-9; Conservation Advocates at 12-25.

[41] These hypocritical positions demonstrate that their desire to eliminate research and development in clean fuel technologies has little to do with the potential that it will not decarbonize. It is the exact opposite. It is a tacit acknowledgement that the technology, if properly supported, can and will reach that goal, and the Advocacy Groups want to eliminate competition for their preferred option.

quickly as possible – when the options to meet those electricity demands is through additional gas-fired electric generation or even increased use of coal – conflicts with the goal of reducing emissions.[42] The Advocacy Groups' plan to electrify buildings is built around a belief that, long-term, electricity demands will be met entirely by non-gas renewables,[43] something that NV Energy has not determined is feasible.[44] However, in focusing solely on the speculative long-term possibilities, they ignore that today and in the near future any increased electricity demand will increase GHG emissions.[45] By transitioning away from the more efficient direct-use of natural gas to the less efficient process of generating electricity, Nevada will consume more natural gas to meet its energy needs. Even assuming *arguendo* that electric appliances are more efficient, they still consume more energy on a full-fuel-cycle analysis.[46] Because of the energy lost in production, conversion, transmission, and distribution of electricity, electric appliances require more energy over a full-fuel-cycle.[47] The result is an increase in fuel consumption and in GHG emissions. Any call to electrify end-uses as quickly as possible is a call to forego reductions today and tomorrow in the hopes of arriving at a pre-determined destination in 2050 – a destination which may be a cost prohibitive mirage.[48]

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[42] Indeed, they acknowledge that electrification will not have a positive impact on emissions until more renewables are added to the grid. Conservation Advocates. at 27. Indeed, their own studies indicate that incorporating 50% renewable sources by 2030 is not sufficient to meaningfully reduce GHG emissions if buildings are electrified. *Pathways and Policies to Achieve Nevada's Climate Goals: An Emissions, Equity, and Economic Analysis*, Evolved Energy, GridLab, NRDC, Sierra Club, at 33 (October 2020).

[43] To borrow the words of Advanced Energy Economy, there is a risk that this "does not materialize or materializes at a cost that is not competitive with alternatives."

[44] NV Energy Phase 1 Opening Comments, at 6-7.

[45] *Energy Analysis: A Comparison of Energy Use, Operation Costs, and Carbon Dioxide Emissions of Home Appliances 2020 Update*, American Gas Association at 2-3 (October 1, 2020) available at https://www.aga.org/contentassets/9cb08cba5eaa4ec9bfbdddb12634a2fd/ea-2020-04-appliance-cost-and-emissions-comparison-2020.pdf

[46] *Id.*

[47] *Id.*

[48] For example, they minimize the strides that CNG has made in reducing emissions in the mass-transit portion of the transportation sector because it is not as clean as electric vehicles. Yet they fail to appreciate that the electricity to power those theoretical electric buses will be produced by natural gas generation. Advanced Energy Economy at 10.

This approach also increases the costs to Nevadans and undermines the reliability and resiliency of the energy grid. Requiring consumers to trade BTUs for GWh forces them to purchase a more expensive form of energy.[49] Currently, the average American household saves an average of $879 per year by using natural gas appliances.[50] If Nevadans are forced to convert their appliances and pay for the costly grid transformations,[51] the financial burden will be much greater. Not only will the monthly utility bills increase to pay for those improvements, but consumers will also bear the burden of purchasing new electric appliances, which will cost approximately $15,830 to $21,140 per household.[52]

For aggressive building electrification to reduce GHG emissions in the short-term, Nevada would need to match the building electrification with an even more aggressive push to incorporate renewables. According to one report cited by the Advocate Groups, Nevada would need 82% of its electric generation to come from renewable sources by 2030.[53] To reach the levels the Advocacy Groups would require, the electric utilities would need to nearly triple the amount of renewable sources in the state in eight years. This is, of course, without factoring in the impacts of increased electrical demand from the newly electrified buildings. Even if it was feasible to achieve this level of renewable resource penetration in the next eight years, the costs would be prohibitive.

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[49] In Nevada, Southwest Gas' natural gas rates for single family homes are $0.79269/therm or $0.02705/KWhr equivalent in Southern Nevada and $1.0713/therm or $0.03656/KWhr equivalent in Northern Nevada. In comparison, NV Energy's rates for single family homes is $0.1040/KWhr in Southern Nevada and $0.09397/KWhr.

[50] AGA Playbook, available at https://playbook.aga.org/.

[51] Some of the Advocacy Groups claim this is already happening. *See* Conservation Advocates at 36.

[52] *Implications of Policy-Driven Residential Electrification,* ICF (July 2018) at 6. available at https://www.aga.org/research/reports/implications-of-policy-driven-residential-electrification/. Exhibit P to Southwest Gas' Phase 1 Opening Comments; *Eliminating natural gas in housing could cost $5.9B*, San Francisco Examiner, available at https://www.sfexaminer.com/news/eliminating-natural-gas-in-housing-could-cost-5-9b/.

[53] *Pathways and Policies to Achieve Nevada's Climate Goals: An Emissions, Equity, and Economic Analysis*, Evolved Energy, GridLab, NRDC, Sierra Club, at 33 (October 2020).

