Docket No.: A.25-10-008

Exhibit No.: _____

Date: March 13, 2026

Witnesses: Dr. Emily Grubert

Dr. Ranajit Sahu

PREPARED TESTIMONY OF EMILY GRUBERT AND RANAJIT (RON) SAHU ON BEHALF OF SIERRA CLUB ON THE APPLICATION OF SOUTHERN CALIFORNIA GAS COMPANY FOR APPROVAL OF ITS WOODY BIOMASS TO METHANE PILOT PROJECT (904G)

(PUBLIC VERSION)

Sierra Club submits the following testimony on the Application of Southern California Gas Company ("SoCalGas") Proposing Woody Biomass Pilot Project (904G) ("Pilot Project" or "Project"). The Application seeks authority to execute a Pilot Project that would direct ratepayer funds to a SoCalGas pipeline upgrade in Tulare County and use any leftover funds for the construction of a new, woody biomass gasification facility located over 50 miles away in Fresno County.[1] The facility would be owned and operated by West Biofuels LLC ("West Biofuels").[2] All produced methane would be trucked to SoCalGas's modified interconnection point; SoCalGas does not propose to procure the produced biomethane.[3]

The first section from Dr. Emily Grubert addresses the lifecycle greenhouse gas impacts of the proposed Project. The second section from Dr. Ranajit ("Ron") Sahu covers issues related to the direct air emissions from the proposed Project at the West Biofuels facility and to the study and reporting of those emissions.

TESTIMONY OF EMILY GRUBERT

I. INTRODUCTION AND KEY FINDINGS AND RECOMMENDATIONS

Q. Please state your name, position, and organization.

A. My name is Emily Grubert. I am an Associate Professor of Sustainable Energy Policy and, concurrently, of Civil and Environmental Engineering and Earth Sciences at the University of Notre Dame.

Q. Please summarize your qualifications.

I am a licensed Professional Engineer and hold a PhD from Stanford University, an MA and MS from The University of Texas at Austin, and a BS from Stanford University. I served as Deputy Assistant Secretary for the Office of Carbon Management (2021-2022) and as Senior Advisor for Energy Asset Transformation (2022-2023) at the US Department of Energy. My specific expertise focuses on GHG (carbon) accounting, life cycle assessment, and energy systems, including those involving carbon capture technologies. I was the Chair of Argonne National Lab's Greenhouse gases, Regulated Emissions, and Energy use in Technologies ("GREET") Model Review Committee in 2024 and also have other direct experience with the GREET model for evaluating GHG intensities.

[1] SoCalGas Corrected Chapter 2 Testimony at JLMS-2, JLMS-8; SoCalGas Response to ALJ Ruling Seeking Additional Information (Jan. 7, 2026), Attachment A (map indicating approximately 60 miles distance between facility and injections point).
[2] SoCalGas Corrected Chapter 2 Testimony at JLMS-8.
[3] SoCalGas Corrected Chapter 2 Testimony at JLMS-8.

I also have extensive experience as an expert witness, especially focused on evaluating the GHG intensity of renewable gas projects. I have previously submitted testimony or comments to the California Air Resources Board ("CARB"), the New York State Public Service Commission, the Vermont Public Utility Commission, the Washington D.C. Public Service Commission, the Colorado Air Quality Control Commission, the Minnesota Public Utilities Commission, and the Multnomah County Circuit Court of the State of Oregon, largely on issues related to GHG accounting.

My CV is included with this testimony as Attachment 1.

Q. Are you familiar with other projects that have intentionally produced methane from biogenic sources?

A. Yes. Several of the cases for which I have testified in other states have involved the intentional production of methane from biogenic sources, including by enhancing methane ratios from sources with nondiscretionary methane production. My work in these cases has included the evaluation of pilot projects including proposals for small-scale biomethane interconnection and use proposals.

Q. What is your experience evaluating carbon capture and storage ("CCS") projects?

A. As an academic, I have been modeling CCS in the energy sector since 2010. From 2021-2022, I was the Deputy Assistant Secretary for Carbon Management at the US Department of Energy, where I was responsible for an office with a ~$1 billion/year budget related to research and development on CCS for power, industrial, and carbon removal purposes, as well as non-CCS based forms of carbon removal. I currently serve on the Board of the Carbon Removal Institute, and I am an expert reviewer for carbon removal for Frontier Climate, a major purchaser of carbon removal capacity. I note that CCS capturing CO_2 from biomass-based processes is generally considered to be a form of carbon removal, and is a topic I am familiar with from my academic, government, and board work.

Q. What is the purpose of this testimony?

The purpose of this testimony is to offer an assessment of the GHG impacts of the proposed Pilot Project and specifically whether, in my opinion, the Application has demonstrated GHG reductions as is required by the governing California Public Utilities Commission ("CPUC") decision (D.22-02-025) and the regulation governing the use of Cap-and-Trade allowance action proceeds.

Q. What are your key findings and recommendations regarding the proposed Pilot Project?

A. Based on my review of the record in this matter, as well as my experience in evaluating numerous pilot projects over the past 5 years, including biomethane interconnection and use proposals, it is my recommendation that the Application be denied. My key concerns with the Application and basis for this recommendation are:

1) **Failure to demonstrate GHG reductions**: SoCalGas proposes to use Cap-and-Trade allowance auction proceeds to fund the proposed Pilot Project, but in my opinion, it has not demonstrated that the proposed Project will achieve GHG reductions. My analysis of the evidence in the record shows that major inconsistencies in accounting for biogenic carbon dioxide ("CO_2") and failure to consider methane emissions from the Project challenges the validity of SoCalGas's claims. In my opinion, SoCalGas has not met the requirement in D.22-02-025 and in the applicable regulations that it demonstrate GHG reductions in its Application.

2) **High risk of GHG increases.** My analysis also shows that there is a high risk and near certainty that the proposed Project will *increase* GHG emissions without a carbon capture and storge ("CCS") component, and some risk that the proposed Project will increase GHG emissions even with a questionably viable CCS component. This conflicts with California's GHG reduction goals and the requirements of D.22-02-025.

II. CONCERNS WITH SOCALGAS'S CLAIMS OF GHG REDUCTIONS

Q. Please describe your understanding of SoCalGas's proposed Pilot Project.

A. My understanding is that the Application seeks approval of a pilot project that would direct ratepayer funds to a SoCalGas pipeline upgrade and use any leftover funds to the construction of a new, woody biomass gasification facility located over 50 miles from the point of pipeline injection. The facility would be owned and operated by West Biofuels and would be collocated with an almond processing facility. It would use woody biomass feedstock in the form of almond orchard waste and almond shells as feedstock to make methane. It could potentially use CCS to capture roughly 80% of the CO_2 that would otherwise be vented into the atmosphere. The produced methane would be trucked to the new interconnection point and injected into the SoCalGas pipeline network.

Q. Please describe your understanding of the basis for SoCalGas's claim that it has demonstrated GHG reductions from the proposed Pilot Project.

A. I understand SoCalGas to claim of GHGs reductions to be based primarily on an analysis conducted by an engineer at the National Renewable Energy Law ("NREL"), which is presented in Attachment 1 to SoCalGas's Corrected Opening Testimony of James Lucas and Mathew Summers ("Corrected Opening Testimony"). That analysis assumes a "base case" and compares the total carbon intensity ("CI") of the "base case" to the estimated CIs of two "use cases" for the proposed Project. As explained in the Corrected Opening Testimony at Table 2, the two use cases are the Project as proposes with and without CCS added to facility to capture carbon emissions.[4]

The testimony asserts that the NREL analyst used a model called Greenhouse gases, Regulated Emissions, and Energy use in Technologies ("GREET"), and finds that the CI scores for both Project "use cases" are lower than the base case.[5] On that basis, it claims that the Project will reduce GHGs.[6]

Q. What is carbon intensity and why is it relevant here?

A. Carbon intensity is a term used to describe the amount of climate-affecting GHG emitted per unit of a given product, like a unit of electricity. It is usually presented in terms of carbon dioxide-equivalents (CO_2-e), which is why we refer to it as a "carbon" intensity even though it should include the impacts of non-carbon-based GHGs (for example, N_2O) as appropriate. CI does not include the impacts of emissions that are not contributing to human-caused climate change, such as water. For the same reason, by convention, it does not include biogenic CO_2 emissions (e.g., from biomass decomposing, or from burning plant-based material), as the CO_2 is generally understood to be taken up by new plants in the near-term as they are replanted, rather than contributing to accumulating carbon dioxide stocks in the atmosphere.

Carbon intensities expressed in CO_2-e depend on a choice of equivalency factor that attempts to characterize the relative impacts of different GHGs on climate warming, usually a Global Warming Potential ("GWP"). For gases that do not last as long in the atmosphere as CO_2, which persists for many generations, the CI is highly sensitive to the policy choice of time frame. For example, methane ("CH_4"), the principal component of fossil and renewable natural gas, degrades in the atmosphere within a few decades and thus has much greater climate impact in the near term. Evaluating impacts over 20 years

[4] SoCalGas Corrected Chapter 2 Testimony at JLMS-13 to JLMS-16.
[5] SoCalGas Corrected Chapter 2 Testimony at JLMS-13 to JLMS-16; *see also* SoCalGas Corrected Chapter 2 Testimony, Attach.1.
[6] SoCalGas Corrected Chapter 2 Testimony at JLMS-16.

suggest that methane is about 80 times as impactful as CO_2, while evaluating them over 100 years suggests that methane is about 30 times as impactful as CO_2. Using the 100-year time-frame is most typical, but many scholars and some jurisdictions (including New York State and Maryland) require evaluation of methane's impacts on a 20-year basis, in part due to the point that near-term climate warming poses immediate risks.

"CI score" is a term sometimes used to refer to carbon intensity for a particular group of produces, like electricity from different sources, when their climate impacts are being directly compared, usually for the purpose of compliance or subsidy allocation. It is not strictly a technical term, and CI scores might reflect policy decisions to declare carbon intensities by definition for the purposes of particular policy implementations, rather than to require full analysis of individual projects.[7]

Q. What is the GREET model, and why is it relevant here?

A. The GREET model is an Excel-based life cycle analysis tool developed by Argonne National Laboratory for the US government. There are multiple versions of GREET, including both a research and development ("R&D") model primarily for academic and research use and several specific GREET implementations for specific policies (e.g., California's Low Carbon Fuel Standard and the federal 45V hydrogen tax credit). The model versions vary across assumptions, usually in service of ensuring that specific policy choices are reflected in the calculation of CIs. Again, a CI or CI score is not an objective measurement of emissions, in part because it necessarily includes factors for comparing non-like things (e.g., different GHGs). Policy implementation priorities, such as certainty for project developers, also mean that some policies declare rather than measure inputs that are important for estimating the GHG impacts of a given project. Different versions of GREET reflect these different policy goals.

Q. Do you have concerns with the validity of SoCalGas's stated claim that it has demonstrated GHG reductions, specifically via analysis based on a GREET model?

A. Yes. I have several concerns.

Q. Please summarize your concerns with SoCalGas's claim of GHG reductions.

A. In my expert opinion, there are at least three reasons why the analysis upon which SoCalGas relies is invalid and does not sufficiently demonstrate GHG reductions.

[7] *See, e.g.*, Grubert, Emily, Wilson Ricks, and Danny Cullenward. 2025. "Greenhouse Gas Offsets Distort the Effect of Clean Energy Tax Credits in the United States." Environmental Research: Energy 2 (1): 015001. https://doi.org/10.1088/2753-3751/ad9f65.

First, SoCalGas has not demonstrated that its assessment of GHG reductions is consistent with validated models of carbon intensity, despite claiming the estimates are from GREET.

Second, even if SoCalGas were using GREET validly, which the documents available to me suggest it is not, the assumptions embedded in the base case are questionable and inconsistently applied. As a result, SoCalGas's conclusion that the Project's CI scores indicate that the Project will reduce GHG emissions is unsupported.

Third, SoCalGas did not account for methane emissions associated with biosynthetic natural gas ("Bio-SNG") (aka methane) manufacturing. As a result, it failed to account for a major source of GHG emissions from the Project.

Fourth, SoCalGas's analysis of a potential CCS component for the Project has not demonstrated viability. As a result, claims that my concerns about emissions are solvable using CCS are unsupported.

Q. Let's first discuss the first basis for your concern. Please elaborate on why it is your expert opinion that SoCalGas's CI scores are misrepresented as validated estimates.

A. Based on the documents made available to me, , SoCalGas did not actually provide a GREET model file in response to a data request but rather an Excel workbook containing some assumptions derived from what it describes as the R&D GREET 2024 model, and others from other sources.[8] As such, I cannot comment on whether SoCalGas's claims are consistent with California's implementation of GREET in other CI calculation contexts, though I do note that the version of GREET referenced in the provided Excel workbook ("R&D GREET 2024") is not California's state-specific GREET. The current version was released in July 2025.[9] Although CA-GREET is primarily used for the implementation of the California's Low Carbon Fuel Standard, I would generally expect a GREET-based analysis for California compliance to be consistent with, or at least very clear on its lack of consistency with, the state-approved CI calculation model for fuels like biomethane.

More generally, SoCalGas is claiming to be using GREET to calculate the CI score of the Proposed Project but has not provided any evidence that its CI scores were actually generated with any GREET model. The documentation provided suggests that CIs were calculated in a bespoke workbook that happens to derive some assumptions, particularly

[8] Attach. 3, SoCalGas Response to Sierra Club Data Request, Confidential SoCalGas Modeling Spreadsheet.
[9] California Air Resources Board, CA-GREET4.0 Model, https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation.

for fossil fuel comparators (which appear to be Low Sulfur Diesel and North American-Compressed Natural Gas) from the R&D GREET 2024 model.

Q. Let's now discuss your second concern, which is around the base case assumptions. What is your primary concern?

A. The concern I evaluated most carefully involves the claim that whole orchard recycling ("WOR") generates GHG emissions of 1700 g CO_2/kg applied biomass.[10] I believe that this number is a substantial overestimate of the actual climate change-causing GHG emissions associated with WOR and reflects both inconsistent application of assumptions through the analysis and a math error.

Q. Please explain what methods you used to evaluate this assumption.

A. I reviewed the relevant literature and SoCalGas's Application, data request responses, and also changed inputs in the spreadsheet model that SoCalGas shared (which, as I noted above, is not GREET) to evaluate how changes in inputs and assumptions affected the model outputs which include GHG emissions and CI scores for the base case and use cases.

Q. In your opinion, what is the correct approximate WOR GHG emissions estimate?

A. Based on my evaluation of the relevant literature and my adjustments to the assumptions used in the spreadsheet model that SoCalGas disclosed, it is my opinion that the WOR GHG estimate is approximately -110 g CO_2/kg biomass applied if soil carbon sequestration is considered, or 10 g CO_2/kg if not.

Q. How does SoCalGas's use of an incorrect, inflated number for WOR GHG emissions affect its overall conclusion that the Project will reduce GHGs?

A. As explained above, SoCalGas claims GHG reductions based on a comparison of a base case (aka business as usual) CI scores to two project use case CI scores (with and without CCS). Based on this comparison, SoCalGas finds that because the project use case CI scores are lower than the base case, there are GHG reductions from the Project, regardless of whether CCS is used.[11] Given this methodology, it is critical to have correct base case GHG estimates and CI score.

In my opinion, the use of an incorrect, inflated estimate for the baseline WOR GHG emissions estimate undermines SoCalGas's conclusion that the Proposed Project will

[10] Attach. 3, SoCalGas Response to Sierra Club Data Request, Confidential SoCalGas Modeling Spreadsheet, Baseline Case sheet at cell B30.
[11] SoCalGas Corrected Chapter 2 Testimony at JLMS-16.

reduce GHGs. I specifically evaluated the WOR base case both because the underlying data were accessible to me and because it accounts for the majority of the biomass under consideration (70% of 90%, or 63%).[12] Although all base case disposal method emissions factors have a listed source, only the value for "Incorporation direct" cite to a source I could access with high confidence that the value is the one being used – in this case, a journal article.[13]

As such, what I claim is a very substantial overestimate of emissions – at minimum, 170 times what it should have been – has a high impact on the final Baseline Carbon Intensity ("Baseline CI", also referred to as "base case CI") provided.

The inflated estimate for the base case emissions means that, when comparing base case CI score to the Project's use case CI score, the Project appears to produce lower GHG emissions than the base case. In my opinion, if the correct base case WOR GHG emissions estimates were used, the CI score for the base case would be lower, and the Project would show higher GHG emissions than business as usual. This outcome is in direct conflict with SoCalGas's claim that a comparison of the CI score for base case to the CI scores of the use cases shows GHG reductions.

Q. Please provide more information as to why you believe the WOR base case estimate is incorrect and inflated, leading to an inaccurate and inflated base case CI score.

The SoCalGas assumption in the spreadsheet that WOR generates GHG emissions of 1700 g CO_2/kg of applied biomass relies on a citation to Culumber et al. 2025, an academic study that I read while preparing this testimony. In SoCalGas's March 6, 2026 Response 4-1 to Sierra Club's February 20, 2026 data request, SoCalGas states:

> According to Culumber et al. (2025), most of the biogenic CO2 is expected to decompose and return to the atmosphere over time, with only 4.05 Mg C/ha projected to remain in the soil after 20 years with whole orchard recycling application rate of 61.6 Mg C/ha.[14]

[12] SoCalGas Corrected Chapter 2 Testimony at JLMS-15 (Table 1); SoCalGas Corrected Chapter 2 Testimony, Attach. 1, p. 3 (Table 1).
[13] Attach. 3, SoCalGas Response to Sierra Club Data Request, Confidential SoCalGas Modeling Spreadsheet, Baseline Case sheet at cell I30.
[14] Attach. 3, SoCalGas Response to Sierra Club Data Request 4, Question 4-1.

Based on my review of Culumber et al. 2025, I agree with this summary of the paper's findings. However, SoCalGas goes on to state:

> Considering that the biomass was 46.1% C and the relative molecular weights of CO2 and C, this results in flux of 1690 g CO2e/kg of biomass applied.[15]

I disagree with this statement for several reasons.

Most importantly, in my opinion, the flow of biogenic CO_2 (from the decomposition of plant matter) should not be counted toward the CI score, which measures GHG emissions that contribute to climate change, as described above. Essentially, SoCalGas is claiming that all of the carbon embodied in the woody biomass contributes to climate change, including the component that remains in the soil for at least 20 years. This assumption is inconsistent both with scientific convention, which assumes that biogenic CO_2 is carbon neutral,[16] and with assumptions elsewhere in SoCalGas's analysis. For example, the analysis assumes that when methane derived from woody biomass is burned, the CO_2 is carbon neutral.[17] It is incorrect to assume that if woody biomass decomposes over time, the resultant CO_2 emissions contribute to climate change, but if the same woody biomass is converted to methane and then burned, the CO_2 emissions from the same carbon do not contribute to climate change. This assumption is highly influential on the overall Baseline CI, contributing 100.3 g CO_2-e/MJ,[18] or 70%, to the Baseline CI. Correcting for biogenic CO_2 neutrality would adjust the GHG intensity of WOR to 10 g CO_2-e/kg of applied biomass.

Secondarily, in my opinion, there is a math error in the analysis presented by SoCalGas. Specifically, the estimate of 1690 g CO_2-e/kg of biomass provided in SoCalGas's Response 4-1 to Sierra Club's data request corresponds to the incorrect assumption that all 61.6 million grams of carbon per hectare (Mg C/ha) returns to the atmosphere.[19] As stated in the response quoted above, Culumber et al. find that 4.05 Mg C/ha of the originally applied 61.6 Mg C/ha remain in the soil after years. As such, the biogenic CO_2

[15] Attach. 3, SoCalGas Response to Sierra Club Data Request 4, Question 4-1. Note that there are also 10 g CO_2-e/kg of applied biomass attributed to other gas emissions, which I do not review here: this is the difference between the values of 1690 and 1700 (see same response).
[16] *See, e.g.*, Intergovernmental Panel on Climate Change ("IPCC"), Sixth Assessment Report, Climate Change 2023 Synthesis Report (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf.
[17] Attach. 3, SoCalGas Response to Sierra Club Data Request, Confidential SoCalGas Modeling Spreadsheet, WIW sheet at row 28.
[18] The original assumption is that 1700 gCO_2-e/kg biomass are associated with WOR, driving a contribution of 100.9 gCO_2-e/MJ to the Baseline CI: the value of 100.3 gCO_2-e/MJ is the share of 100.9 associated with the 1690 gCO_2-e/kg of biogenic CO_2, excluding the 10 gCO_2-e/kg from other gases.
[19] Attach. 3, SoCalGas Response to Sierra Club Data Request 4, Question 4-1.

emissions are ~1580 g CO_2/kg of biomass applied, not 1690 g CO_2/kg, using the calculation approach provided in the response. The impact of this error is minor numerically but demonstrates a lack of close attention to the source data.

In sum, after looking carefully at SoCalGas's model and the conclusions it drew from it, it is my opinion that SoCalGas's analysis and conclusions regarding the Project's CI score are insufficiently rigorous and thus unsupported.

Q. Do you see other problems with the assumptions used for the base case in the CI score analysis?

Yes. In my opinion, the SoCalGas analysis also fails to address the long-term carbon sequestration in soil of the "base case," which is another way it incorrectly inflates the CI score of the base case. In addition to not counting biogenic CO_2 emissions as climate contributors (as discussed above), it is relatively common practice to count decadal-scale carbon sequestration in soil as a negative emission (or net uptake).[20] Although this assumption is somewhat controversial when used to offset a long-term fossil-based CO_2 emission because of the impermanence of soil sequestration, it is common in carbon assessment settings, so I note also that accounting for the 4.05 Mg C/ha that Culumber et al. 2025 estimate are still stored in soil after 20 years post-WOR application as a sequestration would mean that WOR has a CI of -101 g CO_2/kg of applied biomass, contributing to net carbon dioxide removal rather than emissions for this practice.

Q. Did you evaluate the other base case assumptions? If not, why not?

A. I did not carefully review the assumptions related to treatment of biogenic emissions for the Dairy Bedding Direct, Air Curtain Incinerator Direct, or Biomass Plant Direct because the sources were not easily available (e.g., the source for Dairy Bedding Direct is listed as "NREL data").

Q. Although you have not evaluated these other base case assumptions, do you have an opinion about what would occur if an error were present for these factors similar to the error that is present for the WOR assumption?

A. Yes. If a similar error is present for these factors, the baseline CI for the woody biomass is likely negative, indicating that the Project would need to demonstrate net GHG removals to claim better climate performance than the business-as-usual fate for woody biomass.

---

[20] *See, e.g.*, U.S. Dep't of Energy, "DOE Explains…Carbon Sequestration," https://www.energy.gov/science/doe-explainscarbon-sequestration; Paustian, Keith, Eric Larson, Jeffrey Kent, Ernie Marx, and Amy Swan. 2019. "Soil C Sequestration as a Biological Negative Emission Strategy." Frontiers in Climate 1 (October). https://doi.org/10.3389/fclim.2019.00008.

Q. Please summarize your concerns with SoCalGas's methodology for calculating the CI score of the Project.

In my opinion, SoCalGas has not provided a CI score estimate that is consistent with California's validated approaches for calculating CI (e.g., through CA-GREET or a modified version of that model that has been vetted and approved by the CPUC), and as explained above, it appears to have misrepresented that its CI calculations—which have grave inconsistencies embedded—were done through a widely used, validated model (e.g. GREET). In fact, in my expert opinion based on the documentation made available to me, SoCalGas did not use GREET. Further, the CI scores it reports are inaccurate such that SoCalGas's statements in the Corrected Testimony that the Project will reduce GHGs are unsupported by the record.

Q. Your third concern is about methane emissions. Please explain why, in your view, methane emissions are a problem.

A. In my opinion, excluding methane emissions associated with the Bio-SNG plant from the analysis of the Project's CI is a highly concerning decision, both because SoCalGas is required to consider these emissions and because the Project is predicated on the intent to manufacture a GHG: Bio-SNG (also known as RNG or biomethane) is essentially pure methane, and but for this Project, the methane in question would not have existed. As such, any methane that escapes from the system contributes to climate change. Note that the methane in this case contributes to climate change even if one assumes that the CO_2 does not, because the methane would not have existed without this Project, but the CO_2 would have because that is what biomass becomes when it breaks down in the presence of oxygen. Methane is a powerful GHG, creating a warming impact of ~30-80 times that of CO_2 on a mass basis.

Operational data on methane emissions from plants like the one proposed by SoCalGas are rare, but literature estimates from other methane-generating activities suggest they can be quite high, as with a study of biogas plants that found emissions of 0.4-14.9% of methane by mass.[21] As I have modeled in my peer-reviewed, published research,[22] any project that creates new methane must factor in these emissions when evaluating the project's CI scores, and SoCalGas should be responsible for providing conservative

[21] Scheutz, Charlotte, and Anders M. Fredenslund. 2019. "Total Methane Emission Rates and Losses from 23 Biogas Plants." Waste Management 97 (September): 38–46. https://doi.org/10.1016/j.wasman.2019.07.029.

[22] Grubert, Emily. 2020. "At Scale, Renewable Natural Gas Systems Could Be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates." Environmental Research Letters 15 (8): 084041. https://doi.org/10.1088/1748-9326/ab9335.

engineering estimates for potential methane losses Also, in my analysis, CCS would not address these emissions, as it only manages CO_2.

Q. Please describe how you think methane emissions of this Proposed Project should be evaluated.

A. I have developed a peer-reviewed model for this purpose and, in my expert opinion, I believe it can be used to evaluate methane emissions from this Project. Using my model[23] for intentionally produced methane, as for this Project, emissions for both the Bio-CNG and Bio-CNG w/ CCS cases would be 2-88 g CO_2-e/MJ higher than the emissions range above (i.e. 0.4-14.9% methane emissions, mass basis) using CA-GREET4.0's GWP-100 for methane of 25. This value (i.e. 25 kg CO_2e/kg CH_4, 100 year basis) is lower than the most current international consensus on methane's warming impact (27 kg CO_2e/kg CH_4, 100 year basis, non-fossil methane),[24] which would suggest additional CO_2-e impact of 2-95 g CO_2-e/MJ on a 100-year basis, or 6-280 g CO_2-e/MJ on a 20-year basis. I further observe that according to SoCalGas's March 6, 2026 Response 4-2 to Sierra Club's February 20, 2026 data request, it notes use of a GWP-100 of 30 for methane, citing "AR5," (i.e. the IPCC 5th Assessment Report).[25] This GWP-100 value is neither the one used by the State of California (which is 25), nor the one that has been internationally accepted since the publication of the IPCC 6th Assessment Report several years ago (which is 27 for non-fossil methane).[26]

It is difficult to establish the threshold at which fugitive methane emissions would make even the Bio-SNG w/ CCS case a larger emitter than the baseline disposal practices for the woody biomass in question given the inconsistencies related to biogenic CO_2 described above. If all CI contributors for the alternative fate cases are biogenic; WOR results in some carbon sequestration; and the Bio-SNG plant's direct CO_2 emissions are also entirely biogenic, the threshold would be around 15% over 100 years, which is high but within the range of observations; on a 20-year basis, the threshold would be around 5.6%. A full evaluation would require complete information on the nature of the CO_2 emissions across biomass fates.

---

[23] Grubert, Emily. 2020. "At Scale, Renewable Natural Gas Systems Could Be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates." Environmental Research Letters 15 (8): 084041. https://doi.org/10.1088/1748-9326/ab9335.

[24] *See* IPCC, Sixth Assessment Report, Climate Change 2023 Synthesis Report (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf.

[25] Attach. 3, SoCalGas Response to Sierra Club Data Request 4, Question 4-2.

[26] *See* IPCC, Sixth Assessment Report, Climate Change 2023 Synthesis Report (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf.

Q. Your fourth concern is around the viability of the potential carbon capture and sequestration component of the Project. Please explain why, in your view, CCS success is highly uncertain.

A. In my opinion, which is informed by my experience running the federal Carbon Management program through the Department of Energy, SoCalGas's description of a potential CCS element of this Project does not account for major challenges and uncertainties with CCS deployment. Woody biomass gasification with CCS has not been commercially demonstrated, to my knowledge, and analysis has suggested that even if the technology succeeds, costs would be extremely high.[27] In this case, my expert opinion is that proposing a pilot where leftover funds from pipeline upgrades would be used to construct a biomass gasification plant, and maybe a CCS component, signals a lack of rigorous engineering work focused on the technological and cost challenges of successfully completing such a project. Without far more detail on the CCS project's technological challenges, costs, and contingencies, it is my opinion that the CCS element should be considered unlikely to move forward, and that the Project's CI scores should be evaluated primarily based on the no-CCS case.

Even if the CCS element were successfully implemented, CI scores would need to be estimated much more carefully than the current analysis has done. In addition to accounting for biogenic versus non-biogenic CO_2 shares across base and project cases and accounting for methane emissions, which CCS does not reduce, the CI score should reflect the ultimate fate of the captured CO_2. For a small project like this one, given the lack of commercially available CO_2 storage facilities, I would be concerned about reemissions of the CO_2—for example, if the captured CO_2 were converted to a fuel (which releases the CO_2 when burned), used for commercial purposes like beverages or greenhouse agriculture, or stored in a manner that offsets natural CO_2 uptake (e.g., in concrete). If the CO_2 were to be geologically stored, in my opinion, SoCalGas would need to provide estimates of reservoir leakage in addition to demonstrating access to funding and permits to secure CO_2 transportation and geologic storage, which is typically understood to rely on a type of well (Class VI) that had never been permitted in the State of California before the end of 2024.[28]

---

[27] *See, e.g.*, California Energy Commission, Renewable Natural Gas Production from Woody Biomass via Gasification and Fluidized-Bed Methanation (2020), https://www.energy.ca.gov/publications/2020/renewable-natural-gas-production-woody-biomass-gasification-and-fluidized-bed.

[28] California Resource Corporation, CRC's Carbon TerraVault Receives EPA Permits for CO2 Injection and Storage in California (Dec. 31, 2024), https://www.crc.com/news-releases/news-release-details/crcs-carbon-terravault-receives-epa-permits-co2-injection-and (last visited Mar. 13, 2026).

III. RISK OF GREENHOUSE GAS INCREASES

Q. Do you also have concerns about this Project increasing GHG emissions.

A. Yes**.**

Q. Please explain why, in your opinion, there is a risk that this proposed Project will increase GHGs.

A. In my opinion, there are several reasons why this Project will likely increase GHG emissions relative to the stated counterfactual fates for the biomass in question.

First, as noted above, my research has demonstrated that because of system methane leakage, any intentionally produced methane will increase emissions – regardless of source.

Second, *even assuming methane emissions are 0*, which is extremely unlikely based on the way that essentially all other methane-based systems work, the analytical inconsistencies related to accounting for biogenic CO_2 suggest that in fact, the counterfactual baseline has lower GHG emissions than the Project. Thus, on its face, the Project will increase GHG emissions relative to what would have happened anyway.

Third, simply demonstrating that the emissions from this Project could be lower than fossil fuel-based vehicle fuels is not the same as demonstrating reduced GHGs from this potential Project, particularly given that California's strict GHG constraints mean that fossil fuel-based vehicle fuels are not an appropriate comparator.

Q. In your evaluation, based on modifications of the spreadsheet that SoCalGas provided, does the base case have lower GHG emissions than the Project use case without CCS?

A. Yes, based on my best expert opinion of which emissions are likely to be biogenic, without access to full information. In my evaluation, based on modifications of the SoCalGas-provided spreadsheet, the base case has lower GHG emissions than the no-CCS use case, even without accounting for methane. This is the case when 1) only the WOR incorporation CI is biogenic or 2) all direct GHG emissions associated with the biomass – both for the Bio-SNG plant and for all alternative fates – are biogenic. It is possible that some end uses have mixed biogenic and non-biogenic CO_2 and other GHG emissions, which would require additional evaluation to confirm this claim.

Q. Is there sufficient information about the fate of captured CO2 to evaluate the GHG emissions from the CCS use case?

A. No. In my opinion, there is insufficient information about the fate of captured CO_2 to evaluate the GHG emissions of the CCS use case. Therefore, in my opinion, the reported CI score for this use case is not supported.

Q. Given your conclusions about GHG risk, in your opinion, is this Project consistent with California's goal of reducing short-lived climate pollutants, as expressed in Commission decision D.22-02-025?

A. No. In my opinion, this Project is not consistent with the California goal, reiterated in D.22-02-025, of reducing short-lived climate pollutants ("SLCPs") and GHGs. Rather than reduce SLCPs and GHGs, the Project risks increasing them.

Q. In D.22-02-025, the Commission requires gas utilities to "require biomethane producers to include a methane leak standard in the . . . life cycle carbon intensity accounting in the modified [GREET] Model."29 Based on your review of the Application, does such standard exist in the lifecycle model presented in the Application?

A. No, it does not.

Q. What role, if any, do you think the intentional production of methane from woody biomass could play in California's effort to reduce SLCPs?

A. Intentionally producing methane from woody biomass is unlikely to reduce SLCP emissions, as methane is an SLCP and methane-based systems emit some methane. Methane production from woody biomass and other resources could plausibly contribute to overall GHG reduction goals if it is used only in cases where methane specifically is required (as for feedstocks) and where fossil methane systems have been fully phased out. That is, because the combustion emissions from biogenically derived methane do not contribute to climate change as much as those from fossil derived methane, some methane emissions might be acceptable in exchange for continued access to truly methane-dependent services once fossil methane is gone.

Q. Given these deficiencies and the likely emissions increases, is it your opinion that the Commission should approve the Application?

A. No. In my view, the Commission should deny the Application.

[29] CPUC, D.22-02-025, Ordering Paragraph 49.

Q. Please summarize why, in your opinion, denial is appropriate.

I reach this opinion because of the near certainty that this proposed Project will increase, rather than decrease, GHG emissions and other pollutants. Having read the relevant sections of D.22-02-025, I understand the Commission to have ordered SoCalGas to propose a pilot project that complies with the CARB regulations governing the use of Cap-and-Trade allowance auction proceeds. Further, I understand that California is a state with GHG and SLCP reduction targets that it is attempting to meet. And my understanding of the regulations that apply to the use of Cap-and-Trade allowance auction proceeds is that utilities must demonstrate that they are being used to demonstrably reduce GHGs or else return the proceeds to ratepayers. Given SoCalGas's failure to demonstrate emissions reductions, and the risk of GHG emissions increases, I do not think these requirements have been met, and as a result, I believe denial of the Application is appropriate.

Q. Does this conclude your testimony?

A. Yes.

TESTIMONY OF RON SAHU

I. INTRODUCTION AND KEY FINDINGS AND RECOMMENDATIONS

Q. Please state your name, position, and organization.

A. My name is Dr. Ranajit (Ron) Sahu, and I am an independent consultant on environmental, mechanical, chemical engineering and energy matters based in California with a nation-wide practice.

Q. Please summarize your qualifications.

A. I have over 34 years of experience in the fields of environmental, mechanical, and chemical engineering, including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources including stationary and mobile sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the federal Clean Air Act, the Clean Water Act, and the National Environmental Policy Act, among others, as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality New Source Review/Prevention of Significant Deterioration permitting, Title V permitting, Clean Water Act permitting for industrial and storm water discharges, and Resource Conservation and Recovery Act permitting, among others); multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support, including negotiation of consent agreements and orders.

I have over thirty years of project management experience and have successfully managed and executed hundreds of projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

I have provided consulting services to numerous private sector, public sector and public interest group clients. My major clients over the past three decades include various trade associations as well as individual companies such as steel mills, petroleum refineries, chemical plants, cement manufacturers, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, land development companies, and various entities in the public sector,

including the U.S. Environmental Protection Agency ("U.S. EPA"), the U.S. Department of Justice, several states (including New York, New Jersey, Connecticut, Kansas, Oregon, New Mexico, Pennsylvania, and others), various agencies such as the California Department of Toxics Substances Control, and various cities and municipalities. I have executed projects in all 50 U.S. states, numerous local jurisdictions, and internationally.

In addition to consulting, for approximately two decades, I taught numerous courses in several Southern California universities as adjunct faculty, including University of California ("UC") Los Angeles (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management). I also taught at Caltech, my alma mater (various engineering courses), at the University of Southern California (air pollution controls), and at California State University, Fullerton (transportation and air quality).

Over the past three decades I have evaluated at least 30-40 pilot projects in a number of industries, including material processing, waste disposal, energy generation, chemical transformations, and others.

My CV is included with this testimony as Attachment 2. It includes a summary of the expert testimony I have provided before various administrative and judicial bodies, including state and Federal courts and public utility commissions.

Q. What is the purpose of this testimony?

A. The purpose of this testimony is to offer an assessment of the emissions impacts of the proposed Pilot Project facility and specifically whether, in my opinion, the Application has met the requirements of the governing California Public Utilities Commission ("CPUC") Decision ("D.") 22-02-025 to study and report emissions, including methane leakage, and to demonstrate greenhouse gas ("GHG") reductions given facility emissions. I will also offer an opinion on the impacts of the Project's emissions on any environmental and social justice communities.

Q. Are you familiar with other projects that have intentionally produced methane from biogenic sources?

A. Yes.

Q. Please describe those other projects.

A. I evaluated the Application of Pacific Gas & Electric submitted to the CPUC in 2023. It proposed to convert woody biomass to methane at a different West Biofuels Facility in Woodland, California. I was involved in projects in the mid-1990s in Hawaii where methane was produced from sugarcane bagasse. In the last decade, I have reviewed and

provided technical comments on the quantification of emissions from projects that convert livestock waste and other agricultural waste to livestock.

Q. What are your key findings and recommendations regarding the proposed Pilot Project?

A. Based on my review of the record in this matter, as well as my experience in evaluating numerous pilot projects over the last three-plus decades, it is my recommendation that the Application be denied. My key concerns with the Application and basis for this recommendation are:

1) **Air pollutants and impacts on environmental and social justice communities:** In addition to emitting GHGs, the proposed Project will also emit other health-harming air pollutants. My review of the available data shows that the facility will emit a range of air pollutants, and in greater quantities than at present, that are harmful to human health. These emissions will occur in and around Kerman, CA, the location of the proposed Project, which is ranked in the 88th percentile for pollution burdens in CalEnivroScreen.[30] CalEnviroScreen also indicated that Kerman, CA is a "disadvantaged community,"[31] which means it may include areas "disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure, or environmental degradation" or areas "with concentrations of people that are of low income, high unemployment, low levels of homeownership, high rent burden, sensitive populations, or low levels of educational attainment."[32] In my opinion, as a result of the facilities' emissions, there will be increased air pollution in this community.

2) **Air emissions study and reporting**: Based on my assessment of the available information, SoCalGas has not shown that the emissions from the proposed Pilot Project will be studied and reported as the Commission required in D.22-02-025.[33] There is insufficient information about the proposed Project's design, the

[30] State of California Office of Env't Health Hazard Assessment, "CalEnviroScreen 4.0 Indicator Maps" (last visited Mar. 9, 2026), https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40 (a search for "8325 S Madera Ave, Kerman, CA, 93630, USA." in the Map of CalEnviroScreen 4.0 Indicator generated an 88th percentile result for Pollution Burden).
[31] State of California Office of Env't Health Hazard Assessment, "SB 535 Disadvantaged Communities" (last visited Mar. 9, 2026), https://oehha.ca.gov/calenviroscreen/sb535 (a search for the address of the proposed Project—i.e. "8325 S Madera Ave, Kerman, CA, 93630, USA" as indicated in SoCalGas's December 22, 2025 Response 4 to Cal Advocates' December 8, 2025 data request—in the SB535 Disadvantaged Communities map generated a "Disadvantaged Community" designation as indicated by red shading).
[32] Cal. Health & Safety Code § 39711(a).
[33] D. 22-02-025, Ordering Paragraph 43.

emissions that would result from the Project, the emissions monitoring technologies that will be used, where such monitors will be located, and how frequently emissions will be monitored and reported. It is my opinion that without important additional details relating to project design emissions estimates, and how emissions are to be monitored including monitor types, locations, and durations, it is impossible to determine whether the proposed Project complies with D.22-02-025 and whether the proposed Project will ensure emissions are properly characterized and avoided to protect air quality for impacted communities and prevent GHG increases.

This absence contravenes the very purpose of a pilot project, which, in my experience, is to gather detailed information about the pilot's performance, including emissions, so that impacts can be fully evaluated and disclosed, thereby informing decision-making. It is my opinion that SoCalGas has failed to build in such a process for this proposed Pilot Project.

3) **Greenhouse gases**: SoCalGas proposes to use Cap-and-Trade allowance auction proceeds to fund the proposed Pilot Project, but in my opinion, it has not demonstrated that the proposed Project has any chance of achieving GHG reductions, since presumed GHG reductions are all based on a speculative use of carbon capture and sequestration ("CCS") of a portion of the CO_2 that will result from the Pilot Project. My analysis of the evidence in the record shows that there is a high risk and near certainty that the proposed Project will *increase* GHG emissions as well as other types of health-harming pollutants. In my opinion, this conflicts with the Commission's D. 22-02-025 and California's climate goals.

II. PROPOSED PROJECT EMISSIONS CONCERNS

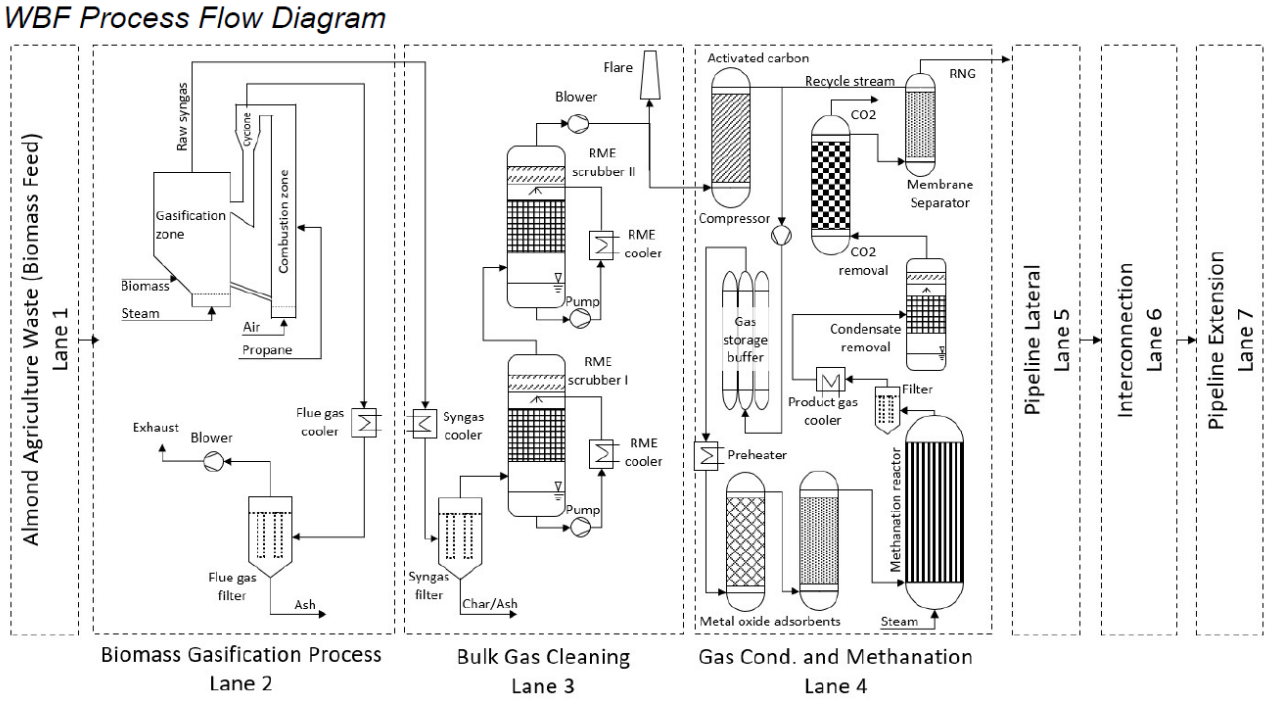
Q. What is your understanding of what SoCalGas proposes to fund with the Cap-and-Trade allowance auction proceeds?

A. My understanding, which is based on my review of SoCalGas's Application and Corrected Opening Testimony, is that SoCalGas proposes to use Cap-and-Trade allowance auction proceeds to fund modifications to its pipeline system and related infrastructure in Visalia, CA. If funds remain after these modifications, SoCalGas proposes to use those remaining funds to support the construction of a biomass gasification facility in Kerman, California. This facility will be owned and operated by West Biofuels LLC.

Q. What is depicted in this schematic, which we will call Figure 1?

A. This figure is from SoCalGas's December 22, 2025 Response 4 to California Public Advocates' ("Cal Advocates") December 8, 2025 data request. It depicts a "process flow diagram" of the West Biofuels facility that would be built as part of the Pilot Project, if there are funds remaining after SoCalGas's investment in its own pipeline infrastructure.

Figure 1: WBF Process Flow Diagram



Q. Please describe your understanding of the basic proposed Pilot Project facility design.

A. My understanding, which is based on the descriptions provided in the SoCalGas Application, the Corrected Opening Testimony of James Lucas and Matthew Summers ("Corrected Testimony"), and SoCalGas's responses to Intervenors' data requests, is that the facility would be designed to convert woody biomass into methane via gasification and methanation. Specifically, based on the description provided in Figure 2, Section III.A, and Section III.C of the Corrected Testimony, my understanding is that the basic proposed design is the gasification of the biomass to create syngas, followed by the cleanup of the syngas to enable its methanation to form bio-synthetic natural gas ("Bio-SNG"). According to my review, these are accomplished in Lanes 2 and 3 of Figure 2 in the Corrected Opening Testimony. This Bio-SNG is then processed in Lanes 4-10 in

Figure 2 in the Corrected Opening Testimony to enable its transport via truck to an injection point, where it would be injected into the SoCalGas pipeline system in Visalia.

Additional details of the processed in Lanes 2 and 3 are shown in Figure 1 (referenced above), which as noted was provided in SoCalGas's December 22, 2025 Response 4 to Cal Advocates' December 8, 2025 data request. I note that Lanes 2 and 3 steps in Corrected Testimony Figure 2 are shown as Lanes 2, 3, and 4 in Figure 1.

Q, To your knowledge, what does the gasification of woody biomass entail?

A. Gasification seeks to convert biomass (or carbonaceous raw materials) into synthesis gas (or syngas), composed mainly of carbon monoxide ("CO") and hydrogen.[34] Typically gasification occurs in a gasifier, a high temperature/pressure vessel, in which the feedstock biomass and steam are reacted to form syngas. In the proposed design of the gasified discussed below, combustion is a part of the gasification process. Therefore, a range of combustion-generated air pollutants will be created, which will include so-called criteria air pollutants such as NOx, CO, and particulate matter as well as other, which I will collectively refer to as "air toxics."

Q. To your knowledge, in this proposed Project, how will gasification occur?

A. Based on my review of SoCalGas's Application, Opening Testimony, and responses to Intervenor data requests, and my knowledge of gasification more generally, the gasification step in the Project will used a Fast Internally Circulating Fluidized Bed ("FICFB"), which will used a dual fluidized bed gasification system using synthetic bed material to transfer heat from the combustion zone to the gasification zone. Biomass will be fed into the gasification zone via a screw auger where it will be thermochemically converted to raw syngas via contact with the hot fluidized bed material and steam. The steam will be provided from other parts of the process via heat recovery.[35] The bed material and the non-gasified remaining char will be transported to the combustion side by gravity where air will be injected and the char will be combusted to heat the bed material. The hot bed material will be lifted up the riser with the combustion flue gases into a cyclone where the bed material and flue gases will be separated. The re-heated bed material will be reintroduced into the fluidized bed gasification chamber while the flue gases continue through the flue gas treatment system.

[34] *See* U.S. Dep't of Energy, "Hydrogen Production: Biomass Gasification," https://www.energy.gov/eere/fuelcells/hydrogen-production-biomass-gasification#:~:text=Biomass%20gasification%20is%20a%20mature,and%20other%20products%2C%20without%20combustion.

[35] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2a.

The raw syngas from gasification will then be cleaned to remove impurities (see Lane 3 in the excerpted Figure 1 above) before proceeding to methanation.

Q. To your knowledge, will this Project include some amount of biomass combustion?

A. Yes. The FICFB explicitly has a combustion zone.

Q. To your knowledge, what does the methanation of woody biomass entail?

A. Methanation is the conversion, after gasification, of the remaining CO2 in the syngas to methane.

Q. To your knowledge, how will methanation occur in this proposed Project?

A. As described in SoCalGas's Corrected Testimony Section III.C, and as shown in Lane 4 in the excerpted Figure 1 above, the conversion of the syngas into Bio-SNG is to be accomplished through a catalytic methanation process followed by cleaning of the Bio-SNG stream via removal of water, unreacted hydrogen and carbon monoxide. These recovered impurity gases from the process supposed to be recycled back to the methanation unit for further conversion to Bio-SNG.

Q. Have you evaluated a similar facility design? If so, where?

A. Yes. A very similar facility design and gasification and methanation process using FICFB was presented in the Application of Pacific Gas & Electric Company, A.23-6-023, which proposed to fund modifications to an existing biomass gasification owned and operated by West Biofuels in Woodland, California.[36] I submitted testimony analyzing the potential emissions impacts of that facility.[37] To provide that testimony I examined the

[36] PG&E Application, A.23-6-023 at 2, https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M512/K707/512707890.PDF; PG&E Prepared Testimony (Public Version) at 1-7, https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2306023/6419/513343059.pdf.

[37] Testimony of Ranajit (Ron) Sahu and Sasan Saadat on Behalf of the Sierra Club, A.23-06-023 (Feb. 16, 2024), https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2306023/7054/525583319.pdf; Supplemental Testimony of Ranajit (Ron) Sahu on Behalf of the Sierra Club, A.23-06-023 (Apr. 29, 2024), https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2306023/7272/530646456.pdf.

facility design and emissions data carefully. I note that SoCalGas references the performance and operation of this West Biofuels facility as relevant to this proceeding.[38]

Q. Please summarize how, in your opinion, the proposed Pilot Project will impact emissions from each "Lane" presented in Figure 1?

A. Based on what is shown in just Lanes 2-4 in Figure 1, as well as prior processing of the biomass before it can be gasified and the steps after methanation up to pipeline injection, there are multiple potential sources of air pollutant emissions consisting of a wide range of pollutants. Specifically:

1. Lane 2 – Biomass Gasification Process. This lane will include emissions of GHGs, criteria pollutants and air toxics from the exhaust, as well as fugitive methane, also a GHG.
2. Lane 3 and 4 – Bulk Gas Cleaning and Gas Conditioning and Methanation. This lane will include emissions of GHGs, criteria pollutants and air toxics from the flare, as well as fugitive methane.

Q. In your assessment, what will be the likely emissions from Lane 2, the biomass gasification process?

A. It is my opinion that air pollutants will be emitted from the emission point noted as "Exhaust" in Figure 1, Lane 2. Specifically, given the FICFB combustion zone, this exhaust stream will contain a range of criteria pollutants, GHG, and combustion-generated air toxics. Further, fugitive emissions of methane from various components in this Lane, such as connectors, valves, pump seals, and storage devices, as indicated in Figure 1 will also occur.

Q. In its March 3, 2026 Response 3-2d to Sierra Club's February 18, 2026 data request, SoCalGas lists exhaust emissions to be monitored by the local air district as O_2 and NOx, as well as "periodic third-party testing of all criteria pollutant emissions[.]"[39] In your assessment, is this statement an accurate listing of the likely emitted pollutants?

A. No, because, in my expert opinion, Response 3-2d to the Sierra Club states that this exhaust will only contain NOx and "criteria pollutants" alone. SoCalGas omits other pollutants that, in my opinion, will be emitted including GHGs such as CO_2 and N_2O as

[38] Attach. 3, SoCalGas Response to Sierra Club Data Request 2, Question 2-13(a)-(b); Attach. 4, SoCalGas Response to Cal Advocates Data Request 2, Question 9a; *see also* SoCalGas Corrected Chapter 2 Testimony at JLMS-22 (noting experience working at the facility).
[39] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2d.

well as a range of combustion air toxics such as benzene, toluene, xylenes, hexane, formaldehyde, and acetaldehyde, among others.

Q. In your opinion, why will the emissions from Lane 2 increase as a result of the proposed Project?

A. These emissions described above from Lane 2 "exhaust" would not occur but for the proposed Pilot Project. Therefore, they are directly emissions increases as a result of the proposed Project.

Q. Based on your knowledge, please explain the potential emissions from Lane 3, the bulk gas cleaning process.

A. Emissions from Lane 3, gas cleaning, will consist of emissions from the "flare" indicated in Figure 1 when the downstream methanation process cannot accept the syngas from Lane 3. In my opinion, flaring of the syngas will produce a wide range of combustion-generated pollutants including criteria pollutants such as NOx, CO, $PM_{2.5}$ as well as CO_2, uncombusted methane, N_2O and also a range of air toxics such as benzene, toluene, xylenes, hexane, formaldehyde, acetaldehyde, and others. Furthermore, as with Lane 2, it is my opinion that there will likely be fugitive methane leakage from various components in this lane such as connectors, valves, pump seals, and storage devices.

Q. In its March 3, 2026 Response 3-2c to Sierra Club's February 18, 2026 data request, SoCalGas states that this flare will be used "infrequently."[40] Does this statement impact your conclusion that emissions from the flare are likely?

A. No. In my opinion, even though this flare is supposed to be used "infrequently[,]"[41] it is my experience that flaring can be considerable in pilot projects because of the very nature of these projects, in which there is no assurance that the new methanation process will always be available. It is my opinion that considerable downtimes in the various processes in methanation will mean that the syngas cleaned in Lane 3 has to be flared.

[40] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2c.
[41] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2c.

Q. SoCalGas states in its February 23, 2026 Response 2-14a to Sierra Club's February 9, 2026 data request that the flare will only be used 0.5% of the hours.[42] It also states in its March 11, 2026 Response 5-9f to Sierra Club's February 25, 2026 data request that "WBF estimates the flare will be used for a maximum of 10 minutes for an initial startup or emergency shutdown of the methanation system. In the first year, which includes commissioning, WBF anticipates up to 120 startups and shutdowns which is the basis for less than 0.5% of hours. After the facility is commissioned, WBF only anticipates approximately 8 to 10 startups/shutdowns annually."[43] Do these responses address your concerns with flare emissions? If not, why not?

A. No, these responses do not address my concerns. In my opinion, there is a high risk if not certainty that the flare will operate much more frequently than anticipated by SoCalGas, thereby releasing a substantial amount of health-harming emissions. I based this opinion on several factors: first, this is a pilot project where experimentation with the process, especially the methanation step, will occur regularly. Indeed, based on the information I have reviewed and based on my experience reviewing West Biofuels's project at Woodland proposed by Pacific Gas & Electric Company ("PG&E") in A.23-06-023, West Biofuels does not have much experience with syngas generation or methanation. The associated experimentation necessarily entails many stops and starts and generation of syngas that is off-spec and must therefore be flared. Similarly, there will be substantial experimentation in the methanation lane of the proposed Project. Second, the scale of the proposed Project is substantial and much larger than any gasification and methanation project that West Biofuels has operated before. This large size means that a lot of syngas will be produced that may be off-spec and that needs to be flared. So, based on how much as well as how often the flare will be used in this experimental proposed Project, the emissions from flaring will be considerable.

Q. In its March 3, 2026 Response 3-2e to Sierra Club's February 18, 2026 data request, SoCalGas lists the composition of the gas that would be flared. Does this information indicate what the flare emissions will be?

A. No, it does not. These are not emissions from the flare. Those emissions will be based on combusting the inlet gases and will have a very different composition, for which we have no information other than that provided in SoCalGas's March 3, 2026 Response 3-2d to the Sierra Club's February 18, 2026 data request, where SoCalGas indicates that West Biofuels expects to have a NOx continuous monitor and do stack testing. In its March 11, 2026 Response 5-9c to Sierra Club's February 25, 2026 data request, West Biofuels

[42] Attach. 3, SoCalGas Response to Sierra Club Data Request 2, Question 2-14a.
[43] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-9f.

confirms its lack of knowledge of the flare emissions since those will be "estimated by the supplier[.]"[44]

Q. In your opinion, why will the emissions from Lane 3 increase as a result of the proposed Project?

A. These emissions described above from Lane 3 flare would not occur but for the proposed Pilot Project. Therefore, they are directly emissions increases as a result of the proposed Project.

Q. In your view, what will be the emissions from Lane 4, the gas conditioning and methanation lane?

A. To the extent that pre-heating will be needed as contemplated by the existence of a "preheater" (as indicated in Lane 4 of Figure 1), additional combustion-related emissions may occur if combustion is needed to generate this heat. In my opinion, these combustion-generated emissions will include CO_2, criteria pollutants such as NOx and CO, as well as a range of air toxics previously noted.

Further, as described in the record and as shown in Lane 4 on excerpted Figure 1 earlier, there will be fugitive emissions of methane and CO_2 from the Lane 4 processes. This air pollution fugitive leakage will occur from various components in this Lane such as connectors, valves, pump seals, and storage devices.

Q. Why, in your opinion, will there be fugitive emissions in Lane 4?

A. Since gases will flow through pipes and connections through this overall methanation Lane 3, fugitive emissions cannot be avoided due to leaking through connectors, valves, pump seals, and storage devices, as indicated in Figure 1. It is my opinion that the only way to avoid these fugitive leaks is to have specially designed components such as seal-less pumps, leakless valves, and the elimination of connectors (which, in my view, is practically impossible).

Q. In Lane 4. what is your understanding of what the proposed Project will do with the CO_2?

A. SoCalGas states that a portion of the CO_2 that will be emitted from the Pilot Project will be reduced by the use of CCS.[45] In fact, SoCalGas takes credit for this CCS and arrives at its conclusion that the carbon intensity ("CI") for the Pilot Project will be lower than its

[44] Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 5-9c.
[45] SoCalGas Corrected Chapter 2 Testimony atJLMS-12 to JLMS-13; Attach. 3, SoCalGas Response to Sierra Club Data Request 2, Question 2-14e.

"base case" scenario. However, it provides no details as to how CCS will be implemented. First, it speculates about which technologies it may use to separate CO_2 from the waste gases before that CO_2 can be compressed to enable later sequestration.[46] Second, it is not consistent in the amount of CO_2 project emissions that it will capture. In the Corrected Testimony, SoCalGas states that the capture rate will be 80%.[47] But in at least one other instance, it estimates 78%.[48] In either case, large quantities of CO_2 will still be vented directly into the atmosphere from the Pilot Project. Third, and critically, regardless of whether the level of capture is 78% or 80% (which is important)), SoCalGas says nothing about how that captured CO_2 will be sequestered in order to provide the speculative CI benefit it simply assumes. SoCalGas admits that "[c]ontinuously capturing CO_2 for long term onsite storage will not be practical so implementation of [carbon dioxide removal] will be dependent on having an offtake partner for carbon dioxide.[49] To my knowledge, there is no offtake agreement in place. Therefore, the feasibility of carbon capture at the Project is still unclear. As a result, it is my opinion that the CCS discussion in the Application, which is important to the justification of the Project and the claim that it will reduce GHGs, is completely speculative and unsupported.

Q. What is the GHG impact of CO_2 venting?

A. CO_2 is a GHG. Venting CO_2 means that there will be additional GHG emissions to the atmosphere.

Q. Beyond Lanes 2-4, do you have concerns with any other Lanes of the Project?

A. Yes. With respect to Lane 1, in my opinion, there may be emissions from feedstock handling that could include particulate matter of a variety of sizes including particulate matter ("PM"), PM_{10}, and $PM_{2.5}$. Also, with respect to Lane 5, there will be emissions from trucking the methane from the facility to the injection point. These emissions will

[46] SoCalGas Corrected Chapter 2 Testimony, JLMS-12 to JLMS-13; Attach. 3, SoCalGas Response to Sierra Club Data Request 2, Question 2-14e ("CO2 in the flue stream will also be captured, labeled 'exhaust' in Lane 2 of the Process Flow Diagram. There are supplier technologies being considered that separate the CO2 from this stream including adsorption and filtration.").
[47] SoCalGas Corrected Chapter 2 Testimony at JLMS-15 ("While the CCS requires energy, it captures about 80% or more of the plant CO2 emissions.").
[48] Attach.3, SoCalGas Response to Sierra Club Data Request 4, Question 4-3 ("[e]ffectively, the overall capture rate estimate is 78% compared to the pre-CCS case.").
[49] SoCalGas Corrected Chapter 2 Testimony at JLMS-13.

include NOx and PM as well as other pollutants emitting by trucks. Based on my review of the record, SoCalGas has not fully characterized these emissions.

Q. The next set of questions focus on fugitive methane, which you mention as a likely from all parts of the facility. SoCalGas states in its February 26, 2026 Response 5 to Cal Advocates' February 11, 2026 data request that "[t]he WBF Bio-SNG production infrastructure (Lanes 2-5) are not permitted to operate with leakage for safety reasons. The WBF Facility uses gas-tight reactor vessels, valves, and compressors and methane impervious stainless-steel piping that are not expected to have any leakage during normal operations."[50] It concludes that "[t]herefore, no continuous leakage assumption was used in the GREET modeling."[51] Do you believe it is reasonable to assume no leakage is expected given these assertions? If not, why not?

A. No, I do not. SoCalGas conflates and confuses the term "leakage." Leakage, from an air pollution fugitive emissions standpoint, means the escaping of gases from their containment (such as in pipes or vessels), often at low concentrations that may not pose potential safety risks such as flammability or explosions. While lower than concentrations that can cause flammability or explosions, these "low" concentrations can themselves be substantial (tens to hundreds or even thousands of parts per million) and are often persistent, and are therefore important from an air pollution standpoint. These fugitive air pollution emissions need to be minimized and quantified. Using instruments that are appropriate for measuring and then quantifying these "low" levels.

In contrast, leakage of high levels of flammable gases, such as methane from containment, can reach concentrations that could pose flammability and explosion risks. SoCalGas rightly monitors for this type of leakage using instruments and protocols that are geared towards detection and safeguarding against flammability/explosion risks. However, the instruments used for this monitoring are not the same as those needed for detecting the "low" levels of fugitives that are concerning from an air pollution and GHG impact standpoint.

In my opinion, based on the context above and as confirmed by SoCalGas itself, SoCalGas's use of "gas-tight" equipment may safeguard against large leaks from a safety standpoint. But that does not mean that smaller fugitive leaks of methane and other gases will not occur from this same equipment or others such pipeline connections, valves, or pump seals. It is these low-level fugitive leaks that SoCalGas has not addressed from

[50] Attach. 4, SoCalGas Response to Cal Advocates Data Request 2, Question 5.
[51] Attach. 4, SoCalGas Response to Cal Advocates Data Request 2, Question 5.

proper monitoring (i.e., exactly what instruments or protocols it will use), quantification, and reporting standpoints.

Q. In its February 23, 2026 Response 2-3 to Sierra Club's February 9, 2026 data request, SoCalGas states that "[f]or indoor and confined facilities, gas detectors will be installed that would immediately detect leakages from equipment to the building and trigger an immediate shutdown to assess and correct the leakage issue. For outdoor piping and equipment, daily leak checks will be performed using portable gas detection equipment. For each leakage event, the total leakage amount will be estimated based on size and duration of the leakage."[52] Does this description of the proposed gas detection methods address your concerns about fugitive methane leakage from the Project? If not, why not.

A. No. Based on my review of the available information, there is no evidence that the leakage detection methods contemplated will detect, measure and prevent fugitive leakage. In response to questions about the exact "gas detectors" and "portable gas detection equipment" that will be used, SoCalGas responded that the "specific make and model" will be selected "following CPUC approval of the application."[53] Therefore, there no assurance that the Project will detect and prevent methane leakage from the Project.

Q. In its December 5, 2025 Response 1-5(c) to Sierra Club's November 4, 2025 data request, SoCalGas states that it "assume[s] no fugitive methane emissions as the level of leakage is expected to be negligible."[54] Do you believe this assumption is support? If not, why not.

A. No, it is not supported or reasonable. It is speculative. Fugitive methane leakage rates from the proposed Project might seem "negligible" to SoCalGas because it is used to large leak concentrations that are relevant to safety (see prior discussion above), but there is no basis for this "negligible" assumption in the context of leakage that is relevant to the Project's GHG emissions.[55] Fugitive emissions need to be properly monitored, quantified, and reported in order to determine GHG impacts.

[52] Attach. 3, SoCalGas Response to Sierra Club Data Request 2, Question 2-3.
[53] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-2(a)-(b).
[54] Attach. 3, SoCalGas Response to Sierra Club Data Request 1, Question 1-5(c).
[55] Attach. 3, SoCalGas Response to Sierra Club Data Request 1, Question 1-5(c).

Q. Without such measurement and reporting, do you think SoCalGas can credibly claim that it has demonstrated GHG reductions in this Application?

A. No, I do not. In my opinion, no claim of GHG reductions from this Project is credible if fugitive emissions are simply assumed to be non-detect or zero. In my opinion, they will not be zero and could be substantial.

Q. In its February 26, 2026 Response 4 to Cal Advocates' February 11, 2026 data request, SoCalGas indicates that "WBF employs regular scheduled inspections using advanced methane detection technologies, such as handheld detectors, optical gas imaging cameras, and continuous monitoring systems within confined areas and buildings. Inspections are conducted at key points, including production equipment, pipeline connections, and transfer points."[56] In your opinion, is this methane leak detection sufficient to ensure no fugitive methane leakage occurs.

A. No, in my expert opinion, it is not. Optical imaging is typically for large leaks, not smaller fugitive leaks that can persist for long periods of time. Continuous monitoring is typically used in confined spaces to prevent safety risks, not detect fugitive leaks throughout the system. With respect to handheld monitors, it is unclear what model they would use and whether it would be sufficient to detect fugitive leaks. As a result, I do not believe the proposed Project ensures sufficient methane leak detection to prevent methane leakage and a net increase in GHG emissions form the Project.

Q. I will now ask questions about what if any information is missing about Project emissions. In your opinion, what aspects of the facility's emissions are unknown?

A. Based on my assessment, SoCalGas has not provided sufficient information about the level and range of emissions that are going to occur as a result of the Project, including NOx and other criteria pollutants from the Lane 2 "exhaust" and criteria pollutants from the flare in Lane 3 as well as the numerous air toxics that will be emitted at least from these sources within the proposed plant. In addition, as noted above, the emissions from processing the feedstock and trucking the methane are not known nor are the quantities of fugitive emissions from throughout the Project lanes, as explained above.

[56] Attach. 4, SoCalGas Response to Cal Advocates Data Request 2, Question 4.

Q. What is your assessment of the information on emissions intensities and factors provided by SoCalGas in Table 2 of the Corrected Testimony at JLMS-16 and in the associated Attachment 1?

A. SoCalGas presents emissions intensities and emission factors that, in my opinion, are not useful to determining actual emissions from the proposed Project. I have several specific concerns with the information as presented in Table 2 at JLMS-16.[57]

First, Table 2 contains no information for the air toxic compounds that will be emitted due to combustion. Those are nowhere to be found in the record.

Second, I am concerned about SoCalGas's March 11, 2026 Response 5-8ato Sierra Club's February 25, 2026 data request suggesting that the Table 2 entry "Bio-SNG plant direct emissions" includes only exhaust emissions (Lane 2) and fails to account for other emissions such as emissions from the flare (Lane 3) and, potentially, the preheater (Lane 4). I am concerned that this is the case because SoCalGas states that "[t]he exhaust emissions are the 'Bio-SNG plant direct emissions' in Table 2."[58] If this is indeed the case, then it is my opinion that the Table 2 emissions factors for the "Bio-SNG plant direct emissions" is greatly underestimating the facility emissions since the CO_2 from Lane 4 is not included.

Second, if the emissions entry for the "Bio-SNG plant direct emissions" in Table 2 does intend to include different sources of emissions (e.g. exhaust, flare, preheater) to create an overall Project NOx intensity, it is my opinion that the units of the intensity noted in Table 2 makes no sense. As I indicated above, criteria pollutants such as NOx will be emitted from several locations at the facility, such as the flare and the exhaust and potentially the preheater. The pollution intensities from these separate sources will be different and expressed differently. For example, flare emissions are typically measured as the amount of pollutant mass generated or released per unit of heat release. While exhaust emissions would typically be expressed as amount of pollutant mass per unit amount of syngas produced. Therefore, SoCalGas's combined intensity in Table 2 from these disparate source types to create an overall "Bio-SNG Plant" emissions intensity is technically unsupported. If SoCalGas were properly reporting the emissions intensities of the Bio-SNG plant, it would do so separately from each source type (i.e., exhaust, flare, preheater). In its Table 2, SoCalGas should have disaggregated the criteria pollutant emissions from individual sources instead of plant-wide "Intensity" for each such

[57] SoCalGas Corrected Chapter 2 Testimony at JLMS-16 (Table 2); SoCalGas Corrected Chapter 2 Testimony, Attach. 1, pp. 4 (Table 2).
[58] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-8a.

pollutant.[59] It did not do so. And, as noted prior, Table 2 simply omits any and all air toxics that will be emitted.

Q. Do you think SoCalGas could provide more information about air emissions at this juncture?

Yes. In my view, SoCalGas's characterization of this lack of basic information as a data gap that will be filled in via the Pilot Project is puzzling to me when, according to SoCalGas, there is already a FICFB that has operated at the West Biofuels in Woodland, CA, including as recently as [redacted], which should have been characterized for emissions of all air pollutants.[60] Indeed, SoCalGas states that "[s]yngas was tested at the Woodland Biomass Research Center under a number of operating conditions by varying temperature, pressure, hydrogen to carbon ratio, and residence time to determine best performance for the methanation catalyst."[61] Further, West Biofuels has a "pilot system" that "has been used to test multiple methanation catalysts under a number of operating parameters including pressure, temperature, fluidization rate, space velocity, syngas composition, steam addition, etc."[62] Given this information, SoCalGas should be able to provide more information about the range and level of pollutant emissions expected from this Project. These prior operations should have been the basis for substantial air pollution characterization. No such information is provided in the record.

Q. To summarize, in your opinion, what pollutants will be emitted from the proposed Pilot Project?

A. In my assessment, in addition to GHG emissions such as methane and CO_2, additional pollutants that will be emitted from the proposed Pilot Project include additional GHG emissions from N_2O, resulting from combustor exhaust and the flare, and numerous criteria and hazardous air pollutants from the combustor venting and flare.[63] These include NOx, CO, and various sizes of particulate matter, including PM_{10} and $PM_{2.5}$,[64] which are considered "criteria pollutants."[65] It also includes volatile organic compounds

[59] SoCalGas Corrected Chapter 2 Testimony at JLMS-16 (Table 2); SoCalGas Corrected Chapter 2 Testimony, Attach. 1, pp. 4 (Table 2).
[60] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 2-13b, 2-13(c); SoCalGas Response to Sierra Club Data Request 5, Question 5-6a.
[61] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-6d.
[62] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-6e.
[63] *See* Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2d.
[64] *See* Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2d.
[65] *See* California Air Resources Board, "Criteria Air Pollutants," https://ww2.arb.ca.gov/our-work/programs/criteria-air-pollutants#:~:text=Criteria%20air%20pollutants%20are%20air,5;

and air toxics such as benzene, toluene, xylenes, hexane, formaldehyde, various polycyclic aromatic compounds, and numerous metals.

Q. On what basis do you conclude that the proposed Project will emit these pollutants?

A. SoCalGas presented some of these pollutants in Table 2 of the Corrected Testimony on page JLMS-16. Others like the air toxics I have noted prior are unavoidable due to the nature of combustion. These pollutants are created unavoidably as a result of combustion of carbon-based fuels in the FICFB exhaust vent gas and will therefore be emitted**.** I provide my opinion about the types of pollutants that will be emitted based on my education (combustion engineering) and over 34 years of consulting experience for a wide range of clients and industrial processes. Just combustion-generated pollutants alone will consist of criteria pollutants, GHGs, and air toxics.[66]

In addition, as explained above, fugitive emissions are inevitable from pipeline connections as well as fittings such as valves, flanges, connectors, and the like. I note that even if the concentrations of these fugitive emissions appear to be non-detectable using safety-focused monitoring devices not capable of measuring the lower concentrations of fugitive emission), that does not mean that fugitive emissions below the detection limit of these inappropriate devices are not being emitted.

Q. In Corrected Testimony, SoCalGas states that "[t]he results also show that for almost all of the major criteria pollutants, the Bio-SNG production use cases generate less emissions than the baseline practices."[67] Do you concur with this conclusion? If not, why not?

A. No, I do not concur because, as I explained above, I do not believe that the figures presented in Table 1 for the "Use Case" scenarios, both with and without CCS, are correct or supported by the available evidence. Therefore, a comparison of the base case and use cases, will not show the emissions effects of the Project.

Q. What are the potential health impacts of these emissions?

A. The criteria pollutants such as NOx, CO, and $PM_{2.5}$ have known adverse health impacts. That is why they are regulated. Specifically, each of these criteria pollutants are subject to

[66] U.S. EPA, Compilation of Air Emissions Factors from Stationary Sources, AP-42 1.4, Supplement D, Natural Gas Combustion (July 1998), Table 1.4-2 https://www.epa.gov/sites/default/files/2020-09/documents/1.4_natural_gas_combustion.pdf (indicating that burning natural gas, essentially methane, produces a wide variety of air toxics, including VOC species as well as metals).
[67] SoCalGas Corrected Testimony, JLMS-16.

National Ambient Air Quality Standards ("NAAQS"), and the NAAQS are periodically revised as needed based on toxicological data and evidence.

Each of the non-criteria, toxic pollutants including examples listed in the previous answers have adverse health impacts over multiple time scale – including acute, chronic (non-cancer), and chronic (cancer).[68]These include pollutants such as benzene and formaldehyde are known human carcinogens,[69] for example. Again, as noted above, these are not identified as being potential pollutants from the proposed Project at all.

Q. To your knowledge, which of these likely Project emissions are considered short-lived climate pollutants?

A. At least methane is a short-lived climate pollutant, given its intense global warming potential for a relatively short period of time in the atmosphere once emitted.

Q. To summarize, in your opinion, what would be the effect of the proposed Pilot Project with respect to emissions?

A. The effect of the proposed Project would be to increase criteria, GHG, and air toxic pollutants that would otherwise not occur but for the Project.

III. ENVIRONMENTAL AND SOCIAL JUSTICE COMMUNITY IMPACT CONCERNS.

Q. We will now turn the topic of impacts to environmental and social justice communities and consistency with the Commission's environmental and social justice action plan. We will start with the area near the proposed WBF facility. To your knowledge, where would the gasification facility be located?

A. As I explained above, according to my understanding of the Application, the proposed facility would be located in Kerman, California.

[68] *See, e.g.*, U.S. EPA, "AirToxScreen Frequent Questions," https://www.epa.gov/AirToxScreen/airtoxscreen-frequent-questions#background1; U.S. EPA, Enviro Atlas Fact Sheet, Cumulative Cancer Risk Per Million from Air Toxics, https://enviroatlas.epa.gov/enviroatlas/DataFactSheets/pdf/Supplemental/Cancerriskcumulative.pdf.

[69] U.S. EPA, https://www.epa.gov/formaldehyde/facts-about-formaldehyde; U.S. EPA, "Volatile Organic Compounds Impact on Indoor Air Quality" (last updated July 5, 2025), https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-qualitye; National Cancer Institute, "Formaldehyde and Cancer Risk, National Cancer Institute, "Formaldehyde and Cancer Risk" (last visited Mar. 9, 2025), https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/formaldehyde/formaldehyde-fact-sheet#can-formaldehyde-cause-cancer.

Q. What is CalEnviroScreen?

A. My understanding is that it is a tool developed by the Office of Environmental Health Hazard Assessment to identify California communities disproportionately burdened by multiples sources of pollution.[70]

Q. Based on your understanding of the available CalEnviroScreen data, what is the pollution status of the area in Kerman, CA where the facility will be located?

A. Based on my interpretation of the results of CalEnviroScreen 4.0, the area ranks in the 88th percentile for pollution burden.[71]

Q Based on your understanding of the available CalEnviroScreen data, what is the socio-economic status of the area in Kerman, CA where the facility will be located?

A. Based on my interpretation of the results of CalEnviroScreen 4.0, the area is majority low-income[72] and Hispanic.[73]

Q. Is the region considered "a disadvantaged community" under CalEnviroScreen?

A. Yes. Based on my review of CalEnviroScreen 4.0, Kerman, CA is designated a "disadvantaged community."[74]

---

[70] State of California Office of Env't Health Hazard Assessment, "CalEnviroScreen4.0" (last visited Mar. 13, 2026); https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40.

[71] State of California Office of Env't Health Hazard Assessment, "CalEnviroScreen 4.0" (last visited Mar. 13, 2026), https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40 (a search for "8325 S Madera Ave, Kerman, CA, 93630, USA." in the Map of CalEnviroScreen 4.0 Indicators generated an 88th percentile result for pollution burden).

[72] State of California Office of Env't Health Hazard Assessment, "CalEnviroScreen 4.0" (last visited Mar. 13, 2026), https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40 (a search for "8325 S Madera Ave, Kerman, CA, 93630, USA." in the Map of CalEnviroScreen 4.0 Indicators revealed that, in this area, "the percent of people living below twice the poverty level is higher than 74% of the census tracts in California").

[73] State of California Office of Env't Health Hazard Assessment, "CalEnviroScreen 4.0" (last visited Mar. 13, 2026), https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40 (a search for "8325 S Madera Ave, Kerman, CA, 93630, USA" in the CalEnviroScreen 4.0 Data Dashboard generated a majority Latino race/ethnicity result).

[74] State of California Office of Env't Health Hazard Assessment, "SB 535 Disadvantaged Communities" (last visited Mar. 13, 2026), https://oehha.ca.gov/calenviroscreen/sb535 (a search for "8325 S Madera Ave, Kerman, CA, 93630, USA." in the SB535 Disadvantaged Communities map generated a "Disadvantaged Community" designation, as indicated by red shading).

Q. The Commission defines an "Environmental and Social Justice Community" as one which includes low-income or communities of color, including Disadvantaged Communities.[75] Does the region meet this definition?

A. Yes, the region meets the definition for an Environmental and Social Justice Community.

Q. With regard to your understanding of the Clean Air Act, is this region in attainment for Particulate Matter-2.5 ($PM_{2.5}$)?

A. No. Based on my review of the U.S. EPA data, it is not.[76]

Q. What is the severity level of nonattainment for $PM_{2.5}$ in this region?

A. The severity level is listed by the U.S. EPA as "serious."[77]

[75] CPUC, "Environmental & Social Justice Action Plan, Version 2.0" at 11-12, (Apr. 7, 2022) (defining Environmental and Social Justice Communities as "low-income or communities of color that have been underrepresented in the policy setting or decision-making process, are subject to a disproportionate impact from one or more environmental hazards, and likely to experience disparate implementation of environmental regulations and socio-economic investments in their communities[,]" as well as "Disadvantaged Communities, defined as census tracts that score in the top 25% of CalEnviroScreen 3.0, along with those that score within the highest 5% of CalEnviroScreen 3.0's Pollution Burden but do not receive an overall CalEnviroScreen score; all Tribal lands; low-income households; and low-income census tracts").
[76] U.S. EPA, "Current Nonattainment Counties for All Criteria Pollutants" (last updated Feb. 28, 2026, https://www3.epa.gov/airquality/greenbook/ancl.html#CA.
[77] U.S. EPA, "Current Nonattainment Counties for All Criteria Pollutants" (last updated Feb. 28, 2026, https://www3.epa.gov/airquality/greenbook/ancl.html#CA.

Q. Is this region in attainment under the Clean Air Act for ozone?

A. No. Based on my review of the U.S. EPA data, it is not.[78]

Q. What is the severity level of nonattainment for ozone in this region?

A. The severity level is "extreme," which is the most concerning designation for a nonattainment level.[79]

Q. What does it mean to be out of attainment for a pollutant under the Clean Air Act?

A. It means that, with respect to the particular pollutant, it is at levels in the region that do not meet national air quality standards.[80] This essentially means that the air is unhealthy for humans to breathe. The further out of attainment a region is for a particular criteria pollutant, the less healthy (and more dangerous) the air is for human health.

Q. In your opinion, will the proposed Project improve the air quality in and around Kerman, CA?

A. No. As explained above, I believe and the Application admits that the proposed facility will cause additional pollution. That pollution will worsen air quality in the region.

Q. Will the Project bring the region closer to attainment for $PM_{2.5}$ and Ozone under the Clean Air Act?

A. No. In my view, it will do the opposite—that is, it will bring it further out of attainment for $PM_{2.5}$ and ozone because it will emit PM and NOx, which is a precursor to ozone.

Q. To your knowledge, what will be the effects of this worsened air quality?

A. As noted above, the pollution from the proposed Project will have adverse health impacts. The Project is adding additional emissions to an area that is already out of attainment. In my view, this additional pollution risks exacerbating the health harms caused by polluted air and will add to the high pollution burden that this disadvantaged community already bears.

---

[78] U.S. EPA, "Current Nonattainment Counties for All Criteria Pollutants" (last updated Feb. 28, 2026, https://www3.epa.gov/airquality/greenbook/ancl.html#CA.
[79] U.S. EPA, "Current Nonattainment Counties for All Criteria Pollutants" (last updated Feb. 28, 2026, https://www3.epa.gov/airquality/greenbook/ancl.html#CA.
[80] U.S. EPA, "Process to Determine Whether Areas Meet the NAAQS (Designations Process)" (last updated Nov. 5, 2025), https://www.epa.gov/criteria-air-pollutants/process-determine-whether-areas-meet-naaqs-designations-process.

Q. In your opinion, what will be the impacts of the Project on environmental and social justice communities?

A. As noted above, it will have an adverse impact in and around Kerman, California in the form of additional health-harming air pollution.

Q. Are you familiar with the Commission's Environmental and Social Justice ("ESJ") Action Plan ("the Plan")?

A. Yes.

Q. Are you familiar with Goal 2 in the Plan?

A. Yes.

Q. Please describe Goal 2 and any relevant objectives.

A. Goal 2 involves investing in clean energy to benefit environmental and social justice communities, "especially to improve local air quality and public health."[81] Objective 2.4 pertains to "address[ing] ongoing and legacy impacts in ESJ communities in the resilient, clean energy space[,]" and Objective 2.5 sets a goal to "[c]ontinue to make prioritized resilient, clean energy investments in ESJ communities."[82]

Q. In your opinion, how will the proposed Project impact the achievement of the Goal 2 in the Plan?

A. I believe the proposed Project is inconsistent with Goal 2 because it increases health-harming air pollutants in an environmental and social justice community. It will worsen, rather than improve, local air quality and public health.

Q. Are you familiar with Goal 9 in the Plan?

A. Yes.

Q. Please describe Goal 9 and any relevant objectives.

A. Goal 9 involves monitoring the CPUC's environmental and social justice efforts to understand whether they are achieving their objectives.[83] Objective 9.1 pertains to "pursu[ing] opportunities to standardize metrics related to ESJ communities in CPUC

[81] CPUC, Environmental & Social Justice Action Plan, Version 2.0 (Apr. 7, 2022) at 23-24.
[82] CPUC, Environmental & Social Justice Action Plan, Version 2.0 (Apr. 7, 2022) at 24.
[83] CPUC, Environmental & Social Justice Action Plan, Version 2.0 (Apr. 7, 2022) at 26.

programs and proceedings," and Objective 9.2 relates to cultivating feedback "from the public and demonstrate[ing] resulting impact back to members of the public."[84]

Q. In your opinion, how will the proposed Project impact the achievement of the Goal 9 in the Commission's Plan?

A. I believe the proposed Project is inconsistent with Goal 9 because there is no monitoring plan included in the Application. Therefore, there is no insight into the proposed Project's resulting emissions or impact nor means to communicate these impacts to the community or the public more broadly.

IV. EMISSIONS MONITORING CONCERNS

Q. This next line of questioning will address emissions study and reporting. To your knowledge, how will West Biofuels monitor emissions from the facility?

A. In my opinion, very little monitoring is proposed for the proposed Project. SoCalGas states that "SoCalGas and WBF have not established or considered methods to document, study and report emissions."[85] This indicates to me that the study and reporting of emission is lacking as a general matter. Further, from the information that they have provided regarding methane, exhaust, and flare emissions monitoring, I have confirmation that there is insufficient monitoring of emissions to ensure they are detected and avoided.

Q. Let's first discuss study and reporting of methane emissions. In its February 26, 2026 Response 4 to Cal Advocates' February 11, 2026 data request, SoCalGas lists a method for methane leak detection and remediation at the West Biofuels facility and the SoCalGas interconnection point. Do you believe these methods will provide sufficient monitoring?

A. No. As described above, SoCalGas intends to monitor methane to detect leaks that are prohibited for safety reasons.[86] Such methods do not detect low levels of leakage that in my opinion will occur as a result of the Project. Such low levels of leakage are highly relevant for purposes of determining the Project's GHG emissions impacts. Further, SoCalGas, as indicated above, has not determined the exact equipment it will use to monitor methane. It indicates it will do so only after the CPUC approves the Application.[87]

---

[84] CPUC, Environmental & Social Justice Action Plan, Version 2.0 (Apr. 7, 2022) at 26.
[85] Attach. 4, SoCalGas Response to Cal Advocates Data Request 2, Question 3a.
[86] Attach. 4, SoCalGas Response to Cal Advocates Data Request 2, Question 5.
[87] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-2(a)-(b).

Q. In its February 26, 2026 Response 3b to CalAdvocates' February 11, 2026 data request asking what analyses SoCalGas and/or West Biofuels "have conducted regarding the feasibility and/or effectiveness of fugitive emission monitoring technologies or methodologies for the Woody Biomass Project[,]" SoCalGas states that "SoCalGas and/or WBF have not conducted this type of specific analysis for the SB 1440 Woody Biomass Pilot Project."[88] Do you believe that such an analysis is needed in order to monitor methane leakage?

A. Yes.

Q. With respect to the monitoring of exhaust emissions, SoCalGas states in its March 3, 2026 Response 3-2d to Sierra Club's February 18, 2026 data request that "[i]t is likely the local air district will require monitoring of the exhaust emissions. This will likely entail continuous recording of facility throughput, continuous monitoring of stack O2 and NOx, and periodic third-party testing of all criteria pollutant emissions from the exhaust."[89] Does this response present a monitoring method?

A. No. SoCalGas does not commit to using any form of exhaust monitoring. It merely states that such monitoring, if it is required by the air district, may include these methods.

Q. Let's turn to the monitoring of flare emissions. As noted above, in its March 3, 2026 Response 3-2c to Sierra Club's February 18, 2026 data request, SoCalGas states, "[t]he total hours of use of the flare will be monitored, and the emissions can be estimated using the emissions factors for the flare. The flare is designed as an emergency flare and is expected to operate infrequently. Its use will adhere to the requirements of the local air district."[90] In your opinion, is the flare emissions monitoring for the proposed Project sufficient to ensure such emissions are detected?