Indeed, one need look no further than California to see the result of hyper aggressive phasing out natural gas generation resources and conversion to renewable energy sources. From 2011 to 2019, California's electricity prices increased six times more than the rest of the United States due to the state's huge expansion of renewables.[54] But despite this expansion, Californians have seen their electric grid's reliability deteriorate. In August 2020, the state's electric grid was unable to meet increased demand caused by a heat wave, and for the first time in nearly 20 years, the California Independent System Operator (CAISO) had to cut power to people across the state. Following an investigation into the blackouts, CAISO determined that a significant factor was the state's transition to renewables left it with insufficient resources to meet the peak demand.[55]

Now California is forced to resort to emergency measures to provide some levels of stability and try to meet anticipated demands. Governor Gavin Newsome was forced to issue emergency orders calling for increased natural gas generation to stabilize the grid and meet projected capacity shortfalls for 2021, 2022, and 2023.[56] Similarly, the California Public Utilities Commission is employing an "all hands on deck approach" "trying to find additional capacity wherever they [sic] can."[57] This includes doubling the financial incentives to

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[54] *Why California's Climate Policies Are Causing Electricity Blackouts*, Forbes August 15, 2020. Available at https://www.forbes.com/sites/michaelshellenberger/2020/08/15/why-californias-climate-policies-are-causing-electricity-black-outs/?sh=4992c4e41591

[55] *Preliminary Root Cause Analysis: Mid-August 2020 Heat Storm*, California ISO, October 6, 2020. Available at http://www.caiso.com/Documents/Preliminary-Root-Cause-Analysis-Rotating-Outages-August-2020.pdf

[56] *California to Build Temporary Gas Plants to Avoid Blackouts*, Bloomberg, August 19, 2021. Available at https://www.bloomberg.com/news/articles/2021-08-19/california-to-build-temporary-gas-plants-to-avoid-blackouts; California Energy Commission moves to add generation sought by governor, S&P Global, August 18, 2021. Available at https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/081821-california-energy-commission-moves-to-add-generation-sought-by-governor; *California proposes demand response, other measures to shore up summer grid reliability*, Utility Dive, November 2, 2021. Available at https://www.utilitydive.com/news/california-grid-reliability-2022-2023-summer/609261/?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue:%202021-11-02%20Utility%20Dive%20Newsletter%20%5Bissue:37743%5D&utm_term=Utility%20Dive

[57] *California proposes demand response, other measures to shore up summer grid reliability*, Utility Dive, November 2, 2021.

persuade users to minimize demand during extreme heat events, as well as scrambling to bring 2,000 MW to 3,000 MW of supply on line by summer 2022.[58] The end result of California's aggressive drive to phase out natural gas generation and expand renewable generation is increased prices, decreased reliability, and, despite all its efforts to clean its electricity, an electric grid that still remains heavily reliant on natural gas. And yet, despite almost a decade of pushing to increase renewable energy sources and leaving consumers in a wake of increased prices and decreased reliability, renewable sources make up approximately 23.1% of the state's source for electric generation whereas natural gas provides over 40%.[59]

This sentiment is echoed in the New York Independent System Operator's (NYISO) Climate Change Impact and Resilience Study:

> The current system is heavily dependent on existing fossil-fueled resources to maintain reliability and eliminating these resources from the mix will require an unprecedented level of investment in new and replacement infrastructure, and/or the emergence of a zero-carbon fuel source for thermal generating resources. A power system that is effectively free of GHG emissions in 2040 cannot include the continued operation of thermal units fueled by well-based natural gas. However, these are the very units that are currently vital to maintain power system reliability throughout the year. This is the fundamental challenge of the power system transition that will take place over the next two decades. Indeed, this transition must take place at the same time that electricity demand in the state will grow significantly if electrification of other economic sectors, such as transportation and heating, is needed to meet the economy-wide GHG emission reduction requirements. In all four cases studied, the required investment in and development of

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[58] *Id.*

[59] U.S. Energy Information Administration, Electricity Data Browser, California 2020. Available at https://www.eia.gov/electricity/data/browser/#/topic/0?agg=2,0,1&fuel=vtvv&geo=g&sec=g&linechart=ELEC.GEN.ALL-US-99.A~ELEC.GEN.COW-US-99.A~ELEC.GEN.NG-US-99.A~ELEC.GEN.NUC-US-99.A~ELEC.GEN.HYC-US-99.A~ELEC.GEN.WND-US-99.A~ELEC.GEN.TSN-US-99.A&columnchart=ELEC.GEN.ALL-US-99.A~ELEC.GEN.COW-US-99.A~ELEC.GEN.NG-US-99.A~ELEC.GEN.NUC-US-99.A~ELEC.GEN.HYC-US-99.A~ELEC.GEN.WND-US-99.A&map=ELEC.GEN.ALL-US-99.A&freq=A&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0

renewable resources is substantial, and far greater than anything previously experienced in New York.[60]

b. The Future of Electric Buildings Powered by Distributed Energy Resources is Uncertain.