A. No. Based on my review of the available information, flare emissions are to be monitored by simply monitoring the hours of operation of the flare and then using emission factors (which it will get from its supplier) to estimate emissions.[91] I do not believe this is sufficient because, in my opinion and to the best of my knowledge, the flare (thermal oxidizer) emissions can be directly measured at the stack using continuous monitoring systems ("CEMS") for NOx, $PM_{2,5}$ (filterable), CO, and other emissions and also by conducting periodic, representative, stack testing for other pollutants including air toxics.

[88] Attach. 4, SoCalGas Response to Cal Advocates Data Request 2, Question 3b.
[89] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2d.
[90] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2c.
[91] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2c; Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 5-3c.

Continuous monitoring for NOx and CO as been implemented by U.S. EPA for numerous sources for at least the last 30 years.[92] In fact, as discussed above, SoCalGas itself noted that it may be required to use such monitoring for NOx from the exhaust.[93] In my view, if CEMS can use it for the exhaust, it can be used for the flare.

Q. SoCalGas states that "[t]he air district is unlikely to require continuous emissions monitoring because the flare is used only rarely. However, ports are typically added to the stack to conduct a source test if required and gas flow to the flare is continuously monitored and recorded to determine the total flare usage."[94] Does this response provide any assurance that the flare will be appropriately monitored?

A. No, it does not. Even if the air district does not require West Biofuels to use CEMS, it is my opinion that it should given the risk of emissions levels that far exceed levels that are expected and the fact that this is a pilot project. The very purpose of a pilot project is to test hypotheses and experiment with new potential technologies, while collecting data. This requires testing and monitoring processes comprehensively to gain as much information as possible about the pilot project's operations and effects. The fact that SoCalGas and West Biofuels only intend to monitor emissions at the minimum level required suggests that they are not proposing a project that will meet this purpose.

[92] *See, e.g.*, U.S. EPA, "California Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants" (last updated Feb. 28, 2026), https://www3.epa.gov/airquality/greenbook/anayo_ca.html.
[93] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2d.
[94] Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 5-9e.

Q. In its February 9, 2026 Response 2-6 to Sierra Club's February 9, 2026data request, SoCalGas states that "[c]ommercially available gas analyzers will be utilized to measure the direct carbon dioxide and criteria pollutant emissions from the facility. WBF uses commercial flue gas analyzers from Horiba and Testo and industry standard procedures at its current facilities."[95] It indicates that "[t]he specific make and model of the gas analyzers for the proposed project will be selected following CPUC approval of the application. For the gas analyzers used at other WBF facilities, the model of the Horiba gas analyzer is Horiba PG 250 Portable Gas Analyzer."[96] It also indicates that "[t]he specific make and model of the gas analyzers for the proposed project will be selected following CPUC approval of the application. For the gas analyzers used at other WBF facilities, the model of the Testo gas analyzer is Testo 300-LL-C-KIT Flue Gas Analyzer Kit with NOx Sensor."[97] In your opinion, do these statements ensure that emissions will be properly monitored?

A. No, because this is not continuous emissions monitoring. It is just a spot check. In my opinion, these analyzers are proper for internal process monitoring as part of the research and development effort, but the results are not appropriate for regulatory monitoring and reporting, which have more rigorous requirements, or to ensure overall emissions are minimized and that underreporting is not occurring.

Q. SoCalGas also says it will use "industry standard practices"[98] and states that "[a]n example of industry standard procedures is the guidance of USEPA for good practices in stack testing can be found at https://www.epa.gov/compliance/clean-air-act-nationalstack-testing-guidance, which includes recommended use, for example, of EPA Methods 1, 2, 3A, 7E, 10 for procedures for gas analyzers, setup of sampling lines, and measurement of flow rates."[99] Is following this "standard practice" relevant here?

A. No. Based on my knowledge of Methods 1 and 2, 3, 7E, and 10, they are of no relevance to a handheld criteria pollutant measurement, which is what SoCalGas says it will use for this Project.

[95] Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 2-6.
[96] Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 5-3a.
[97] Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 5-3b.
[98] Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 2-6.
[99] Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 5-3c.

Q. Based on the information that is available, do you believe the monitoring that is currently contemplated by SoCalGas and WBF is sufficient to detect the facility's emissions?

A. It is my opinion that the monitoring proposed is woefully inadequate.

In fact, as noted above, it appears that SoCalGas does not understand what fugitive emissions are from an air pollution standpoint (as opposed to the larger leaks that can cause safety issues).

For the exhaust, SoCalGas does not provide sufficient detail to ensure all emissions will be monitored continuously

For the flare, there is neither knowledge of its exhaust emissions and no monitoring proposed at all, other than its hours of operation.[100] Since the quantities of syngas that will be flared are not being monitored, simply monitoring hours cannot provide estimates of pollutant mass emissions.

Q. Do you have concerns with this lack of information about monitoring?

A. Yes. In my opinion, lack of information about emissions monitoring means that there is no ability to adequately study and report the emissions from this proposed Project. Using emission factors for the flare that will be provided by a supplier for a research pilot project with varying compositions of the flared gases makes no sense.[101] Similarly, in my view, "looking" for fugitive emissions using the wrong instruments and concluding that there are none, is misleading and underestimates emissions.

Q. Are there emissions from the proposed Project that cannot be monitored?

A. Yes. In my opinion, not all air toxics emissions from the exhaust and the flare can be continuously monitored. It is my view that, while periodic stack tests can provide some of this emissions information, even those periodic stack tests cannot account for variability in the compositions of these emissions on a continuous basis.

Q. Can these flare emissions be credibly estimated?

A. In my opinion, given that the flare in question is an enclosed thermal oxidizer, stack monitoring using continuous emissions monitors and periodic stack testing can provide

[100] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2c.
[101] Attach. 3, SoCalGas Response to Sierra Club Data Request, Question 5-9c ("Criteria pollutant emissions from this type of flare will be estimated by the supplier during the procurement process.").

much better data than what is currently proposed (i.e., hours of operation and emission factors from a supplier, which are presumed to be constant but are in fact not).[102]

Q. In its February 26, 2026 Response 4 to Cal Advocates' February 11, 2026 data request, SoCalGas describes "methane leak detection and remediation" that it will use.[103] Do you believe the listed actions are sufficient to prevent all methane leakage? If not, why not?

A. No. As noted, the plan is premised on detection of leaks using technology that does not detect the low level of methane leakage that will, in my opinion, occur as a result of the proposed Project.

Q. In D.22-02-025, the Commission required the pilot projects to "study and report fugitive methane, pollutant, and particulate matter emissions and emissions reduction or elimination methods in the gasification or pyrolysis process, the methanation process, and pipeline infrastructure."[104] In your view, has SoCalGas met this requirement? If not, why not?

A. No, it has not. For the reasons stated above, the current monitoring plans are insufficient to detect the indicated pollutants. Furthermore, SoCalGas has not presented any information suggesting that it will properly study and report these pollutants in the future.

Q. Do you think it is reasonable for the Commission to order pilot projects, as a general matter?

A. Yes, provided that a pilot project has some maturity and has a reasonable chance of success. In my view, pilot projects are a reasonable way for any public agency like the Commission to test hypotheses and experiment with new potential technologies so that it can develop optimal policies and programs.

Q. What is your opinion of West Biofuels's track record in terms of its ability to operate woody biomass gasification and methanation projects that produce useful information about these technologies for the public?

A. In my opinion, West Biofuels does not have a reliable track record in this regard. As noted, I reviewed PG&E proposed pilot project with West Biofuels in A.23-06-023 and found it to be lacking evidence of emissions reductions and a study and reporting plan.[105]

---

[102] Attach. 3, SoCalGas Response to Sierra Club Data Request 3, Question 3-2c; Attach. 3, SoCalGas Response to Sierra Club Data Request 2, Question 2-14a.
[103] Attach. 4, SoCalGas Response to Cal Advocates Data Request 2, Question 4.
[104] D.22-02-025, Ordering Paragraph 43.
[105] *See* PG&E Application, A.23-6-023, https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M512/K707/512707890.PDF; Testimony of Ranajit

I also note that as SoCalGas indicated the Woodland facility operated for only [redacted] in [redacted] and [redacted] in [redacted] [106] SoCalGas indicated that daily volumes of syngas produced during these years "are not available"[107] and that "[t]he volume of syngas 'tested' has not been quantified."[108] Given this information, I do not believe that West Biofuels has a track record of producing valuation information for public decision-makers at its facilities.

Q In your view, does the proposed Pilot Project serve this purpose?

A. It does not. In my opinion, this is a research project at best, proposed by West Biofuels whose track record, even with respect to research projects, does not indicate a contribution to public knowledge. Further, the project design does not set the proposed Pilot Project up for success in reducing emissions. As detailed above, there are numerous problems with the proposed Project that will very likely lead to emissions increases, contrary to the requirements attached to use of ratepayer funds and the CPUC's ESJ Action Plan. Further the monitoring and evaluation protocols are not in place to ensure that the results are properly analyzed and vetted to inform future Commission decisions. Because they are experiments, pilot projects must set up systems to evaluate and disclose results to decision makers and stakeholders. SoCalGas has failed to do so here.

Q. Given these deficiencies and the likely emissions increases, is it your opinion that the Commission should approve the Application?

A. No, I do not believe the Commission should approve the Project.

Q. Please summarize why, in your opinion, denial is appropriate.

A. Denial is appropriate because there will almost certainly be increases in GHG emissions and emissions of criteria pollutants and air toxics. Increases of health-harming pollutants will add to the pollution burden of a disadvantaged community, in conflict with the CPUC's Environmental and Social Justice Action Plan. Further, the Application does not contain sufficient information about the air pollutant emissions or reliable plans to monitor, study and report them. As a result, there is no assurance that the Pilot Project

---

(Ron) Sahu and Sasan Saadat on Behalf of the Sierra Club, A.23-06-023 (Feb. 16, 2024), https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2306023/7054/525583319.pdf; Supplemental Testimony of Ranajit (Ron) Sahu on Behalf of the Sierra Club, A.23-06-023 (Apr. 29, 2024), https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2306023/7272/530646456.pdf.

[106] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-6a.

[107] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-6b.

[108] Attach. 3, SoCalGas Response to Sierra Club Data Request 5, Question 5-6c.

will reduce GHG emissions, avoid harms to nearby residents, or generate information that is useful to CPUC policy-making.

Thus**,** given the increase in criteria pollutants, air toxics, and GHGs that will result from the Project, the risk of adverse impacts to environmental and social justice communities, and the lack of sufficient study and reporting, it is my expert view that the Commissions should not approve this Application.

Q. Does this conclude your testimony?

A. Yes.

Attachments

Attach. 1 – Resume of Emily Grubert

Attach. 2 – Resume of Ron Sahu

Attach. 3 – SoCalGas Responses to Sierra Club Data Requests (Public Version)

Attach. 4 – SoCalGas Responses to California Public Advocates Data Requests

Attachment 1

Emily Grubert
Associate Professor of Sustainable Energy Policy
Keough School of Global Affairs
Civil and Environmental Engineering and Earth Sciences (concurrent)

CONTACT INFORMATION

302 Hesburgh Center
University of Notre Dame
Notre Dame, IN 46556

egrubert@nd.edu
574.631.5911
ORCID: 0000-0003-2196-7571

TABLE OF CONTENTS

I. EARNED DEGREES

PhD **Stanford University**, Environment and Resources, 2017
Dissertation: *Improving Life Cycle Assessment as a Decision Support Tool Using Empirical Data for Multicriteria Prioritization*
Co-advisors: Adam Brandt, Mark Algee-Hewitt

MS **The University of Texas at Austin**, Environmental and Water Resources Engineering, 2011
Thesis: *Freshwater on the Island of Maui: System Interactions, Supply, and Demand*
Advisor: Michael Webber

MA **The University of Texas at Austin**, Energy and Earth Resources, 2010
Thesis: *Maui's Freshwater: Status, Allocation, and Management for Sustainability*
Advisor: Michael Webber

BS **Stanford University**, Mathematics (Honors), Atmosphere/Energy Engineering (Honors), Biological Sciences (Minor), 2009

II. EMPLOYMENT HISTORY

2022- **University of Notre Dame**, Associate Professor of Sustainable Energy Policy, Keough School of Global Affairs
Concurrent Associate Professor of Civil and Environmental Engineering and Earth Sciences
2025-pres: Program Chair in the Institute for Ethics and the Common Good

2022-23 **United States Department of Energy**, Senior Advisor for Energy Asset Transformation, Office of Fossil Energy and Carbon Management

2021-22 **United States Department of Energy**, Deputy Assistant Secretary, Office of Carbon Management

2019-22 **Georgia Institute of Technology**, Assistant Professor, Civil and Environmental Engineering
2021-22: Olmsted Early-Career Professor of Civil and Environmental Engineering
CEE Affinity Groups: Construction and Infrastructure Systems Engineering, Environmental Engineering
Courtesy Appointment: Public Policy
Program Faculty Member: Computational Science and Engineering

2018 **University of California, Berkeley**, Lecturer, Civil and Environmental Engineering

2017-18 **University of California, Berkeley**, Postdoctoral Scholar, Civil and Environmental Engineering
Supervisor: Arpad Horvath

2011-13 **McKinsey & Company**, Business Analyst and Junior Engagement Manager

III. HONORS AND AWARDS

A. INTERNATIONAL OR NATIONAL AWARDS

2023 Leeson Lecturer, Metcalf Institute, University of Rhode Island

2022 Distinguished Lecturer, American Association of Petroleum Geologists *(declined)*

2021 Clean Energy Leadership Institute Fellow, National Cohort

2020 Trusted Reviewer (reflecting "exceptionally high level of peer review competency"), Institute of Physics

2017 Reviewer of the Year, *Environmental Research Letters*

B. UNIVERSITY OR SCHOOL AWARDS

2020-21 Outstanding Faculty/Staff Member, Association of Environmental Engineers and Scientists—Georgia Tech student chapter

2020-21 Diversity and Inclusion Fellow, Georgia Institute of Technology

2019-20 Class of 1969 Teaching Fellow, Georgia Institute of Technology

IV. RESEARCH, SCHOLARSHIP, AND CREATIVE ACTIVITIES

coauthors: * indicates supervised undergraduate; @ indicates supervised graduate student; + indicates supervised postdoc

A. PUBLISHED BOOKS, BOOK CHAPTERS, AND EDITED VOLUMES

A1. Books

no data

A2. Refereed Book Chapters

[2] Grubert, E. 2020. "Social Science and Energy Policymaking: The Need for Social Scientists in Developing Social Life Cycle Assessment." In: *Energy Impacts: A Multidisciplinary Exploration of North American Energy Development*. Eds: J. Jacquet, J. Haggerty, and G. Theodori. Utah State University Press.

[1] Haya, B., A. Strong, E. Grubert, and D. Cullenward. 2015. "Carbon Offsets in California: Science in the Policy Development Process." In: *Communicating Climate Change and Natural Hazard Risk and Cultivating Resilience: Case Studies for a Multi-disciplinary Approach*. Eds: Yekaterina Kontar et al. Springer.

A3. Edited Volumes

no data

A4. Other Parts of Books

[1] Lovins, A. and Rocky Mountain Institute. September 2011. *Reinventing Fire: Bold Business Solutions for the New Energy Era.* Chelsea Green Publishing Company, Vermont. *(E. Grubert as research contributor, natural gas and coal systems)*

B. Refereed Publications and Submitted Articles

B1. Published and Accepted Journal Articles

[91] [+]Lappen, J. and E. Grubert. 2026. Fossil energy minimum viable scale. *Science*. DOI: 10.1126/science.aea0972.

[90] Lang, V., S. Camilleri, A. Montgomery, M. Visa, J. Schnell, M. Janssen, Z. Adelman, S. Anenberg, E. Grubert, and D. Horton. 2025. Watts-to-Wheel Comparison of the Air Quality, Health, and Equity Impacts of Light- versus Heavy-Duty Vehicle Electrification in the U.S. Midwest. *Environmental Research: Health*. DOI: 10.1088/2752-5309/ae16c8.

[89] [@]Kopp, T., K. Kurtis, and E. Grubert. 2025. Life cycle analysis of proposed performance-based specifications for structural concrete and portland cement concrete pavement in Georgia, USA. *Journal of Transportation Engineering, Part B: Pavements (ASCE)*. DOI: 10.1061/JPEODX.PVENG-1727.

[88] Olmstead, S., B. Leibowicz, C. Mason, A. Waxman, E. Grubert, H. Huber-Rodriguez, and J. Stemmler. 2025. How to design better incentives for carbon capture and storage in the United States. *Proceedings of the National Academy of Sciences*. DOI: 10.1073/pnas.2404677122.

[87] Cha, M. and E. Grubert. 2025. Managing the Decline of Coal: Pathways to Public Ownership of the Powder River Basin, Wyoming. *Environmental Research: Energy*. DOI: 10.1088/2753-3751/adbf24.

[86] [@]Moe, L. and E. Grubert. 2025. Planning for the energy transition by considering sites of community ties and environmental social value. *Environmental Research: Energy*. DOI: 10.1088/2753-3751/adb9ec.

[85] Tarroja, B., D. Mulvaney, R. Peer, and E. Grubert. 2025. Evaluating the effectiveness of cost-minimal planning of decarbonized electricity systems in reducing life cycle greenhouse gas emissions. *Environmental Research: Energy*. DOI: 10.1088/2753-3751/ada95c.

[84] Grubert, E., W. Ricks, and D. Cullenward. 2025. Greenhouse gas offsets distort the effect of clean energy tax credits in the United States. *Environmental Research: Energy*. DOI: 10.1088/2753-3751/ad9f65.

[83] Marshall, A., E. Grubert, and S. Warix. 2025. Unanticipated consequences of temperature overshoot for hydrology and water resources. *Water Resources Research*. DOI: 10.1029/2024WR037950.

[82] Grubert, E. 2024. Carbon markets have no future in a (net) zero-carbon world. *Dialogues on Climate Change*. DOI: 10.1177/29768659241300681.

[81] Gunda, T., A. Cantor, E. Grubert, A. Harris, and Y. McDonald. 2024. The Water-Climate Nexus: Toward an Integrated, Multi-Sectoral Approach. *Wiley Interdisciplinary Reviews: Water*. DOI: 10.1002/wat2.1759.

[80] Cha, J.M., and E. Grubert. 2024. Public Control of Coal Resources of the United States' Powder River Basin for a Managed Decarbonization Transition. *Progress in Energy*. DOI: 10.1088/2516-1083/ad756d.

[79] Clarke, L., M. Curtis, A. Eisenberg, E. Grubert, J. Haggerty, A. James, N. Jensen, N. Kaufman, E. Krause, D. Raimi, D. Tingley, and J. Weber. 2024. A Research Agenda for Economic Resilience in Fossil Fuel-Dependent

Communities. *Environmental Research: Energy*. DOI: 10.1088/2753-3751/ad6d70.

[78] [@]Broesicke, O., V. Thomas, E. Grubert, and J. Crittenden. 2024. Water consumption in absorption chillers is not negligible: Water-for-cooling consumption of chiller systems for commercial buildings in the United States. *Sustainable Energy Technologies and Assessments*. DOI: 10.1016/j.seta.2024.103827.

[77] Giang, A., M. Edwards, S. Fletcher, R. Gardner-Frolick, R. Gryba, J-D. Mathias, C. Venier-Cambron, J. Anderies, E. Berglund, S. Carley, J. Erickson, E. Grubert, A. Hadjimichael, J. Hill, E. Mayfield, D. Nock, K. Pikok, R. Saari, M. Lezcano, A. Siddiqi, J. Skerker, and C. Tessum. 2024. Equity and modeling in sustainability science: examples and opportunities throughout the modeling process. *Proceedings of the National Academy of Sciences*. DOI: 10.1073/pnas.2215688121.

[76] [@]Henao, Y., E. Grubert, M. Korey, L. Bank, and R. Gentry. 2024. Life Cycle Assessment and Life Cycle Cost Analysis of Repurposing Decommissioned Wind Turbine Blades as High-Voltage Transmission Poles. *Journal of Construction Engineering and Management (ASCE)*. DOI: 10.1061/JCEMD4.COENG-13718. *(Editor's Choice)*

[75] Grubert, E., and S. Talati. 2023. The Distortionary Effects of Unconstrained For-Profit Carbon Dioxide Removal and the Need for Early Governance Intervention. *Carbon Management*. DOI: 10.1080/17583004.2023.2292111.

[74] Grubert, E. and F. Sawyer. 2023. Reply to 'A commentary on "US power sector carbon capture and storage under the Inflation Reduction Act could be costly with limited or negative abatement potential"'. *Environmental Research: Infrastructure and Sustainability*. DOI: 10.1088/2634-4505/ad0ff1.

[73] [@]Maxim, A. and E Grubert. 2023. Highly Energy Efficient Housing Can Reduce Peak Load and Increase Safety Under Beneficial Electrification. *Environmental Research Letters*. DOI: 10.1088/1748-9326/ad114d.

[72] Visa, M., S. Camilleri, A. Montgomery, J. Schnell, M. Janssen, Z. Adelman, S. Anenberg, E. Grubert, and D. Horton. 2023. Neighborhood-scale air quality, public health, and equity implications of multi-modal vehicle electrification. *Environmental Research: Infrastructure and Sustainability*. DOI: 10.1088/2634-4505/acf60d.

[71] Camilleri, S., A. Montgomery, M. Visa, J. Schnell, Z. Adelman, M. Janssen, E. Grubert, S. Anenberg, and D. Horton. 2023. Air quality, health, and equity implications of electrifying heavy-duty vehicles. *Nature Sustainability*. DOI: 10.1038/s41893-023-01219-0

[70] [+]Mulrow, J., J. Bozeman, S. Pai, E. Grubert, and S. Derrible. 2023. Energy-Material Cycles: A materials-based perspective of vehicle energy systems. *Resources, Conservation & Recycling*. DOI: 10.1016/j.resconrec.2023.107039.

[69] Tarroja, B., R. Peer, and E. Grubert. 2023. Assessing how non-carbon co-priorities affect zero-carbon electricity system development in California under current policies. *Journal of Cleaner Production*. DOI: 10.1016/j.jclepro.2023.136833.

[68] [+]Mulrow, J. and E. Grubert. 2023. Greenhouse gas emissions embodied in electric vehicle charging infrastructure: A method and case study of Georgia, United States, 2021-2050. *Environmental Research: Infrastructure and Sustainability*. DOI: 10.1088/2634-4505/acc548.

[67] [@]Ha, S. and E. Grubert. 2023. Hybridizing Qualitative Coding with Natural Language Processing and Deep Learning to Assess Public Comments: A Case Study of the Clean Power Plan. *Energy Research & Social Science*. DOI: 10.1016/j.erss.2023.103016.

[66] Grubert, E. and F. Sawyer. 2023. US power sector carbon capture and storage under the Inflation Reduction Act could be costly with limited or negative abatement potential. *Environmental Research: Infrastructure and Sustainability*. DOI: 10.1088/2634-4505/acbed9.

[65] Grubert, E. 2023. Results from a Survey of Life Cycle Assessment-Aligned Socioenvironmental Priorities in US and Australian Communities Hosting Oil, Natural Gas, Coal, and Solar Thermal Energy Production. *Environmental Research: Infrastructure and Sustainability*. DOI: 10.1088/2634-4505/acbeda.

[64] Grubert, E. 2023. Water Consumption from Electrolytic Hydrogen in a Carbon-Neutral US Energy System. *Cleaner Production Letters*. DOI: 10.1016/j.clpl.2023.100037.

[63] Moglen, R., K. Chawla, P. Levi, Y. Sun, O. Phillips, B. Leibowicz, J. Jenkins, and E. Grubert. 2023. The State of Macro-Energy Systems Research: Common Critiques, Current Progress, and Research Priorities. *iScience*. DOI: 10.1016/j.isci.2023.106325.

[62] Raimi, D., E. Grubert, J. Higdon, G. Metcalf, S. Pesek, and D. Singh. 2023. The fiscal implications of the U.S. transition away from fossil fuels. *Review of Environmental Economics and Policy*. DOI: 10.1086/725250.

[61] [+]Lolli, F., [@]R. Rios, K. Schoenrock, E. Grubert, and K. Kurtis. 2022. Policy-Making Framework for Performance-Based Concrete Specifications. *ACI Structural and Materials Journals*.

[60] Siddik, A., E. Grubert, P. Caldwell, and L. Marston. 2022. Retirement of US Fossil Fuel-Fired Power Plants Will Increase Water Availability. *Journal of Hydrology*. DOI: 10.1016/j.jhydrol.2022.128984.

[59] Grubert, E. 2022. Yellow, red, and brown energy: leveraging water footprinting concepts for decarbonizing energy systems. *Environment, Development and Sustainability*. DOI: 10.1007/s10668-022-02760-2.

[58] Ravikumar, A.P., E. Baker, A. Bates, D. Nock, D. Venkataraman, T. Johnson, M. Ash, S.Z. Attari, K. Bowie, S. Carley, S. Castellanos, M. Cha, D.L. Clark, D. Deane-Ryan, D. Djokic, J.C. Ford, A. Goldstein, E. Grubert, L. Hu, D.M. Kammen, U. Kosar, C. Miller, M. Pastor, and M. Tuominen. 2022. Enabling an Equitable Energy Transition Through Inclusive Research. *Nature Energy*. DOI: 10.1038/s41560-022-01145-z.

[57] Khan, Z., E. Abraham, S. Aggarwal, M. Ahmad, R. Arguellos, M. Babbar-Sebens, J. Bereslawski, J. Bielicki, P. Campana, M. Silva Carrazzone, H. Castanier, F. Chang, P. Collins, A. Conchado, K. Dagani, B. Daher, S. Dekker, R. Delgado, F. Diuana, J. Doelman, A. Elshorbagy, C. Fan, R. Gaudioso, S. Gebrechorkos, H. Geli, E. Grubert, D. Huang, T. Huang, A. Ilyas, A. Ivakhnenko, G. Jewitt, M.

Ferrerira dos Santos, J. Jones, E. Kellner, E. Krueger, I. Kumar, J. Lamontagne, A. Lansu, S. Lee, R. Li, P. Linares, D. Marazza, M. Mascari, R. McManamay, M. Meng, S. Mereu, F. Miralles-Wilhelm, R. Mohtar, A. Muhammad, A. Opejin, S. Pande, S. Parkinson, R. Payet-Burin, M. Ramdas, E. Ramos, S. Ray, P. Roberts, J. Sampedro, K. Sanders, M. Saray, J. Schmidt, M. Shanafield, S. Siddiqui, M. Suriano, M. Taniguchi, A. Trabucco, M. Tuninetti, A. Vinca, B. Weeser, D. White, T. Wild, K. Yadav, N. Yogeswaran, T. Yokohata, and Q. Yue. 2022. Emerging themes and future directions of multi-sector nexus research and implementation. *Frontiers in Environmental Science*. DOI: 10.3389/fenvs.2022.918085.

[56] [+]Marshall, A. and E. Grubert. 2022. Hydroelectricity modeling for low-carbon and no-carbon grids: Empirical operational parameters for optimization and dispatch models. *Earth's Future*. DOI: 10.1029/2021EF002503.

[55] Grubert, E. and [@]M. Zacarias. 2022. Paradigm shifts for environmental assessment of decarbonizing energy systems: Emerging dominance of embodied impacts and design-oriented decision support needs. *Renewable and Sustainable Energy Reviews*. DOI: 10.1016/j.rser.2022.112208.

[54] Grubert, E. and S. Hastings-Simon. 2022. Designing the mid-transition: A review of medium-term challenges for coordinated decarbonization in the United States. *WIREs Climate Change*. DOI: 10.1002/wcc.768. *(Invited review)*

[53] *Reinhart, K. and E. Grubert. 2022. How Much New Forest Land Would It Take to Offset a Coal Plant's Greenhouse Gas Emissions? An Engineering Case Study of Georgia's Plant Scherer. *Case Studies in the Environment*. DOI: 10.1525/cse.2022.1552208. *(Best environmental case study (2022), Case Studies in the Environment Prize Competition)*

[52] Gallo, E., K. Spahr, E. Grubert, and T. Hogue. 2022. Improving the Decision-making Process for Stormwater Management Using Life Cycle Costs and a Benefit Analysis. *Journal of Sustainable Water in the Built Environment (ASCE)*. DOI: 10.1061/JSWBAY.0000977.

[51] Grubert, E. and [+]A. Marshall. 2021. Water for Energy: Characterizing Co-evolving Energy and Water Systems under Twin Climate and Energy System Nonstationarities. *WIREs Water*. DOI:10.1002/wat2.1576. *(invited review)*

[50] [+]Mulrow, J., *Gali, M., and E. Grubert. 2021. The Cyber-Consciousness of Environmental Assessment: A Review of Environmental Assessments of Digitalized Technologies. *Environmental Research Letters*. DOI:10.1088/1748-9326/ac413b. *(invited review)*

[49] Glazer, Y., D. Tremaine, J. Banner, M. Cook, R. Mace, J. Nielsen-Gammon, E. Grubert, K. Kramer, A. Stoner, B. Wyatt, A. Mayer, T. Beach, R. Correll, M. Webber. 2021. Winter Storm Uri: A test of Texas' water infrastructure and water resource resilience to extreme winter weather events. *Journal of Extreme Events*. DOI: 10.1142/S2345737621500226.

[48] [@]Cohen, A., G. Chen, E. Berger, S. Warrier, G. Lan, E. Grubert, F. Dellaert, and Y. Chen. 2021. Dynamically Controlled Environment Agriculture: Integrating Machine Learning and Mechanistic and Physiological Models for Sustainable Food Cultivation. *ACS ES&T Engineering*. DOI:10.1021/acsestengg.1c00269. *(Editor's Choice)*

[47] [@]Maxim, A. and E. Grubert. 2021. Effects of Climate Migration on Town-to-City Transitions in the United States: Proactive Investments in Civil Infrastructure for

Resilience and Sustainability. *Environmental Research: Infrastructure and Sustainability*. DOI: 10.1088/2634-4505/ac33ef.

[46] Grubert, E. 2021. Beyond Carbon in Socioenvironmental Assessment: Life Cycle Assessment as a Decision Support Tool for Net-Zero Energy Systems. *Energy and Climate Change*. DOI: 10.1016/j.egycc.2021.100061.

[45] @Maxim, A. and E. Grubert. 2021. Anticipating Climate-related Changes to Residential Energy Burden in the United States: Advance Planning for Equity and Resilience. *Environmental Justice*. DOI: 10.1089/env.2021.0056.

[44] +Lolli, F., K. Kurtis, and E. Grubert. 2021. How Important Are Electricity Demand Charges for Cost Estimates? An Industrial Electrification Case Study. *The Electricity Journal*. DOI: 10.1016/j.tej.2021.107011.

[43] @Burns, D. and E. Grubert. 2021. Contribution of Regionalized Methane Emissions to Natural Gas-Fired Electricity and Carbon Capture in the United States. *Environmental Science & Technology Letters*. DOI: 10.1021/acs.estlett.1c00531.

[42] Grubert, E. 2021. Emissions Projections for US Utilities Through 2050. *Environmental Research Letters*. DOI: 10.1088/1748-9326/ac1628.

[41] @Broesicke, O., J. Yan, V. Thomas, E. Grubert, S. Derrible, and J. Crittenden. 2021. Combined Heat and Power May Conflict with Decarbonization Goals—Air Emissions of Natural Gas Combined Cycle Power versus Combined Heat and Power Systems for Commercial Buildings. *Environmental Science & Technology*. DOI: 10.1021/acs.est.1c00980.

[40] *Schmidt, I. and E. Grubert. 2021. Effects of fuel cost and driving behaviors on operational costs of gasoline and electric vehicles in the US. *IOP SciNotes*. DOI: 10.1088/2633-1357/ac10bd.

[39] Busby, J., K. Baker, M. Bazilian, A. Gilbert, E. Grubert, V. Rai, J. Rhodes, S. Shidore, C. Smith, and M. Webber. 2021. Cascading Risks: Understanding the 2021 Winter Blackout in Texas. *Energy Research and Social Science*. DOI: 10.1016/j.erss.2021.102106. *(reached the Reddit front page in r/science)*

[38] *Zacarias, M. and E. Grubert. 2021. Effects of implausible power plant lifetime assumptions on US federal energy system projected costs, greenhouse gas emissions, air pollution, and water use. *Environmental Research: Infrastructure and Sustainability*. DOI: 10.1088/2634-4505/abff0c.

[37] Miller, S. and E. Grubert. 2021. US industrial sector decoupling of energy use and greenhouse gas emissions under COVID: durability and decarbonization. *Environmental Research Communications*. DOI: 10.1088/2515-7620/abf0f2.

[36] @Burns, D. and E. Grubert. 2021. Attribution of Production-Stage Methane Leakage to Assess Spatial Variability in the Climate Intensity of US Natural Gas Consumption. *Environmental Research Letters*. DOI: 10.1088/1748-9326/abef33.

[35] @Krieger, J. and E. Grubert. 2021. Life cycle costing for distributed stormwater control measures on the gray-green continuum: A planning-level tool. *Journal of Sustainable Water in the Built Environment (ASCE)*. DOI: 10.1061/JSWBAY.0000933. *(selected by ASCE as a promoted article)*

[34] Grubert, E. 2020. Fossil electricity retirement deadlines for a just transition. *Science*. DOI: 10.1126/science.abe0375.

[33] Grubert, E. 2020. Same-plant trends in capacity factor and heat rate for US power plants, 2001-2018. *IOP SciNotes*. DOI: 10.1088/2633-1357/abb9f1.

[32] Grubert, E., J. Stokes-Draut, A. Horvath, and W. Eisenstein. 2020. Utility-specific projections of electricity sector greenhouse gas emissions: A committed emissions model-based case study of California through 2050. *Environmental Research Letters*. DOI: 10.1088/1748-9326/abb7ad.

[31] Haya, B., D. Cullenward, A. Strong, E. Grubert, R. Heilmayr, D. Sivas, and M. Wara. 2020. Managing Uncertainty in Carbon Offsets: Insights from California's Standardized Approach. *Climate Policy*. DOI: 10.1080/14693062.2020.1781035.

[30] Grubert, E., E. Rogers, and K. Sanders. 2020. Consistent Terminology and Reporting are Needed to Describe Water Quantity Use. *Journal of Water Resources Planning and Management (ASCE)*. DOI: 10.1061/(ASCE)WR.1943-5452.0001241.

[29] Grubert, E. 2020. At scale, renewable natural gas systems could be climate intensive: The influence of methane feedstock and leakage rates. *Environmental Research Letters*. DOI: 10.1088/1748-9326/ab9335.

[28] Tarroja, B., R. Peer, K. Sanders, and E. Grubert. 2020. How do non-carbon priorities affect zero-carbon electricity systems? A case study of freshwater consumption and cost for SB100 compliance in California. *Applied Energy*. DOI: 10.1016/j.apenergy.2020.114824.

[27] Meng, M., E. Grubert, R. Peer, and K. Sanders. 2020. Spatially allocating life cycle water use for US coal-fired electricity across producers, generators, and consumers. *Energy Technology*. DOI: 10.1002/ente.201901497.

[26] Grubert, E. and J. Stokes-Draut. 2020. Mitigation Life Cycle Assessment: Best Practices from LCA of Energy and Water Infrastructure That Incurs Impacts to Mitigate Harm. *Energies*. DOI: 10.3390/en13040992.

[25] Grubert, E. 2020. Conventional Hydroelectricity and the Future of Energy: Linking National Inventory of Dams and Energy Information Administration Data to Facilitate Analysis of Hydroelectricity. *The Electricity Journal*. DOI: 10.1016/j.tej.2019.106692.

[24] Peer, R., E. Grubert, and K. Sanders. 2019. A Regional Assessment of the Water Embedded in the US Electricity System. *Environmental Research Letters*. DOI: 10.1088/1748-9326/ab2daa.

[23] Grubert, E. 2019. Every Door Direct Mail in US survey research: An anonymous census approach to mail survey sampling. *Methodological Innovations*. DOI: 10.1177/2059799119862104.

[22] *Greer, F., *J. Chittick, *E. Jackson, *J. Mack, *M. Shortlidge, and E. Grubert. 2019. Energy and Water Efficiency in LEED: How Well are LEED Points Linked to Climate Outcomes? *Energy and Buildings*. DOI: 10.1016/j.enbuild.2019.05.010.

[21] Grubert, E. and A. Brandt. 2019. Three Considerations for Modeling Natural Gas System Methane Emissions in Life Cycle Assessment. *Journal of Cleaner Production*. DOI: 10.1016/j.jclepro.2019.03.096.

[20] Bell, C., K. Spahr, E. Grubert, J. Stokes-Draut, E. Gallo, J. McCray, and T. Hogue. 2018. Decision-making on the Grey-green Stormwater Infrastructure

Continuum. *Journal of Sustainable Water in the Built Environment (ASCE)*. DOI: 10.1061/JSWBAY.0000871.

[19] Grubert, E. 2018. Relational Values in Environmental Assessment: The Social Context of Environmental Impact. *Current Opinion in Environmental Sustainability*. DOI: 10.1016/j.cosust.2018.10.020.

[18] Grubert, E. 2018. The Eagle Ford and Bakken Shale Regions of the United States: A Comparative Case Study. *The Extractive Industries and Society*. DOI: 10.1016/j.exis.2018.09.011.

[17] Grubert, E. and K. Sanders. 2018. Water Use in the United States Energy System: A National Assessment and Unit Process Inventory of Water Consumption and Withdrawals. *Environmental Science & Technology (ACS)*. DOI: 10.1021/acs.est.8b00139.

[16] Grubert, E. and M. Cook. 2017. Communication Science for Science Communication: Water Management for Oil and Natural Gas Extraction. *Journal of Water Resources Planning and Management (ASCE)*. DOI: 10.1061/(ASCE)WR.1943-5452.0000842.

[15] Grubert, E. and W. Skinner. 2017. A Town Divided: Community Values and Attitudes Towards Coal Seam Gas Development in Gloucester, New South Wales. *Energy Research and Social Science*. DOI: 10.1016/j.erss.2017.05.041.

[14] *Drummond, V. and E. Grubert. 2017. Fault Lines: Seismicity and the Fracturing of Energy Narratives in Oklahoma. *Energy Research and Social Science*. DOI: 10.1016/j.erss.2017.05.039.

[13] Grubert, E. and M. Algee-Hewitt. 2017. Villainous or Valiant? Depictions of Oil and Coal in American Fiction and Nonfiction Narratives. *Energy Research and Social Science*. DOI: 10.1016/j.erss.2017.05.030.

[12] Grubert, E. 2017. The Need for a Preference-based Multicriteria Prioritization Framework in Life Cycle Sustainability Assessment. *Journal of Industrial Ecology (ISIE)*. DOI: 10.1111/jiec.12631.

[11] Grubert, E. 2017. How to Do Mail Surveys in the Digital Age: A Practical Guide. *Survey Practice.*

[10] Grubert, E. 2017. Implicit prioritization in Life Cycle Assessment: Text mining and detecting metapatterns in the literature. *International Journal of Life Cycle Assessment.* DOI: 10.1007/s11367-016-1153-2.

[9] Grubert, E. 2016. Water Consumption from Hydroelectricity in the United States. *Advances in Water Resources*. DOI: 10.1016/j.advwatres.2016.07.004.

[8] Grubert, E. and A. Siders. 2016. Benefits and applications of interdisciplinary digital tools for environmental meta-reviews and analyses. *Environmental Research Letters*. DOI: 10.1088/1748-9326/11/9/093001. *(selected for September 2016 monthly highlights)*

[7] Lukacs, H., N. M. Ardoin, and E. Grubert. 2016. Beyond formal groups: neighboring acts and watershed protection in Appalachia. *International Journal of the Commons*. DOI: 10.18352/ijc.578.

[6] Grubert, E. and M. E. Webber. 2016. Synthetic flows for engineered systems with nonstationary parameters: A study of Maui's Wailoa Ditch. *Journal of Hydrologic Engineering (ASCE)*. DOI: 10.1061/(ASCE)HE.1943-5584.0001468.

[5] Grubert, E. 2016. Rigor in Social Life Cycle Assessment: Improving the scientific grounding of SLCA. *International Journal of Life Cycle Assessment.* DOI: 10.1007/s11367-016-1117-6.

[4] Grubert, E. and M. E. Webber. 2015. Energy for water and water for energy on Maui Island, Hawaii. *Environmental Research Letters*. DOI: 10.1088/1748-9326/10/6/064009.

[3] Grubert, E., A. Stillwell, and M. E. Webber. 2014. Where does solar-aided desalination make sense? A method for identifying sustainable sites. *Desalination*. DOI: 10.1016/j.desal.2014.02.004.

[2] Grubert, E., F. Beach, and M. E. Webber. 2012. Can switching fuels save water? A life cycle quantification of freshwater consumption for Texas coal- and natural gas-fired electricity. *Environmental Research Letters*. DOI: 10.1088/1748-9326/7/4/045801.

[1] Grubert, E. 2012. Reserve reporting in the United States coal industry. *Energy Policy*. DOI: 10.1016/j.enpol.2012.01.035.

B2. Conference Presentation with Proceedings (Refereed)

[14] Zerbe, E., A. Amekudzi-Kennedy, K. Haas, E. Grubert, S. Burns, A. Russell, I. Tien, K. Watkins, J. Koon, R. Simon, J. Taylor, D. Webster, and L. Rosenstein. June 2022. Early Engagement and Vertically-Integrated Learning: Developing Holistic and Entrepreneurially-Minded Engineers. *American Society for Engineering Education 2022 Annual Conference and Exposition*.

[13] @Burns, D., and E. Grubert. May 2020. Attributing Natural Gas Production to Natural Gas Users: A Geospatial Approach. *Proceedings of the World Environmental and Water Resources Congress 2020*. DOI: 10.1061/9780784482964.030

[12] Cook, M., and E. Grubert. April 2017. Water Use in the Oil and Gas Industries: An Evaluation of Best Practices for Communicating with Scientists, Policymakers, and the Public. *Proceedings of the Society of Petroleum Engineers Health, Safety, Security, Environment, & Social Responsibility Conference-North America*. DOI: 10.2118/184431-MS

[11] Grubert, E., D. Kelly, B. Rumbelow, and J. Wilson. May 2015. Improving Produced Water Management: A Case Study of Designing an Inland Desalination Pilot Project. *Proceedings of the World Environmental and Water Resources Congress 2015*. DOI: 10.1061/9780784479162.052

[10] Grubert, E., B. Parks, E. Schneider, and S. Sekar. December 2011. Pebble Bed Modular Reactors Versus Other Generation Technologies: Costs and Challenges for South Africa. *Proceedings of GLOBAL 2011*. Paper 391144

[9] Grubert, E., C. King, and M. E. Webber. November 2011. Water for Biomass-based Energy on Maui, Hawaii. *Proceedings of the ASME 2011 International Mechanical Engineering Congress and Exposition*. DOI: 10.1115/IMECE2011-63199

[8] Grubert, E. and M. E. Webber. August 2011. Water, Energy, and Land Use Planning on Maui Island, Hawaii: Estimating Surface Water Supply. *Proceedings of the ASME 2011 5th International Conference on Energy Sustainability*. DOI: 10.1115/ES2011-54332

[7] Grubert, E. May 2011. Lifecycle Water Impacts of Coal Use in the United States. *Proceedings of the World Environmental and Water Resources Congress 2011: Bearing Knowledge for Sustainability*. DOI: 10.1061/41173(414)344

[6] Grubert, E. May 2011. Modeling Maui's Freshwater System to Inform Water Resource Management. *Proceedings of the World Environmental and Water Resources Congress 2011: Bearing Knowledge for Sustainability*. DOI: 10.1061/41173(414)105

[5] Phillips, R. and E. Grubert. May 2011. Water and Deforestation in Brazil: Future Challenges for Policy Implementation. *Proceedings of the World Environmental and Water Resources Congress 2011: Bearing Knowledge for Sustainability*. DOI: 10.1061/41173(414)129

[4] Grubert, E. February 2011. Energy Resource Extraction, Water Resources, and a Human Right to Water in the West. "Implementing the Human Right to Water in the West: Conference Report." Willamette Law Review. Volume 48:1.