Beyond the short-term questions about the environmental and financial impact of increased electrical reliance, there are questions about the ability of electric end-uses to replace gas applications, the ability to generate sufficient electricity, and the ability to store that electricity. Ironically, the reason the Advocacy Groups give for discouraging investment in clean fuel technologies – the possibility that it does not materialize – is the same reason Nevada should refrain from diving headlong into electrification. Rather than locking itself into an electric future and hoping that the technology shows up, Nevada should take a more reasoned and balanced approach to reducing GHG emissions economy-wide.

The Advocacy Groups themselves acknowledge a series of barriers that make an electric future uncertain.[61] For example, in nearly every discussion of applications where electric appliances can replace gas appliances, the Conservation Advocates identify at least one barrier to wide-spread adoption and use.[62] Whether that barrier is the cost, the need to retro-fit homes and upgrade electrical panels, the need for additional technologies to emerge, or the overall consumer preference for natural gas,[63] each provides a reason that electrifying buildings may not organically materialize between now and 2050.[64] Indeed, when it comes to the cost of electrification, the Advocacy Groups recognize it will require extreme subsidies

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[60] *Climate Change Impact and Resilience Study – Phase II, An Assessment of Climate Change Impacts on Power System Reliability in New York State* (September 2020), at 85.
[61] Advanced Energy Economy at 4; *see also* Conservation Advocates at 14-26; CHR, Inc. at 2.
[62] *See* Conservation Advocates at 14-26.
[63] *See e.g.,* Consumer Advocates at 22.
[64] Advanced Energy Economy at 4.

to help low-income and underserved communities, and that without those subsidies the transition will unduly burden those communities.[65]

And beyond the barriers the Conservation Advocates identify to implementing electric end-use applications, there are unanswered questions about the ability to reliably supply the increased demand. By some estimations, electrifying buildings will require electric utilities to quintuple the amount of electricity they must generate.[66] Without natural gas as a backstop to power generators when distributed resources are unavailable or when demands peak, the necessary energy must be generated and stored ahead of time. This means that not only must sufficient electricity be generated to meet real-time demands, but the utilities must also be able to generate surplus energy. As discussed in Southwest Gas' Phase 1 Opening Comments, transitioning to a single energy source that lacks the ability to quickly generate electricity to supply unexpected spikes in demand, raises serious concerns about the reliability and resiliency of the electric grid, particularly in cold months when the consequences of outages are much more dire.

Moreover, storing the electricity is an equally large hurdle. Today, most independent system operators and regional transmission organizations rely on lithium-ion batteries, which have limited storage capabilities.[67] Even in ideal conditions, lithium-ion batteries can only provide energy for four hours or less.[68] This is not enough to get through a single night, let alone days or even weeks that may be required. What is more, the costs of batteries are

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[65] Conservation Advocates at 37-38.
[66] *Xcel first utility to adopt net zero carbon target across gas and electric operations, CEO says,* Utility Drive Nov. 1, 2021. Available at https://www.utilitydive.com/news/xcel-natural-gas-zero-carbon-greenhouse-emissions-goal-/609211/?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue:%202021-11-01%20Utility%20Dive%20Newsletter%20%5Bissue:37720%5D&utm_term=Utility%20Dive
[67] Fact Sheet, Energy Storage (2019), available at https://www.eesi.org/papers/view/energy-storage-2019
[68] *Id.*

currently soaring because of increased demand and global supply limitations.[69] While the costs of lithium-ion batteries had been on a decline, recently that trend has reversed. Because of increased demand from both electric vehicles manufacturers and utilities combines with supply chain limitations and raw material shortages, both now and projected in the future, the prices of batteries may not continue to see any costs reductions. And beyond the financial costs of lithium-ion batteries are the safety and reliability concerns[70] as well as the serious human rights abuses associated with mining the necessary elements.[71]

With so many questions unanswered, now is not the time to decide that electrifying buildings is the solution to reducing GHG emissions. Nevada should refrain from attempting to predict the future of energy technology and instead keep all pathways open and develop policies to support and encourage them.

III. CONCLUSION

The only outcome that Nevada should be focused on is an outcome that allows it to reduce GHG emissions across all sectors of the state. It should not focus all of its efforts on a particular option for reducing GHG emissions in limited sectors that are not even the largest contributors to GHG emissions. Particularly when that option increases costs for consumers,

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[69] *Battery Costs are Soaring Amid a Global Supply Crunch*, Irina Slav, OilPrice.com, Nov. 2, 2021 available at https://oilprice.com/Energy/Energy-General/Battery-Costs-Are-Soaring-Amid-A-Global-Supply-Crunch.html

[70] *Burning concern: Energy storage industry battles battery fires*, S&P Global Market, May 24, 2019 (discussing a fire at a lithium-ion battery storage facility in Surprise, Arizona) available at https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/burning-concern-energy-storage-industry-battles-battery-fires-519030636; *Major Calif. Battery outage highlights energy storage risks*, Energy Wire, Sept. 13, 2021 (discussing safety concerns following a fire at a 300-MW lithium-ion battery facility in Moss Landing, California). Available at https://www.eenews.net/articles/major-calif-battery-outage-highlights-energy-storage-risks/; *Emerging Hazards of Battery Energy Storage System Fires,* FEMA. Available at https://www.fema.gov/case-study/emerging-hazards-battery-energy-storage-system-fires

[71] *US lithium-ion battery imports spike amid scramble to address ethical risks*, S&P Capital IQ, Oct. 25, 2021, available at https://www.capitaliq.spglobal.com/web/client?auth=inherit#news/article?id=66838633&KeyProductLinkType=58&utm_source=MIAlerts&utm_medium=realtime-minewsresearch-newsfeature-sector%20spotlight&utm_campaign=Alert-Email

makes energy delivery less reliable, increases GHG emissions in the short-term, and makes it more difficult, if not impossible, to reduce emissions in other sectors of the economy. In contrast, natural gas and the gas infrastructure have a proven track record of significantly reducing GHG emissions in Nevada and, along with the clean fuel technologies that will come in the future, the ability to further reduce GHG emissions in Nevada both in the short-term and long-term. Natural gas utilities in the state also could help reduce emissions in hard to decarbonize sectors and areas, and the ability to reduce emissions without disparately impacting low-income and historically underserved communities. Ultimately, Nevada's approach to reducing GHG emissions should not focus on a single outcome and then spend resources trying to solve the known and anticipated problems that accompany that single outcome. Instead, Nevada should build a tool chest full of tools to reduce GHG emissions across all sectors of the state. Now is not the time to eliminate tools, it is the time to invest in them.

EXHIBIT A

Issues that Render the Sierra Club/UCLA Study of *Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California* Not Useful for Decision-Making Purposes

Daniel Tormey, Ph.D., P.G., Steve Huntley

Catalyst
ENVIRONMENTAL SOLUTIONS

CALIFORNIA
RESTAURANT
ASSOCIATION

Introduction

The report *Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California* (UCLA Report), published in April 2020, was prepared on behalf of the Sierra Club by the UCLA Fielding School of Public Health. Several cities in California have passed electrification policies for new construction, and such programs are being considered Statewide. Most of the focus on electrification efforts has been on reducing greenhouse gas emissions in general. The UCLA Report takes a different perspective and focuses on potential health effects rather than greenhouse gas emissions. The UCLA Report advocates that replacing natural gas-fired stoves and ovens with electric appliances would have public health benefits and continued use of natural gas-fired appliances will result in adverse health effects. The discussion of these effects is divided into two main sections: (1) indoor air quality and health effects and (2) outdoor air quality and health effects.

As discussed in this Technical Memorandum, there are several significant flaws in the UCLA Report that undermine its use in decision-making on the topic of the health effects of natural gas stoves and ovens. We identify five major issues and three other issues for this conclusion. The major issues are as follows:

Issue 1: Indoor air modeling results presented in Table 2-2 of the UCLA Report are incorrectly compared to NAAQS and CAAQS. Had the UCLA Report made the correct comparisons, it would have concluded that there are no adverse health impacts from indoor use of natural gas appliances.

Issue 2: The UCLA Report cites several references that conclude that indoor air quality is more a function of what is being cooked, rather than the fuel used for cooking. Emissions from cooking oils and foods would remain in indoor air whether or not there is a transition from natural gas to electric cooking appliances.

Issue 3: The UCLA Report does not consider unanticipated consequences of replacing natural gas with electric stoves and ovens. The focus is solely on combustion of natural gas. Considering the UCLA Report advocates for eliminating natural gas for stoves and ovens, the consequences of electrification (cost and disproportionate adverse impacts to disadvantaged communities, availability, hazards) are certainly relevant and belong in the decision-making process.

Issue 4: The results of the UCLA Report depend upon a sequential series of assumptions, some of which are unsupported by the literature. The approach of the paper leads to compounding (increasing) these uncertainties rather than reducing them.

Issue 5: Numerous statements throughout the UCLA Report are not supported by the data provided or the references cited. Because the UCLA Report is built on data in the published literature, this problem indicates a flawed foundation for the findings.

The technical basis for each major issue, as well as the three other issues, are described in the next sections.

Major Issues

Issue 1: Indoor air modeling results presented in Table 2-2 of the UCLA Report are incorrectly compared to NAAQS and CAAQS. Had the UCLA Report made the correct comparisons, it would have concluded that there are no health impacts from indoor use of natural gas appliances.

Table 2-2 in the UCLA Report presents the key results for the indoor air modeling exercise. The results are divided into two categories for indoor air appliance emissions: (1) stoves and ovens and (2) stoves only. In both cases, indoor air modeling was conducted assuming no venting of appliance emissions to the outside. Within each of these two categories, indoor air concentrations of CO, NO_2, and NO_x are presented under four cooking time scenarios: (1) peak (maximum) concentration, (2) 15-minute cooking time, (3) 1-hour cooking time, and (4) 2-hour cooking time. The following discussion focuses on the three purported exceedances of NAAQS and/or CAAQS as presented in Table 2-2.