[3] Grubert, E. September 2010. Mining-related Environmental Impacts of Carbon Mitigation: Coal-based Carbon Capture and Sequestration. *Proceedings of the World Energy Congress*.

[2] Grubert, E. May 2010. Centralized Transportation Fuel Planning: Leveraging Californian Refineries as Transportation Utilities. *Proceedings of the ASME 2010 4th International Conference on Energy Sustainability*. DOI: 10.1115/ES2010-90027

[1] Grubert, E. and M. E. Webber. May 2010. Water Impacts of the American Clean Energy and Security Act Renewable Portfolio Standard on Texas. *Proceedings of the ASME 2010 4th International Conference on Energy Sustainability*. DOI: 10.1115/ES2010-90029

B3. Other refereed material

[5] Grubert, E. 2024. Introducing Environmental Research: Energy – advancing interdisciplinary understanding of energy systems during decarbonization. *Environmental Research: Energy*. DOI: 10.1088/2753-3751/ad3967. *(Editor-refereed)*

[4] Grubert, E., L. L. B. Lazaro, A. Popp, L. Merfort, T. Luo, V. Kati, P. Meshram, F. M. Dorn, and D. Hernández. 2024. Making low-carbon energy sustainable. *One Earth*. DOI: 10.1016/j.oneear.2024.01.019. *(Editor-refereed)*

[3] Grubert, E. 2018. Civil engineering's internal skepticism on climate change. *Journal of Professional Issues in Engineering Education and Practice*. DOI: 10.1061/(ASCE)EI.1943-5541.0000370 *(Editor-refereed)*

[2] Grubert, E. 2016. Response to "Discourse over a contested technology on Twitter: A case study of hydraulic fracturing" – Word choice as political speech. *Public Understanding of Science.* DOI: 10.1177/0963662515626310 *(Editor-refereed)*

[1] Emerging Leaders in Science and Society (ELISS) Fellows*. December 2015. Reimagining Epidemic Communications. *Domestic Preparedness Journal*. (*equal contributions by R. Erion, E. Grubert, S. Mosbah, M. Munyikwa, B. Paul, and C. Tran) *(Editor-refereed)*

B4. Submitted Journal Articles

[3] Cha, J. and E. Grubert. Operationalizing Publicly Managed Decline: Public Asset Acquisition in the Powder River Basin, Wyoming. Submitted January 2026, *Energy Research and Social Science*.

[2] Grubert, E. Could Electrified Energy Systems Be More Reliable with Less Reliable Supply? Revision under review January 2026, *iScience*.

[1] Bergero, C., E. Brutschin, M. Gidden, Z. Nicholls, E. Grubert, and S. Davis. The climate implications of failing to manage carbon. In revision October 2025, *Nature Geoscience*.

C. Other Publications and Creative Products

C1. Software

[4] Grubert, E. December 2020. "The future of United States fossil fuel-fired electricity: Environmental and labor implications of retiring generators at the end of their typical lifespans." Web map.

[3] @Krieger, J. and E. Grubert. May 2020. "Integrated Decision Support Tool (iDST) Life Cycle Costing Module for Distributed Stormwater Control Measures (SCMs)." Life cycle cost model.

[2] Grubert, E. January 2019. "US power plants by capacity, age, and fuel." Web map.

[1] Grubert, E. (contributor). October 2015. Energy Policy Simulator. Web model.

C2. Other Creative Products

[22] Foster, T., ed. 2025. (E. Grubert: essay contributor). *Exploring Time: A Painter's Perspective*. The Foster Museum, Palo Alto, CA.

[21] Cullenward, D., E. Grubert, and W. Ricks. Methane Offsets in the Final Hydrogen Production Tax Credit Regulations. 6 January 2025. *Kleinman Center for Energy Policy Blog.*

[20] Grubert, E. 2024. Carbon Capture Tax Credit. Accountability in a Sustainable World Quarterly. Volume 3, Issue 1, pages 26-28.

[19] Caggiano, H., E. Grubert, and M. Paul. Voters Support Phasing Out Fossil Fuel Extraction. 2024. Climate and Community Institute.

[18] Grubert, E. 2024. Societal considerations, impacts, and public engagement for atmospheric methane removal technologies. Paper Commissioned by the Committee on Atmospheric Methane Removal: Development of a Research Agenda. http://nap.edu.nationalacademies.org/catalog/27157.

[17] Maxim, A. and E. Grubert. "Winter storms and heat waves: Home energy efficiency can keep us all safer while addressing climate change." 12 February 2024. *LinkedIn*.

[16] Grubert, E. "Biden's 'hard look' at liquefied natural gas exports raises a critical question: How does natural gas fit with US climate goals?" 7 February 2024. *The Conversation*.

[15] Grubert, E. "DOE's error-ridden analysis on coal CCS project threatens climate and engagement goals." 5 September 2023. *Utility Dive*.

[14] Ash, M., E. Baker, M. Tuominen, D. Venkataraman, M. Burke, S. Castellanos, M. Cha, G. Chan, D. Djokić, J. Ford, A. Goldstein, D. Hsu, M. Lackner, C. Miller, D. Nock, A. Ravikumar, A. Bates, A. Stefanopoulou, E. Grubert, D. Kammen, M. Pastor, S. Attari, S. Carley, D. Clark, D. Deane-Ryan, U. Kosar, K. Bowie, and T. Johnson. 2023. "White Paper: Research Challenges at the Intersection of Energy and Equity in the Energy Transition." Energy Transition Institute (ETI) Reports.

[13] Raimi, D., E. Grubert, J. Higdon, G. Metcalf, S. Pesek, and D. Singh. January 2022. "The Fiscal Implications of the US Transition away from Fossil Fuels." Resources for the Future.

[12] Raimi, D. (editor and contributor), with A. Barone, S. Carley, D. Foster, E. Grubert, J. Haggerty, J. Higdon, M. Kearney, D. Konisky, J. Michael, G. Michaud, S. Nabahe, N. Peluso, M. Robertson, and T. Reames (contributors). April 2021. "Policy Options to Enable an Equitable Energy Transition." Resources for the Future.

[11] Davis, S. and C. Bataille (leads) with Bazilian, M., Brouwer, J., Doig, S., Fennell, P., Gielen, D., Grubert, E., and D. Tong (contributors). "5.3 Accelerating Net-Zero Emissions Industry in the U.S." *In*: SDSN 2020. *Zero Carbon Action Plan*. New York: Sustainable Development Solutions Network (SDSN).

[10] Grubert, E. July 2020. 'Renewable' natural gas may sound green, but it's not an antidote for climate change. *The Conversation*.

[9] Amekudzi-Kennedy, A., S. Labi, B. Woodall, G. Marsden, and E. Grubert. April 2020. *Role of Socially-Equitable Economic Development in Creating Resilient and Sustainable Systems: COVID-19-Related Reflections*. Preprint (preprints.org).

[8] Haya, B., D. Cullenward, A. Strong, E. Grubert, R. Heilmayr, D. Sivas, and M. Wara. August 2019. *Managing Uncertainty in Carbon Offsets: Insights from California's Standardized Approach*. Stanford Law School Environmental & Natural Resources Law and Policy Program Working Paper. Stanford, CA.

[7] Grubert, E. 2018. *Analyzing the Energy Sector for California Climate Investments: Literature Review of Energy Documents and GHG Electricity Emission Factors*. California Air Resources Board. Berkeley, CA.

[6] Rogers, L. and E. Grubert. 2017. *Terraforming: Art and Engineering in the Sacramento Watershed*. Green Library, Stanford University, Stanford, CA. *(Co-curator, library exhibition)*

[5] Grubert, E., C. King, and M. E. Webber. August 2013. "Maui's Complicated Relationship With Water." Earth Magazine.

[4] Grubert, E. August 2011. "Why Business-as-Usual Coal Consumption Could Mean Dramatic Changes." Scientific American Guest Blog: Commentary invited by editors of Scientific American.

[3] Grubert, E. and S. Kitasei. December 2010. *How Energy Choices Affect Fresh Water Supplies: A Comparison of U.S. Coal and Natural Gas.* Worldwatch Institute Briefing Paper. Worldwatch Institute: Washington, D.C.

[2] Grubert, E. January 2010. "Beat a Dead Horse or Breed Immortal Ones." *Solutions*. National Council for Science and the Environment.

[1] Grubert, E. Over 60 published print columns, *The Stanford Daily* (January – June 2009)*, The Daily Texan* (August 2009 – December 2010). Additional web columns for Americans for Energy Leadership and Elmrox (2010 – 2011).

D. PRESENTATIONS

D1. Keynote Addresses and Plenary Lectures

[7] Macro-Energy Systems Workshop. June 2024. "Energy Systems for Justice**:** Modeling policy that supports people." Princeton, New Jersey. *(Individual)*

[6] Alabama Water Rally. March 2024. "How does decarbonization affect water for energy systems?" Nauvoo, Alabama. *(Individual)*

[5] Leeson Lecture. June 2023. "How We Move On: Planning for a Future Without Fossil Fuels." Narragansett, Rhode Island. *(Individual)*

[4] Energy Policy Research Conference. September 2018. "Water-Energy Nexus in the West, Plenary Session & Lunch." Boise, Idaho. *(Plenary moderator)*

[3] Resources for Future Generations. June 2018. "Keynote: Estimating water usage for the US energy system: Suggestions for improving data collection and reporting." Vancouver, British Columbia. *(Co-author with R. Peer, K. Sanders)*

[2] Convent of the Sacred Heart. June 2017. Commencement Address. Greenwich, Connecticut. *(Individual)*

[1] Texas Leadership Society Luncheon. April 2010. Keynote Address. Austin, Texas. *(Individual)*

D2. Invited Conference and Workshop Presentations

[20] National Academies of Sciences, Engineering, and Medicine. Guardrails and Governance for the Demonstration and Deployment of Emerging GHG Removal Approaches. September 2025. Washington, DC. *(Panel; remote)*

[19] MultiSector Dynamics Urban Systems Working Group. April 2024. "Planning for Failure: Can Energy Systems be Reliable Even When the Power Goes Out?" Online. *(Individual; remote)*

[18] The University of Texas at Austin. Austin Electricity Conference. February 2024. "Domestic Content and Clean Energy Prices." Austin, TX. (*Panel)*

[17] University of Oklahoma Sustainability Day. January 2024. "Justice in the Energy Transition." Norman, OK. *(Individual; remote)*

[16] National Academies of Sciences, Engineering, and Medicine. Atmospheric Methane Removal: Needs, Challenges, and Opportunities Workshop. October 2023. "Potential Social Impacts of Atmospheric Methane Removal Technologies." Washington, DC. *(Individual; remote)*

[15] National Renewable Energy Laboratory Workshop, Flexible Demand in 100% Clean Grids. September 2023. "Role of Deep Building Efficiency for Electricity Grids." Golden, CO. *(Individual)*

[14] TED Countdown Dilemma Series. October 2022. "Planning Fossil Infrastructure Closures for a Just Transition." London, UK. *(Individual)*

[13] Environmental Protection Agency, California Air Resources Board, and Stanford Doerr School of Sustainability Carbon Capture and Storage Symposium. September 2022. “Real World Implications of a CCS Project.” Stockton, CA. *(Panel)*

[12] New York University Institute for Policy Integrity Annual Conference. September 2022. “Implementing the Inflation Reduction Act.” New York, NY. *(Panel)*

[11] National Renewable Energy Laboratory Human Dimension of Energy Systems Workshop. September 2022. “Community-oriented decision support for a just transition.” Golden, CO. *(Individual)*

[10] International Association for Society and Natural Resources Conference. June 2021. “Natural Resource Social Science & the US Energy Transition ca. 2021.” Online due to COVID-19. *(Panel)*

[9] MIT Energy Conference. March 2021. “Stranded Assets.” Online due to COVID-19. *(Panel)*

[8] American Geophysical Union Fall Meeting. December 2019. “Conventional Hydroelectricity and Near-zero Emission Energy Systems.” San Francisco, CA. *(Individual)*

[7] INFORMS Annual Meeting 2019. October 2019. “How do we reconcile priorities during the energy transition?” Seattle, Washington. *(Individual)*

[6] Solar Power and Energy Storage Mountain West. April 2019. “The Energy System is Changing.” Aurora, Colorado. *(Individual)*

[5] Southeastern Energy Conference. March 2019. “Global Electrification.” Atlanta, Georgia. *(Panel)*

[4] Data Science for Sustainability Meetup. October 2018. “The Water-Energy Nexus: Water Use for Energy Systems.” San Francisco, CA. *(Individual)*

[3] South by Southwest Eco. October 2013. “New Global Models: Real-Time and Local.” Austin, Texas. *(Panel)*

[2] Society of Women Engineers 12th Annual Conference for Women Engineers. November 2012. “Understanding the Water Implications of our Energy Choices.” Houston, Texas. *(Panel)*

[1] International Student Energy Summit. June 2011. “Global Energy Dynamics: The Nexus between Energy and Water.” Vancouver, Canada. *(Panel)*

D3. Conference and Workshop Presentations

[80] Grubert, E. December 2025. “Macro-Energy Systems: Governance and Strategies for a Just, Decarbonized Future.” American Geophysical Union Fall Meeting. New Orleans, LA. *(Oral)*

[79] Grubert, E. May 2025. “Hydrogen and Other Water-Intensive Energy Carriers in the Energy-Water Nexus.” World Environmental and Water Resources Congress. Anchorage, AK. *(Oral)*

[78] @Glass, J. and E. Grubert. May 2025. “Dynamic Life Cycle Assessment for Predicting Water Consumption Impacts Amid Climate and Socio-Economic Changes.” World Environmental and Water Resources Congress. Anchorage, AK. *(Oral)*

[77] Grubert, E. May 2024. “Deep Residential Building Efficiency as a Resilience Strategy.” World Environmental and Water Resources Congress. Milwaukee, WI. *(Oral)*

[76] @Glass, J. and E. Grubert. May 2024. “Water Consumption Quantification in Life Cycle Assessments: A Temporal-Specific Approach.” World Environmental and Water Resources Congress. Milwaukee, WI. *(Oral)*

[75] Gunda, T., A. Cantor, E. Grubert, A. Harris, and Y. McDonald. April 2024. “The Climate-Water Nexus: Toward an Integrated, Multi-Sectoral Approach.” American Association of Geographers Annual Meeting 2024. Honolulu, HI. *(Oral)*

[74] Davis, S., and others *(including E. Grubert)*. December 2023. “Chapter 32 – Mitigation – The Fifth National Climate Assessment.” American Geophysical Union Fall Meeting. San Francisco, CA. *(Poster)*

[73] Tarroja, B., D. Mulvaney, R. Peer, and E. Grubert. December 2023. “Maximizing the Life Cycle Greenhouse Gas Reductions from Electricity Resource Portfolios.” American Geophysical Union Fall Meeting. San Francisco, CA. *(Oral)*

[72] Grubert, E. December 2023. “How Planning for Failure Increases Urban Resilience.” American Geophysical Union Fall Meeting. San Francisco, CA. *(Oral)*

[71] Sanders, K., E. Grubert, M. Craig, and M. Peplinski. December 2023. “Energy Consumption in a Changing Climate: Patterns, Drivers, and Feedbacks.” American Geophysical Union Fall Meeting. San Francisco, CA. *(Session Chair; Oral)*

[70] Tarroja, B., R. Peer, and E. Grubert. October 2023. “Exploring Zero-Carbon Electricity System Planning Under Different Non-Carbon Co-Priorities in California.” INFORMS Annual Meeting 2023. Phoenix, AZ. *(Oral)*

[69] Camilleri, S., A. Montgomery, M. Visa, J. Schnell, Z. Adelman, M. Janssen, E. Grubert, S. Anenberg, M. Harris, and D. Horton. August 2023. “Neighborhood-Scale Air Quality and Health Impacts Associated with Electrifying Heavy-Duty Vehicles in the U.S. Midwest.” International Society of Exposure Science Annual Meeting. Chicago, IL. *(Oral)*

[68] Grubert, E. January 2023. “The Mid-transition: Planning Just and Sustainable Decarbonization.” Massachusetts Institute of Technology Environmental Justice & Energy Sustainability Mini-Symposium. Hybrid Cambridge, MA / online. *(Oral)*

[67] Mulrow, J., J. Bozeman, S. Pai, E. Grubert, and S. Derrible. January 2023. “All Cars Run on Materials: Comparing Vehicle Energy Systems in a Post-Fossil Fuel World.” Transportation Research Board Annual Meeting. Washington, DC. *(Poster)*

[66] Mulrow, J. and E. Grubert. January 2023. “Greenhouse Gas Emissions Embodied in Electric Vehicle Charging Infrastructure: A Method and Case Study of Georgia, 2021–2050.” Transportation Research Board Annual Meeting. Washington, DC. *(Poster)*

[65] Camilleri, S., A. Montgomery, M. Visa, J. Schnell, Z. Adelman, M. Janssen, E. Grubert, S. Anenberg, and D. Horton. December 2022. “Neighborhood-Scale Air Quality and Health Impacts Associated with Electrifying Heavy-Duty Vehicles in the US Midwest.” American Geophysical Union Fall Meeting. Chicago, IL. *(Oral)*

[64] Horton, D., S. Camilleri, A. Montgomery, M. Visa, Z. Adelman, E. Grubert, and S. Anenberg. December 2022. “Air Quality, Public Health, and Equity Implications of Electric Vehicle Adoption in Chicago, IL.” American Geophysical Union Fall Meeting. Chicago, IL. *(Poster)*

[63] Tarroja, B., R. Peer, and E. Grubert. December 2022. “Comparing the Development of Decarbonized Electricity Systems under Different Environmental Co-Priorities: A California Case Study.” American Geophysical Union Fall Meeting. Chicago, IL. *(Oral)*

[62] Visa, M., A. Montgomery, S. Camilleri, J. Schnell, M. Janssen, Z. Adelman, S. Anenberg, E. Grubert, and D. Horton. December 2022. “Neighborhood-Scale Air Quality and Health Impacts from EV Adoption in the US Midwest.” American Geophysical Union Fall Meeting. Chicago, IL. *(Poster)*

[61] Marston, L., A.B. Siddik, E. Grubert, and P. Caldwell. December 2022. “Retirement of US Fossil Fuel-Fired Power Plants Increases Water Availability.” American Geophysical Union Fall Meeting. Chicago, IL. *(Oral)*

[60] You, J., A. Marshall, and E. Grubert. December 2022. “Introducing a Typology for Hydroelectric Dams.” American Geophysical Union Fall Meeting. Chicago, IL. *(Poster)*

[59] Grubert, E. November 2022. “Maintaining Energy System Safety and Reliability During the Mid-Transition.” United States Association for Energy Economics 39th North American Conference. Houston, TX. *(Oral)*

[58] +Marshall, A. and E. Grubert. December 2021. “Hydroelectricity Modeling for Low-Carbon and No-Carbon Grids: Empirical Constraints for Optimization and Dispatch Models.” American Geophysical Union Fall Meeting. New Orleans, LA. *(Oral)*

[57] @Ha, S. and E. Grubert. June 2021. “Understanding the Public Attitudes towards the Clean Power Plan Using Natural Language Processing and Deep Learning.” International Association for Society and Natural Resources Conference. Online due to COVID-19. *(Oral)*

[56] Grubert, E. June 2021. “The Climate Implications of Renewable Natural Gas.” World Environmental and Water Resources Congress. Online due to COVID-19. *(Oral)*

[55] Grubert, E. June 2021. “Decarbonization and facility closures: planning for a just transition away from fossil fuels.” World Environmental and Water Resources Congress. Online due to COVID-19. *(Oral)*

[54] Grubert, E. May 2021. “Fossil fuel retirement deadlines for a just transition: Implications for the Western US.” Pacific Northwest Regional Economic Conference. Online due to COVID-19. *(Oral, invited)*

[53] Grubert, E. February 2021. “Sustainability Assessment Beyond Carbon.” Second Food-Energy-Water Nexus Conference. Online due to COVID-19. *(Oral, invited)*

[52] Gallo, E., K. Spahr, E. Grubert, and T. Hogue. December 2020. “Optimizing between green and grey stormwater infrastructure using hydrologic modeling, life cycle costs, and a benefit analysis.” American Geophysical Union Fall Meeting. Online due to COVID-19. *(Oral)*

[51] Tarroja, B., R. Peer, K. Sanders, and E. Grubert. December 2020. “Assessing the influence of freshwater consumption priorities on zero-carbon electricity planning: A case of Senate Bill 100 compliance in California.” American Geophysical Union Fall Meeting. Online due to COVID-19. *(Poster)*

[50] [@]Maxim, A. and E. Grubert. December 2020. “Assessing Impacts of Climate Change and Climate Migration on Urban Infrastructure Resilience.” American Geophysical Union Fall Meeting. Online due to COVID-19. *(Oral)*

[49] [+]Mulrow, J. and E. Grubert. December 2020. “Environmental Implications of the EV Cyber-Physical System.” American Geophysical Union Fall Meeting. Online due to COVID-19. *(Poster)*

[48] Grubert, E. December 2020. “Beyond Carbon in Socioenvironmental Assessment for Zero Carbon Systems.” American Geophysical Union Fall Meeting. Online due to COVID-19. *(Poster)*

[47] Grubert, E. August 2020. “Conventional Hydroelectricity and the Grid.” American Water Resources Association Spring Conference. Austin, TX. *(Virtual due to COVID-19)*

[46] Grubert, E. July 2020. “Life Cycle Cost and Environmental Assessment: Distributed Stormwater Control Measures.” Integrated Decision Support Tool Beta Testing for Stormwater Practitioners Workshop. International Low Impact Development Conference. Web. *(Virtual due to COVID-19)*

[45] Grubert, E. July 2020. “Socioenvironmental priorities in resource-producing communities: Case studies from US and Australian communities hosting fossil fuel and solar production.” International Symposium on Society and Resource Management. Cairns, Queensland, Australia. *(Virtual due to COVID-19)*

[44] [@]Maxim, A. and E. Grubert. June 2020. “How could open data standards affect energy and water sustainability in agriculture?” International Symposium for Sustainable Systems and Technology. Pittsburgh, PA. *(Virtual due to COVID-19)*

[43] [@]Ha, S. and E. Grubert. May 2020. “Understanding the Public Attitudes towards the Clean Power Plan Using Natural Language Processing and Deep Learning.” Duke University Energy Data Analytics Symposium. Durham, NC. *(Postponed due to COVID-19)*

[42] Kirkman, R. and E. Grubert. February 2020. “Rethinking Relational Values for Environmental Assessment.” 2020 Annual International Conference of the Association for Practical and Professional Ethics. Atlanta, GA. *(Oral)*

[41] Kirkman, R. and E. Grubert. January 2020. “Rethinking Relational Values for Environmental Assessment.” Workshops on Original Policy Research (WOPR). Georgia Institute of Technology. Atlanta, Georgia.

[40] Grubert, E. December 2019. “Phasing Out Fossil Fuels: Socioenvironmental Priorities and Just Transitions for Extraction Communities.” American Geophysical Union Fall Meeting. San Francisco, CA. *(Oral)*

[39] Meng, M., K. Sanders, and E. Grubert. December 2019. “Resolving the life cycle water consequences of U.S. coal-fired electricity: A challenge of data availability, spatial attribution, and consumer accountability.” American Geophysical Union Fall Meeting. San Francisco, CA. *(Oral)*

[38] Gallo, E., C. Bell, A. Beziou, K. Spahr, E. Grubert, and T. Hogue. December 2019. “Development of a new integrated decision support tool (i-DST) for optimizing the benefits and tradeoffs of greener to greyer stormwater infrastructure.” American Geophysical Union Fall Meeting. San Francisco, CA. *(Poster)*

[37] Ravikumar, A., E. Grubert, and D. Sanchez. December 2019. “An Introduction to the Green New Deal and its Implications for Climate Policy.” American Geophysical Union Fall Meeting. San Francisco, CA. *(Oral—Session Chair, The Green New Deal: From Resolution to Reality)*

[36] Grubert, E. September 2019. “Conventional Hydroelectricity and the Future of the Grid.” Energy Policy Research Conference. Boise, ID. *(Oral)*

[35] Grubert, E. August 2019. “Modeling Regionalized Life Cycle Cost Ranges for Stormwater Infrastructure.” Operation & Maintenance of Stormwater Control Measures. Minneapolis, MN. *(Oral)*

[34] Grubert, E. June 2019. “What can public comments on the Clean Power Plan tell us about public attitudes toward climate-oriented regulation of the electricity system? A computational analysis.” International Symposium on Society and Resource Management. Oshkosh, WI. *(Oral)*

[33] Peer, R., E. Grubert, and K. Sanders. May 2019. “A High-resolution Geospatial Assessment of Water for the US Energy System.” World Environmental and Water Resources Congress. Pittsburgh, PA. *(Oral)*

[32] Grubert, E. May 2019. “A Life Cycle Cost Model of United States Green Stormwater Infrastructure Including Monetized Environmental Costs.” World Environmental and Water Resources Congress. Pittsburgh, PA. *(Oral)*

[31] Grubert, E. April 2019. “Energy in Atlanta: Regional Priorities and Governance.” Atlanta Studies Symposium. Atlanta, Georgia. *(Oral)*

[30] Sanders, K. and E. Grubert. December 2018. “Estimating the water usage of the US energy system within the context of change.” American Geophysical Union Fall Meeting. Washington, D.C. *(Oral)*

[29] Stokes-Draut, J., and E. Grubert. December 2018. “Unraveling the Water-Energy-Carbon Nexus for California’s Urban Water Future.” American Geophysical Union Fall Meeting. Washington, D.C. *(Oral)*

[28] Hogue, T., C. Bell, E. Gallo, K. Spahr, E. Grubert, J. Stokes-Draut, and J. McCray. December 2018. “Advancing tools for holistic management of water resources: Development of an integrated decision support tool (i-DST) for grey and green infrastructure implementation.” American Geophysical Union Fall Meeting. Washington, D.C. *(Oral)*

[27] Peer, R., E. Grubert, and K. Sanders. December 2018. “A Geospatial Assessment of the Water Consumed and Withdrawn for US Fossil Fuel Production.” American Geophysical Union Fall Meeting. Washington, D.C. *(Poster)*

[26] Gallo, E., T. Hogue, C. Bell, K. Spahr, E. Grubert, and J. Stokes-Draut. December 2018. “Application of a new integrated decision support tool (i-DST) for urban water infrastructure: Analyzing water quality compliance pathways in Ballona Creek Watershed in Los Angeles, California.” American Geophysical Union Fall Meeting. Washington, D.C. *(Poster)*

[25] Grubert, E. June 2018. “Socioenvironmental priorities and experiences in the Eagle Ford and Bakken Shale regions of the United States: A comparative case study.” International Symposium on Society and Resource Management. Salt Lake City, Utah. *(Oral)*

[24] *Groenke, A., E. Grubert, J. Stokes-Draut, and A. Horvath. May 2018. “Analysis of California water conservation programs for low-income communities: Decision support systems for utility planning.” Re-Inventing the Nation’s Urban Water Infrastructure (ReNUWIt) Spring Meeting. Stanford, California. *(Poster)*

[23] Grubert, E. May 2018. “Developing Social Elements of Life Cycle Assessment.” World Environmental and Water Resources Congress. Minneapolis, Minnesota. *(Oral)*

[22] Webber, M. and E. Grubert. December 2017. “Thirst for Power: Energy, Water, and Human Survival.” American Geophysical Union Fall Meeting. New Orleans, Louisiana. *(Oral)*

[21] Grubert, E. December 2017. “Water Use for Unconventional Energy Development: How Much, What Kind, and to What Reaction?” American Geophysical Union Fall Meeting. New Orleans, Louisiana. *(Poster, Invited)*

[20] Traer, M., R. Haupt, and E. Grubert. December 2017. “Stop saving the planet! Carbon accounting of superheroes and their impacts on climate change.” American Geophysical Union Fall Meeting. New Orleans, Louisiana. *(Poster)*

[19] Wang, J. and E. Grubert. November 2017. “Perceived variability in attribute outcomes, moral attributes, and compromise.” Society for Judgment and Decision Making Annual Meeting. Vancouver, British Columbia. *(Poster)*

[18] Grubert, E. November 2017. “Integrating Water Quantity to Life Cycle Assessment: A US-based Energy Water Nexus Case Study.” American Water Resources Association Annual Conference. Portland, Oregon. *(Oral)*

[17] *Suganuma, J. and E. Grubert. July 2017. “Community Response to Unconventional Oil and Gas Development in North America.” Energy Impacts Symposium 2017. Columbus, Ohio. *(Oral)*

[16] Grubert, E. and K. Sanders. June 2017. “A National Assessment of the Water Withdrawn and Consumed for the US Energy Economy.” 2017 Joint Conference of the International Society for Industrial Ecology and International Symposium on Sustainable Systems and Technology. Chicago, Illinois. *(Oral)*

[15] Grubert, E. and M. Cook. May 2017. “Communicating Controversial Scientific Issues: Water Use for Oil and Natural Gas.” World Environmental and Water Resources Congress. Sacramento, California. *(Poster)*

[14] Grubert, E. and K. Sanders. December 2016. “Water for Energy: Quantifying Water Use in the United States Energy Economy as of 2014.” American Geophysical Union Fall Meeting. San Francisco, California. *(Oral)*

[13] Jagdeo, J., A. Ravikumar, E. Grubert, and A. Brandt. December 2016. “A Holistic Assessment of Energy Production: Environmental, Economic, and Social Impacts of Hydraulic Fracturing in Williams County, North Dakota.” American Geophysical Union Fall Meeting. San Francisco, California. *(Poster)*

[12] *Melby, G., E. Grubert, and A. Brandt. December 2016. “Perceptions of Shale Gas Development: Differences in Urban and Rural Communities.” American Geophysical Union Fall Meeting. San Francisco, California. *(Poster)*

[11] *Drummond, V., E. Grubert, and A. Brandt. December 2016. “Fault Lines: Seismicity and the Fracturing of Energy Narratives in Oklahoma.” American Geophysical Union Fall Meeting. San Francisco, California. *(Poster)*

[10] Grubert, E. May 2016. “The Dynamic Water Intensity of Hydroelectricity.” World Environmental and Water Resources Congress. West Palm Beach, Florida. *(Oral)*

[9] Cook, M. and E. Grubert. May 2016. “Water Use in the Oil and Gas Industries: Communicating with Scientists, Policymakers, and the Public.” World Environmental and Water Resources Congress. West Palm Beach, Florida. *(Poster)*

[8] Grubert, E. April 2016. “The Water Intensity of Coal Mining in the United States: A Basin Level Evaluation.” American Water Resources Association Spring Specialty Conference. Anchorage, Alaska. *(Oral)*

[7] Grubert, E. December 2015. “Social Priorities as Data.” American Geophysical Union Fall Meeting. San Francisco, California. *(Poster)*

[6] Grubert, E. December 2015. “Empowering Graduate Students to Lead on Interdisciplinary Societal Issues.” American Geophysical Union Fall Meeting. San Francisco, California. *(Oral)*

[5] Grubert, E. and A. Brandt. October 2015. “Methane Leakage in LCA: Quantifying the Effect of Fugitive Methane Emissions on Greenhouse Gas Inventories.” American Center for Life Cycle Assessment LCA XV. Vancouver, Canada. *(Oral)*

[4] Grubert, E. February 2015. “Hearing the Unspoken: Using Text Mining to Investigate Social and Environmental Priorities.” American Association for the Advancement of Science Annual Meeting. San Jose, California. *(Poster)*

[3] Grubert, E. March 2015. “Evaluating Produced Water as a New Source in the United States.” American Water Resources Association Spring Specialty Conference. Los Angeles, California. *(Oral)*

[2] Grubert, E. August 2011. “Modeling Water Supply and Demand on Maui: Forests as a Land Use Category.” Hawaii Conservation Conference. Honolulu, Hawaii. *(Oral)*

[1] Grubert, E. October 2010. “Air Impacting Water: How Carbon Emissions Standards Could Impact West Virginia Water.” West Virginia Water Conference: West Virginia’s Water Resources: Threats and Opportunities. Morgantown, West Virginia. *(Oral)*

D4. Invited Seminar Presentations

[34] Korea University. Korea University Global Energy Expert Seminar. September 2025. “Managing the Mid-Transition from Fossil Fuels to Zero Carbon.” Seoul, South Korea. *(Individual; remote)*

[33] Curtin University. Curtin Institute for Energy Transition. July 2025. “Managing the Mid-Transition from Fossil Fuels to Zero Carbon.” Bentley, WA, Australia. *(Individual; remote)*

[32] University of California, Los Angeles. April 2025. Focus on Environment and Sustainability Series. “Managing the Mid-Transition from Fossil Fuels to Zero Carbon.” Los Angeles, CA. *(Individual)*

[31] The Pennsylvania State University. EarthTalks. April 2025. “Public Support for Energy and Climate Technology Deployment.” University Park, PA. *(Individual; remote)*

[30] Harvard University. Energy Policy Seminar. April 2024. “Planning the Mid-Transition for Just and Sustainable Decarbonization.” Cambridge, MA. *(Individual)*

[29] University of Calgary. November 2023. NZERI (Net Zero Electricity Research Initiative) Learning Series. “U.S. Fossil Power CCS Under the Inflation Reduction Act.” Calgary, AB. *(Individual; remote)*

[28] Princeton University. November 2023. Conversations on the Environment, Responsible Energy, And Life (CEREAL). “Justice in the Mid-Transition.” Princeton, NJ. *(Individual)*

[27] Princeton University. Bradford Seminar. November 2023. “Planning the Mid-Transition for Just and Sustainable Decarbonization.” Princeton, NJ. *(Individual)*

[26] The University of Texas at Austin. UT Energy Symposium. October 2023. “Fossil Phase-out and the Just Energy Transition.” Austin, TX. *(Individual; remote)*

[25] The University of Texas at Austin. DeFord Lecture. October 2023. “Planning the Mid-Transition: Aligning Fossil Phase-out and Zero Carbon Phase-in for Just Decarbonization.” Austin, TX. *(Individual)*

[24] Council of Economic Advisers (United States White House). July 2023. “The Mid-transition: Planning and Implementation in the US.” Washington, DC. (*Individual; remote)*

[23] North American Carbon Program and US Carbon Cycle Science Program. November 2022. The Carbon Dioxide Removal (CDR) Academy. “CDR similarities and differences across earth systems.” *(Panel; remote)*

[22] North American Carbon Program and US Carbon Cycle Science Program. October 2022. The Carbon Dioxide Removal (CDR) Academy. “Role of the atmosphere in deep decarbonization.” *(Individual; remote)*

[21] University of California, Los Angeles. Joint Seminar: UCLA Institute of the Environment & Sustainability and UCLA Department of Civil and Environmental Engineering. May 2021. “Fossil electricity retirement deadlines for a just transition.” Los Angeles, CA. *(Individual; remote)*

[20] Stanford University. Energy Resources Engineering Spring Seminar. March 2021. “Fossil electricity retirement deadlines for a just transition.” Stanford, CA. *(Individual; remote)*

[19] Lawrence Berkeley National Lab. Electricity Markets & Policy Department Seminar. March 2021. “Fossil electricity retirement deadlines for a just transition.” Berkeley, CA. *(Individual; remote)*

[18] MSE Village Conversations. March 2021. “Fossil electricity retirement deadlines for a just transition.” Atlanta, GA. *(Individual; remote)*

[17] Lawrence Berkeley National Lab. Energy Analysis & Environmental Impacts (EAEI) Happy Hour Seminar. February 2021. “Fossil electricity retirement deadlines for a just transition.” Berkeley, CA. *(Individual; remote)*

[16] Human-Water Systems Monthly. January 2021. “Conventional Hydroelectricity and the Energy Transition.” Online seminar series (session hosted by Virginia Tech). *(Individual; remote)*

[15] Georgia Institute of Technology. GeoSeminar. October 2020. “Decarbonization and a Just Transition in the United States Energy Sector.” Atlanta, GA. *(Individual; remote)*

[14] University of California, Santa Barbara. October 2020. “Energy, Water, and Facilitating Infrastructure Decisions Under Climate Change.” Santa Barbara, CA. *(Individual; remote)*

[13] Stanford University. September 2020. “Macro-Energy Systems: Toward a New Discipline.” Stanford, CA. *(Panel; remote)*

[12] Stanford University. May 2020. “Renewable natural gas and climate: The influence of feedstock and methane leakage.” Stanford, CA. *(Individual; remote)*

[11] University of Southern California. February 2020. “Conventional Hydroelectricity and the Energy Transition.” Los Angeles, CA. *(Individual)*

[10] University of Illinois Urbana-Champaign. February 2020. “Conventional Hydroelectricity and the Energy Transition.” Urbana, IL. *(Individual)*

[9] North Carolina State University. November 2019. “Conventional Hydroelectricity and the Grid.” Raleigh, NC. *(Individual)*

[8] North Carolina State University. November 2019. “Power Shift: The Future of Energy and the Women Shaping It.” Raleigh, NC. *(Panel)*

[7] Carnegie Institution for Science Department of Global Ecology. October 2019. “The Energy System is Changing: Industrialization, Deindustrialization, and Adapting What We Have.” Stanford, CA. *(Individual)*

[6] NextProf Nexus. October 2019. “Preparing for the Interview.” Atlanta, Georgia. *(Panel)*

[5] Georgia Institute of Technology. Environmental Engineering Seminar. October 2019. “The Energy System is Changing: Industrialization, Deindustrialization, and Adapting What We Have.” Atlanta, Georgia. *(Individual)*

[4] American Center for Life Cycle Assessment and the International Society for Industrial Ecology. February 2018. “The Need for a Preference-Based Multicriteria Prioritization Framework in Life Cycle Sustainability Assessment.” LCSA Webinar Series. *(Individual)*

[3] Energy Impacts Research Coordination Network. February 2017. “New Voices in Energy Impacts Research: Graduate Research Highlights.” Webinar. *(Panel)*

[2] Yale Climate and Energy Institute, Yale University. February 2013. “Fuel Switching Can Save Water: Freshwater Use for Coal Versus Natural Gas Extraction and Power Generation in Texas.” New Haven, Connecticut. *(Individual)*

[1] Rocky Mountain Institute. January 2011. “The Role of Coal in the United States: Reserves and Externalities.” Boulder, Colorado. *(Individual)*

D5. Other Presentations

[53] Grubert, E. August 2025. Michiana Science Cafe. “What Does it Mean to Manage Carbon? Carbon Capture and Storage, Carbon Removal, and Why it Matters.” South Bend, IN. *(Individual)*

[52] Grubert, E. June 2025. Massachusetts Office of Energy Transformation Decarbonizing the Peak (DTP) Focus Area Work Group. “Decarbonizing peak electricity.” Online. *(Individual; remote)*

[51] Grubert, E. May 2025. Maryland Department of the Environment Alternative Fuels Working Group. “Clean Heat: Analytical support for transition policies.” Online. *(Individual; remote)*

[50] Grubert, E. April 2025. “Environmental Ethics.” Ethical Practice Seminar. University of Notre Dame. Notre Dame, IN. *(Individual)*

[49] Grubert, E. April 2025. Alphabet Modeling Talks Series. “Life Cycle Assessment and Decarbonization: What is LCA Good At?” Online. *(Individual; remote)*

[48] Grubert, E. March 2025. “Carbon dioxide removal is a limited resource.” Carbon Dioxide Removal Webinar Series. The Climate Center. *(Individual; remote)*

[47] Grubert, E. January 2025. “Managed Transition.” Climate Change and the Law. University of Chicago. Chicago, IL. *(Individual)*

[46] Grubert, E. October 2024. “Carbon capture for climate action and federal context.” Indiana State Bar Association Utility Law Section Fall Seminar. *(Individual; remote*)

[45] Grubert, E. February 2024. “What number is your life worth?” Technology, Self, and Society. University of Notre Dame. Notre Dame, IN. *(Individual)*

[44] Grubert, E. February 2024. “Subnational governments and the just energy and climate transition.” Cities, States, & Global Governance. University of Notre Dame. Notre Dame, IN. *(Individual)*

[43] Grubert, E. December 2023. “Methane.” Zero Emissions by 2040 Technical Conference. New York Department of Public Service. *(Panel; remote)*

[42] Grubert, E. December 2023. “What role does direct air capture (DAC) play in achieving net zero?” Direct Air Capture Webinar. The Transition Accelerator. *(Panel; remote)*

[41] Grubert, E. November 2023. “Clearing the Air: Progress and Pitfalls of Carbon Dioxide Removal.” Forward in Energy Forum, Wisconsin Energy Institute. *(Panel; remote)*

[40] Grubert, E. October 2023. “The taxonomy of carbon capture for climate action.” CURE Convening: Carbon Capture & Minnesota’s “Carbon Free” Future. *(Individual; remote)*

[39] Grubert, E. October 2023. “Panel 1: Failing Forward.” Funder Collaborative on Oil and Gas. Carbon Capture: A Deep Dive for Journalists. Houston, TX. *(Panel; remote)*

[38] Grubert, E. October 2023. “Justice-centering decarbonization and equitable energy transitions.” Environmental Policy. University of Notre Dame. Notre Dame, IN. *(Individual)*

[37] Grubert, E. September 2023. “Planning the Mid-Transition: Aligning Fossil Phase-out and Zero Carbon Phase-in for Just Decarbonization.” ND Energy Faculty Lunch. University of Notre Dame. Notre Dame, IN. *(Individual)*

[36] Grubert, E. September 2023. “Confronting the Climate Crisis Across the Disciplines.” Cushwa Center and ND Energy. University of Notre Dame. Notre Dame, IN. *(Panel)*

[35] Grubert, E. January 2023. “Planning for the Mid-transition.” Pacific Northwest Utilities Conference Committee Board of Directors Meeting. *(Individual; remote)*

[34] Grubert, E. December 2022. “Navigating the Energy Transition – Growing Pains and Path Forward.” Illinois Power Agency. Power Hour 11. *(Individual; remote)*

[33] Grubert, E. December 2022. “Life cycle assessment for decision support in the building sector." US Department of Energy. Advanced Building Construction Initiative Coffee Chats. *(Individual; remote)*

[32] Grubert, E. November 2022. “Planning for a just decarbonization transition.” Exploring Civil and Environmental Engineering. Georgia Institute of Technology. Atlanta, Georgia. *(Remote)*

[31] Grubert, E. March 2022. “Fossil electricity retirement deadlines for a just transition.” Climate Adaptation Policy. University of Delaware. Newark, Delaware. *(Remote)*

[30] Grubert, E. June 2021. “Pitfalls of Assuming Low-Use, Low-Cost Natural Gas Electricity in Decarbonized Grid Planning.” RMI Electricity Office Hours. *(Remote)*

[29] Grubert, E. April 2021. “What Went Wrong in Texas? The February 2021 Texas Freeze.” IEEE Kansas City Section Chapter. *(Remote)*

[28] Chen, Y., E. Grubert, and G. Lan. April 2021. “Machine Learning-assisted Design of Sustainable Nanofiltration Membranes for Wastewater Resource Recovery.” School of Civil and Environmental Engineering, Executive Advisory Board Meeting. Atlanta, Georgia. *(Presenter; Remote)*

[27] Grubert, E. April 2021. “ITE & WTS 2021 Faculty Chat.” Georgia Institute of Technology, School of Civil and Environmental Engineering. *(Panel; Remote)*

[26] Grubert, E. March 2021. “Resilient Energy Infrastructure.” Georgia Institute of Technology #SMARTer Together Webinar Series. *(Panel; Remote)*

[25] Grubert, E. March 2021. “Out with the Old, in with the New: How to Build a Net-Zero America While Ensuring a Just Transition.” Columbia Center on Global Energy Policy. Online seminar. *(Panel; Remote)*

[24] Grubert, E. March 2021. “Renewable Natural Gas Regulatory Considerations.” Building Decarbonization Regulatory Working Group. Online seminar. *(Remote)*

[23] Grubert, E. February 2021, March 2021. “Just Transition for Power Plant Retirements.” NYSERDA Just Transition Working Group. *(Remote)*

[22] Grubert, E. January 2021. “Fossil electricity retirements for a just transition.” CHEM 3700. Georgia Institute of Technology. Atlanta, Georgia. *(Remote)*

[21] Grubert, E. December 2020. “Working with Industry.” Strategic Energy Institute. Georgia Institute of Technology. Atlanta, Georgia. *(Remote; panel)*

[20] Grubert, E. November 2020. “Transforming Industry in America's Zero-Carbon Action Plan.” Online Zero Carbon Action Plan seminar. *(Panel)*

[19] Grubert, E. October 2020. “Exploring Civil and Environmental Engineering.” School of Civil and Environmental Engineering, Executive Advisory Board Meeting. Atlanta, Georgia. *(Remote)*

[18] Grubert, E. September 2020. “Life Cycle Assessment.” ENVE 555. San Diego State University. San Diego, California. *(Remote)*

[17] Grubert, E. June 2020. “Beyond CO_2: Water and Methane as Relevant Indicators in a Decarbonizing World.” ZERO Lab. Princeton University. Princeton, New Jersey. *(Remote)*

[16] Grubert, E. May 2020. “Life Cycle Assessment: Sustainability Assessment for Decision Making.” Envres 240. Stanford University. Stanford, California. *(Remote)*

[15] Grubert, E. May 2020. “The Powder River Basin Story.” Ad hoc online seminar. Web.