Note that of the chemicals presented in Table 2-2, NAAQS and CAAQS are only available for CO and NO_2. NAAQS and CAAQS have not been developed for NO_x. For CO, specific NAAQS and CAAQS are only available for 1-hour and 8-hour averaging times. For NO_2, specific NAAQS and CAAQS are only available for 1-hour and annual arithmetic mean averaging times. Table 2-2 of the UCLA Report did not present modeling results for either 8-hour or annual arithmetic mean averaging times. Therefore, the only relevant comparisons that can be made using UCLA modeling results are CO and NO_2 1-hour average concentrations as compared to their respective 1-hour time-averaged NAAQS and CAAQS; these comparisons are presented in the table below.

Table 1. Comparison of UCLA 1-hour Average Modeled Air Concentrations to Relevant CAAQS and NAAQS

Carbon Monoxide	1-hour Average
CAAQS	20,000
NAAQS	35,000
Stoves and ovens¥	2,300¥
Stoves only¥	900¥

Nitrogen Dioxide	1-hour Average
CAAQS	180
NAAQS	100
Stoves and ovens¥	19¥
Stoves only¥	11¥

All concentrations in ppb.

¥ Modeled 1-hour average concentration as reported in Table 2-2 of the UCLA Report.

As shown in the above Table 1, for both CO and NO_2, the modeled indoor air concentrations for Stoves and ovens and for Stoves only are nearly 10-fold below their respective CAAQS and NAAQS, demonstrating a large margin of safety and absence of potential adverse health effects, even under the unrealistic assumption of no venting of stove and oven exhaust.

In contrast to the appropriate comparison presented in Table 1 (above), the UCLA Report presented several comparisons that are not appropriate nor realistic. For comparison to NAAQs and CAAQs, the UCLA Report compared peak (maximum) concentrations directly to 1-hour NAAQs and CAAQs. **The comparison of maximum peak concentrations to a 1-hour standard is not correct and certainly not relevant for assessing health risks.** The 1-hour NAAQS and CAAQS represent health effects thresholds associated with 1-hour time averaged exposures. It is meaningless to compare a maximum to an average. When the incorrect method of the UCLA

Report is applied, the maximum peak NO_2 concentrations for stoves and ovens (860 ppb) and stoves only (400 ppb) exceeded the 1-hour NO_2 NAAQS of 100 ppb and the 1-hour NO_2 CAAQS of 180 ppb. In contrast, when the average concentrations under the 1-hour and 2-hour cooking scenarios are compared to the 1-hour NAAQS and CAAQS, there are no exceedances. Therefore, the argument that natural gas appliances cause adverse health impacts because they exceed air quality limits is not supported by the data presented in the study.

The UCLA Report has a similarly incorrect comparison for assessing potential chronic exposures. The UCLA Report states on page 20, "[w]e compare the modeled 8-hour time-averaged CO concentrations to the 8-hour CO thresholds, and the 24- hour time-averaged NO_2 concentrations to the chronic NO_2 thresholds, under three cooking-time scenarios (15 minutes of cooking, 1 hour of cooking, and 2 hours of cooking." However, the only chronic exposure exceedance shown in Table 2-2 for NO_2 under the stoves and ovens scenario is apparently based on comparison of 1-year annual NAAQs (53 ppb) and CAAQS (30 ppb) to a calculated 24-hour time-averaged concentration (34 ppb). **A 24-hour time-weighted average concentration cannot properly be compared to 1-year annual standards.** While the calculated 24-hour time-weighted average concentration may be a reasonable estimate of exposure concentration over the course of 24 hours, it is not a reasonable estimate of exposure concentration over the course of an entire year. The unrealistic underlying assumption for this comparison is that cooking, using both stove and oven, without venting, would take place in a residence for 2-hours every single day for 365 days per year. This is contrary to available data on residential occupancy and appliance use and is inconsistent with standard risk assessment practices that recommend assessment of reasonable maximum exposures, often referred to as the RME (DTSC 2015[1]).

Based on data provided by the USEPA[2] for the amount of time spent indoors at a residence by age group, the age group that spends the most amount of time indoors is >65 years. Based on these data, this age group representing the upper-bound exposure spends on average 82% of their time indoors at their residence. Therefore, these maximally exposed individuals would experience no exposure 18% of the time or 66 days each year. Adjusting the 24-hour time-weighted NO_2 concentration of 34 ppb by this factor alone reduces the time-averaged NO_2 concentration to 28 ppb, which would eliminate any exceedances since it is below both NAAQs (53 ppb) and CAAQS (30 ppb). Even this comparison is considered to be highly conservative (and unrealistic) as it assumes that none of the stove and oven appliance emissions are vented to the outside and that these individuals >65 years in age cook every day using both stove and oven at full capacity for 2 hours each day.

Issue 2: The UCLA Report cites several references that conclude that indoor air quality is more a function of what is being cooked, rather than of the fuel used for cooking. Emissions from cooking oils and foods would remain in indoor air whether or not there is a transition from natural gas to electric cooking appliances.

The available data indicates that indoor air quality is more a function of what is being cooked than the fuel used for cooking. The UCLA Report's conclusions gloss over this fact. The UCLA Report does not include this fact in the summarized major issues. Yet the Report is forced to acknowledge this issue repeatedly: it notes that "there are indoor air quality issues associated with the use of gas cooking appliances that will remain despite the implementation of electrification, and we do not account for this. Some PM emissions are associated with cooking oils and foods, and there are no mitigation methods for this, other than the use of ventilation devices such as range hoods. We do not claim that the transition to electric appliances would make a substantial difference in terms of emissions from cooking oils and food.[3]" It also notes that "although many studies have measured $PM_{2.5}$ and UFP [ultrafine particle] emissions from cooking with various types of food

[1] DTSC. 2015. PEA Guidance Manual. October.

[2] USEPA. 2011. Exposure Factors Handbook: 2011 Edition. September. EPA/600/R-090/052F

[3] Page 30 of UCLA Report

and cooking oil, these particulate emissions were often attributed to the food and cooking method rather than the operation of gas appliances.[4]" The UCLA Report also acknowledges that "[o]ne caveat mentioned previously is that cooking can be a significant source of exposure to $PM_{2.5}$ due to heating and combustion of food and cooking oil, resulting in indoor concentrations far in excess of the NAAQS 24-hour threshold.[5]"

The UCLA Report[6] further states, "Gas stoves have been associated with increased levels of indoor CO in California homes, but these increases in concentrations are generally negligible,[27,49,51,52]" and "studies measuring PM2.5 emissions found that increases attributed solely to gas kitchen appliances (with no cooking of food involved, though sometimes a pot of water was heated) were negligible.[49,52]"

While it is clear that what is cooked can have a significant effect on indoor air quality, the UCLA Report buries this beneath the headline statement[7] that natural gas stoves and ovens exceed NAAQS and CAAQS. Moreover, while it is clear that the emissions of some pollutants (in particular CO and PM) from home appliance natural gas usage are negligible, the UCLA Report attempts to implicate these very same pollutants in the context of health effects associated with residential natural gas appliance use. As generally concluded by the references cited in the UCLA Report, PM emissions from gas stoves and ovens are elevated during food cooking but are negligible when burners are on without food cooking, and therefore provide no basis for inferring adverse health effects.

Issue 3: The UCLA Report does not consider unanticipated consequences of replacing natural gas with electric stoves and ovens. The focus is solely on combustion of natural gas. Considering the UCLA Report advocates for eliminating natural gas for stoves and ovens, the consequences of electrification (cost and disproportionate adverse impacts to disadvantaged communities, availability, hazards) are certainly relevant and belong in the decision-making process.

The UCLA Report correctly notes that it does not provide any sort of cost benefit comparison between electric and natural gas stoves and ovens. The UCLA Report notes "[w]e also did not assess any exposures or other dangers associated with electrification, as we focus on combustion pollutants in this report…[t]his report does not compare the benefits and costs of electrification versus improving range hood use and efficiency in terms of reducing indoor air pollution. This is an important consideration that needs to be included in any full-scale assessment of indoor air pollution mitigation techniques.[8]" The UCLA Report notes other studies do provide such cost-benefit analysis, but the citation it provides did not do so.[9]

Another unintended consequence of following the advice of the UCLA Report is that it fails to address the disproportionate economic impact on low-income individuals and families resulting from the higher cost of electrification and elimination of natural gas as an economically efficient energy source. A recent study published in January 2021 by the Berkeley and UCLA Schools of Law[10] has proposed a policy resolution for the

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[4] Pages 9 and 12 of UCLA Report

[5] Page 13 of UCLA Report

[6] Pages 12 and 13 of UCLA Report

[7] A statement that is incorrect, as described in Issue 1 of this Technical Memorandum.

[8] Page 30 of UCLA Report

[9] Page 42 of UCLA Report. The citation, reference 15, is to a National Renewable Energy Lab (NREL) report that does not include the words "stove" or "oven" in it, but is a broader view of electrification. No EPRI reference was evident.

[10] Berkeley Law Center for Law, Energy, and the Environment; UCLA School of Law Emmett Institute on Climate Change and the Environment. 2021. Building Toward Decarbonization. Policy Solutions to Accelerate Building Electrification in High-Priority Communities.

higher cost of electric appliances compared to natural gas appliances: raise the cost of natural gas. While this resolution would make the cost comparable, it seeks to shift the cost burden to low-income individuals and families who rely on natural gas as an affordable energy source by artificially increasing natural gas rates to conform with higher electric rates. The effect of this policy would be to reduce demand for natural gas while financially impacting low-income individuals and families.

Even in the absence of focused policy efforts to increase the cost of natural gas to align with electricity costs, as discussed in the Berkeley/UCLA Schools of Law study, the overall shift away from natural gas usage to full electrification will over time result in gradual increased costs to those dependent on natural gas. As discussed in the National Bureau of Economic Research (NBER) working paper recently published by Davis and Hausman (2021)[11], during the period of this shift from natural gas to electrification, historical capital cost recovery, pipeline and other infrastructure maintenance, and operating costs will remain the same, yet natural gas revenues based on declining consumer usage will decrease. Consequently, the shortfall in revenues will need to be resolved by increasing natural gas usage rates to remaining consumers. Since low-income individuals and families have less financial capabilities to shift from natural gas appliances to electric appliances, it is these disadvantaged subpopulations that will be forced to bear the majority of these increased costs of natural gas.