[14] Grubert, E. May 2020. “Conventional Hydroelectricity and the Energy Transition.” Emmett Interdisciplinary Program in Environment and Resources Alumni Seminar. Web.

[13] Grubert, E. April 2020, July 2020, September 2020. “Coal.” CEE 107A/207A/Earthsys 103. Stanford University. Stanford, California. *(Remote, 3x)*

[12] Grubert, E. April 2020. “How Environmental Policy Opened a Coal District.” EH 590R. Emory University. Atlanta, Georgia. *(Remote)*

[11] Grubert, E. March 2020. “Exploring Civil and Environmental Engineering: Engaging Freshmen Early” *(Poster)*. Celebrating Teaching Day. Georgia Institute of Technology. Atlanta, Georgia.

[10] Grubert, E. January 2020. “Life Cycle Assessment: Sustainability Assessment for Decision Making.” ME 4801. Georgia Institute of Technology. Atlanta, Georgia.

[9] Grubert, E. October 2019. “Studying Energy Transitions with Geographic Information Systems.” CP 6541. Georgia Institute of Technology. Atlanta, Georgia.

[8] Grubert, E. March 2019. “Social Life Cycle Assessment.” ISyE 8803-THO. Georgia Institute of Technology. Atlanta, Georgia.

[7] Grubert, E. March 2016. “Water Intensity of Energy Systems: A Major Emerging Policy Issue.” MAP. Palo Alto, California.

[6] Grubert, E. February 2016. “Triple Bottom Line Policy Making: How Do We Balance Priorities?” United World College USA. Montezuma, New Mexico.

[5] Grubert, E. February 2016. “Implementation and Activism: Being Effective While Advocating.” United World College USA. Montezuma, New Mexico.

[4] Grubert, E. March 2015. “The Future of the Energy Industry.” MAP. Palo Alto, California. *(Panel)*

[3] Grubert, E. June 2013. “Natural gas, coal, and water in Texas.” Texas Natural Gas Regulatory Modernization Initiative. Austin, Texas.

[2] Grubert, E., A. Fraser, and E. Holland. September 2012. “Thermal Coal Vision 2030: United States Coal.” McKinsey Basic Materials Knowledge Day. Las Vegas, Nevada.

[1] Grubert, E. April 2010. “Energy and Water.” Amarillo Area Foundation and Texas Energy Forum. Amarillo, Texas.

E. GRANTS AND CONTRACTS

E1. As Principal Investigator

[11] Title of Project: Program Chair in the Institute for Ethics and the Common Good
Sponsor: Institute for Ethics and the Common Good (University of Notre Dame)
Total Dollar Amount: $387,275
Role: PI
Collaborators: n/a
Period of Contract: 7/1/2025-6/30/2028
Candidate’s Share: $387,275 (100%)

[10] Title of Project: Deep Residential Building Efficiency for Climate Change Mitigation and Adaptation
Sponsor: Quadrature Climate Foundation
Total Dollar Amount: $250,375
Role: PI
Collaborators: n/a
Period of Contract: 1/1/2025-12/31/2027
Candidate’s Share: $250,375 (100%)

[9] Title of Project: Workshop on Operationalizing Public Ownership Governance Models for a Just Energy Transition in the United States
Sponsor: Pulte Institute (University of Notre Dame)
Total Dollar Amount: $23,285
Role: PI
Collaborators: n/a
Period of Contract: 6/1/2024-9/1/2024
Candidate’s Share: $23,285 (100%)

[8] Title of Project: Worker and Host Community Experience of Fossil Plant Closure Announcements
Sponsor: Resources for the Future
Total Dollar Amount: $96,606
Role: PI
Collaborators: n/a
Period of Contract: 1/1/2024-12/31/2025
Candidate’s Share: $96,606 (100%)

[7] Title of Project: IPA Assignment with the Department of Energy
Sponsor: US Department of Energy
Total Dollar Amount: $267,586
Role: IPA; Specialized Service Agreement
Collaborators: n/a
Period of Contract: 12/3/2022 – 8/31/2023
Candidate’s Share: $267,586 (100%)

[6] Title of Project: IPA Assignment with the Department of Energy
Sponsor: US Department of Energy
Total Dollar Amount: $187,860

Role: IPA; Specialized Service Agreement
Collaborators: n/a
Period of Contract: 7/19/2021 – 7/18/2022
Candidate's Share: $187,860 (100%)

[5] Title of Project: Integrating End Use and Supply Side Decarbonization Strategies in the Southeast
Sponsor: Georgia Institute of Technology
Total Dollar Amount: $6,489
Role: PI
Collaborators: n/a
Period of Contract: 5/15/2021 – 6/30/2021
Candidate's Share: $6,489 (100%)

[4] Title of Project: Review of Multicriteria Environmental Impacts of Zero and Low Greenhouse Gas Energy Resources and Carriers
Sponsor: Clean Air Task Force
Total Dollar Amount: $8,010
Role: PI
Collaborators: n/a
Period of Contract: 4/1/2021 – 12/31/2021
Candidate's Share: $8,010 (100%)

[3] Title of Project: What Can Grids Expect from Conventional Hydroelectricity?
Sponsor: Carnegie Institution of Washington
Total Dollar Amount: $200,301
Role: PI
Collaborators: n/a
Period of Contract: 1/1/2020 – 12/31/2022
Candidate's Share: $200,301 (100%)

[2] Title of Project: CPS: Medium: Dynamic Pricing for Optimal Design of Sustainable Transportation Systems
Agency/Company: National Science Foundation
Total Dollar Amount: $1,018,602
Role: PI
Collaborators: Samuel Coogan (Co-PI), Omar Asensio (Co-PI)
Period of Contract: 10/1/2019 – 9/30/2022
Candidate's Share: $335,449 (~33%)

[1] Title of Project: What do public comments on environmental regulations reveal about social inequality? A computational analysis
Agency/Company: Russell Sage Foundation
Total Dollar Amount: $7,668
Role: PI
Collaborators: none
Period of Contract: 8/1/2019 – 7/31/2020
Candidate's Share: $7,668 (100%)

E2. As Co-Principal Investigator

[10] Title of Project: Resilient Energy Economies Initiative
Agency/Company: Sloan Foundation
Total Dollar Amount: $1,010,000

Role: Co-PI
Collaborators: Daniel Raimi (PI), Noah Kaufman (Co-PI), Julia Haggerty (Co-PI)
Period of Contract: 7/01/2025-12/31/2027
Candidate's Share: $50,000 *(responsible for an additional $460,000 as pass-through funds)*

[8] Title of Project: NSF Engines Development Award: Developing innovative Climate-Resilient Built Environments
Agency/Company: National Science Foundation
Total Dollar Amount: $1,000,000
Role: Co-PI
Collaborators: James Braun (PI), Panagiota Karava (Co-PI), W. Travis Horton (Co-PI), Arash Adel (Co-PI)
Period of Contract: 3/01/2024-8/31/2025
Candidate's Share: not available

[7] Title of Project: Planning Grant: Engineering Research Center for Green and Climate-Resilient Built Environments (Green CRiBs)
Agency/Company: National Science Foundation
Total Dollar Amount: $150,000
Role: Co-PI
Collaborators: Aram Amassian (PI), Natalie Stingelin (Co-PI), Terri Long (Co-PI), Michael McGehee (Co-PI)
Period of Contract: 9/01/2021-4/30/2022
Candidate's Share: not available

[6] Title of Project: CEE Cross-Cutting Research: Machine learning-assisted design of sustainable nanofiltration membranes for wastewater resource recovery
Agency/Company: Georgia Institute of Technology
Total Dollar Amount: $15,000
Role: Co-PI
Collaborators: Yongsheng Chen (PI), Guanghui Lan (Co-PI)
Period of Contract: 05/01/2021-12/31/2021
Candidate's Share: not available

[5] Title of Project: Estimating the costs of the coal-targeted retirement deadline policies to local communities in the West
Agency/Company: Western Resource Advocates
Total Dollar Amount: $25,000
Role: Co-PI
Collaborators: Robert Godby (PI), Roger Coupal (Co-PI)
Period of Contract: 01/01/2021-12/31/2021
Candidate's Share: $7,000 (~28%)

[4] Title of Project: Life Cycle Comparative Study of Pavements from Modified Sulfur Binder
Agency/Company: Uberbinder
Total Dollar Amount: $114,259
Role: Co-PI
Collaborators: Kimberly Kurtis (PI), Francesca Lolli (Co-PI)
Period of Contract: 6/15/2020 – 12/15/2021
Candidate's Share: $12,062 (~10%)

[3] Title of Project: Recommendations for Future Specifications to Ensure Durable Next Generation Concrete
Agency/Company: Georgia Department of Transportation
Total Dollar Amount: $325,000
Role: Co-PI
Collaborators: Kimberly Kurtis (PI)
Period of Contract: 8/15/2020 – 8/14/2023
Candidate's Share: $196,500 (60%)

[2] Title of Project: FW-HTF-RL: Cultivating Capacities for Responsible Hacking, Creating, and Making the Future of Work in Agriculture
Agency/Company: National Science Foundation
Total Dollar Amount: $1,996,465
Role: Co-PI
Collaborators: Jacqueline Tidwell (PI), Don Edgar (Co-PI)
Period of Contract: 10/1/2019 – 9/30/2023
Candidate's Share: $426,144 (~20%)

[1] Title of Project: Designing "Introduction to Civil and Environmental Engineering"
Agency/Company: Georgia Institute of Technology (Serve-Learn-Sustain Course Development Funds)
Total Dollar Amount: $4,000
Role: Co-PI
Collaborators: Kevin Haas (Co-PI)
Period of Contract: 4/1/2019 – 6/30/2019
Candidate's Share: 100% ($4,000)

E3. As Senior Personnel or Contributor

[1] Title of Project: An Integrated Decision Support Tool (i-DST) for Life-Cycle Cost Assessment and Optimization of Green, Grey, and Hybrid Stormwater Infrastructure
Agency/Company: Environmental Protection Agency
Total Dollar Amount: $1,949,462
Role: subawardee
Collaborators: Terri Hogue (PI), Mengistu Geza (co-PI), Christopher Higgins (co-PI), Arpad Horvath (co-PI), John McCray (co-PI), Rob McDonald (co-PI), Jennifer Stokes-Draut (co-PI)
Period of Contract: 1/1/2019 – 3/31/2020
Candidate's Share: $110,000 (~6%)

F. Other Scholarly and Creative Accomplishments

[20] The Energy Transition Show, Episode 252. 18 June 2025. Steelmaking in the Mid-Transition. *(Podcast guest)*

[19] Engineer Your Success, Episode 192. 13 May 2025. Adapting to Change: Engineering Solutions for a Sustainable Tomorrow. *(Podcast guest)*

[18] The World as You'll Know It: The Great Rebuild, 13 August 2024. Can We Pull Carbon Out of the Air? *(Podcast guest)*

[17] ASCE Plot Points Episode 161, 21 April 2024. Sustaining the sustainability fight. *(Podcast guest)*

[16] The Energy Gang, 6 February 2024. A pause in US gas export approvals: a big win for the climate? *(Podcast guest)*

[15] Zero (Bloomberg Green), 8 November 2023. Big Promise, Little Success: The Precarious State of Carbon Capture. *(Podcast guest)*

[14] The Energy Gang, 8 September 2023. The US government is rolling the dice on direct air capture. *(Podcast guest)*

[13] Catalyst with Shayle Kann, 20 July 2023. Taking a closer look at carbon capture. *(Podcast guest)*

[12] The Energy Gang, 30 June 2023. Controversy over COP28. *(Podcast guest)*

[11] Public Power Underground, 27 April 2023. A conversation about a just mid-transition. *(Podcast guest)*

[10] The Energy Gang, 10 March 2023. Clearing the red tape around renewables. *(Podcast guest)*

[9] Resources Radio, 29 November 2022. Overcoming Obstacles in the Mid-transition to Clean Energy. *(Podcast guest)*

[8] The Energy Transition Show, Episode 185: Designing the Mid-transition. *(Podcast guest)*

[7] The Energy Gang, 23 September 2022. Managing Mid-Transition. *(Podcast guest)*

[6] The Big Switch, Season 1, Episode 1: The Zero-Carbon Backbone. *(Podcast guest)*

[5] The Energy Transition Show, Episode 145: A Slow Take on the Texas Blackout. *(Podcast guest)*

[4] The Energy Transition Show, Episode 140: Methane Leakage. *(Podcast guest)*

[3] ASCE *Plot Points*, Season 4, Episode 8: Are Civil Engineers Doing Enough to Combat Climate Change? *(Podcast guest)*

[2] Resources Radio, 17 December 2019. Understanding Water Use in the US Energy System. *(Podcast guest)*

[1] Hames, Mat (Director). 2018. Thirst for Power. Documentary. http://www.imdb.com/title/tt9032352/. *(Featured interviewee)*

G. Societal and Policy Impacts

G1. Selected Public Comments and Testimony

[16] Grubert, E. February 2026. Environmental Impacts of and Considerations for Refinery Closures. Presentation at Informational Hearing, California Senate Environmental Quality Committee. *(Oral)*

[15] Grubert, E. August 2025. Policy Framework for the Transition: Lessons Learned in Other Regions and Industries. Presentation at the Joint Oversight Hearing on California's Transportation Fuels Transition. *(Oral)*

[14] Grubert, E., W. Ricks, and D. Cullenward. August 2024. Response to docket # IRS-2024-0026. Comment on IRS Notice of Proposed Rulemaking for Section

45Y Clean Electricity Production Credit and Section 48E Clean Electricity Investment Credit. *(Written)*

[13] Grubert, E. May 2024. Response to docket # EPA-HQ-OAR-2024-0135. Comment on EPA's potential rulemaking for existing gas under Clean Air Act Section 111(d). *(Written)*

[12] Grubert, E. and D. Cullenward. February 2024. Response to docket # IRS-2023-0066. Comment on IRS Notice of Proposed Rulemaking for Section 45V Credit for Production of Clean Hydrogen; Section 48(a)(15) Election To Treat Clean Hydrogen Production Facilities as Energy Property. *(Written)*

[11] Grubert, E. February 2024. Declaration of Emily Grubert regarding life cycle emissions of Saratoga Biochar Solutions on behalf of Earthjustice re: the New York State Department of Environmental Conservation. *(Written)*

[10] Grubert, E. February 2024. Testimony of Emily Grubert in the Matter of the Application of Summit Carbon Solutions, LLC, for a Routing Permit for the Otter Tail to Wilkin Carbon Dioxide Pipeline Project on Behalf of CURE before the Minnesota Public Utilities Commission. *(Written)*

[9] Grubert, E. August 2023. Expert Rebuttal Report of Dr. Emily Grubert Re: Direct Air Capture In the Matter Regarding Proposed Revisions to Regulation Number 27 before the Colorado Air Quality Control Commission. *(Written)*

[8] Grubert, E. August 2023. Response to DOE/EA-2197D: Project Tundra, Environmental Assessment. Comment on Draft Environmental Assessment. *(Written)*

[7] Grubert, E., J. Buonocore, and E. Polka. August 2023. Response to docket # EPA-HQ-OAR-2023-0072. Comment on EPA's 111 (power plant greenhouse gas) proposed rule. *(Written)*

[6] Grubert, E. November 2022. Direct Testimony of Emily Grubert, PhD, on behalf of Sierra Club. Testimony before the Washington, D.C. Public Service Commission. *(Written)*

[5] Grubert, E. October 2022. Concerns about Refinery Carbon Capture and Storage Action in Scoping Plan. Comment to the California Air Resources Board. *(Written)*

[4] Grubert, E. September 2022. Direct Testimony of Emily Grubert. Testimony before the Vermont Public Utility Commission. *(Written)*

[3] Grubert, E. November 2020. Direct Testimony of Emily Grubert on Behalf of PACE Energy and Climate Center and Alliance for a Green Economy. Testimony before the New York State Public Service Commission. *(Written)*

[2] Cullenward, D., M. Mastrandrea, E. Grubert, and A. Strong. March 2016. Use of 20-year GWPs in the Draft Aliso Canyon Methane Leak Climate Impacts Mitigation Program. Comment to the California Air Resources Board. *(Written)*

[1] Grubert, E. April 2014. Testimony Regarding the Mine Methane Capture Carbon Offset Protocol. Meeting of the State of California Air Resources Board. *(Oral)*

G2. Selected Press Coverage

New York Times, The New Yorker, Los Angeles Times, Boston Globe, Chicago Tribune, Houston Chronicle, *Forbes*, *Grist, Quartz, Gizmodo, Mother Jones,*

Columbus Dispatch, CleanTechnica, Inside Climate News, Texas Climate News, ClimateNexus, The Climate Pod, Huffington Post, Resources Radio (Resources for the Future), KQED, MIT Technology Review, New Project Media, Platts, Natural Gas Intel, Scientific American, *Environmental Research Web*, *Eos, Montgomery Herald, Mountain West News Bureau, Tonopah Times-Bonanza*, *We Are Engineers, The Alcalde*, *Texas Clean Energy Coalition, Washington Post*

G3. Selected Press Quotes

Los Angeles Times, New York Times, NPR, AP, Wall Street Journal, National Geographic, E&E News, The New Republic, S&P Global, TechCrunch, The Atlantic ("The Weekly Planet"), Business Insider, Bloomberg, BNN Canada, Univision, DeSmog Blog, Gizmodo, Salon, Indy Star, WSBTV (Channel 2), WJCT, *Mashable, Casper Star-Tribune*

G4. Selected Use of Research in Policy

[4] Grubert and Hastings-Simon 2022 used as frame in letter from the California Energy Commission to California Governor Newsom regarding the State's refinery transition

[3] Grubert and Cullenward 2024 submitted to the Internal Revenue Service as a comment on 45V (hydrogen tax credit) implementation

[2] Grubert and Sawyer 2022 submitted to the Internal Revenue Service as a comment on 45Q (carbon oxide sequestration tax credit) implementation

[1] Comment Re: Formal Case No. 1142 by the Apartment and Office Building Association of Metropolitan Washington; Grubert 2020 entered into California Energy Commission Public Docket, 20-IEPR-02-Transportation

H. Other Professional Activities

2026	**Expert**, Sierra Club (California)
2025-pres	**Project Consultant**, California Energy Commission (California)
2025	**Expert**, EarthJustice (national)
2025	**Expert**, Climate Law Foundation (Vermont)
2025	**Expert**, FarmSTAND (Oregon)
2024	**Expert**, EarthJustice (New York)
2024	**Expert**, CURE (Minnesota)
2023-24	**Project Consultant**, Carbon Advocacy Project
2023	**Expert**, Environmental Defense Fund (Colorado)
2022-pres	**Expert Reviewer**, Frontier Climate
2022	**Expert**, EarthJustice (Washington, DC)
2022	**Expert**, Vermonters for a Clean Environment (Vermont)
2022-pres	**Professional Engineer** (Georgia, PE049118)
2021	**Expert**, Sierra Club (Nevada)
2021	**Project Consultant,** Clark Fork Coalition
2020-pres	**Envision Sustainability Professional (ENV SP)** (#35373)

2020-2021	**Expert**, EarthJustice (New York)
2020-2021	**Project Advisor**, The Gas Index (Global Energy Monitor), San Francisco, California
2020	**Project Consultant**, CarbonPlan, San Francisco, California
2016, 18	**Project Consultant**, Lineage Logistics, Irvine, California
2014-15	**Project Consultant**, SandRidge Energy, Oklahoma City, Oklahoma
2013-14	**Project Consultant**, Energy Innovation, San Francisco, California
2013	**Project Analyst**, Pacific Gas and Electric
2011-2022	**Engineer-in-Training**, Environmental Engineering (#45743)
2009-pres	**Leadership in Energy and Environmental Design (LEED) Accredited Professional**, Building Design and Construction

V. EDUCATION

A. COURSES TAUGHT

A1. Notre Dame

Spring, 2026	GLAF 60221	Life Cycle Assessment	11
Spring, 2026	GLAF 40113	Climate and Environmental Justice	30
Fall, 2025	GLAF 30131	Energy Systems for Decarbonization	32
Spring, 2025	GLAF 60221	Life Cycle Assessment	14
Spring, 2025	GLAF 40113	Climate and Environmental Justice	30
Spring, 2024	GLAF 60221	Life Cycle Assessment	7
Spring, 2024	GLAF 40113	Climate and Environmental Justice	19
Fall, 2023	GLAF 30131	Energy Systems for Decarbonization	31

A2. Georgia Tech

Spring, 2021	CEE 8813	Sustainable Buildings	18
Fall, 2020	CEE 2803	Exploring CEE	48
Spring, 2020	CEE 8813	Sustainable Buildings	14
Fall, 2019	CEE 2803	Exploring CEE	24

A3. Berkeley

Spring, 2018	CE 268s	Buildings and Sustainability	25

A4. Stanford

Fall, Spring, 2015-18	CEE 107a/207a	Understanding Energy	30-150
Summer, 2014-17	CEE 107s	Energy Resources: Fuels and Tools	20-40
Winter, 2017	Envres 340	E-IPER PhD Writing Seminar	8
Fall, 2016	Envres 276	Water Resources:	6

		Culture and Context	
Winter, 2015	Envres 275	The Practice of Mining and its Social and Environmental Context	10

B. Individual Student Guidance

B1. Ph.D. Students

[5] Glass, Joshua. Fall 2023-present. Graduation date: Summer 2026 (expected). Project: Advancing Life Cycle Assessment Methodologies in the Water-Energy Nexus Within the United States Utilizing Available Water Remaining (AWARE) Framework.

[4] Henao, Yulizza. Fall 2022-2024. Graduation date: Summer 2024. Project: Repurposing Decommissioned Wind Turbine Blades. Co-advisor: Russell Gentry.

[3] Cohen, Abigail. Spring 2020-Spring 2022. Graduation date: Spring 2026 (expected). Project: The New Greenbelt: Seeding Regional Self-Sufficiency Through the Circular Bioeconomy. Co-advisor: Yongsheng Chen.

[2] Maxim, Alexandra. Fall 2019-Spring 2023. Graduation date: Spring 2023. Project: Housing for Resilience and Equity: Accounting for the Effects of Electrification and Climate-induced Human Mobility in Decision Support Tools. Recipient: Robert Wood Johnson Foundation Health Policy Research Scholar Fellowship, Sloan Foundation Fellowship. *(placement: Stantec)*

[1] Ha, Sooji. Spring 2019-Summer 2021. Graduation date: Summer 2021. Project: Natural Language Processing and Deep Learning Approaches for Sustainability and Infrastructure Policy Analyses. Co-advisor: Omar Asensio. *(placement: Wells Fargo)*

B2. M.S. Students

[8] Doran, Alexandra. Fall 2023-Spring 2024. Project: Decarbonization in the United States: A Review of Power Generation Contributions to National Decarbonization Goals. Thesis: yes. *(as Thesis Director, Harvard University Extension School)*

[7] Drouhard, Bernadette. Summer 2021-Fall 2022. Project: Methane Availability from Wastewater Reclamation Facilities as Fuel for Low Capacity Factor Gas Plants Under Deep Decarbonization. Thesis: yes.

[6] Zacarias, Mathias. Fall 2021-Fall 2022. Project: Assessing the Residential Sector Decarbonization Potential of Demand-Side Management Resources: A Case Study of Georgia and the Atlanta Metro Area. Thesis: yes.

[5] Burns, Diana. Fall 2019-Spring 2021. Project: How Different are US Natural Gas Basins? Spatially Resolved Life Cycle Greenhouse Gas Emissions from Natural Gas. Thesis: yes. Recipient: Georgia Power Fellowship.

[4] Lyford, Kelsey. Fall 2019-Spring 2021. Thesis: no.

[3] Descartes, Jamen. Fall 2019-Spring 2021. Thesis: no.

[2] Dean, Victoria. Summer 2019-Spring 2021. Thesis: no. Recipient: Robert Wood Johnson Foundation Health Policy Research Scholar Fellowship.

[1] Krieger, Jennifer. Spring 2019-Fall 2019. Project: Life Cycle Costing for Green Stormwater Infrastructure for the integrated Decision Support Tool (iDST). Thesis: yes.

B3. Undergraduate Students

[45] Dolan, Noah. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[44] Rado, Gabriella. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[43] Cicchiello, Genevieve. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[42] Marmori Soliz, Cecilia. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[41] Kong, Jacob. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[40] Cruz, Jayna. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[39] Eisenreich, Tatum. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[38] Melchior, Haynes. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[37] Kelly, Eavan. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[36] Heitmann, Kate. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[35] Nofal, Jude. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[34] Cooper, Payton. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[33] Kaye, Ravi. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[32] Vonhof, Marina. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[31] Loes, Lucy. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[30] McCloskey, Ciara. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[29] Gonzàlez Panigua, Ana Maria. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[28] Buck, Sofia. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[27] McCoppin, Daniel. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[26] Theodore, Nathan. Spring 2026-pres. Undergraduate Research Assistant, University of Notre Dame.

[25] LaFever, James. Fall 2025-pres. Undergraduate Research Assistant, University of Notre Dame.

[24] Braden, Mary. Spring 2025-pres. Undergraduate Research Assistant, University of Notre Dame.

[23] Villa, Sebastian. Summer 2025. Undergraduate Research Assistant, University of Notre Dame.

[22] Hoyos Arango, Helena. Spring 2025, Spring 2026. Undergraduate Research Assistant, University of Notre Dame.

[21] Nam, Michael. Spring 2025. Undergraduate Research Assistant, University of Notre Dame.

[20] Conway, Katherine. Spring-Summer 2025. Undergraduate Research Assistant, University of Notre Dame.

[19] Bradshaw, Toby. Spring 2024. Undergraduate Research Assistant, University of Notre Dame.

[18] Burns, Ella. Fall 2023. Undergraduate Research Assistant, University of Notre Dame.

[17] Hill, Clarice. Summer 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[16] Chen, Jeremy. Spring 2021-Summer 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[15] Herrera, Talia. Spring 2021-Summer 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[14] Molnar, Clara. Spring 2021-Summer 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[13] Shreve, Christa. Spring 2021-Summer 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[12] Reinhart, Trina. Spring 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[11] Schmidt, Isaac. Spring 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[10] Zacarias, Mathias. Summer 2020-Summer 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[9] Gali, Manasi. Spring 2020; Fall 2020-Summer 2021. Undergraduate Research Assistant, Georgia Institute of Technology.

[8] Gardner, Anna. Fall 2019. Undergraduate Research Assistant, Georgia Institute of Technology.

[7] Brown, Robert. Spring/Summer 2019. Undergraduate Research Assistant, Georgia Institute of Technology.

[6] Groenke, Alexa. Spring 2018. Undergraduate Research Assistant, University of California, Berkeley.

[5] Drummond, Virginia. Summer 2016. Undergraduate Research Assistant, Stanford University.

[4] Melby, Grayson. Summer 2016. Undergraduate Research Assistant, Stanford University.

[3] Suganuma, Jade. Summer 2016. Undergraduate Research Assistant, Drake University.

[2] Herring, Noelle. 2015-2016. Undergraduate Research Assistant, Stanford University.

[1] Rey, Lindsey. 2010-2011. Undergraduate Research Assistant, The University of Texas at Austin.

B4. Service on thesis or dissertation committees

[13] Moe, Lina. Degree: PhD. Graduation date: TBD. Project: TBD. Advisor: Clint Andrews (Rutgers).

[12] Watson, Madelynn. Degree: Ph.D. Graduation date: TBD. Project: TBD. Advisor: Alexander Dowling.

[11] Chen, Xinhe. Degree: Ph.D. Graduation date: Spring 2026 (expected). Project: Optimal design and operation of integrated energy systems under market interactions and uncertainties. Advisor: Alexander Dowling.

[10] McGiven, Lauren. Degree: Ph.D. Graduation date: Fall 2025 (expected). Project: TBD. Advisors: Marc Müller, Diogo Bolster.

[9] Kopp, Tobias. Degree: M.S. Graduation date: Summer 2023. Project: Development of performance-based specifications and analysis of life cycle impacts for Portland cement concrete pavement and structural concrete. Advisor: Kimberly Kurtis.

[8] Broesicke, Osvaldo. Degree: Ph.D. Graduation date: Fall 2022. Project: Multidisciplinary design optimization for energy systems design: Evaluating the trade-offs between a centralized and distributed energy infrastructure for cities in the United States. Advisor: John Crittenden.

[7] Caceres Gonzalez, Rodrigo. Degree: Ph.D. Graduation date: Summer 2022. Project: Development and prediction of sustainable strategies for integrating solar energy with desalination. Advisor: Marta Hatzell.

[6] Rios, Renee. Degree: Ph.D. Graduation date: Spring 2022. Project: Screening reactivity and predicting performance of supplementary cementitious materials using statistical analysis and machine learning. Advisor: Kimberly Kurtis.

[5] Santoyo, Cesar. Degree: Ph.D. Graduation date: Spring 2022. Project: Probabilistic analysis and control methods for electric vehicle charging. Advisor: Samuel Coogan.

[4] Kasturi, Abishek. Degree: M.S. Graduation date: Fall 2020. Project: Near-term and long-term CO_2 sequestration potential in the United States using Bio-Energy with Carbon Capture and Storage. Advisor: Sotira Yiacoumi.

[3] Francisco, Abigail. Degree: Ph.D. Graduation date: Summer 2020. Project: Urban Energy Informatics: Improving the Usability of Building Energy Data for Community Energy Efficiency. Advisor: John Taylor.

[2] Samuels, Rachel. Degree: Ph.D. Graduation date: Summer 2020. Project: Identifying, Defining, and Utilizing Sociospatial Variances in Social Media Usage to Improve Crisis Response and Urban Resilience. Advisor: John Taylor.

[1] Jin, Qingxu. Degree: Ph.D. Graduation date: Fall 2019. Project: "Fundamental Understanding of NO_x Sequestration Capacity and Pathways in Nano-TiO_2 Engineered Cementitious Materials." Advisor: Kimberly Kurtis.

B5. Mentorship of postdoctoral fellows or visiting scholars

[4] Kamana-Williams, Baxter. December 2025-present.

[3] Lappen, Joshua. September 2024-present.

[2] Marshall, Adrienne. January 2021-August 2021. *(placement: Assistant Professor, Colorado School of Mines)*

[1] Mulrow, John. July 2020-June 2022. *(placement: Visiting Assistant Professor, Purdue University)*

C. Educational Innovations and Other Contributions

2024 Workshop designer and host, "Operationalizing Public Ownership." Notre Dame, IN.

2021 Workshop Co-Lead, "Peer review excellence: become an IOP trusted reviewer." Institute of Physics Publishing.

VI. Service

A. Professional Contributions

2025-pres. **Vice Chair**, Sustainability Committee, Interdisciplinary Council, Environmental and Water Resources Institute of the American Society of Civil Engineers

2025-pres. **Editorial Board Member**, Dialogues on Climate Change

2025 **Reviewer**, NYSERDA Energy Social Science Research Projects

2024-pres. **Member**, National Academies Committee, Enabling DOE Regional Energy-Water Demonstrations

2024-pres. **Leadership Team,** Resilient Energy Economies Initiative

2024-2025 **Member**, Technical Advisory Group, Vermont Clean Heat Standard

2024 **Reviewer**, NYSERDA Energy Social Science Research Projects (E-SSRP) Funding Opportunity Design

2024 **Steering Committee Member**, "Aligning California's Hydrogen Research and Innovation" Workshop, California Council on Science and Technology

2024 **Chair**, GREET Model Review Committee. Argonne National Laboratory.

2024 **Steering Committee Member**, Resilient Energy Economies Initiative

2024 **Reviewer**, Resilient Energy Economies Initiative

2023-2024 **Workshop Committee Member**, National Academies of Science, Engineering, and Medicine, "Developing and Assessing Ideas for Social

	and Behavioral Research to Speed Efficient and Equitable Industrial Decarbonization”
2023	**Ad Hoc Reviewer**, National Science Foundation, Decision, Risk, and Management Sciences Program
2023-pres.	**Editor in Chief**, *Environmental Research: Energy*
2022-pres.	**Fellow**, Climate and Community Institute
2022-2023	**Associate Editor**, *The Electricity Journal*
2022-2023	**Vice Chair**, Committee on Sustainable Energy, United Nations Economic Commission for Europe *(elected as United States representative)*
2022-2023	**Committee Member**, 2023 German-American Frontiers of Engineering Symposium
2022	**Ad Hoc Reviewer**, National Science Foundation, Human-Environment and Geographical Sciences Program
2022	**Panel Reviewer**, Environmental Protection Agency, Science to Achieve Results Program
2021-2023	**Fifth National Climate Assessment (NCA5) Chapter Author**, Mitigation
2021-2022	**Technical Co-Chair**, 2022 Environmental and Water Resources Institute (EWRI) Congress (ASCE), Atlanta, Georgia
2021	**Advisory Committee Member**, Environmental Research 2021, IOP Publishing, Virtual Conference
2021, 2022	**External Reviewer**, University of Michigan Carbon Neutrality Acceleration Program
2020-pres.	**Editorial Board Member**, *Environmental Research: Infrastructure and Sustainability*
2020-2023	**Associate Editor**, *Journal of Environmental Studies and Sciences*
2020	**Steering Committee Member**, Macro-Energy Systems Workshop
2020-2021	**Vice Chair**, Sustainability Committee, Interdisciplinary Council, Environmental and Water Resources Institute of the American Society of Civil Engineers
2020	**Panel Reviewer**, National Science Foundation, Directorate for Computer and Information Science and Engineering (CISE)
2019-2023	**Editorial Board Member**, *IOP SciNotes* (IOPSN)
2019-2020	**Secretary**, Sustainability Committee, Interdisciplinary Council, Environmental and Water Resources Institute of the American Society of Civil Engineers
2018-pres.	**Advisory Board Member**, *Environmental Research Letters*
2018-2019	**Program Committee Member**, International Conference on Sustainable Infrastructure (ICSI) 2019: Sustainable Cities for an Uncertain World, American Society of Civil Engineers
2016-2021	**Member**, Environmentally Responsible Energy Production (formerly Hydraulic Fracturing) Technical Committee, Interdisciplinary Council,

Environmental and Water Resources Institute of the American Society of Civil Engineers

ongoing **Journal Referee**, *Science*, *Proceedings of the National Academy of Sciences*, *Environmental Science & Technology*, *Environmental Research Letters*, *Water Resources Research*, *Journal of Industrial Ecology*, *Energy Research and Social Science*, *Society and Natural Resources*, *Journal of Water Resources Planning and Management*, others

B. PUBLIC AND COMMUNITY SERVICE

2023-pres. Scientific Advisory Board Member, Watershed Technology, Inc.

2023-pres. Board Member, Carbon Removal Institute

2021-pres. Capital Deployment for Community Needs Task Force Member, Maui ESG Project, Maui, Hawaii

C. UNIVERSITY SERVICE

C1. Notre Dame

2026 Admissions Committee Member, Master of Global Affairs – Sustainable Development (MGA-SD) concentration

2025-pres. Sustainability and Environmental Justice (SEJ) Group Representative, Keough School of Global Affairs Leadership Council

2025-pres. Just Transformations to Sustainability (JTS) Curriculum Committee Member

2025 PhD Dismissal Appeals Committee Member

2024-pres. Appeals Committee Member

2023 Search Committee Member (Dolšak)

2023 Search Committee Member (Energy, School of Engineering)

2023 Fulbright Campus Committee Reviewer

C2. Georgia Tech

2021 Strategic Energy Institute Faculty Advisory Council Member *(Institute level)*

2021 Civil and Environmental Engineering Strategic Planning Core Team Member *(School level*)

2021 Strategic Energy Institute Director Search Committee Member *(Institute level)*

2020-21 Civil and Environmental Engineering Committee on Diversity and Inclusion Faculty Representative and Vice-Chair *(School level)*

2020 Environmental Engineering Faculty Search Sub-committee Member *(School level)*

2020 College of Engineering Dean Search Committee Member *(College level)*

2019-21 Construction and Infrastructure Systems Engineering Representative, Undergraduate Committee *(School level)*

2019 OceanVisions2019 Session Co-chair *(School level)*

Attachment 2

RANAJIT (RON) SAHU, PH.D, CEM (NEVADA)

CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

e-mail: ronsahu@gmail.com; sahuron@earthlink.net

EXPERIENCE SUMMARY

Dr. Sahu has over thirty five years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources including stationary and mobile sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

He has almost thirty six years of project management experience and has successfully managed and executed hundreds of projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past three decades include various trade associations as well as individual companies such as steel mills, petroleum refineries, chemical plants, cement manufacturers, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, land development companies, and various entities in the public sector including EPA, the US Dept. of Justice, several states (including Arizona, New York, New Jersey, Connecticut, Kansas, Oregon, New Mexico, Pennsylvania, Texas, and others), various agencies such as the California DTSC, Oregon Public Utility Commission, and various cities and municipalities. Dr. Sahu has executed projects in all 50 US states, numerous local jurisdictions and internationally.

In addition to consulting, for approximately two decades, Dr. Sahu taught numerous courses in several Southern California universities as adjunct faculty, including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management). He also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental and engineering areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing a variety of private sector (industrial companies, land development companies, law firms, etc.), public sector (such as the US Department of Justice), and public interest group clients with project management, environmental consulting, project management, as well as regulatory and engineering support consulting services.

1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for** Air Quality/Geosciences/Hazardous Waste Groups, Pasadena, CA.

Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.

1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department.

1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department.

1989-1990 Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.

1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1984 M. S., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

“Thermodynamics and Heat Transfer,” Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

"Advanced Hazardous Waste Management" University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

"Environmental Risk Assessment," Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 1998.

"Hazardous Waste Remediation" Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

"Environmental Planning and Management," 5 week program for visiting Chinese delegation, 1994.

"Environmental Planning and Management," 1 day program for visiting Russian delegation, 1995.

"Air Pollution Planning and Management," IEP, UCR, Spring 1996.

"Environmental Issues and Air Pollution," IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-mid-1990s.

Air and Waste Management Association, West Coast Section, 1989-mid-2000s.

PROFESSIONAL CERTIFICATIONS

EIT, California (#XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, 2000 - 2021.

CEM, State of Nevada (#EM-1699).

PUBLICATIONS (PARTIAL LIST)

"Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).

"Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).

"On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).

"Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).

"Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).

"A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).

"Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R. Gavalas, *Combust. Flame*, **77**, 337-346 (1989).

"Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).

"Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.

"Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).

"HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).

"Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).

"Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).

"NOx Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

“From Purchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada,” with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.

“The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants,” with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

"Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).

"Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

Annex A

Expert Litigation Support

A. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

1. In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled "Hitting the Ethanol Blend Wall – Examining the Science on E15."

B. Matters for which Dr. Sahu has provided affidavits and expert reports include:

2. Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.

3. Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

4. Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

5. Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).

6. Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).

7. Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.

8. Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc*., 5:04-cv-00034-KSF (Eastern District of Kentucky).

9. Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.

10. Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.

11. Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.

12. Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.

13. Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo's eight new proposed PRB-fired PC boilers located at seven TX sites.

14. Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).

15. Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.

16. Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

17. Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.

18. Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with *General Power Products, LLC v MTD Products Inc*., 1:06 CVA 0143 (Southern District of Ohio, Western Division) .

19. Expert Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.

20. Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.

21. Affidavits (May 2010/June 2010 in the Office of Administrative Hearings))/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).

22. Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).

23. Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.us

24. Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.

25. Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone's proposed Unit 3 in Texas.

26. Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*

27. Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper's proposed Pee Dee plant in South Carolina).

28. Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.

29. Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

30. Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

31. Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

32. Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

33. Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

34. Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.

35. Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (Eastern District of Michigan).

36. Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.

37. Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (District of Colorado).

38. Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

39. Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

40. Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. Public Service Company of New Mexico* (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE) (District of New Mexico).

41. Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

42. Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

43. Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant*

Generation Company LLC, Case No. 5:10-cv-00156-DF-CMC (Eastern District of Texas, Texarkana Division).

44. Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

45. Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.

46. Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

47. Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority,* Civil Action No. 4:11-cv-00791 (Southern District of Texas, Houston Division).

48. Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

49. Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

50. Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.,* Civil Action No. A-08-CA-648-LY (Western District of Texas, Austin Division).

51. Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.,* Case No. 3:10-cv-747 (TJM/DEP) (Northern District of New York).

52. Declaration (October 2011) on behalf of the Plaintiffs in the matter of *American Nurses Association et. al. (Plaintiffs), v. US EPA (Defendant)*, Case No. 1:08-cv-02198-RMC (US District Court for the District of Columbia).

53. Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association,* Case No. 11-417-MJP (Western District of Washington).

54. Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

55. Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency,* Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).

56. Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).

57. Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality,* Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261st Judicial District).

58. Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.,* Civil Action No. 07-CV-5298 (JKG) (Eastern District of Pennsylvania).

59. Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project.

60. Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.

61. Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.

62. Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.

63. Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

64. Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.

65. Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

66. Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.

67. Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

68. Declaration (April 2013) on behalf of Petitioners in the matter of *Sierra Club, et al., (Petitioners) v Environmental Protection Agency et al. (Respondents),* Case No., 13-1112, (Court of Appeals, District of Columbia Circuit).

69. Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

70. Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of *A. J. Acosta Company, Inc., v. County of San Bernardino*, Case No. CIVSS803651.

71. Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.

72. Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.

73. Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

74. Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.

75. Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).

76. Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States*, Civil Action No. 13-1820 RC (District Court for the District of Columbia).

77. Declaration (April 2014) on behalf of Respondent-Intervenors in the matter of *Mexichem Specialty Resins Inc., et al., (Petitioners) v Environmental Protection Agency et al.,* Case No., 12-1260 (and Consolidated Case Nos. 12-1263, 12-1265, 12-1266, and 12-1267), (Court of Appeals, District of Columbia Circuit).

78. Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).

79. Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).

80. Direct Prefiled Testimony (August 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of Consumers Energy Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17317 (Michigan Public Service Commission).

81. Declaration (July 2014) on behalf of Public Health Intervenors in the matter of *EME Homer City Generation v. US EPA* (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).