The UCLA Report also notes that eliminating combustion of natural gas in stoves and ovens will typically lead to increased natural gas combustion at power plants: "One aspect to keep in mind throughout this analysis, which will be mentioned again in the Results and Discussion section, is that electricity generation at gas power plants emits both GHGs and criteria air pollutants. Even if all residential gas appliances were transitioned to electric appliances, the electricity required to power these appliances must still be generated by some form of fuel, and gas power plants currently produce almost half of the electricity generation in the state.[12]"

As illustrated in Figure B-5 of the UCLA Report, the contribution of NO_x from residential gas appliances to outdoor air as compared to the total NO_x emissions from all sources in California is very small. Therefore, the relative net beneficial impact of reduced NO_x to outdoor air from the elimination of residential gas appliances is very likely close to zero given the need to supplement electrical generation with other fuel-dependent power sources. This is also likely the case for the other gas combustion by-products evaluated in the UCLA Report such as CO, PM, and NO_2.

Overall, these unintended consequences of following the advice in the UCLA Report undermines the purported benefits highlighted in the report.

Issue 4: The results of the UCLA Report depend upon a sequential series of assumptions, some of which are unsupported by the literature. The approach of the paper leads to compounding (increasing) these uncertainties rather than reducing them.

The UCLA Report acknowledges that the literature and underlying data are uncertain and inconclusive, and that they collected no new data, and yet their approach was to apply an uncertain model in order to address the uncertainty in the literature data. That is, the underlying data on all these issues is inconclusive, lacking, or in some cases contradictory, yet the Report purports to "analyze" it to draw "clear" conclusions. By relying on the same uncertain data, the model simply compounds this uncertainty with model-related uncertainty:

Page 17: "While there is clear evidence of a relationship between indoor air quality and health, and combustion falls under that domain, there is some inconclusive literature related to gas appliance use and

[11] Davis, L.W. and C. Hausman. 2021. Who Will Pay for Legacy Utility Costs? NBER Working Paper 28955.

[12] Page 33 of UCLA Report.

specific health effects. The broader relationship between NO_2 and adverse health effects is well-established but a recurrent theme in the literature is the uncertainty regarding the link between indoor NO_2 exposures from gas combustion and respiratory illness. [30,31,113,117]"

Page 29: "Due to the limited scope of this project, we did not conduct any primary data collection; we only analyzed existing literature and datasets. While we used as many relevant data sources as we could access, data paucity was a major limitation for this report. Particularly for conducting future quantitative analyses with regard to equity, the development of additional, publicly available databases to include more detailed and higher spatial resolution data would be a significant asset."

Page 17-18: "While several studies investigating gas appliances and asthma exacerbation produced mixed results, evidence supports a clearer association between gas appliances and asthma and respiratory symptoms in children with one meta-analysis reporting that children living in homes using gas for cooking have a 42% higher risk of having asthma.[33] While we did not estimate the association between specific health symptoms and use of gas appliances, our literature review and analysis aim to clarify the relationship between pollutants associated with gas appliance use and human health…To our knowledge, there are no existing literature review and secondary analysis studies that tie together indoor air quality modeling for various pollutants, housing types, and low-income vulnerability in California."

In conducting studies of the type presented in the UCLA Report, the uncertainties at each step compound, leading to even more uncertain results. While the UCLA Report purports to improve understanding of the effects of indoor combustion of natural gas for cooking, the study design leads to greater uncertainty and less understanding.

Issue 5: The UCLA Report contains numerous statements that are not supported by the data provided or the references cited. Because the UCLA Report is built on data in the published literature, this problem indicates a flawed foundation for the findings.

The UCLA study is a literature-based study; that is, it relies on studies in the published and at times peer-reviewed literature. However, many of the statements made in the report do not correspond to the cited literature. A few examples are provided, which call into question the foundation of this report.

***Example 1*:** In the first paragraph of Section 1.2 it states, "[h]owever, there are significant risks associated with the burning of gas in residences, due to the indoor emission of pollutants, such as CO and formaldehyde (from incomplete combustion), as well as nitrogen oxides (NO_X) such as NO_2 (caused by the oxidation of nitrogen during combustion). Other hazardous compounds emitted from the burning of gas inside homes include volatile organic compounds (VOCs), sulfur oxides, and PM.[20] "

The statement is misleading. The reference cited (Reference 20) is USEPA (1998) *Compilation of Emission Factors*, specifically Section 1.4 (Natural Gas Combustion). This document includes residential furnace and boiler emission factors for CO, formaldehyde, NO_x, NO_2, VOCs, sulfur oxides, and PM. However, there is no mention of potential health risks or the burning of gas in residences in this USEPA document. The UCLA Report provides no basis or specific reference for the statement that "there are significant risks associated with the burning of gas in residences, due to the indoor emission of pollutants…"

Furthermore, use of the term "significant" in scientific reports generally implies statistical significance. The phrase "statistically significant" is used several times in the UCLA Report, but never in the context of the actual evaluations. Not only does USEPA (1998) not refer to statistically significant health risks for any pollutant, as already noted, but in the two instances where the UCLA Report specifically discusses formaldehyde, it acknowledges that there is no statistically significant association between gas appliance use and indoor air

formaldehyde concentrations. On pg. 13, the UCLA Report states: "Gas appliances also emit formaldehyde,[27,44,62] but some studies did not find a statistically significant association between gas appliance use and indoor formaldehyde concentrations.[45,46,74]" In this instance, the reference is to the absence of statistical significance. And on pg. 14 of the UCLA Report, it states: "However, an LBNL study of California homes found that although 95% of homes tested had formaldehyde concentrations above the OEHHA chronic REL, these levels were not statistically significantly associated with gas appliances.[45]" and "Due to the lack of emission data and statistically significant evidence reported in the primary literature, we did not include formaldehyde or acetaldehyde in our quantitative analysis." In this instance, the reference is also to the absence of statistical significance. Despite acknowledging the *absence* of any statistically significant formaldehyde emissions associated with gas appliances, the UCLA Report nevertheless asserts "there are significant risks associated with the burning of natural gas in residences, due to the indoor emission of . . . formaldehyde."

Moreover, in Section 2.2.1 Emission Factor Database, and specifically the first subsection entitled *Results of Statistical Analyses*, the only reference to statistical analyses or statistical significance in this entire subsection is as follows: "Consistently, as the year of the publication from which EFs were gathered became more recent, the ng/J emissions decreased (e.g., a paper in 1995 would report higher emissions than a paper published in 2009, with a statistically significant difference); this indicates that emissions have reduced over time. For NO_X, there is a statistically significant increase in EFs for appliances designed to be vented outdoors (e.g., water heaters and home heating devices)." No references were provided for either the 1995 paper for the 2009 paper, and no reference is provided for the statistically significant increase in EFs for water heaters and home heating devices. Moreover, despite the misleading name of the subsection, there is no statistical analyses presented.

Example 2: In Section 1.2 (page 9) it states, "[t]he resulting indoor air pollution can have adverse effects on human health, as Americans spend almost 90% of their time indoors,[21]..." The statement is misleading. The reference cited (Reference 21; Klepeis et al. 2001) does not present any evaluation of potential adverse effects on human health resulting from indoor air pollution. Further, while the survey conducted by Klepeis et al. did report that Americans spend almost 90% (specifically 87%) of their time indoors, **the UCLA Report failed to indicate that only 67% of time is spent inside residences.** Since the focus on the UCLA Report is on residential exposure, 67% of time spent inside residences would be the appropriate metric to present.

Other Issues

Issue	Facts Supporting the Issue	Relevance
The UCLA Report advocates eliminating natural gas stoves and ovens for health reasons. The hypothetical risk, however, is already addressed through existing stove and hood design.	The UCLA Report did not model use of residential appliances under the scenarios of manufacturers' safety recommendations, state regulations, or local ordinances. Can natural gas usage be held accountable for improper use of appliances? Page 18: "Unsurprisingly, the EFs of gas appliances have declined over time, likely due to the technological advances of appliances and pollutant capture technology, which reduce emissions. Consistently, as the year of the publication from which EFs were gathered became more recent, the ng/J emissions decreased (e.g., a paper in 1995 would report higher emissions than a paper published in 2009, with a statistically significant difference); this indicates that emissions have reduced over time. "	The air concentrations of CO, NO_2, and NO_x as reported in Table 2-2 of the UCLA Report are incorrect (over-estimated) because the modeling scenario was not based on use according to manufacturer's requirements (nor on real-world conditions). Therefore, the corresponding health implications discussed in the UCLA Report are greatly exaggerated.
The section on outdoor air quality effects of indoor use of natural gas for stoves and ovens only serves to confuse the issues. For the indoor air emissions exposures, the UCLA Report assumed 0% venting to outdoors; for the outdoor air exposures the UCLA Report assumed 100% venting to outdoors. This is double counting and does not give any consideration to the available science on indoor air ventilation rates and similar relevant subjects. **Furthermore, most of the outdoor air section does not address actual stove and oven emissions, which are a small portion of GHG emissions; instead, it evaluates the effects of reducing fossil fuel emissions on GHG-forming compounds in general, not from stoves and ovens and not related to health effects.**	Page 32-33: "A study modeling the impact of future building electrification found that all-electric homes performed better than mixed-fuel buildings, in terms of both GHG emissions reductions and abatement costs associated with the construction of buildings compliant with the Title 24 California Building Standards.[269]" Page 38: "For the year 2018 (as described in Section 3.2.2), the improvement in outdoor air quality from residential building electrification alone would reduce approximately 354 deaths (all-cause mortality), 304 cases of chronic bronchitis, and 596 cases of acute bronchitis in California (see Table B-5 for confidence intervals for mortality). The most affected counties are the higher Population areas, i.e., Los Angeles County and Orange County, due to the nature of the concentration-response function."	The section on outdoor air quality impacts from indoor use of stoves confuses the issues because it in fact addresses overall GHG impacts and health effects of electrification in general, not solely due to cooking.