82. Expert Report (September 2014), Rebuttal Expert Report (December 2014) and Supplemental Expert Report (March 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

83. Expert Report (November 2014) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

84. *Declaration (January 2015) relating to Startup/Shutdown in the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.*

85. Pre-filed Direct Testimony (March 2015), Supplemental Testimony (May 2015), and Surrebuttal Testimony (December 2015) on behalf of Friends of the Columbia Gorge in the matter of the Application for a Site Certificate for the Troutdale Energy Center before the Oregon Energy Facility Siting Council.

86. Brief of Amici Curiae Experts in Air Pollution Control and Air Quality Regulation in Support of the Respondents, On Writs of Certiorari to the US Court of Appeals for the District of Columbia, No. 14-46, 47, 48. *Michigan et. al., (Petitioners) v. EPA et. al., Utility Air Regulatory Group (Petitioners) v. EPA et. al., National Mining Association et. al., (Petitioner) v. EPA et. al.,* (Supreme Court of the United States).

87. Expert Report (March 2015) and Rebuttal Expert Report (January 2016) on behalf of Plaintiffs in the matter of *Conservation Law Foundation v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

88. Declaration (April 2015) relating to various Technical Corrections for the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.

89. Direct Prefiled Testimony (May 2015) on behalf of the Michigan Environmental Council, the Natural Resources Defense Council, and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Increase its Rates, Amend its Rate Schedules and Rules Governing the Distribution and Supply of Electric Energy and for Miscellaneous Accounting Authority, Case No. U-17767 (Michigan Public Service Commission).

90. Expert Report (July 2015) and Rebuttal Expert Report (July 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

91. Declaration (August 2015, Docket No. 1570376) in support of "Opposition of Respondent-Intervenors American Lung Association, et. al., to Tri-State Generation's Emergency Motion;" Declaration (September 2015, Docket No. 1574820) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors for Remand Without Vacatur;" Declaration (October 2015) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors to State and Certain Industry Petitioners' Motion to Govern, *White Stallion Energy Center, LLC v. US EPA*, Case No. 12-1100 (US Court of Appeals for the District of Columbia).

92. Declaration (September 2015) in support of the Draft Title V Permit for Dickerson Generating Station (Proposed Permit No 24-031-0019) on behalf of the Environmental Integrity Project.

93. Expert Report (Liability Phase) (December 2015) and Rebuttal Expert Report (February 2016) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., Environmental Law and Policy Center, and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

94. Declaration (December 2015) in support of the Petition to Object to the Title V Permit for Morgantown Generating Station (Proposed Permit No 24-017-0014) on behalf of the Environmental Integrity Project.

95. Expert Report (November 2015) on behalf of Appellants in the matter of *Sierra Club, et al. v. Craig W. Butler, Director of Ohio Environmental Protection Agency et al.,* ERAC Case No. 14-256814.

96. Affidavit (January 2016) on behalf of Bridgewatch Detroit in the matter of *Bridgewatch Detroit v. Waterfront Petroleum Terminal Co., and Waterfront Terminal Holdings, LLC.*, in the Circuit Court for the County of Wayne, State of Michigan.

97. Expert Report (February 2016) and Rebuttal Expert Report (July 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

98. Direct Testimony (May 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

99. Declaration (June 2016) relating to deficiencies in air quality analysis for the proposed Millenium Bulk Terminal, Port of Longview, Washington.

100. Declaration (December 2016) relating to EPA's refusal to set limits on PM emissions from coal-fired power plants that reflect pollution reductions achievable with fabric filters on behalf of Environmental Integrity Project, Clean Air Council, Chesapeake Climate Action Network, Downwinders at Risk represented by Earthjustice in the matter of *ARIPPA v EPA, Case No. 15-1180.* (D.C. Circuit Court of Appeals).

101. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

102. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Backus Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

103. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Drakulic Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

104. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Deutsch Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

105. Affidavit (February 2017) pertaining to deficiencies water discharge compliance issues at the Wood River Refinery in the matter of *People of the State of Illinois (Plaintiff) v. Phillips 66 Company, ConocoPhillips Company, WRB Refining LP (Defendants)*, Case No. 16-CH-656, (Circuit Court for the Third Judicial Circuit, Madison County, Illinois).

106. Expert Report (March 2017) on behalf of the Plaintiff pertaining to non-degradation analysis for waste water discharges from a power plant in the matter of *Sierra Club (Plaintiff) v. Pennsylvania Department of Environmental Protection (PADEP) and Lackawanna Energy Center*, Docket No. 2016-047-L (consolidated), (Pennsylvania Environmental Hearing Board).

107. Expert Report (March 2017) on behalf of the Plaintiff pertaining to air emissions from the Heritage incinerator in East Liverpool, Ohio in the matter of *Save our County (Plaintiff) v. Heritage Thermal Services, Inc. (Defendant), Case No. 4:16-CV-1544-BYP*, (US District Court for the Northern District of Ohio, Eastern Division).

108. Rebuttal Expert Report (June 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight (Plaintiffs) v Coyote Creek Mining Company LLC (Defendant),* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

109. Expert Affidavit (August 2017) and Penalty/Remedy Expert Affidavit (October 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant,)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

110. Expert Report (August 2017) on behalf of Appellant in the matter of *Patricia Ann Troiano (Appellant) v. Upper Burrell Township Zoning Hearing Board (Appellee)*, Court of Common Pleas of Westmoreland County, Pennsylvania, Civil Division.

111. Expert Report (October 2017), Supplemental Expert Report (October 2017), and Rebuttal Expert Report (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

112. Declaration (December 2017) on behalf of the Environmental Integrity Project in the matter of permit issuance for ATI Flat Rolled Products Holdings, Breckenridge, PA to the Allegheny County Health Department.

113. Expert Report (Harm Phase) (January 2018), Rebuttal Expert Report (Harm Phase) (May 2018) and Supplemental Expert Report (Harm Phase) (April 2019) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

114. Declaration (February 2018) on behalf of the Chesapeake Bay Foundation, et. al., in the matter of the Section 126 Petition filed by the state of Maryland in *State of Maryland v. Pruitt (Defendant)*, Civil Action No. JKB-17-2939 (Consolidated with No. JKB-17-2873) (US District Court for the District of Maryland).

115. Direct Pre-filed Testimony (March 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of *NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC*, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

116. Expert Affidavit (April 2018) and Second Expert Affidavit (May 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

117. Direct Pre-filed Testimony and Affidavit (December 2018) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

118. Expert Report (February 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

119. Declaration (March 2019) on behalf of Earthjustice in the matter of comments on the renewal of the Title V Federal Operating Permit for Valero Houston refinery.

120. Expert Report (March 2019) on behalf of Plaintiffs for Class Certification in the matter of *Resendez et al v Precision Castparts Corporation* in the Circuit Court for the State of Oregon, County of Multnomah, Case No. 16cv16164.

121. Expert Report (June 2019), Affidavit (July 2019) and Rebuttal Expert Report (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

122. Affidavit/Expert Report (August 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

123. Expert Report (October 2019) relating to the appeal of air permit (Plan Approval) on behalf of Appellants in the matter of *Clean Air Council and Environmental Integrity Project (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection and Sunoco Partners Marketing and Terminals L.P.*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-057-L.

124. Expert Report (December 2019), Affidavit (March 2020), Supplemental Expert Report (July 2020), and Declaration (February 2021) on behalf of Earthjustice in the matter of *Objection to the*

Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

125. Affidavit (December 2019) on behalf of Plaintiff-Intervenor (Surfrider Foundation) in the matter of *United States and the State of Indiana (Plaintiffs), Surfrider Foundation (Plaintiff-Intervenor), and City of Chicago (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant),* Civil Action No. 2:18-cv-00127 (US District Court for the Northern District of Indiana, Hammond Division).

126. Declarations (January 2020, February 2020, May 2020, July 2020, and August 2020) and Pre-filed Testimony (April 2021) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

127. Expert Report (April 2020) on behalf of the plaintiff in the matter of Orion Engineered Carbons, GmbH (Plaintiff) vs. Evonik Operations, GmbH (formerly Evonik Degussa GmbH) (Respondent), before the German Arbitration Institute, Case No. DIS-SV-2019-00216.

128. Expert Independent Evaluation Report (June 2020) for *PacifiCorp's Decommissioning Costs Study Reports dated January 15, 2020 and March 13, 2020 relating to the closures of the Hunter, Huntington, Dave Johnston, Jim Bridger, Naughton, Wyodak, Hayden, and Colstrip (Units 3&4) plants*, prepared for the Oregon Public Utility Commission (Oregon PUC).

129. Direct Pre-filed Testimony (July 2020) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

130. Expert Report (August 2020) and Rebuttal Expert Report (September 2020) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware Operating – NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

131. Expert Report (July 2020) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

132. Expert Report (August 2020) and Supplemental Expert Report (February 2021) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

133. Expert Report (August 2020) and Supplemental Expert Report (December 2020) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

134. Pre-filed Direct Testimony (October 2020) and Sur-rebuttal Testimony (November 2020) on behalf of petitioners (Ten Persons Group, including citizens, the Town of Braintree, the Town of Hingham, and the City of Quincy) in the matter of Algonquin Gas Transmission LLC, Weymouth MA, No. X266786 Air Quality Plan Approval, before the Commonwealth of Massachusetts, Department of Environmental Protection, the Office of Appeals and Dispute Resolution, OADR Docket Nos. 2019-008, 2019-009, 2019010, 2019-011, 2019-012 and 2019-013.

135. Expert Report (November 2020) on behalf of Protect PT in the matter of *Protect PT v. Commonwealth of Pennsylvania Department of Environmental Protection and Apex Energy (PA) LLC*, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2018-080-R (consolidated with 2019-101-R)(the "Drakulic Appeal").

136. Expert Report (December 2020) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (Defendants)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

137. Pre-filed Testimony (January 2021) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

138. Expert Reports (March 2021 and May 2021) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, Central Planning Board, City of Newark, New Jersey.

139. Expert Report (April 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 2:20-CV-01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Eastern District of Louisiana, New Orleans Division).

140. Affidavit (April 2021) for *Clayton Faerber et.al., (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 20-CV-00328 01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Southern District of Mississippi).

141. Expert Report (April 2021, June 2023) for *Floyd Ruffin (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-cv-00334-CJB-JCW (US District Court for the Eastern District of Louisiana, New Orleans Division).

142. Expert Report (April 2021) and Sur-Rebuttal Report (June 2021) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

143. Expert Report (May 2021) for *Clifford Osmer (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendants)* related to No. 18-CV-12557 (US District Court for the Eastern District of Louisiana).

144. Expert Report (May 2021) and Rebuttal Expert Report (January 2022) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 1:19-CV-00694-JB-MU-C (US District Court for the Southern District of Alabama, Southern Division).

145. Expert Report (June 2021) and Declarations (May 2021 and June 2021) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division.)

146. Expert Witness Disclosure (June 2021) on behalf of the Plaintiffs in the matter of *Jay Burdick, et. al., (Plaintiffs) v. Tanoga Inc. (d/b/a Taconic) (Defendant)*, Index No. 253835, (State of New York Supreme Court, County of Rensselaer).

147. Expert Report (June 2021) on behalf of Appellants in the matter of *PennEnvironment and Earthworks (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection (Appellee) and MarkWest Liberty Midstream and resource, LLC (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2020-002-R.

148. Expert Report (June 2021) for *Antonia Saavedra-Vargas (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:18-CV-11461 (US District Court for the Eastern District of Louisiana, New Orleans Division).

149. Affidavit (June 2021) for Lourdes Rubi in the matter of *Lourdes Rubi (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendants)*, related to 12-968 BELO in MDL No. 2179 (US District Court for the Eastern District of Louisiana, New Orleans Division).

150. Expert Report (June 2021) for *Wallace Smith (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:19-CV-12880 (US District Court for the Eastern District of Louisiana, New Orleans Division).

151. Declaration (July 2021) on behalf of Plaintiffs in the matter of *Stephanie Mackey and Nick Migliore, on behalf* of *themselves and all others similarly situated (Plaintiffs) v. Chemtool Inc. and Lubrizol Corporation (Defendants)*, Case No. 2021-L-0000165, State of Illinois, Circuit Court of the 17th Judicial Circuit, Winnebago County.

152. Declaration (July 2021, August 2021) on behalf of Petitioners in the matter of the Petition for a Hearing on the Merits Regarding Air Quality Permit No. 3340-RMD issued to New Mexico Terminal Services, LLC by *Mountain View Neighborhood Association et. al., (Petitioners) v. City of Albuquerque Environmental Health Department*, AQCB Petition No. 2020-1 before the Albuquerque-Bernalillo County Air Quality Control Board.

153. Expert Disclosure (September 2021), Affidavit (May 2023), and Affirmation (May 2024) on behalf of the Plaintiffs in the matter of *State of New York, Town of Hempstead, Town of Brookhaven, Incorporated Village of Garden City and Long Island Power Authority et. al., (Plaintiffs) v. Covanta Hempstead Company et. al., (Defendants)*, Index No. 7549/2013 before the Supreme Court of the State of New York, County of Nassau.

154. Expert Report (October 2021) for *John A. Battiste (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 1:21-CV-00118 (US District Court for the Southern District of Alabama, Mobile Division)

155. Declaration/Expert Report (October 2021) for *Charles K. Grasley et. al., (Plaintiffs) v. Chemtool Incorporated (Defendant)*, Case No. 2021-L-0000162 (State of Illinois, In the Circuit Court of the 17th Judicial Circuit, Winnebago County).

156. Declaration (October 2021) and Expert Report (November 2021) on behalf of the Plaintiffs in the matter of Toll Brothers, Inc., and Porter Ranch Development Company (Plaintiffs) v. Sempra Energy, Southern California Gas Company et. al., (Defendants), Southern California [Aliso Canyon] Gas Leak Cases, JCCP No.: 4861, Lead Case No.: BC674622, Superior Court of the State of California for the County of Los Angeles.

157. Expert Report (November 2021) and Declaration (September 2022) on behalf of Plaintiffs in Re: Deepwater Horizon BELO Cases, Case No. 3:19cv963-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

158. Declaration (November 2021) for the *United States of America and the State of Kansas, Department of Health and Environment (Plaintiffs) v. Coffeyville Resources Refining & Marketing, LLC (Defendant)*, Civ. No. 6:04-cv-01064-JAR-KGG (US District Court for the District of Kansas).

159. Expert Report/Affidavit (December 2021) on behalf of the City of Detroit in the matter of Marathon Petroleum Company (Claimant) v. City of Detroit Building Safety Engineering and Environmental Department, BSEED Case No. MCR 2018-2525, DAH Appeal No. 21-SWA-01, before the State of Michigan, City of Detroit Department of Appeals and Hearings.

160. Expert Report (December 2021) for *John Pabst (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 21-CV-00290 (US District Court for the Eastern District of Louisiana).

161. Expert Report (December 2021) for *Audrey Annette Tillery-Perdue individually and as person representative of the estate of Eddie Lewis Perdue (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendant)*, Civil Action No. 5:19-cv-00052-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

162. Expert Report (February 2022) for *Richard Dufour (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 19-cv-00591 (US District Court for the Southern District of Mississippi).

163. Expert Report (February 2022) and Rebuttal Expert Report (June 2022, in preparation) for *Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

164. Expert Report (February 2022) in the matter of the *Appeal Petition for Hearing on Air Quality Permit No. 8585 on behalf of Earth Care New Mexico et. al., (Petitioners) v. New Mexico Environment Department and Associated Asphalt and Materials, LLC (Applicant),* No. EIB 21-48 before the State of New Mexico Environmental Improvement Board.

165. Expert Report (March 2022), Affidavit (June 2022), Supplemental Expert Report (April 2023) in the matter of *Clean Air Council et. al., (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection (Appellee) and Renovo Energy Center (Permittee)* EHB Docket No. 2021-055-R before the Commonwealth of Pennsylvania Environmental Hearing Board.

166. Declaration (March 2022) in the matter of Max Midstream Texas LLC Air Quality Permit No. 162941 for the Seahawk Crude Condensate Terminal in Calhoun County Texas, TCEQ Docket No. 2022-0157-AIR, before the Texas Commission on Environmental Quality.

167. Expert Pre-filed Testimony (April 2022) in the matter of Application of TPC Group LLC for New State and PSD Air Quality Permits (various), TCEQ Docket No. 2021-1422-AIR, SOAH Docket No. 582-22-0799, Before the Texas State Office of Administrative Hearings.

168. Expert Report (April 2022) and Rebuttal Report (August 2022) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

169. Rule 26 Disclosure (May 2022) in the matter of the *Water Works and Sewer Board of the City of Gadsden (*Plaintiff*) v. 3M Company, et. al., (Defendants)*, Civil Action No.: 31 CV-2016-900676.00 (Circuit County of Etowah County, Alabama)

170. Expert Report (June 2022) for *Heather Schumacher (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-011939 (Circuit Court of Cook County, Illinois.)

171. Expert Report (June 2022), Rebuttal Reports (August 2022, September 2022) for Plaintiffs in *Phylliss Grayson et. al. (Plaintiffs), v Lockheed Martin Corporation (Defendant),* Case No. 6:20-cv-01770. (US District Court for the Middle District of Florida – Orlando Division.)

172. Expert Affidavit (July 2022) for Center for Environmental Rights in connection with the 2019 South Africa Integrated Resource Plan in *African Climate Alliance et. al. v. The Minister of Mineral Resources and Energy et. al.*, in the High Court of South Africa, Gauteng Division, Pretoria.

173. Expert Affidavit (July 2022) for Center for Environmental Rights in connection with the Limpopo Mine (Lephalale Coal Mines Ltd.) in *Earthlife Africa v. The Minister of Forestry, Fisheries and Environment et. al.*, in the High Court of South Africa, Gauteng Division, Pretoria, Case No. 9149/2022.

174. Pre-filed Testimony (July 2022) and Rebuttal Testimony (September 2020) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)* before the Washington Utilities and Transportation Commission, Docket UE-220066 and UG-220067 (Consolidated).

175. Expert Report (September 2022) *Clean Air Council, Citizens for Pennsylvania's Future, Mountain Watershed Association (Appellants) v. Allegheny County Health Department (Appellee) and Allegheny Energy Center (*Intervenor*, Permittee),* Case No. 21-043 before the Hearing Officer of the Allegheny County Health Department.

176. Expert Affidavit (October 2022) for *Concerned Citizens of Cook County GA (Petitioner) v. Georgia Department of Natural Resources (Respondent) and Spectrum Energy Georgia, LLC (Respondent Intervenor)* before the Office of State Administrative Hearings, State of Georgia, Docket No: 2303405-OSAH-BNR-AQ-37-Barnes.

177. Expert Rebuttal Report (January 2023), Supplemental Rebuttal Expert Report (March 2023, May 2023, November 2023) for *Ann Jordan et. al., and Blake Darnell (Plaintiffs) v. Terumo BCT et. al., (Defendants)* before District Court, Jefferson County, Colorado Case Numbers: 2020CV031457, 2021CV030474 (consolidated with 2020CV031457) and 2020CV03148.

178. Expert Report (January 2023) and Rebuttal Expert Report (April 2023) for *Potomac Riverkeeper and Sierra Club (Plaintiffs) v. Virginia Electric and Power Company (Defendant)*, Civil Action No. 2:21-CV-23 (Kleeh) (US District Court for the Northern District of West Virginia, Elkins Division).

179. Affidavit (January 2023) for *Richard Dufour (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:19-cv-00591-HSO-BWR (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Southern District of Mississippi).

180. Expert Report (January 2023) and Supplemental Expert Report (July 2023) on behalf of Plaintiffs in the matter of *Stephanie* Mackey *et. al., (Plaintiffs) v. Chemtool Inc. et. al., (Defendants) and Holian Insulation Company Inc. (Third-party Defendant)*, Case No.: 3:21-cv-50283, U.S. District Court, Northern District of Ilinois, Western Division.

181. Expert Report (February 2023) for *Vervicia Henderson, et al. (Plaintiff) v. Lockheed Martin Corporation (Defendant)*, Case No. 6:21-cv-01363, U.S. District Court, Middle District of Florida, Orlando Division.

182. Expert Report (February 2023) for *Carol Davis (Plaintiff) v. Lockheed Martin Corporation (*Defendant*)*, Case No. 6:22-cv-81-RBD-EJK, U.S. District Court, Middle District of Florida, Orlando Division.

183. Expert Report (February 2023) for Mark Letart (Plaintiff), et al. v. Union Carbide Corporation, et al. (Defendants), Case No. 2:19-cv-877, U.S. District Court, Southern District of West Virginia, Charleston Division.

184. Affidavit (March 2023) on behalf of plaintiffs in the matter of the *State of New Mexico, ex rel. Raul Torrez, Attorney General (Plaintiffs) v. Sterigenics US LLC, Sotera Health Holdings, LLC, Sotera Health LLC and Sotera Health Company (Defendants)*, Case No.: D-307-CV-2020-02629, State of New Mexico, Third Judicial District Court, County of Dona Ana

185. Pre-filed Direct Testimony (March 2023) in the matter of *Algonquin Gas Transmission LLC., on behalf of Community Residents (*Petitioners*)*, Commonwealth of Massachusetts Department of Environmental Protection, Office of Appeals and Dispute Resolution, OADR Docket Nos. 2017-011 and 012, Waterways Application License No. W16-4600, Weymouth Mass.

186. Declaration (April 2023) in the matter of Sierra Club (Plaintiff) v. Tennessee Valley Authority in the matter of the Johnsonville Aeroderivative Combustion Turbines Project, Case No.: 3:22-cv-1054, U.S>, District Court, Middle District of Tennessee, Nashville Division.

187. Expert Report (May 2023/June 2023), Affidavit (April 2023) and Declaration (July 2023) for *Ezequiel Caraballo-Pache (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 8:20-cv-00263-SCB-JSS (US District Court for the Middle District of Florida, Tampa Division).

188. Affidavit (May 2023) for *Lawrence Tucei (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00078-HSO-BWR (US District Court for the Southern District of Mississippi).

189. Expert Report (May 2023/June 2023) for *Vincent Culliver (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 3:21-cv-4942-MCR/HTC (US District Court for the Northern District of Florida).

190. Expert Report (June 2023) for *Matthew Williams (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00278-LG-BWR (US District Court for the Southern District of Mississippi).

191. Declaration (June 2023) in support of public commenters relating to the Michigan Department of Environment Great Lakes and Energy (EGLE)'s Annual Network Monitoring Plan 2024.

192. Expert Report (July 2023) and Rebuttal Expert Report (September 2023) relating to Greenhouse Gas and Energy Management (GEMM2) for Manufacturing in Colorado (September 2023) on behalf of Environmental Defense Fund.

193. Pre-filed Direct Testimony (July 2023) on behalf of Citizens for Environmental Justice in the matter of the permit Application of Valero Refining-Texas, LP for Modification to State and Prevention of Significant Deterioration Air Quality Permits No. 38754 and PSDTX324M15 before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-23-14975, TCEQ Docket No. 2023-0203-AIR.

194. Declaration (August 2023) in support of comments by Environmental Defense Fund in connection with the "Good Neighbor Plan" for the 2015 Ozone National Ambient Air Quality Standards, published at 88 Fed. Reg. 36,654 (June 5, 2023) ("Final Rule"), Docket ID No. EPA-HQ-OAR-2021-0668.

195. Expert Report (August 2023) on behalf of Appellants in the matter of *PennEnvironment and Sierra Club (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection, (Appellee), and PPG Industries, Inc. (Permittee)*, EHB Docket No. 2022-032-B. Environmental Hearing Board, Department of Environmental Protection, State of Pennsylvania.

196. Pre-filed Testimony (September 2023) and Cross Answering Testimony (October 2023) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)*, Docket: UG-230393. Before the Washington Utilities and Transportation Commission.

197. Expert Report (December 2023) on behalf of plaintiffs in the matter of *PennEnvironment and Sierra Club (Plaintiffs) v. PPG Industries, Inc. (Defendant).* Case No.: Civil Action Nos. 2:12-cv-00342, 2:12-cv-00527, 2:13-cv-01395, 1:13-cv-01396, 2:14cv-00229 (consolidated). U.S. District Court Western District of Pennsylvania.

198. Expert Report (December 2023) and Rebuttal Expert Report (June 2024) on behalf of the plaintiff in the matter of *Jennifer Perrotti (Plaintiff) v. Lockheed Martin Corporation (Defendant).* Case No. 6:22-cv-01338 in the U.S. District Court Middle District of Florida – Orlando Division.

199. Expert Report (Tranche 1 - January 2024, Tranche 2 – May 2024, Tranche 3 – June 2024) and Rebuttal Report (Tranche 1 – June 2024), Third Supplemental/Rebuttal Report (January 8, 2025) on behalf of the plaintiffs in the matter of *Emily Glass et. al., (Plaintiff) v. B. Braun Medical Inc., et. al., (Defendants).* Case No. 00315 (May Term 2021) and Consolidated Cases in the First Judicial District of Pennsylvania Court of Common Pleas of Philadelphia County.

200. Expert Report (February 2024) and Supplemental Expert Report (March 2024) on behalf of the plaintiff in the matter of *Kathleen Koch (Plaintiff) v. Medline Industries, Inc. et. al. and Vantage Specialty Chemicals, Inc. (Defendants)*. Case No. 2320 L 000686 in the Circuit Court of Cook County, IL.

201. Expert Report (April 2024 and August 2024) on behalf of the plaintiff in the matter of *Paula Johnson et. al., (Plaintiff) v. Prairie Farms Dairy, Inc. et. al., (Defendants).* Case No. 2017 L 001562 in the Circuit Court, Third Judicial Circuit Madison County, Illinois.

202. Expert Report (Phase I: April 2024) and Expert Report (Phase II: March 18, 2025) on behalf of the plaintiffs in the matter of *Tom Mutz et al., (Plaintiffs) v. Sterigenics US, LLC (Defendants).* Civil Action File No. 20-A-3448 in the State Court of Cobb County, State of Georgia. Additional Related Cases: Emma J. Bonner 21-A2420; Mary Ann Harrell 21-A4396.

203. Expert Report (April 2024), Declaration (August 2024) and Rebuttal Expert Report (November 2024) on behalf of the plaintiff in the matter of *United States of America (plaintiff) v. EES Coke Battery, LLC (Defendant)*. Civil Action No. 22-11191 in the US District Court for the Eastern District of Michigan.

204. Affidavit on behalf of the petitioner (April 2024) in the matter of Dr. Darren Masier (Petitioner) v. North Carolina State University (Expected Adverse Party). File No. 24CV013058-910 in the General Court of Justice, Superior Court Division, Wake County, North Carolina.

205. Affirmation (June 2024) on behalf of the petitioners in the matter of Gwendolyn Harris et. al. (Petitioners) v. Marie Therese Dominguez (Commissioner of the New York State Department of Transportation) et. al., (Respondents) in the Supreme Court of the State of New York, County of Erie relating to the Kensington Expressway.

206. Expert Report (July 2024) on behalf of the Plaintiff in the matter of *Mourad Abdelaziz et. al., (Plaintiff) v. B. Braun Medical Inc., (Defendant)*. Case No. 2020-C-1984 in the Pennsylvania Court of Common Pleas, Lehigh County.

207. Prefiled Direct Testimony (August 2024) on behalf of *Sierra Club and Portland Citizens United in the matter of the permit Application by Corpus Christie Liquefaction LLC* for Air Quality Permit Nos. 105710 and PSDTX1306M1 before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-24-14373, TCEQ Docket No. 2023-1474-AIR.

208. Expert Report (August 2024) on behalf of the Plaintiff in the matter of *Pamela Knobbe (Plaintiff) v. Isomedix Operations, Inc., and Cosmed Group, Inc. (Defendants)*. Case No. 2022 L 008574 in re. Medline EtO Release, Consolidated with 2023 L 00686 in the Circuit Court of Cook County, Illinois.

209. Expert Rebuttal Report (September 2024) for *Eve Isaacks et. al., (Plaintiffs) v. Terumo BCT et. al., (Defendants)* before District Court, Jefferson County, Colorado Case Numbers: 2022CV031124 (consolidated with *Douglass et. al.* 2023CV30085).

210. Prefiled Direct Testimony (October 2024) and Rebuttal Testimony (December 2024) on behalf of the *Sierra Club in the matter of the Application of Duke Energy Kentucky, Inc. for a Certificate of Public Convenience and Necessity* to Convert its Wet FGD etc. Case No. 2024-00152 before the Public Service Commission, Commonwealth of Kentucky.

211. Expert Report (December 2024) on behalf of the plaintiffs in the matter of *Mary Beth Tamm et. al., (Plaintiff), Cibelli (Case No. 2023-L-011216) and Wagner (Case No. 2024-L-009290) v. Sterigenics U.S., LLC, et. al., (Defendants),* Case No. 2023-L-5701 in the Circuit Court of Cook County, Illinois.

212. Expert Report (May 19, 2025) on behalf of Appellants Friends of Grays Harbor, et. al., v ORCAA, the City of Hoquiam, and Pacific Northwest Renewable Energy LLC (PNWRE) before the State of Washington Pollution Control Hearings Board, PCHB No. 24-037.

213. July 14. Affidavit in the matter of Environmental Integrity Project, Petitioner v. Pennsylvania Department of Environmental Protection, Office of Open Records, Respondent, relating to records associated with the multi-point ground flare located at Shell Chemical Appalachia LLC Polymers Monaca plant, in the Commonwealth Court of Pennsylvania, Docket No. 728 CD 2025.

214. July 15. Affidavit in Support of the Decision by the Mississippi Environmental Quality Permit Board to Deny the Issuance of a Title V Operating Permit (and Air Permit to Construct) to Amite BioEnergy, LLC's Wood Pellet Manufacturing Facility in Amite County, MS.

215. Expert Report (July 24, 2025) and Updated Expert Report (August 12) in the matters of: Joseph Simonetti et al., v. Sterigenics U.S., LLC, et al., Case No. 2024 L 012328; Mark Leuck et al., v. Sterigenics U.S., LLC, et al., Case No. 2024 L 012500; Karen Ryan, v. Sterigenics U.S., LLC, et al., Case No. 2024 L 013616; Brenda Williams, v. Sterigenics U.S., LLC, et al., Case No. 2024 L 013949 and Myra Burgonio et al., v. Sterigenics U.S., LLC, et al., Case No. 2024 L 013806 on behalf of the Plaintiffs in Circuit Court of Cook County, IL.

216. Supplemental Expert Report (August 29, 2025), Rebuttal Expert Report (October 1, 2025) and Affidavit (December 8, 2025) in the matter of Jordan, et al. v. Terumo BCT Sterilization Services and Terumo BCT, Inc., Case Number: 2020CV031457, on behalf of the Plaintiffs before the District Court Jefferson County, CO

217. Expert Report (September 25, 2025) in the matters of: Andrew and Bridget Kurt v. Sterigenics U.S., LLC, et al., Civil Action No.. 20-A-3432; Kathryn Measel v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-275; Rhonda and Neal Crawford v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-278; Holly and Gary Campbell v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-281; Claudia and Luke Kennison v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2432; Brantley Barrow Sr. v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2257; Robert Ford v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2106; Karl Goodhew v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2402; and Rafael and Elizabeth San Miguel v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2709 on behalf of the Plaintiffs before the State Court of Cobb County, State of Georgia.

218. Declaration (October 12, 2025) In re: Appeal of Construction Permit No. 01156-01PC for CTC (xAI) Property LLC, 3231 Paul R. Lowry Road, Memphis, Tennessee 38109, Memphis and Shelby County Air Pollution Control Board, Memphis, TN.

219. Expert Report (December 31, 2025) in the Matter *Hernandez et al. v. United States Steel Corp.*, Case No. 19-GD-005325, on behalf of the Plaintiffs, Court of Common Pleas, Allegheny County, PA

C. Occasions where Dr. Sahu has provided oral testimony <u>in depositions, at trial or in similar proceedings</u> include the following:

220. Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.

221. Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.

222. Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

223. Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

224. Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et* al*. v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).

225. Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia DEP.

226. Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.

227. Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.

228. Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.

229. Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.

230. Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

231. Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al*.

232. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coleto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

233. Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

234. Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

235. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).

236. Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

237. Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

238. Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

239. Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

240. Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

241. Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

242. Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

243. Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

244. Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

245. Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

246. Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

247. Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).

248. Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

249. Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

250. Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

251. Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

252. Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

253. Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

254. Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

255. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

256. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

257. Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

258. Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

259. Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

260. Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the *US Federal Trade Commission (FTC) v. ECM Biofilms* (FTC Docket #9358).

261. Deposition (February 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

262. Oral Testimony at Hearing (April 2015) and Testimony via Zoom (April 2024) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

263. Deposition (August 2015) on behalf of Plaintiff in the matter of *Conservation Law Foundation (Plaintiff) v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

264. Testimony at Hearing (August 2015) on behalf of the Sierra Club in the matter of *Amendments to 35 Illinois Administrative Code Parts 214, 217, and 225* before the Illinois Pollution Control Board, R15-21.

265. Deposition (May 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

266. Trial Testimony (October 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

267. Deposition (April 2016) on behalf of the Plaintiffs in *Natural Resources Defense Council, Respiratory Health Association, and Sierra Club (Plaintiffs) v. Illinois Power Resources LLC and Illinois Power Resources Generation LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (Central District of Illinois, Peoria Division).

268. Trial Testimony at Hearing (July 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

269. Trial Testimony (December 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

270. Trial Testimony (July-August 2016) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

271. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

272. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Backus Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

273. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Drakulic Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

274. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Deutsch Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

275. Deposition Testimony (July 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight v Coyote Creek Mining Company LLC (Defendant)* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

276. Deposition Testimony (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

277. Deposition Testimony (December 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

278. Deposition Testimony (January 2018) in the matter of National Parks Conservation Association (NPCA) v. State of Washington Department of Ecology and British Petroleum (BP) before the Washington Pollution Control Hearing Board, Case No. 17-055.

279. Trial Testimony (January 2018) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

280. Trial Testimony (April 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

281. Deposition (June 2018) (harm Phase) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

282. Trial Testimony (July 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

283. Deposition (January 2019) and Trial Testimony (January 2019) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

284. Deposition (February 2019) and Trial Testimony (March 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

285. Deposition (June 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

286. Deposition (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power*

Midwest (Permittee), before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

287. Deposition (December 2019) on behalf of the Plaintiffs in the matter of David Kovac, individually and on behalf of wrongful death class of Irene Kovac v. BP Corporation North America Inc., Circuit Court of Jackson County, Missouri (Independence), Case No. 1816-CV12417.

288. Deposition (February 2020, virtual) and testimony at Hearing (August 2020, virtual) on behalf of Earthjustice in the matter of *Objection to the Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation*, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

289. Hearing (July 14-15, 2020, virtual) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

290. Hearing (September 2020, virtual) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware* Operating – *NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

291. Deposition (December 2020, March 4-5, 2021, all virtual) and Hearing (April 2021, virtual) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

292. Hearing (September 2020, virtual) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

293. Deposition (December 2020, virtual and Hearing February 2021, virtual) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

294. Deposition (January 2021, virtual) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

295. Deposition (February 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (*Defendants*)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

296. Deposition (April 2021, virtual) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

297. Deposition (June 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division).

298. Deposition (June 2021, virtual) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

299. Testimony (June 2021, virtual) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, (Central Planning Board, City of Newark, New Jersey).

300. Testimony at Hearing (October 2021) on behalf of Evraz Rocky Mountain Steel in the matter of Colorado's Proposed Revisions to Regulation 22, the Greenhouse Gas Emissions and Energy Management for the Manufacturing Sector in Colorado (GEMM Rule), before the Colorado Air Quality Control Commission.

301. Deposition (November 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 2:20-CV-01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Eastern District of Louisiana).

302. Testimony at Hearing (November 2021) on behalf of *National Parks Conservation Association, et. al*., in the matter of the Proposed Revisions to Colorado's Regional Haze State Implementation Plan (SIP) and Colorado Regulation 23, before the Colorado Air Quality Control Commission.

303. Deposition (December 2021) on behalf of Plaintiffs in Re: Deepwater Horizon BELO Cases, Case No. 3:19cv963-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

304. Deposition (December 2021) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 1:19-CV-00694-JB-MU-C (US District Court for the Southern District of Alabama, Southern Division).

305. Testimony at Hearing (February 2022, virtual) in the matter of the *Appeal Petition for Hearing on Air Quality Permit No. 8585 on behalf of Earth Care New Mexico et. al., (Petitioners) v. New Mexico Environment Department and Associated Asphalt and Materials, LLC (Applicant),* No. EIB 21-48 before the State of New Mexico Environmental Improvement Board.

306. Deposition (March 2022) and Rebuttal Deposition (July 2022) for *Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois.)

307. Deposition (April 2022, virtual) in the matter of Application of TPC Group LLC for New State and PSD Air Quality Permits (various), TCEQ Docket No. 2021-1422-AIR, SOAH Docket No. 582-22-0799, Before the Texas State Office of Administrative Hearings.

308. Deposition (May 2022, virtual) in the matter of the *Water Works and Sewer Board of the City of Gadsden (Plaintiff) v. 3M Company, et. al., (*Defendants*)*, Civil Action No.: 31 CV-2016-900676.00 (Circuit County of Etowah County, Alabama)

309. Deposition (June 2022 and September 2022, both virtual) for *Teresa* Fornek *(Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

310. Deposition (June 2022, virtual) on behalf of the Plaintiffs in the matter of Toll Brothers, Inc., and Porter Ranch Development Company (Plaintiffs) v. Sempra Energy, Southern California Gas Company et. al., (Defendants), Southern California [Aliso Canyon] Gas Leak Cases, JCCP No.: 4861, Lead Case No.: BC674622, Superior Court of the State of California for the County of Los Angeles.

311. Deposition (July 2022) for *Richard Dufour (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 19-cv-00591 (US District Court for the Southern District of Mississippi).

312. Trial (August 2022) on behalf of the Plaintiffs in the matter of Modern *Holdings, LLC, et al. (Plaintiffs) v. Phillips (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

313. Trial (August 2022, in person) for *Susan Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

314. Deposition (September 2022, virtual) for *Heather Schumacher (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

315. Deposition (September 2022) on behalf of Plaintiffs in *Phylliss Grayson et. al. (Plaintiffs), v Lockheed Martin Corporation (Defendant),* Case No. 6:20-cv-01770. (US District Court for the Middle District of Florida – Orlando Division.)

316. Deposition (September 2022) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

317. Hearing (October 2022) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)* before the Washington Utilities and Transportation Commission, Docket UE-220066 and UG-220067 (Consolidated).

318. Trial (October 2022, in person) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

319. Depositions (March 2023, June 2023) for *Ann Jordan et. al., and Blake Darnell (Plaintiffs) v. Terumo BCT et. al., (Defendants)* before District Court, Jefferson County, Colorado Case Numbers: 2020CV031457, 2021CV030474 (consolidated with 2020CV031457) and 2020CV03148.

320. Depositions (March 2023, April 2023, May 2023) for Quinn Buczek (Plaintiff) v. Sterigenics US, LLC, Sotera Health, LLC, Prologis First US Properties, LP, et. al., (Defendants) before State Court of Gwinnett County, State of Georgia, Case No. Civil Action File No. 20-C-05918-S1.

321. Deposition (May 2023) for *Potomac Riverkeeper and Sierra Club (Plaintiffs) v. Virginia Electric and Power Company (Defendant)*, Civil Action No. 2:21-CV-23 (Kleeh) (US District Court for the Northern District of West Virginia, Elkins Division).

322. Deposition (May 2023) for Mark Letart (Plaintiff), et al. v. Union Carbide Corporation, et al. (Defendants), Case No. 2:19-cv-877, U.S. District Court, Southern District of West Virginia, Charleston Division.

323. Testimony at Hearing on behalf of Evraz North America In the Matter of Colorado Air Quality Regulation Proposed Revisions to Regulation Number 3 to establish enhanced Modeling, monitoring and permitting requirements for Stationary sources in disproportionately impacted communities 5 CCR 1001-5, before the Air Quality Control Commission, State of Colorado.

324. Deposition (2023) and Daubert Hearing (August 2024) for *Vervicia Henderson, et al. (Plaintiff) v. Lockheed Martin Corporation (Defendant)*, Case No. 6:21-cv-01363, U.S. District Court, Middle District of Florida, Orlando Division.

325. Testimony at Hearing (July 2023) *Clean Air Council, Citizens for Pennsylvania's Future, Mountain* Watershed *Association (Appellants) v. Allegheny County Health Department (Appellee) and Allegheny Energy Center (*Intervenor*, Permittee),* Case No. 21-043 before the Hearing Officer of the Allegheny County Health Department.

326. Deposition (July 2023) for *Ezequiel Caraballo-Pache (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 8:20-cv-00263-SCB-JSS (US District Court for the Middle District of Florida, Tampa Division).

327. Deposition (August 2023) for *Floyd Ruffin (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-cv-00334-CJB-JCW (US District Court for the Eastern District of Louisiana, New Orleans Division).

328. Deposition (August 2023) on behalf of petitioners in *Doreen Carey et; al., (Petitioners) v. Fulcrum Centerpoint LLC. (Permittee/Respondent) and Indiana Department of Environmental*

Management (Respondent), Permit Number 089-44042-00660, before the Indiana Office of Environmental Adjudication.

329. Deposition (August 2023) on behalf of the Plaintiff in the *Water Works and Sewer Board of the Town of Centre, Alabama v. 3M Company, et. al.*, Civil Action No.: CV-2017-900049. Circuit Court of Cherokee County, State of Georgia.

330. Deposition (August 2023) for *Matthew Williams (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 1:22-cv-00278-LG-BWR (US District Court for the Southern District of Mississippi).

331. Deposition (September 2023) for *Vincent Culliver (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 3:21-cv-4942-MCR/HTC (US District Court for the Northern District of Florida).

332. Testimony at Hearing for Greenhouse Gas and Energy Management (GEMM2) for Manufacturing in Colorado (September 2023) on behalf of Environmental Defense Fund.

333. Testimony at Hearing (October 2023) in the matter of *Algonquin Gas Transmission LLC., on behalf of Community Residents (*Petitioners*)*, Commonwealth of Massachusetts Department of Environmental Protection, Office of Appeals and Dispute Resolution, OADR Docket Nos. 2017-011 and 012, Waterways Application License No. W16-4600, Weymouth Mass.

334. Testimony at Hearing (August 2023) on behalf of Citizens for Environmental Justice in the matter of the permit Application of Valero Refining-Texas, LP for Modification to State and Prevention of Significant Deterioration Air Quality Permits No. 38754 and PSDTX324M15 before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-23-14975, TCEQ Docket No. 2023-0203-AIR.

335. Testimony at Hearing (September 2023) on behalf of Appellants in the matter of *PennEnvironment and Sierra Club (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection, (Appellee), and PPG Industries, Inc. (Permittee)*, EHB Docket No. 2022-032-B. Environmental Hearing Board, Department of Environmental Protection, State of Pennsylvania.

336. Testimony at Hearing (November 2023) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)*, Docket: UG-230393. Before the Washington Utilities and Transportation Commission.

337. Deposition (February 6, 2024, July 2024) in the matter of *Gena M. McLendon (Plaintiff) v. Becton, Dickinson and Company, et. al. (Defendants)*, on behalf of the Plaintiff in Civil Action File No. 20-C-07123-S1 in the State Court of Gwinnett County, State of Georgia.

338. Testimony at Hearing (February 7, 2024) in the matter of *Jefferson County Foundation, et. al., (Appellants) v. Laura M. Crowder, Director, Division of Air Quality, Department of Environmental Protection (Appellee)*, No. 23-02.AQB on behalf of the Appellant, before the West Virginia Air Quality Hearing Board, Charleston, WV. Also, testimony in related matter No. 23-01-AQB (Roxul USA Inc., d/b/a Rockwool v. same Appellee at No. 23-02-AQB).

339. Deposition (February 2024) and Trial testimony (June 2024) on behalf of the Plaintiffs in the matter of *Penn Environment and Sierra Club (Plaintiffs) v. PPG Industries, Inc. (Defendants).* Case No. 2:12-CV-00342 in the US District Court for the Western District of Pennsylvania.

340. Mediation Expert Testimony (February, March, and September 2024) in the matter of Pueblo Y Salud, Inc., and Jorge Rodriguez, et al. v. City of Los Angeles acting by and through The Los Angeles Department of Water & Power, Case No. 21STCV04346 (Lead Case) and Related Cases: 20STCV48159; 21STCV21942,21STCV22541, 21STCV25022, and22STCV27707, Superior Court of the State of California, Los Angeles County

341. Deposition (March 2024 and April 2024) on behalf of the Plaintiff in the matter of Kathleen *Koch (Plaintiff) v. Medline Industries, Inc. et. al. and Vantage Specialty Chemicals, Inc. (Defendants)*. Case No. 2320 L 000686 in the Circuit Court of Cook County, IL.

342. Deposition (May 2024 and September 2024) on behalf of the plaintiff in the matter of *Paula Johnson et. al., (Plaintiff) v. Prairie Farms Dairy, Inc. et. al., (Defendants).* Case No. 2017 L 001562 in the Circuit Court, Third Judicial Circuit Madison County, Illinois.

343. Deposition (Phase I: August 2024) and Deposition (Phase II: May 6, 2025) on behalf of the plaintiffs in the matter of *Tom Mutz et al., (Plaintiffs) v. Sterigenics US, LLC (Defendants).* Civil Action File No. 20-A-3448 in the State Court of Cobb County, State of Georgia. Additional Related Cases: Emma J. Bonner 21-A2420; Mary Ann Harrell 21-A4396.

344. Deposition (October 2024 and November 2024) in the matter of *Gary B. Walker (Plaintiff) v. Becton, Dickinson and Company, et. al. (Defendants)*, on behalf of the Plaintiff in Civil Action File No. 21-C-08201-S1 in the State Court of Gwinnett County, State of Georgia.

345. Trial (November 2024) on behalf of the plaintiffs in the matter of *Emily Glass et. al., (Plaintiff) v. B. Braun* Medical *Inc., et. al., (Defendants).* Case No. 00315 (May Term 2021) and Consolidated Cases in the First Judicial District of Pennsylvania Court of Common Pleas of Philadelphia County.

346. Deposition (August 2024) on behalf of the plaintiff in the matter of *Jennifer Perrotti (Plaintiff) v. Lockheed Martin Corporation (Defendant).* Case No. 6:22-cv-01338 in the U.S. District Court Middle District of Florida – Orlando Division.

347. Deposition (August 2024) and Hearing (September 2024) on behalf of *Sierra Club and Portland Citizens United in the matter of the* permit *Application by Corpus Christie Liquefaction LLC* for Air Quality Permit Nos. 105710 and PSDTX1306M1 before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-24-14373, TCEQ Docket No. 2023-1474-AIR.

348. Deposition (September 2024) and Trial (December 2024) on behalf of the Plaintiff in the matter of *Pamela Knobbe (Plaintiff) v. Isomedix Operations, Inc., and Cosmed Group, Inc. (Defendants).* Case No. 2022 L 008574 in re. Medline EtO Release, Consolidated with 2023 L 00686 in the Circuit Court of Cook County, Illinois.

349. Deposition (December 2024) and Testimony at Trial (February 6-7 and 10-11, 2025) for *Eve Isaacks et. al., (Plaintiffs) v. Terumo BCT Sterilization Services, Inc. et. al., (Defendants)* before District Court, Jefferson County, Colorado Case Numbers: 2022CV031124 (consolidated with *Douglass et. al.* 2023CV30085).

350. Deposition (January 14, 2025) in the maters of: Cibelli v. Sterigenics U.S., LLC, et al. Case No. 2023 L 011216 (Consolidated Case No. 2023-L-5701); and Wagner v. Sterigenics U.S., LLC, et al. Case No. 2024 L 009290 (Consolidated Case No. 2023-L-5701), on behalf of the Plaintiffs before the Circuit Court of Cook County, IL

351. January 31 (Prefiled Testimony and Deposition (January 31, 2025) and Testimony at Hearing (March 6, 2025) Cheniere Stage 3/Trains 8 and 9 Texas SOAH Challenge. SOAH Docket No. 582-25-02533, TCEQ Docket No. 2024-1197-AIR, Application by Corpus Christie Liquefaction, LLC for Amendment of Air Quality Permit Nos. 139479 AND PSDTX1496M1

352. Deposition (February 27, 2025) and Testimony at Trial (June 23, 2025) on behalf of Appellants Friends of Grays Harbor, et. al., v ORCAA, the City of Hoquiam, and Pacific Northwest Renewable Energy LLC (PNWRE) before the State of Washington Pollution Control Hearings Board, PCHB No. 24-037.

353. Testimony at Trial (April 17, 2025) and Rebuttal Testimony via Zoom at Trial (April 28, 2025) in the matter of Gary B. Walker (Plaintiff) v. Becton, Dickinson, and Company, et. al., (Defendants) on behalf of the Plaintiff in Civil Action File No. 21-C-08201-S1 in the State Court of Gwinnett County, State of Georgia.

354. July 16. Deposition (July 16, 2025) and Affidavit (September 19, 2025) in the matter of Dr. Lisa D. Miller and Michael E. Dauphin (Plaintiffs) v. Becton, Dickinson and Company, et. al., Defendants, Civil Action No. 20-C-07124-S1 on behalf of the Plaintiffs in the State Court of Gwinnett County, State of Georgia.

355. Daubert Hearing (August 18, 2025) in the matter of *Tom Mutz et al., (Plaintiffs) v. Sterigenics US, LLC (*Defendants*)*. Civil Action File No. 20-A-3448 in the State Court of Cobb County, State of Georgia. Additional Related Cases: Emma J. Bonner 21-A2420; Mary Ann Harrell 21-A4396.

356. Testimony and Rebuttal Testimony (August 21-22, 2025) in the matter of Proposed Regulation No. 31: Control of Methane Emissions from Municipal Solid Waste Landfills (Proposed 5 CCR 1001-33) before the Air Quality Control Commission, State of Colorado.

357. Class Certification Hearing (September 2, 2025) on behalf of the Plaintiff in the matter of *Mourad Abdelaziz et. al., (Plaintiff) v. B. Braun Medical Inc., (Defendant).* Case No. 2020-C-1984 in the Pennsylvania Court of Common Pleas, Lehigh County.

358. Deposition (September 9-10, 2025) in the matters of: Joseph Simonetti et al., v. Sterigenics U.S., LLC, et al., Case No. 2024 L 012328; Mark Leuck et al., v. Sterigenics U.S., LLC, et al., Case No. 2024 L 012500; Karen Ryan, v. Sterigenics U.S., LLC, et al., Case No. 2024 L 013616; Brenda Williams, v. Sterigenics U.S., LLC, et al., Case No. 2024 L 013949 and Myra Burgonio et al., v. Sterigenics U.S., LLC, et al., Case No. 2024 L 013806 on behalf of the Plaintiffs in Circuit Court of Cook County, IL.

359. Deposition (September 30, 2025) in the matters of: Andrew and Bridget Kurt v. Sterigenics U.S., LLC, et al., Civil Action No.. 20-A-3432; Kathryn Measel v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-275; Rhonda and Neal Crawford v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-278; Holly and Gary Campbell v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-281; Claudia and Luke Kennison v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2432; Brantley Barrow Sr. v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2257; Robert Ford v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2106; Karl Goodhew v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2402; and Rafael and Elizabeth San Miguel v. Sterigenics U.S., LLC, et al., Civil Action No. 23-A-2709 on behalf of the Plaintiffs before the State Court of Cobb County, State of Georgia.

360. Hearing (October 14, 2025), Rebuttal Testimony Affidavit (August 20, 2025), Affidavit Testimony (July 15, 2025) in Support of the Decision by the Mississippi Environmental Quality Permit Board to Deny the Issuance of a Title V Operating Permit 0080-00031 (and Air Permit to Construct) to Amite BioEnergy LLC, Gloster, Amite County, MS, before the Mississippi Environmental Quality Permit Board

361. Testimony at Hearing (December 3, 2025) In the matter of Tucker United, West Virginia Highlands Conservancy, and Sierra Club (Appellants) v. Director, Division of Air Quality, Department of Environmental Protection (Appellee) and Fundamental Data LLC (Intervenor), Appeal No. 25-AQB-02 on behalf of the Appellants, West Virginia Air Quality Hearing Board, Charleston, WV.

362. Deposition (October 24, 2025) in the matter of Jordan, et al. v. Terumo BCT Sterilization Services and Terumo BCT, Inc., Case Number: 2020CV031457, on behalf of the Plaintiffs before the District Court Jefferson County, CO

363.

Attachment 3

(Public Version)

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-01
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: November 4, 2025
RESPONSE DUE: December 5, 2025

QUESTION 1-1:

The Testimony of James Lucas prepared on October 15, 2025 ("Lucas Testimony") at page JL-7 proposes that Utility-Owned Pipeline Infrastructure (Lanes 7-10 in Figure 2) be eligible for the Cap-and-Trade funds that SoCalGas has set aside for the Project.

a. What are the estimated costs for each of the listed utility-owned infrastructure in Lanes 7-10?
b. If SoCalGas cannot provide the cost estimate requested above for each lane at this time, when will it be able to provide such a cost estimate?

RESPONSE 1-1:

a) SoCalGas has not completed the estimated costs for lanes 7-9. There are no costs for lane 10 because this lane is part of existing infrastructure.
b) The estimated costs for lanes 7 to 9 are estimated to be provided no later than December 19, 2025. SoCalGas will supplement this response as soon as it has such an estimate.

QUESTION 1-2:

Please provide a complete version of April 22, 2025 Solicitation.

RESPONSE 1-2:

SoCalGas objects to this request because it seeks documents that are not relevant and not reasonably calculated to lead to the discovery of admissible evidence. SoCalGas also objects to this request to the extent that it seeks documents that contain confidential information, including proprietary, market sensitive information.

QUESTION 1-3:

Lucas Testimony at pages J-19 to JL-20 states that "[t]he date for the WBF facility to be operational and trucking biomethane to the interconnection facility is not more than five years after WBF has received notification by SoCalGas that the Commission granted to application."

a. Please indicate where this five-year deadline is established in the SB 1440 Pilot Project Agreements.
b. When or at what point in time will SoCalGas commence construction of Lanes 7-10?
c. What is the deadline, if any, by which SoCalGas must commence construction of Lanes 7-10 in Figure 2 on JL-7.
d. What is the deadline, if any, by which SoCalGas must complete construction of Lanes 7-10.

RESPONSE 1-3:

a) The SB 1440 Gasification/Pyrolysis Pilot Project Funding Agreement, Attachment B of the Application, states at page 7, "[S]uch Target Date shall be [X] years after the Project Owner has received notification by SoCalGas of a successful Application."

   The SB 1440 Gasification/Pyrolysis Pilot Project Funding Agreement reflects a target date of [X] years, which may be less than five years depending on when the CPUC issues a final decision on the Application. As ordered in D.22-02-02, "Any unspent Cap-and-Trade allowance proceeds shall be returned to ratepayers in the Climate Credit by December 31, 2032." Such statutory requirement will serve as a driver for timely completion of construction of the project within the specified timeframe.

b) SoCalGas's commencement of the facilities in lanes 7-10 will be dependent on CPUC approval of the Application and when West Biofuels is able to demonstrate project readiness as discussed on JLMS-19.

c) The estimated deadline for SoCalGas to commence construction for Lanes 7 to 10 is Q2/Q3 of 2030.

d) The estimated deadline for SoCalGas to complete construction for Lanes 7 to 10 is Q4 of 2030/Q1 of 2031.

QUESTION 1-4:

Lucas Testimony at JL-1 states that "SoCalGas is proposing a Project that appears financially sustainable in the long-term." The Application states at page 3 that "SoCalGas is nonetheless optimistic that this proposed project will be successful because of WBF's experience with similar projects and the Project's characteristics."

a. On what basis does Mr. Lucas conclude that the Project "appears financially stable"?
b. What are the "similar projects" with which WBF has experience?

RESPONSE 1-4:

a) West Biofuels provided SoCalGas a high-level project pro-forma that was used to gain insight into the financial viability of the project.

b) See the link provided below, which shows three projects which were developed and/or constructed by West Biofuels (2009, 2022, and 2025):

https://www.westbiofuels.com/history

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-01
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: November 4, 2025
RESPONSE DUE: December 5, 2025

QUESTION 1-5:

Lucas Testimony at page JL-15 to JL-17 and Attachment 1 to the Lucas Testimony estimate carbon intensities and emissions intensities from the Project.

a. Please provide the emissions factors used to estimate carbon intensity and the emissions presented in Tables 1, 2, and 3 the Lucas Testimony and please list the sources of those emissions factors.
b. Please provide the basis for the percentages assumed I the "Base case disposal method" and "Qty" columns provided in Table 1 of the Lucas Testimony.
c. What level of methane leakage was assumed in each of the Lanes of the Project (as presented in Figure 2 on JL-7)?
d. Please provide the daily and annual emissions estimates for each emissions category in Tables 1 and 2 of the Lucas Testimony.
e. Please provide the facility specifications used to estimate "Bio-SNG plant direct emissions" in Table 2 of the Lucas Testimony.
f. Please provide the carbon capture and storage facility specifications used to estimate "CCS" in Table 2 of the Lucas Testimony
g. Has SoCalGas estimated the annual greenhouse gas emissions effects from Lanes 7-10 (in Figure 2 on JL-7), separate and apart from the other Lanes of the Project?
h. If the answer to question (e) above is yes, please provide that estimate.
i. Has SoCalGas estimated the annual greenhouse gas emissions effects from Lanes 1-6 (in Figure 2 on JL-7), separate and apart from the other Lanes of the Project?
j. If the answer to question (e) above is yes, please provide that estimate.
k. What is the estimated number of daily truck tips in Lane 6 (in Figure 2 on JL-7)?

RESPONSE 1-5:

a. Emission factors used for typical activities in the modelling are sourced from the 2024 R&D GREET model.[1] GREET emissions factors for activities in NREL's baseline and Bio-SNG use cases included the following:

[1] Available at https://doi.org/10.11578/GREET-Excel-2024/dc.20241203.1.

	GHG	VOC	CO	NOx	PM10	SOx	Unit
Biomass transportation	92.06	0.013	0.17	0.11	0.0064	0.0041	g/ton.mile of biomass
Biomass preprocessing	7.02	0.0035	0.016	0.034	0.0024	0.00031	g/kg of biomass
Bio-SNG compression (3,000 psi)	68.78	0.011	0.037	0.067	0.0079	0.024	g/kg of Bio-SNG
Electricity[2]	290.53	0.046	0.15	0.28	0.034	0.10	g/kWh
Bio-SNG transportation	92.06	0.013	0.17	0.11	0.0064	0.0041	g/ton.mile of Bio-SNG
Carbon capture & storage	57.65	0.0090	0.031	0.056	0.0067	0.020	g/kg of CO2
CIDI Vehicle:Conv. & LS Diesel	90.54	0.047	0.95	0.045	0.010	0.0040	g/MJ
Dedicated CNGV, NA NG	70.12	0.032	0.63	0.076	0.0079	0.0014	g/MJ

	GHG	VOC	CO	NOx	PM10	SOx	Unit	Sources
Dairy Bedding Direct	866.0	--	--	--	--	--	g/kg	NREL (preliminary study)
Incorporation Direct	1700	--	--	--	--	--	g/kg	Culumber et al (2025)[3]
Air Curtain Incinerator Direct	1445	0.21	3.45	0.80	3.85	0.25	g/kg	EPA Curtain Incinerator[4]
Biomass Plant Direct	1742	0.010	0.16	1.04	0.023	2.00	g/kg	R&D GREET 2024
Bio-SNG Plant Direct	1249	0.0076	0.025	0.11	0.0089	0.0033	g/kg	This study (w/o CCS)

Note: all units are g/kg of biomass feedstock

b. Base case disposal methods and quantities were developed based on conversations with the Central California Almond Growers Association (CCAGA) and what they are currently doing with their almond biomass. The project plans to get all of its almond biomass from CCAGA, so these percentages are representative of where the biomass is currently going and projected to go in the future.

c. The calculations assume no fugitive methane emissions as the level of leakage is expected to be negligible.

d. Daily and annual CO2e emissions are provided below for Tables 1 and 2.

[2] Uses WECC region emissions for statewide average electric grid emissions.
[3] https://www.sciencedirect.com/science/article/pii/S0167880925001963?via%3Dihub.
[4] SJVAPCD, Air Curtain Incinerator Emission Factor Determination, March 10, 2017, available at: https://ww2.valleyair.org/media/dpipwseq/criteria-air-incinerator-ef-determination-analysis.pdf.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-01
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: November 4, 2025
RESPONSE DUE: December 5, 2025

Table 1

Biomass feed, dry			Base case handling	Baseline CI		Daily CO2e	Annual CO2e
		kg /hr		kg CO2e/kg biomass	g CO2e/MJ Bio-SNG	Metric tons CO2e	Metric tons CO2e
Almond shells	20%	607.5	100% go to the dairy	0.17	16.15	12.7	4,636
Stick	10%	303.8	50% air curtain burner	0.07	6.74	5.2	1,909
			50% cogeneration plant	0.09	8.12	6.7	2,455
Orchard removal	70%	2,126.3	90% incorporation	1.07	99.87	79.1	29,182
			10% cogeneration plant	0.12	11.37	8.9	3,272
Residue processing			Chipping & loading	0.02	1.60	1.4	545
Total	**100%**	**3,037.5**		**1.54**	**143.85**	**113.9**	**42,000**

Table 2

	Bio-SNG Use Case CI	**Daily Emissions**	**Annual Emissions**

	Without CCS (g CO2e/MJ Bio-SNG)	With CCS (g CO2e/MJ Bio-SNG)	Without CCS (Metric tons CO2e)	With CCS (Metric tons CO2e)	Without CCS (Metric tons CO2e)	With CCS (Metric tons CO2e)
Biomass preprocessing	0.52	0.52	0.4	0.4	153	153
Biomass transportation (~114 miles)	1.03	1.03	0.8	0.8	303	303
Bio-SNG plant electricity	4.01	4.01	3.2	3.2	1,180	1,180
Bio-SNG plant direct emission	116.55	23.31	93.9	18.8	34,282	6,856
CCS	-	7.71	0	6.2	0	2,268
Bio-SNG compression (3,000 psi)	1.47	1.47	1.2	1.2	432	432
Bio-SNG transportation (~114 miles)	0.22	0.22	0.2	0.2	64	64
Total	123.81	38.27	99.8	30.8	36,415	11,257

e. The proposed Bio-SNG facility will utilize agricultural waste from the CCAGA facility in Kerman, where the plant will be co-located. The proposed system has a thermal input of 15MW, which equates to about 30,000 dry tons of biomass feed to the system and is about a third of CCAGA's total annual production. Expressed on a daily basis, the Bio-SNG facility will generate approximately 750 MMBTU per day (9 MW thermal) of RNG from processing about 80 dry tons of biomass per day.

f. In total, there are about 32,000 tons of CO2 emissions annually from the Bio-SNG plant which can be captured. The CO2 concentrates in two main streams during the Bio-SNG process, one at the gasifier flue gas and the other after the methanation reactor. Both streams have relatively high CO2 concentrations and available commercial technologies can capture CO2 from both locations.

g. SoCalGas has not selected the decanter equipment and is unable to provide a figure at this time.

h. Based on some initial estimates, SoCalGas does not expect the greenhouse gas emissions for Lanes 7-10 to be more than 1% of the estimated CO2e emissions for Lanes 1-6 (under both cases – with CCS and without CCS).

i. Table 2 of Jim Lucas/Matthew D. Summers Testimony contains the greenhouse gas emissions for lanes 1-6.

j. See Table 2 of Jim Lucas/Matthew D. Summers Testimony.

k. There will be approximately two to three truck trips to the point of injection per day.

QUESTION 1-6:

Lucas's Testimony provides a "well-to-wheel" estimate of the carbon intensity of the Project. The Application at page 2 states that the biomethane will be used for a "variety of end-uses including transportation, utility biomethane procurement and commercial industrial customers, etc."

a. What percentage of the Project's biomethane will go to the transportation sector?
b. What percentage of the Project's biomethane will go to utility biomethane procurement.

Response 1-6:

a) Page 2 of the Application does not state that the biomethane **will be used** for a variety of end-uses including transportation, utility biomethane procurement and commercial industrial customers, etc. Rather, the referenced language provides that the biomethane **can be used** for such end-uses: "Once it reaches the interconnection point, the biomethane can be used or sold for a variety of end-uses, such as transportation, utility biomethane procurement, commercial/industrial customers, etc." At this time, West Biofuels has not made a decision on the end-use for the biomethane.

b) See response to question a).

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-01 SUPPLEMENTAL
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: November 4, 2025
RESPONSE DUE: December 23, 2025

QUESTION 1-1:

The Testimony of James Lucas prepared on October 15, 2025 ("Lucas Testimony") at page JL-7 proposes that Utility-Owned Pipeline Infrastructure (Lanes 7-10 in Figure 2) be eligible for the Cap-and-Trade funds that SoCalGas has set aside for the Project.

a. What are the estimated costs for each of the listed utility-owned infrastructure in Lanes 7-10?
b. If SoCalGas cannot provide the cost estimate requested above for each lane at this time, when will it be able to provide such a cost estimate?

RESPONSE 1-1:

Estimated costs for Lanes 7, 8, and 9 are based on a Class 5 estimate. A Class 5 estimate can range from –50% on the low side to +100% on the high side. The provided costs are preliminary estimates based on the project description. The estimate was developed using historical data from comparable Renewable Natural Gas Point-Of-Receipt facility projects, recent budgetary vendor quotes, and assumptions about project design and construction. These ranges encompass anticipated costs for engineering, equipment and materials, construction, labor, and other applicable categories.

Utility-Owned Infrastructure (SoCalGas) Cost				
Lane 7	Lane 8	Lane 9	Lane 10	Total
RNG Connection & Decanting at Point of Receipt (POR)	Interconnection POR	Interconnection (Pipeline Extension)	Existing Pipeline Network	
$1,419,967	**$7,626,329**	**$919,923**	**$0**	**$9,966,219**

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-1:

Attachment 1 to the Lucas Summers Testimony (aka "NREL memo") states that "this analysis relied on the best available process and emissions factor data for the baseline and use case scenarios."

QUESTION 2-1a:

Table 1 at JLMS-15 indicates a CI of 100.9 gCO2e/MJ for the carbon intensity of 90% incorporation. This figure is also provided in the NREL memo, Table 1. Please provide the source for the CI estimate of 100.9 g CO2e/MJ in Table 1 at JLMS-15.

RESPONSE 2-1a: (WBF)

Refer to the "Baseline Case" sheet in the previously provided Excel file titled "NREL GREET MODEL – WBF", cell E43.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-1b:

Note: this question is also listed as “a” in original request

Please provide the sources of all other emissions factors presented in Table 1 at JLMS-15.

RESPONSE 2-1b: (WBF)

Refer to the “Baseline Case” sheet in the previously provided Excel file titled “NREL GREET MODEL – WBF”.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-1c:

Note: This question is listed as “b” in original request

Please provide the sources of all other emissions factors presented in Table 2 at JLMS-16.

RESPONSE 2-1c: (WBF)

Refer to the “Bio-SNG Use Case” sheet in the previously provided Excel file titled “NREL GREET MODEL – WBF”.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-1d:

Note: This question is listed as “c” in original request

> The NREL Memo states “this analysis also credits the avoided emissions from the ‘business as usual’ disposal fate of the biomass from the baseline case (aka counterfactual credit).” Please state the basis for concluding emissions are “avoided” and list the sources used to estimate these “avoided emissions.”

RESPONSE 2-1d: (WBF)

The avoided emissions are the emissions associated with the baseline for the almond agricultural waste, which include a mix of air curtain burning, incorporation, dairy bedding, etc. (Table 1 at JLMS-15). They are avoided because that biomass will no longer have its previous disposal pathway and will instead be utilized in the proposed Bio-SNG plant.

Refer to the “Baseline Case” sheet in the previously provided Excel file titled “NREL GREET MODEL – WBF” for the list of sources.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-2:

Will SoCalGas monitor methane leakage in Lanes 7-10 of the proposed project? If so, what technologies will it use to measure such leakage? How frequently will such monitoring occur?

RESPONSE 2-2: (SCG)

Yes, methane leakage detection would be conducted in accordance with SoCalGas's most current gas standard for leakage survey. Because the nature of the gas standard is subject to change, and the leak detection technologies will be referenced within the standard itself, we cannot definitively state which technologies will be utilized at this point. Frequency of monitoring will be based on location, material type, and operating pressure.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-3:

Will WBF monitor methane leakage in Lanes 1-6 of the proposed project? If so, what technologies will it use to measure this leakage? How frequently will such monitoring occur?

Response 2-3: (WBF)

For indoor and confined facilities, gas detectors will be installed that would immediately detect leakages from equipment to the building and trigger an immediate shutdown to assess and correct the leakage issue. For outdoor piping and equipment, daily leak checks will be performed using portable gas detection equipment. For each leakage event, the total leakage amount will be estimated based on size and duration of the leakage.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-4:

The Lucas and Summers Testimony and NREL memo refer to both Bio-SNG and Bio-CNG. What, if any, is the difference between the two terms in this Application?

Response 2-4: (SCG)

As provided on JLMS at pages 13 and 14, “In the first step, the ‘well-to-pipeline’ emissions for the Bio-SNG were compared to the business as usual ‘baseline’ emissions using the standard biomass disposal methods. In the second step, the ‘well-to-wheels’ carbon intensity (‘CI’) is calculated for the compressed Bio-SNG fuel (‘Bio-CNG’) produced from this project.”

The Bio-SNG is “well-to-pipeline” and Bio-CNG is “well-to-wheels”.

QUESTION 2-5:

In Table 3 at JLMS-17, what is the meaning of "(VO)"?

Response 2-5: (WBF)

VO means vehicle operation, referring to biogenic CO2 emissions that are a result of vehicle operation.

QUESTION 2-6:

What technologies will be used to monitor the "direct emissions" listed in Table 2 at JLMS-16 at the WBF facility?

Response 2-6: (WBF)

Commercially available gas analyzers will be utilized to measure the direct carbon dioxide and criteria pollutant emissions from the facility. WBF uses commercial flue gas analyzers from Horiba and Testo and industry standard procedures at its current facilities. Air permit conditions may require periodic third-party testing of emissions and production and emissions data to be continuously collected and stored on the facility SCADA systems.

QUESTION 2-7:

What technologies will be used to monitor the emissions listed in Table 2 at JLMS-16 for Bio-SNG compression and transportation?

Response 2-7: (WBF)

Emissions associated with Bio-SNG compression are indirect emissions associated with electricity being used from the grid. The facility can document energy consumption associated with compression activities and apply relevant emission factors to accurately estimate resulting emissions impact. Similarly, the number of transportation miles can be tracked, and an appropriate trucking emission factor applied to determine transport-related emissions.

QUESTION 2-8:

How will SoCalGas report the emissions from the proposed project as required by D.22-02-025?

Response 2-8: (SCG)

As provided in SoCalGas's Reply Comments Section II(A)(3) at pages 4 and 5.[1], "Section IV of the Application's Chapter 2 Corrected Revised Direct Testimony (titled "Program Reporting") nonetheless provides a roadmap for studying and monitoring emissions.[2] This includes SoCalGas working "with the Commission and/or other state agencies to develop a reporting template for the SB 1440 Pilot Project."[3] This approach is similar to that undertaken in the SB 1383 Dairy Biomethane Pilot Projects. The Commission and its constituent agencies are leading the data reporting process in such projects.[4] The Application thus contemplates monitoring, studying, and reporting emissions by proposing to utilize the existing processes used by these pilot projects, pending determination by the Commission and its constituent agencies."

1 https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M588/K915/588915254.PDF.
2 SoCalGas Chapter 2 Corrected Revised Direct Testimony (Lucas/Summers) at JLMS-20.
3 *Id*.
4 D.17.12-004, Attachment B at 4.

QUESTION 2-9:

Please state the basis for the baseline disposal practices for each type of biomass to be used at the WBF facility, as presented in Table 1.

Response 2-9: (WBF)

As provided in Lucas/Summers Corrected Revised Direct Testimony at JLMS-14,

- In the "well-to-pipeline" analysis, the baseline emissions from the current and projected future biomass disposal practices of the CCAGA were analyzed. Without the development of the WBF Facility, these practices are expected to continue into the future.
- The almond industry and CCAGA expect the need for off-site removal of this biomass will continue to increase with time.

QUESTION 2-10:

What volatile organic compounds will the WBF facility emit?

Response 2-10: (WBF)

The volatile organic compounds from West Biofuels facilities have been quantified using EPA Method 25A which measures total hydrocarbons using a flame ionization detector. This air district approved method is utilized to quantify total volatile organic compounds but does not speciate the individual VOC compounds.

QUESTION 2-11:

SoCalGas states in its Response SC 1-5(g) that is "has not selected the decanter equipment and is unable to provide a figure [of the estimated the greenhouse gas emissions effects attributable to Lanes 7-10] at this time." SoCalGas also states that "[b]ased on some initial estimates" SoCalGas does not expect the GHGs for lanes 7-10 to be more that 1% of the estimated total CO2e emissions for Lanes 1-6."

QUESTION 2-11a:

Please state the basis for the "initial estimates" described above.

Response 2-11a:

SoCalGas's initial estimates for the electricity consumption for Lanes 7 to 10 is approximately 370,000 kWh/year. Using a GHG factor of 290.53 gCO_2/kWh[5] for the WECC region provides annual emissions of approximately 108,000 $kgCO_2$/year (or ~108 metric tons CO_2/year). The project's annual metric tons of CO_2 emissions are 11,257 with CCS and 36,415 without CCS,[6] and 108 metric tons of CO_2 represents less than 1% of either total.

[5] Figure is included in the response to Q 1-5a of Sierra Club-SCG-01.
[6] Figure is included in the response to Q 1-5d of Sierra Club-SCG-01.

QUESTION 2-11b:

When will SoCalGas be able to provide an estimate of the greenhouse gas emissions effects attributable to Lanes 7-10?

Response 2-11b: (SCG)

SoCalGas will be able to provide an accurate estimate of the greenhouse gas emissions from Lanes 7-10 after the interconnection facility is designed and decanter equipment is selected. SoCalGas anticipates the final design and equipment selection process may take up to 24 months after the CPUC issues a final decision on this application.

QUESTION 2-11c:

When will SoCalGas select the decanter for the project?

Response 2-11c:

See response to 2-11b.

QUESTION 2-11d:

How does the decanter type impact greenhouse gas emissions?

Response 2-11d:

The decanter will produce indirect emissions as electricity is required to operate the unit.

QUESTION 2-12:

In its response to SC 1-5(f), SoCalGas states that "there are about 32,000 tons of CO2 emissions annually from the Bio-SNG plant which can be captured. Both streams have relatively high CO2 concentrations and available commercial technologies can capture CO2 from both locations."

QUESTION 2-12a:

How many tons of annual CO2 emissions from the proposed project cannot be captured?

Response 2-12a:

As provided in the response to Data Request SC 1-5(d) Table 2, WBF estimates there may be approximately 6,856 metric tons of CO_2 not captured

QUESTION 2-12b:

Please specify the available commercial technologies that can capture CO2 from the gasifier flue gas and the methanation reactor?

Response 2-12b:

WBF has not selected a specific technology or supplier, but commercially available solutions include cryogenic separation, adsorbents and membranes and combinations of these solutions tailored to the specifications of the project.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-13:

In Response to SC 1-4(b), SoCalGas cites “three projects which were developed and/or constructed by West Biofuels (2009, 2022, and 2025)”.

QUESTION 2-13a:

Please list the names of these projects.

Response 2-13a:

2009 – Woodland Biomass Research Center, Woodland, CA
2022 – Rice Hull Bioenergy Facility in Williams, CA
2025 – Hat Creek Bioenergy Facility in Burney, CA

QUESTION 2-13b:

Please indicate which, if any, of the three facilities has ever produced methane from woody biomass through Fast Internally Circulating Fluidized Bed ("FICFB") gasification technology.

Response 2-13b:

The Woodland Biomass Research Center has an FICFB gasifier and the other two facilities have reciprocating grate systems. All three facilities produce syngas (which includes some methane) from woody biomass, although this methane is not removed and refined into Bio-SNG. At the Woodland Biomass Research Center, the syngas produced by the FICFB gasifier has been tested in a pilot system for producing Bio-SNG.

QUESTION 2-13c:

Please indicate which, if any of the facilities has produced methane from woody biomass through FICFB technology in 2025. For any that did produce methane in 2025, please list in MMBTU the quantity of methane produced woody biomass from each facility in 2025.

Response 2-13c:

In 2025, syngas (which includes some methane) was generated by all three facilities during gasification and the syngas was subsequently utilized in synthesis experiments at the research center and for power production at the other two facilities.

QUESTION 2-14:

SoCalGas's Response 4 to CalAdvocates' December 8, 2025 data request includes a process flow diagram.

QUESTION 2-14a:

What emissions will be emitted from the "flare" depicted in that diagram?

Response 2-14a:

The emergency flare is used if the methanation plant becomes unavailable to take the syngas from the gasifier while the FICFB plant performs a safe controlled shut down. The flare is an enclosed thermal oxidizer and the exhaust will consist of syngas combustion products including excess air, carbon dioxide and water vapor. Emission factors for criteria pollutants from this type of flare will be estimated by the supplier during the procurement process. Since the hours of use are expected to be very low for this device (<0.5% of total), it is not expected to make a significant contribution to the facility emissions.

QUESTION 2-14b:

What emissions will be emitted from the "exhaust" depicted in that diagram?

Response 2-14b:

These emissions are included in Table 2 of Lucas/Summers corrected revised direct testimony (JLMS-16) under "Bio-SNG Plant Direct Emissions".

Table 2
Bio-SNG Use Case Carbon Intensity and Criteria Pollutant Analysis

Use Case (Bio-SNG)	CI	NOx	PM10	VOC	CO	SOx
	gCO2e /MJ	mg/MJ				
Feedstock logistics	1.55	3.80	0.25	0.41	3.03	0.07
Bio-SNG plant electricity	4.01	3.91	0.46	0.63	2.14	1.42
Bio-SNG plant direct emissions	116.55	10.26	0.83	0.71	2.33	0.31
CCS						
Bio-SNG compression and transportation	1.69	1.65	0.19	0.29	4.20	0.53
Total, g/MJ Bio-SNG	123.81	19.62	1.73	2.04	11.7	2.33

Use Case (Bio-SNG w/ CCS)	CI	NOx	PM10	VOC	CO	SOx
	g CO2e/ MJ	mg/MJ				
Feedstock logistics	1.55	3.80	0.25	0.41	3.03	0.07
Bio-SNG plant electricity	4.01	3.91	0.46	0.63	2.14	1.42
Bio-SNG plant direct emissions	23.31	10.26	0.83	0.71	2.33	0.31
CCS	7.71	5.24	0.62	0.84	2.86	1.90
Bio-SNG compression and transportation	1.69	1.65	0.19	0.29	4.20	0.53
Total, g/MJ Bio-SNG	38.27	24.86	2.35	2.88	14.57	4.23

QUESTION 2-14c:

Will the proposed project emit N2O? If so, please provide estimated annual emissions of N2O.

Response 2-14c:

The proposed project is expected to emit a small amount of N2O and this was factored into the GREET analysis. N2O is a very minor contributor to the total global warming potential for the project and is estimated as 0.059 g CO2e/MJ for both use cases.

QUESTION 2-14d:

Please provide a process flow diagram that includes carbon capture and storage.

Response 2-14d:

Carbon capture is included in Lane 4 of the Process Flow Diagram in the response to Question 4 of Cal-Advocates_SCG-A2510008-001[7] and labeled “CO2 Removal”. The stream coming out the top of the “CO2 Removal” labeled “CO2” represents the captured CO2 stream.

[7] https://www.socalgas.com/sites/default/files/2026-02/A.25-10-008_Cal_Advocates-SCG-01_Responses.pdf

QUESTION 2-14e:

SoCalGas's response to SC 1-6(f) states that "CO2 concentrates in two main streams during the Bio-SNG process, one at the gasifier flue gas and the other after the methanation reactor." Will the CO2 in flue gas stream be emitted as "exhaust" in Lane 2 of the process flow diagram?

If not, please explain how that stream of CO2 will be managed, if at all..

Response 2-14e:

CO2 in the flue stream will also be captured, labeled "exhaust" in Lane 2 of the Process Flow Diagram. There are supplier technologies being considered that separate the CO2 from this stream including adsorption and filtration.

QUESTION 2-15:

In SoCalGas's Response to SC 1-6, SoCalGas states that "West Biofuels has not made a decision on the end-use for the biomethane."

QUESTION 2-15a:

When will West Biofuels make a decision on the end use for the biomethane?

Response 2-15a:

West Biofuels plans to make a decision on the end use of the biomethane after the CPUC issues a decision on this application.

QUESTION 2-15b:

Will West Biofuels have any control over the biomethane once it enters Lanes 7-10 of the project? If so, how will West Biofuels direct the end use of the biomethane?

Response 2-15b:

West Biofuels will be the owner of the biomethane once it enters Lanes 7-10. See response to Question 2-15a regarding end use of the biomethane.

QUESTION 2-16:

In its reply brief SoCalGas states that "[e]missions associated with 'Bio-SNG plant electricity' and 'Bio-SNG compression and transportation' are calculated using statewide average grid emissions, not localized values. According to GridInfo, Fresno County and Tulare County have significantly higher renewable energy generation power generation facilities than the statewide average, approximately 85% and 95% respectively. Based on these percentages and assuming the WBF Project is receiving power from the local grid at these renewable percentages, the WBF Project would result in even lower local emissions than those reflected in Table 2 of Chapter 2 of SoCalGas's testimony." (internal citations omitted)

QUESTION 2-16a:

Please explain what SoCalGas means by the term "local grid"?

Response 2-16a:

The utility-owned electrical grid in the Fresno and Tulare County area.

QUESTION 2-16b:

Please explain what the stated 85% and 95% figures connote.

Response 2-16b:

These figures represent an estimated percentage of renewable energy generation.

QUESTION 2-16c:

Please state the basis for the assertion that "WBF Project would result in even lower local emissions than those reflected in Table 2 of Chapter 2 of SoCalGas's testimony."

Response 2-16c:

As provided in the response to Question 1-5a of Sierra Club-SCG-01, the electric grid emission factor applied in the WBF project analysis is based on WECC regional emissions. The average percentage of renewable generation for the WECC region is approximately 53%.[8] This percentage is considerably lower than the renewable generation share reported for Fresno and Tulare Counties.

[8] Argonne National Laboratory, R&D GREET 2024 Rev1 Release (May 23, 2025), available at: https://greet.anl.gov/.

QUESTION 2-16d:

What are the updated estimated emissions for Table 2 assuming only the stated “local grid” power is used to power the proposed project?

Response 2-16d:

This analysis has not been performed.

QUESTION 2-16e:

Does the WBF Bio-SNG plant intend to operate only during hours of day when solar generation occurs?

Response 2-16e:

No.

QUESTION 2-16f:

Will SoCalGas only run its Bio-SNG compression equipment during hours of day when solar generation occurs?

Response 2-16f:

No.

QUESTION 2-16g:

Does the WBF intend to operate on a microgrid powered only by the local county's power resources?

Response 2-16g:

No, because WBF's Facility will receive electrical service from the local electric utility.

.

QUESTION 2-16h:

Will SoCalGas power its compression equipment on a microgrid powered only by the local county's power resources?

Response 2-16h:

SoCalGas does not plan to own compression equipment.

QUESTION 2-16i:

How are the missions from Bio-CNG transportation impacted, if at all, by the electric grid emissions?

Response 2-16i:

The Bio-SNG will need to be compressed (using electricity from the electric grid) prior to being put into the truck and this will be done by West Biofuels at its facility in Kerman.

.

QUESTION 2-17:

The combined Lucas and Summers testimony states that "[p]roducing and utilizing the Bio-CNG fuel from this project is estimated to be a net carbon sink over its lifecycle with avoided emissions considered."

QUESTION 2-17a:

If the biomethane is not used for transportation end uses and instead used solely for utility procurement, will the bio-CNG be a "net carbon sink over its lifecycle."?

Response 2-17a:

It is expected to be a net carbon sink over procurement of traditional natural gas.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-02
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 9, 2026
RESPONSE DUE: February 23, 2026

QUESTION 2-17b:

Please explain what is meant by “avoided emissions” in this sentence.

Response 2-17b:

Avoided emissions are the emissions that would have occurred in the base use case as provided in the response to Question 1-5d (Table 1) of Sierra Club-SCG-01.

QUESTION 2-17c:

Please explain what is meant by “net carbon sink” in this sentence.

Response 2-17c:

The Bio-CNG serves as a net carbon sink, as its associated estimated carbon emissions are lower than the estimated emissions that would have occurred under the baseline use case scenario.

QUESTION 2-17d:

Please state the basis for concluding that producing and utilizing the Bio-CNG fuel from the proposed project will be a “net carbon sink” over its lifecycle.

Response 2-17d:

As provided in the response to Question 1-5d (Tables 1 and 2) of Sierra Club SCG-01, the estimated metric tons of CO2 (11,257 with CCS and 36,415 without CCS) emitted annually by the Bio-SNG plant are lower than the 42,000 metric tons emitted annually during the baseline use case. This reduction in annual CO2 emission compared to the baseline use case represents a carbon sink.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-03
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 18, 2026
RESPONSE DUE: March 3, 2026

QUESTION 3-1:

What is the basis for the statement that the facility "will process up to 80 BDT per day of agricultural waste biomass into approximately 750 MMBtu per day of biomethane," presented in SoCalGas's Application at page 6? Please indicate the assumptions underlying the statement that 80BDT will be converted to 750 MMBtu.

RESPONSE 3-1: (WBF)

The basis for the statement is the energy balance on the facility. The facility is designed to process up to 80 bone dry tons of almond biomass (gross calorific value of approximately 1250 MMBtu) into 750 MMBtu of Bio-SNG each day. The process exhibits a thermal efficiency of approximately 60%.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-03
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 18, 2026
RESPONSE DUE: March 3, 2026

QUESTION 3-2:

SoCalGas's Response 4 to CalAdvocates' December 8, 2025 data request includes a "WBF Process Flow Diagram."

QUESTION 3-2a:

How is the "steam" depicted in the diagram generated? Please provide the specifications of the steam generation technology, including the fuel that will be used.

RESPONSE 3-2a: (WBF)

The steam is generated internally to the process using heat recovered from the product gas and flue gas streams using heat exchangers. Steam is generated with a heat recovery boiler that operates with heat transfer fluid in a closed loop within the system. There is no additional fuel needed to generate this steam and no additional emissions associated with this steam.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-03
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 18, 2026
RESPONSE DUE: March 3, 2026

QUESTION 3-2b:

What emissions, if any, are associated with the production of the steam?

RESPONSE 3-2b (WBF)

No additional emissions.

QUESTION 3-2c:

Will the emissions of the flare be monitored? If so, please describe the monitoring technology.

RESPONSE 3-2c: (WBF)

The total hours of use of the flare will be monitored, and the emissions can be estimated using the emissions factors for the flare. The flare is designed as an emergency flare and is expected to operate infrequently. Its use will adhere to the requirements of the local air district.

QUESTION 3-2d:

Will the emissions of the exhaust be monitored? If so, please describe the monitoring technology.

RESPONSE 3-2d: (WBF)

Yes. It is likely the local air district will require monitoring of the exhaust emissions. This will likely entail continuous recording of facility throughput, continuous monitoring of stack O2 and NOx, and periodic third-party testing of all criteria pollutant emissions from the exhaust.

QUESTION 3-2e:

What is the composition of the gas that is flared?

RESPONSE 3-2e: (WBF)

The estimated composition by volume of the syngas that would be flared during a methanation system shutdown is as follows:

Hydrogen	35-45%
Carbon Monoxide	22-25%
Methane	9-11%
Carbon Dioxide	20-25%
Nitrogen	1-3%
Oxygen	<0.1%
Ethylene	2-3%
Ethane	~0.5%
Propene	~0.4%
C4+	<0.1%
Sulfur	<1ppm
Dust/Particulate	<20 mg/Nm3

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-03
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 18, 2026
RESPONSE DUE: March 3, 2026

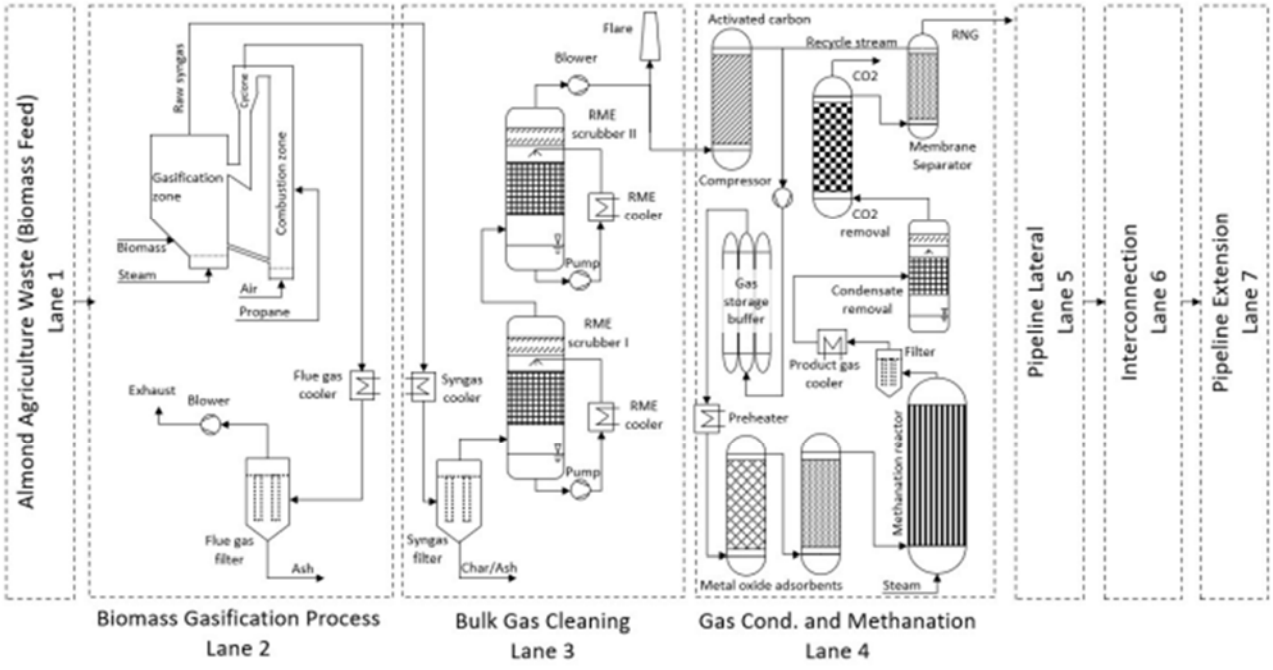
QUESTION 3-2f:

Please indicate the path of the hydrogen, if any, in the process indicated in Lanes 2, 3, and 4.

RESPONSE 3-2f: (WBF)

There is no hydrogen added to this process. The syngas can be composed of up to 40% hydrogen by volume, but it is in a mixture with other gases. The syngas containing hydrogen is generated as part of the gasification process in Lane 2 and is filtered and scrubbed in Lane 3 and then the hydrogen and other gases are converted to Bio-SNG, CO2 and water vapor in Lane 4.

WBF Process Flow Diagram (Submitted for Cal Advocates DR-01 Question 4)



SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-04
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 20, 2026
RESPONSE DUE: March 6, 2026

QUESTION 4-1:

Please state the basis for the value of 1700 g CO2e/kg biomass incorporated to soil as indicated in the GREET spreadsheet provided by SoCalGas to Sierra Club. Culumber et al. 2025 is cited (cell I30 in in the "Baseline Case" tab); please indicate what in that publication or elsewhere provides the basis for the 1700 g CO2e/kg figure.

RESPONSE 4-1:

According to Culumber et al. (2025), most of the biogenic CO2 is expected to decompose and return to the atmosphere over time, with only 4.05 Mg C/ha projected to remain in the soil after 20 years with whole orchard recycling application rate of 61.6 Mg C/ha. Considering that the biomass was 46.1% C and the relative molecular weights of CO2 and C, this results in flux of 1690 g CO2e/kg of biomass applied. In addition, the article looks at the net flux of non-biogenic CO2 and N2O for the whole orchard recycling case and measures a net flux of 137.6 kg CO2e/ha and 476.8 kg CO2e/ha respectively. The study found negligible CH4 emissions. Once corrected for the biomass carbon application rate, these come out to 7.7 g CO2e/kg and 2.2 g CO2e/kg respectively making the total flux of 1700 g CO2e/kg for whole orchard recycling.

.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-04
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 20, 2026
RESPONSE DUE: March 6, 2026

QUESTION 4-2:

Please state the basis for the CO2e calculation by gas as provided in the GREET spreadsheet. Specifically, what are the base numbers for 1) CO2, 2) CH4, and 3) N2O, alongside the GWP values that are used to calculate CO2e for the baseline and project scenarios?

RESPONSE 4-2:

The emission factor base numbers for CO2e calculation are based on various sources. See the summary table below with GHG base numbers broken out by gas: CO2, CH4 and N2O. It is expected that carbon dioxide emissions constitute the main contributor to greenhouse gas CO2e for both baseline and project scenarios. GWP values applied from GREET R&D 2024 are shown in the second table below.

Emission Factors

	GHG	CO2	CH4	N2O	Unit	Source
Biomass transportation	92.06	88.89	1.03E-01	3.26E-04	g/ton.mi	R&D GREET 2024; CIDI Combination Long-Haul Trucks: Conventional and LS Diesel
Biomass preprocessing	7.02	6.74	8.02E-03	1.69E-04	g/kg	R&D GREET 2024; Chipping & Loading
Electricity (CA)	290.53	272.77	5.41E-01	5.95E-03	g/kWh	R&D GREET 2024; Electricity (WECC)
RNG transportation	79.94	70.94	2.88E-01	1.54E-03	g/ton.mi	R&D GREET 2024; SI Combination Long-Haul Trucks: CNG, NA NG
Bio-SNG Plant Direct	3797	3797	--	--	kg/hr	West Biofuels design data, CAP based on comparable oxidizer performance
Dairy Bedding Direct	866.0	866.0	--	--	g/kg	NREL data
Incorporation Direct	1700	1693	--	2.63E-02	g/kg	Culumber et al (2025)
Air Curtain Incinerator Direct	1445	1445	--	--	g/kg	EPA Biomass Air Curtain Incinerator
Biomass Plant Direct	1742	1710	1.60E-01	9.90E-02	g/kg	R&D GREET 2024; Large Industrial Boiler

GWP Values

Gas	GWP (100-year, AR5)
CO_2	1
CH_4	30
N_2O	265

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-04
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 20, 2026
RESPONSE DUE: March 6, 2026

Both the question and response contains confidential information provided pursuant to PUC Section 583, D.21-09-020 and GO 66-D (Revision (Rev.) 2) along with the accompanying declaration. This information is being provided pursuant to a Non-Discloser Agreement between Sierra Club and SoCalGas.

QUESTION 4-3:

Please explain the relationship between the assertion that [redacted]% of baseline (pre-CCS) CO2 is captured and the assertion that the capture unit is running at [redacted]% capture efficiency. Both figures are presented in the "Bio SNG Use Case" tab of the GREET spreadsheet provided by SoCalGas to Sierra Club.

RESPONSE 4-3:

The assumption is that [redacted]% of the CO2 gas is available to the capture unit and the capture efficiency of the unit itself is [redacted]% (ie [redacted]% losses) per R&D GREET 2024 emission factors. Effectively, the overall capture rate estimate is [redacted]% compared to the pre-CCS case. This can be tracked by following the formulas in the spreadsheet.

QUESTION 4-4:

What is the fuel for the CCS capture unit?

RESPONSE 4-4:

Grid electricity is the energy used for the CCS capture unit.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-04
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 20, 2026
RESPONSE DUE: March 6, 2026

QUESTION 4-5:

Is the stated 0.[redacted] kWh/kg entirely electricity? If not, what is the breakdown of heat versus electrical demand for the capture unit? This figure is presented
CONFIDENTIAL – PROTECTED MATERIAL
4 Data Request Sierra Club SCG-04
in the “Bio SNG Use Case” tab of the GREET spreadsheet provided by SoCalGas to Sierra Club.

RESPONSE 4-5:

[redacted]

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-1:

In SoCalGas's response 2-2 to Sierra Club's Second Data Request, SoCalGas states "[y]es, methane leakage detection would be conducted in accordance with SoCalGas's most current gas standard for leakage survey. Because the nature of the gas standard is subject to change, and the leak detection technologies will be referenced within the standard itself, we cannot definitively state which technologies will be utilized at this point. Frequency of monitoring will be based on location, material type, and operating pressure."

QUESTION 5-1a:

Please provide SoCalGas's "most current gas standards for leakage survey."

RESPONSE 5-1a: (SCG)

This response and the attachments contain confidential information provided pursuant to PUC Section 583, D.21-09-020 and GO 66-D (Revision (Rev.) 2)

[redacted]

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-1b:

What is the “material type” referenced?

RESPONSE 5-1b: (SCG)

Material type generally refers to “Non-State-of-the-Art Pipe” and “State-of-the-Art Plastic Pipe”, see Section 3 of Gas Standard 223.0100.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-1c:

What is the “operating pressure” referenced?

RESPONSE 5-1c: (SCG)

Operating pressure generally refers to the pressures as provided in Section 4.1 of Gas Standard 223.0100.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-1d:

What is the “location” or locations referenced?

RESPONSE 5-1d: (SCG)

Location generally refers to the location of the pipe/facilities as provided in Sections 4.1 and 4.2 of Gas Standard 223.0100.

QUESTION 5-2:

In SoCalGas's response 2-3 to Sierra Club's Second Data Request, SoCalGas states that "[f]or indoor and confined facilities, gas detectors will be installed that would immediately detect leakages from equipment to the building and trigger an immediate shutdown to assess and correct the leakage issue. For outdoor piping and equipment, daily leak checks will be performed using portable gas detection equipment. For each leakage event, the total leakage amount will be estimated based on size and duration of the leakage."

QUESTION 5-2a:

What is the make and model type of the "gas detectors" referenced?

RESPONSE 5-2a: (WBF)

The specific make and model of the gas detectors for the proposed project will be selected following CPUC approval of the application.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-2b:

What is the make and model type of the “portable gas detection equipment” referenced?

RESPONSE 5-2b: (WBF)

The specific make and model of the portable gas detection equipment for the proposed project will be selected following CPUC approval of the application.

QUESTION 5-3:

In SoCalGas's response 2-6 to Sierra Club's Second Data Request, SoCalGas states that "[c]ommercially available gas analyzers will be utilized to measure the direct carbon dioxide and criteria pollutant emissions from the facility. WBF uses commercial flue gas analyzers from Horiba and Testo and industry standard procedures at its current facilities."

QUESTION 5-3a:

What are the make and model of the Horiba gas analyzers?

RESPONSE 5-3a: (WBF)

The specific make and model of the gas analyzers for the proposed project will be selected following CPUC approval of the application. For the gas analyzers used at other WBF facilities, the model of the Horiba gas analyzer is Horiba PG 250 Portable Gas Analyzer.

QUESTION 5-3b:

What are the make and model of Testo gas analyzers?

RESPONSE 5-3b: (WBF)

The specific make and model of the gas analyzers for the proposed project will be selected following CPUC approval of the application. For the gas analyzers used at other WBF facilities, the model of the Testo gas analyzer is Testo 300-LL-C-KIT Flue Gas Analyzer Kit with NOx Sensor.

QUESTION 5-3c:

What are the “industry standard procedures” referenced?

RESPONSE 5-3c: (WBF)

An example of industry standard procedures is the guidance of USEPA for good practices in stack testing can be found at https://www.epa.gov/compliance/clean-air-act-national-stack-testing-guidance, which includes recommended use, for example, of EPA Methods 1, 2, 3A, 7E, 10 for procedures for gas analyzers, setup of sampling lines, and measurement of flow rates.

QUESTION 5-3d:

What are the “standard procedures” in use at the WBF facilities where bio-SNG is currently generated?

RESPONSE 5-3d: (WBF)

Bio-SNG is currently not being generated at any WBF facility.

QUESTION 5-4:

In SoCalGas's response 2-7 to Sierra Club's Second Data Request, SoCalGas states that, "[t]he facility can document energy consumption associated with compression activities and apply relevant emission factors to accurately estimate resulting emissions impact. Similarly, the number of transportation miles can be tracked, and an appropriate trucking emission factor applied to determine transport-related emissions."

QUESTION 5-4a:

What are the "relevant emissions factors" referenced?

RESPONSE 5-4a: (WBF)

Relevant emissions factors would be based on the best available data for the grid power consumed by the facility at the time of the compression activities.

QUESTION 5-4b:

What is the “appropriate trucking emissions factor” referenced?

RESPONSE 5-4b: (WBF)

The manufacturer of the heavy-duty vehicle utilized for transport of biomass or Bio-SNG is required by USEPA to provide the estimated emissions per mile for the vehicle, and this can be used for the appropriate trucking emissions factor.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-5:

In SoCalGas's response 2-10 to Sierra Club's Second Data Request, SoCalGas states that,"[t]he volatile organic compounds from West Biofuels facilities have been quantified using EPA Method 25A which measures total hydrocarbons using a flame ionization detector."

QUESTION 5-5a:

At which West Biofuels facilities have the VOCs been quantified?

RESPONSE 5-5a: (WBF)

The VOCs have been quantified at the following facilities:

1. Rice Hull Facility, Williams, CA – EPA Method 18
2. Hat Creek Bioenergy Facility, Burney, CA – EPA Method 25A/18

QUESTION 5-5b:

How many times and over what time period(s) has such quantification occurred for each of the tested West Biofuels facilities?

RESPONSE 5-5b: (WBF)

1. Rice Hull Facility – Source Test 2022 - EPA Method 18 - 3 x 60 mins
2. Hat Creek Facility – Source Test 2025 – EPA Method 25A/18 - 3 x 30 mins

QUESTION 5-5c:

Please provide all test reports generated from such quantification at each of the test facilities.

RESPONSE 5-5c: (WBF)

SoCalGas objects to this question on the grounds that the cited test report data is not relevant to the proposed pilot project and is not reasonably calculated to lead to the discovery of admissible evidence. These reports are irrelevant to the proposed pilot project because they used reciprocating bed technology instead of a fluidized bed and combusted syngas instead of producing Bio-SNG. Methods 25A and 18 are referenced because it is expected the air district would require the same or similar methods to be used to monitor VOC's for a source test at the proposed pilot project.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-6:

In SoCalGas's response 2-13(b) to Sierra Club's Second Data Request, SoCalGas states that, "[a]t the Woodland Biomass Research Center, the syngas produced by the FICFB gasifier has been tested in a pilot system for producing Bio-SNG."

QUESTION 5-6a:

How many days has the Woodland Biomass Research Center facility produced syngas in 2024 and 2025?

RESPONSE 5-6a: (WBF)

This response and the attachments contain confidential information provided pursuant to PUC Section 583, D.21-09-020 and GO 66-D (Revision (Rev.) 2)

2024 – [redacted]
2025 – [redacted]

QUESTION 5-6b:

For the days on which the Woodland Biomass Research Center has operated and produced syngas in 2024 and 2025, please provide the daily production values of the generated syngas.

RESPONSE 5-6b: (WBF)

Daily volumes are not available.

QUESTION 5-6c:

What volume of syngas has been “tested” at the Woodland Biomass Research Center?

RESPONSE 5-6c: (WBF)

The volume of syngas “tested” has not been quantified.

QUESTION 5-6d:

What methods were used to “test” the syngas?

RESPONSE 5-6d: (WBF)

Syngas was tested at the Woodland Biomass Research Center under a number of operating conditions by varying temperature, pressure, hydrogen to carbon ratio, and residence time to determine best performance for the methanation catalyst.

QUESTION 5-6e:

Please describe the “pilot system” referenced.

RESPONSE 5-6e: (WBF)

The fluidized bed methanation reactor test system is an automated, integrated unit consisting of gas-generation, gas-cleaning, and methanation reaction subsystems. This test system has been used to test multiple methanation catalysts under a number of operating parameters including pressure, temperature, fluidization rate, space velocity, syngas composition, steam addition, etc.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-6f:

How do the “reciprocating grate systems” referenced produce methane form woody biomass? Is combustion used in the process?

RESPONSE 5-6f: (WBF)

SoCalGas objects to this question as not relevant and not reasonably calculated to lead to the discovery of admissible evidence because reciprocating grate systems are not being proposed for the pilot project.

QUESTION 5-7:

In SoCalGas's response 2-13(c) to Sierra Club's Second Data Request, SoCalGas states that, "[i]n 2025, syngas (which includes some methane) was generated by all three facilities during gasification and the syngas was subsequently utilized in synthesis experiments at the research center and for power production at the other two facilities."

QUESTION 5-7a:

What are the "synthesis experiments" referenced?

RESPONSE 5-7a: (WBF)

The Woodland facility made the biomass-based syngas in 2023 and 2024, but not 2025. However, the stored syngas from prior years was used for experiments in 2025 with a test system to make diesel fuel precursors using Fischer-Tropsch synthesis in a project conducted in collaboration with the National Renewable Energy Laboratory with funding from the US Department of Energy.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-7b

What volumes of syngas were produced at the Rice Hull and Hat Creek facilities?

RESPONSE 5-7b: (WBF)

This response and the attachments contain confidential information provided pursuant to PUC Section 583, D.21-09-020 and GO 66-D (Revision (Rev.) 2)

Rice Hull – [redacted]

Hat Creek – [redacted]

QUESTION 5-8:

In SoCalGas's response 2-14(b) to Sierra Club's Second Data Request, SoCalGas refers Sierra Club to "Table 2" as a response to the question of "what emissions will be emitted from the "exhaust?".

QUESTION 5-8a:

Where does Table 2 specify exhaust emissions, as separate from other facility emissions?

RESPONSE 5-8a: (WBF)

The exhaust emissions are the "Bio-SNG plant direct emissions" in Table 2.

QUESTION 5-8b:

If Table 2 does not specify exhaust emissions, please list the pollutants that will be emitted from the exhaust and the annual volumes of those pollutants.

RESPONSE 5-8b: (WBF)

See Response to Question 5-8a.

QUESTION 5-9:

In SoCalGas's response 2-14(a) to Sierra Club's Second Data Request, SoCalGas states that "[t]he emergency flare is used if the methanation plant becomes unavailable to take the syngas from the gasifier while the FICFB plant performs a safe controlled shut down. The flare is an enclosed thermal oxidizer and the exhaust will consist of syngas combustion products including excess air, carbon dioxide and water vapor. Emission factors for criteria pollutants from this type of flare will be estimated by the supplier during the procurement process. Since the hours of use are expected to be very low for this device (<0.5% of total), it is not expected to make a significant contribution to the facility emissions."

QUESTION 5-9a:

Please provide the specifications for the "thermal oxidizer" referenced.

RESPONSE 5-9a: (WBF)

The specific make and model of the thermal oxidizer for the proposed project will be selected following CPUC approval of this application.

QUESTION 5-9b:

Please provide the specifications for the flare stack, including height and diameter.

RESPONSE 5-9b: (WBF)

The specific make and model of the flare stack for the proposed project will be selected following CPUC approval of the application.

QUESTION 5-9c:

What other emissions will occur from the flare besides air, carbon dioxide and water vapor?

RESPONSE 5-9c: (WBF)

The specific make and model of the flare for the proposed project will be selected following CPUC approval of the application. Criteria pollutant emissions from this type of flare will be estimated by the supplier during the procurement process.

QUESTION 5-9d:

Will the flare emit air toxics such as benzene, formaldyde, hexane, and others toxic air pollutants?

RESPONSE 5-9d: (WBF)

The purpose of the thermal oxidizer is to eliminate these compounds and other VOC's if present in the syngas prior to venting the gas. The air district will evaluate if air toxics are a concern for the project in their analysis and approval of the facility permit to construct.

QUESTION 5-9e:

Will the flare stack have monitoring ports for continuous monitoring of pollutants?

RESPONSE 5-9e: (WBF)

The air district is unlikely to require continuous emissions monitoring because the flare is used only rarely. However, ports are typically added to the stack to conduct a source test if required and gas flow to the flare is continuously monitored and recorded to determine the total flare usage.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-9f:

What is the basis for statement that the device will only be used for less than .5% of hours?

RESPONSE 5-9f: (WBF)

WBF estimates the flare will be used for a maximum of 10 minutes for an initial startup or emergency shutdown of the methanation system. In the first year, which includes commissioning, WBF anticipates up to 120 startups and shutdowns which is the basis for less than 0.5% of hours. After the facility is commissioned, WBF only anticipates approximately 8 to 10 startups/shutdowns annually.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
SIERRA CLUB-SCG-05
WOODY BIOMASS PILOT PROJECT APPLICATION (A.25-10-008)
DATE REQUESTED: February 25, 2026
RESPONSE DUE: March 11, 2026

QUESTION 5-10:

In SoCalGas's response 2-14 to Sierra Club's Second Data Request, SoCalGas states that, "CO2 in the flue stream will also be captured, labeled 'exhaust' in Lane 2 of the Process Flow Diagram. There are supplier technologies being considered that separate the CO2 from this stream including adsorption and filtration."

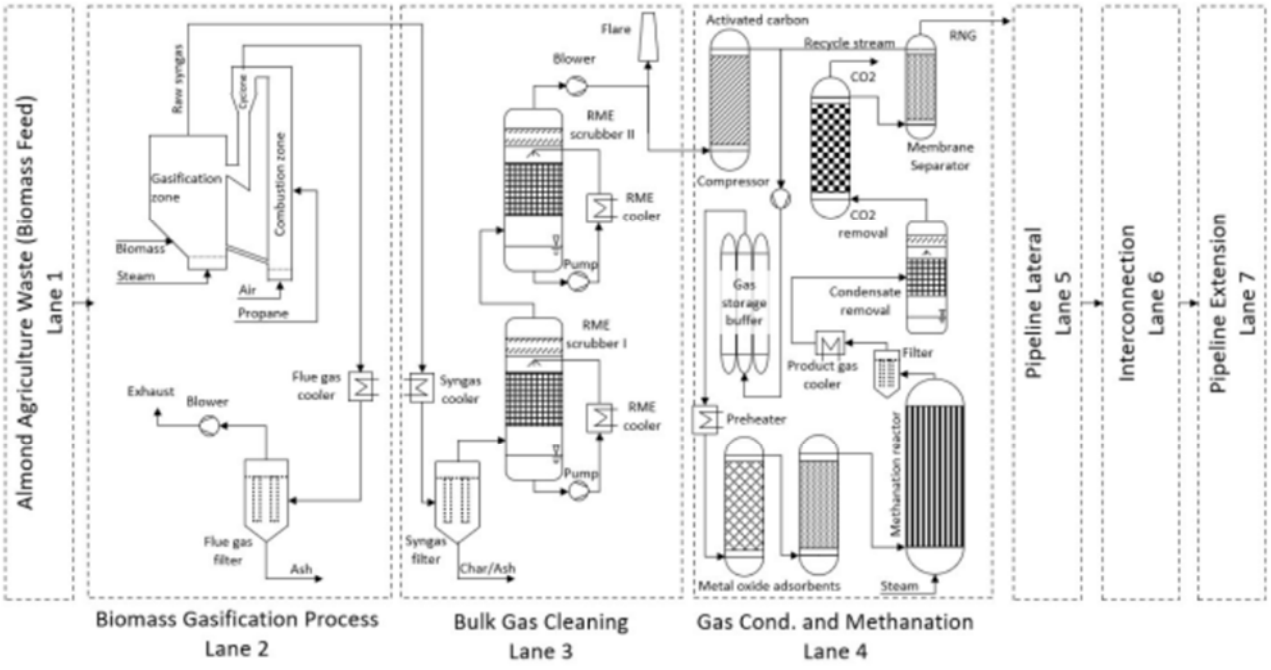
QUESTION 5-10a:

What "supplier technologies" are being considered?

RESPONSE 5-10a: (WBF)

Adsorption and filtration are the technologies being considered.

WBF Process Flow Diagram (Submitted for Cal Advocates DR-01 Question 4)



QUESTION 5-10b:

Provide the composition and quality of exhaust gas that will remain after CO2 separation.

RESPONSE 5-10b: (WBF)

The composition of the exhaust gas will primarily consist of nitrogen, oxygen, water vapor, and carbon dioxide, along with the criteria pollutants as provided in “Bio-SNG plant direct emissions” from Table 2 of Lucas/Summers Testimony.

PREPARED TESTIMONY OF EMILY GRUBERT AND RANAJIT (RON) SAHU ON BEHALF OF SIERRA CLUB

ATTACHMENT 3

PUBLIC VERSION

SoCalGas Modeling Spreadsheet, Solicitation Materials, and Gas Standard Materials

THESE DOCUMENTS ARE
CONFIDENTIAL IN THEIR ENTIRETY

Attachment 4

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-001
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: December 8, 2025
RESPONSE DUE: January 9, 2025

QUESTION 1:

SoCalGas presents the GREET analysis for the proposed pilot project in Table 1 (p. JL-15), Table 2 (p. JL-16), Table 3 (p. JL-17), and Attachment 1 of Prepared Direct Testimony of James Lucas. Provide the full life-cycle GREET model for the proposed pilot project in Excel format. The Excel spreadsheet should include, but not be limited to, active cells and formulas for the following information:

a. Baseline carbon intensity and criteria pollutant biomass types, base case disposal methods, and Bio-SNG use case carbon intensity and criteria pollutants with and without carbon capture and storage (CSS).

b. The methodology used to express baseline carbon intensity and criteria pollutant emissions on a basis of potential megajoule of biosynthetic natural gas (Bio-SNG) production.

c. Delineated calculations by the production steps.

d. Well-to-wheel (WTW) carbon intensity for compressed Bio-SNG fuel (Bio-CNG). e. The sources and assumptions used to determine the biogenic CO2 credit of -55.0 gCO2e/MJ assigned. f. Document the sources of data, emission factors, and other assumptions, including but not limited to any source testing, permits, manufacturer certifications, technical reports, or models used to support the analysis.

RESPONSE 1:

Responses below are from Matt D. Summers

An Excel workbook with active cells will be provided concurrently with a confidentiality declaration in accordance with Decision ("D.") 21-09-020 and General Order ("GO") 66-D Revision 2.

a) Both the base case and the use case results can be traced from the sheets "Baseline Case" and "Bio-SNG Use Case" respectively.

b) The calculations can be traced on the sheet "Baseline Case".

c) These steps are delineated on sheet "Bio-SNG Use Case".

d) The WTW results are shown on sheet "WTW".

e) This is shown on sheet "WTW" and represents the avoided fossil CO2 emissions from CNG combustion during CNG vehicle operation, directly obtained from R&D GREET 2024. This figure assumes that non-CO2 emissions would not necessarily be avoided in the Bio-SNG case (i.e., VOC, CO).

f) The sources for the emissions factors have been shared in other testimony and are noted in the workbook

QUESTION 6:

Provide a breakdown in Excel format of the estimated costs associated with the construction, operation, and maintenance of the pilot's Utility-Owned Infrastructure (lanes 7, 8, and 9) by lane, including estimations of engineering costs, equipment and materials, construction, labor, and/or any other applicable cost categories. Include a line item for costs associated with the construction, operation, and maintenance of gathering pipeline laterals, if applicable.

RESPONSE 6:

Estimated costs for Lanes 7, 8, and 9 are based on a Class 5 estimate. A Class 5 estimate can range from –50% on the low side to +100% on the high side. The provided costs are preliminary estimates based on the project description. The estimate was developed using historical data from comparable Renewable Natural Gas Point-Of-Receipt facility projects, recent budgetary vendor quotes, and assumptions about project design and construction. These ranges encompass anticipated costs for engineering, equipment and materials, construction, labor, and other applicable categories. See supporting Excel file for estimated costs breakdown.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-001
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: December 8, 2025
RESPONSE DUE: December 22, 2025

QUESTION 1:

SoCalGas presents the GREET analysis for the proposed pilot project in Table 1 (p. JL-15), Table 2 (p. JL-16), Table 3 (p. JL-17), and Attachment 1 of Prepared Direct Testimony of James Lucas. Provide the full life-cycle GREET model for the proposed pilot project in Excel format. The Excel spreadsheet should include, but not be limited to, active cells and formulas for the following information:

a. Baseline carbon intensity and criteria pollutant biomass types, base case disposal methods, and Bio-SNG use case carbon intensity and criteria pollutants with and without carbon capture and storage (CSS).

b. The methodology used to express baseline carbon intensity and criteria pollutant emissions on a basis of potential megajoule of biosynthetic natural gas (Bio-SNG) production.

c. Delineated calculations by the production steps.

d. Well-to-wheel (WTW) carbon intensity for compressed Bio-SNG fuel (Bio-CNG).

e. The sources and assumptions used to determine the biogenic CO2 credit of -55.0 gCO2e/MJ assigned.

f. Document the sources of data, emission factors, and other assumptions, including but not limited to any source testing, permits, manufacturer certifications, technical reports, or models used to support the analysis.

RESPONSE 1:

For questions 1, 6, and 7, SoCalGas will need an extension to respond by January 9, 2026. We have been diligently working on gathering responsive data, but the holidays have interfered with our efforts with relevant people out on vacation.

QUESTION 2:

Provide any agreements West Biofuels ("WBF") has made with SoCalGas regarding the vehicles that will be used in the production of Bio-SNG/Bio-CNG and the transport of Bio- CNG between the WBF and SoCalGas facilities, pursuant to OP 38 of D.22-02-025.

RESPONSE 2:

SoCalGas and WBF have not entered into any agreements regarding the vehicles to be used for producing BioSNG or -BioCNG. The requirements outlined in OP 38 of -D.22-02025 apply only if SoCalGas procures the -BioSNG. At this time, WBF has not determined the end use for the biomethane.

QUESTION 3:

Provide any agreements WBF has made with SoCalGas regarding the combustion and non-combustion generation of electricity at the WBF facility pursuant to OP 39 and 40 of D.22- 02-025.

RESPONSE 3:

WBF does not intend to operate an onsite power generation facility; therefore, no agreements between SoCalGas and WBF exist regarding electricity generation.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-001
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: December 8, 2025
RESPONSE DUE: December 22, 2025

QUESTION 4:

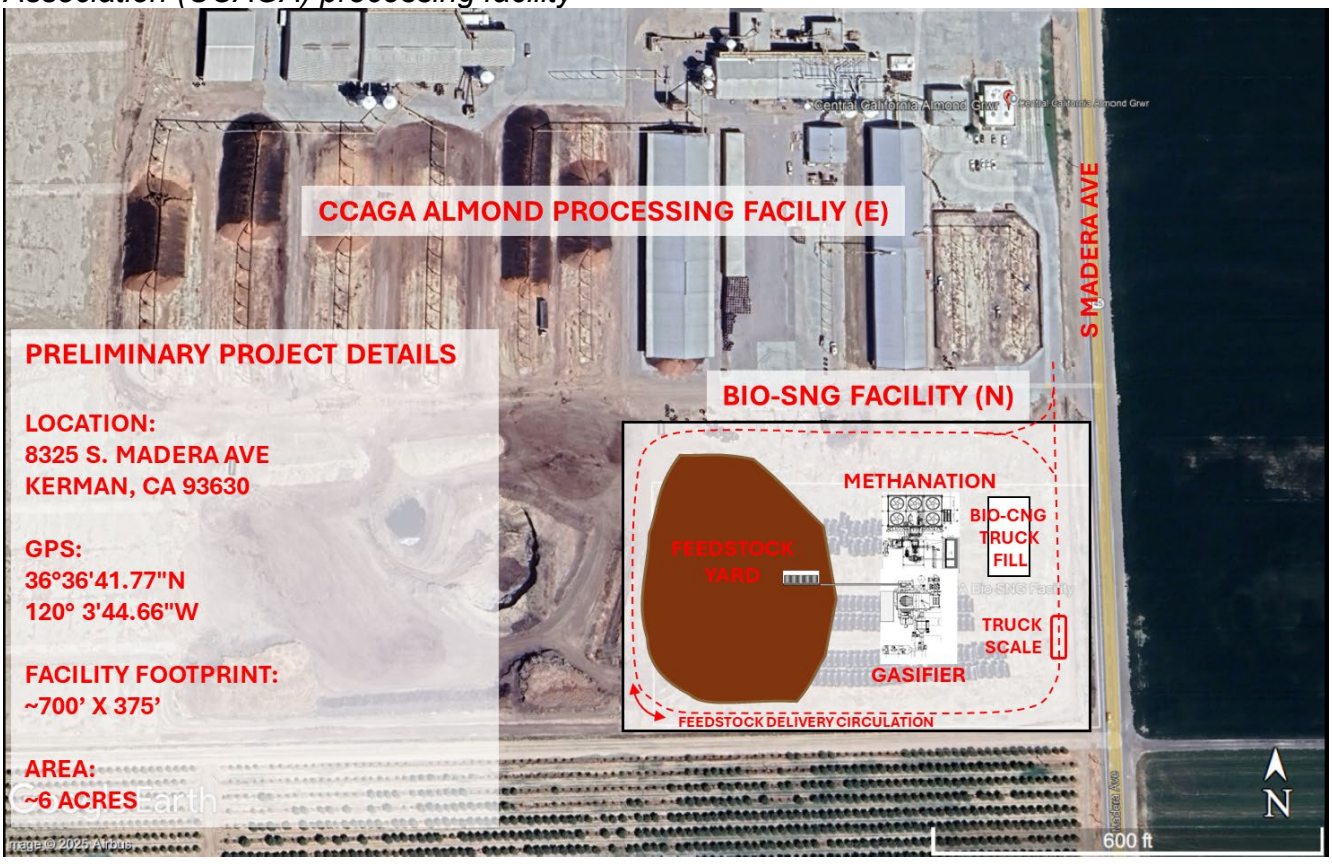
Provide facility maps and available engineering designs of the proposed WBF woody biomass pilot project location and the proposed SoCalGas interconnection point.

RESPONSE 4:

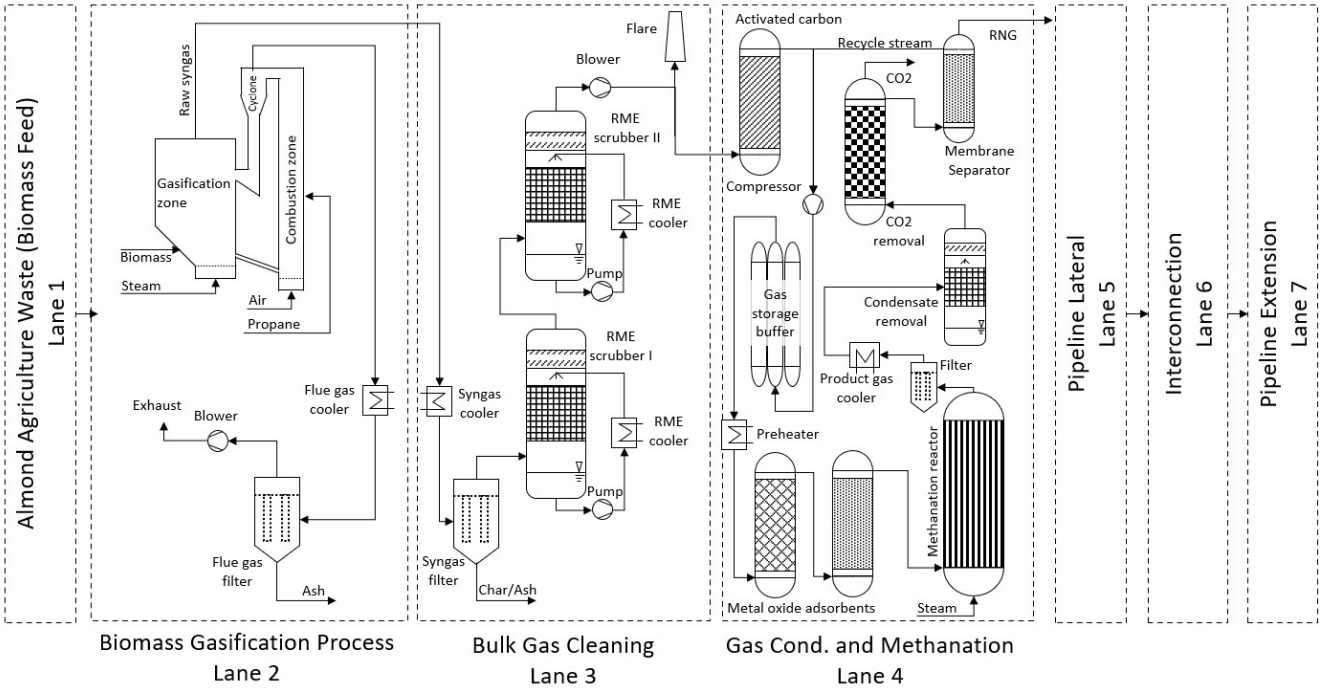
WBF Facility

No design work has been completed to date. Below provides high-level site map and process flow diagram.

Proposed WBF site location located adjacent to Central California Almond Growers Association (CCAGA) processing facility



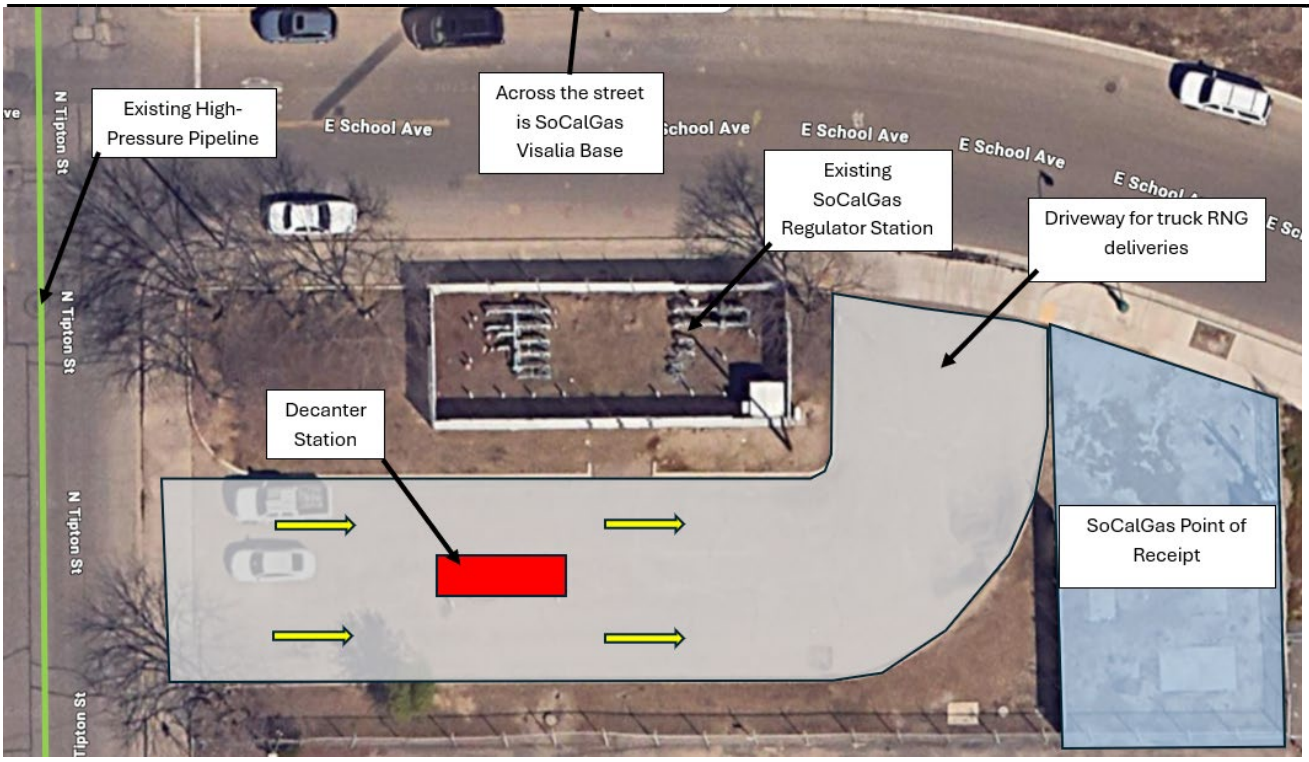
WBF Process Flow Diagram



<u>SoCalGas Interconnection</u>

No design work has been completed to date. Below provides high-level site map for the interconnection facility at the Visalia parcel.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-001
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: December 8, 2025
RESPONSE DUE: December 22, 2025



QUESTION 5:

Did SoCalGas and WBF evaluate the feasibility of establishing the facility at a location at which direct interconnection with SoCalGas's pipelines were feasible? If so, provide all communications and analysis that discuss SoCalGas's and WBF's evaluation.

RESPONSE 5:

SoCalGas conducted an SB 1440 Screening Study to identify the nearest pipeline with sufficient capacity for the projected Bio-SNG volume. The RNG takeaway capacity analysis indicates that the nearest pipeline with adequate capacity is approximately 18 miles away, making it an economically unfeasible option. Below is the information provided to WBF, along with the screening study analysis completed by SoCalGas. Please see attached, Communications provided to WBF and SoCalGas's takeaway capacity analysis

QUESTION 6:

Provide a breakdown in Excel format of the estimated costs associated with the construction, operation, and maintenance of the pilot's Utility-Owned Infrastructure (lanes 7, 8, and 9) by lane, including estimations of engineering costs, equipment and materials, construction, labor, and/or any other applicable cost categories. Include a line item for costs associated with the construction, operation, and maintenance of gathering pipeline laterals, if applicable.

RESPONSE 6:

For questions 1, 6, and 7, SoCalGas will need an extension to respond by January 9, 2026. We have been diligently working on gathering responsive data, but the holidays have interfered with our efforts with relevant people out on vacation.

QUESTION 7:

Provide a breakdown in Excel format of the estimated costs associated with the construction, operation, and maintenance of the pilot's Applicant-Owned Infrastructure (lanes 1 through 6) by lane, including estimations of engineering costs, equipment and materials, construction, labor, and/or any other applicable cost categories.

RESPONSE 7:

For questions 1, 6, and 7, SoCalGas will need an extension to respond by January 9, 2026. We have been diligently working on gathering responsive data, but the holidays have interfered with our efforts with relevant people out on vacation.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-001
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: December 8, 2025
RESPONSE DUE: December 22, 2025

QUESTION 8:

Describe the funding mechanisms anticipated to be used to cover any WBF and SoCalGas project costs that exceed the $19.704 million in Cap-and-Trade allowance proceeds allocated for this project.

a. SoCalGas testimony at JL-19 states “There is no anticipated revenue requirement that is being proposed for recovery from ratepayers associated with the Utility-Owned Pipeline Infrastructure presented herein.” Does SoCalGas anticipate that ratepayer funding will be needed to support any of the costs associated with the construction of applicant-owned infrastructure related to this project? i. If so, what is the anticipated impact on rates that would result from these costs?

b. How does SoCalGas plan to contend with any potential cost-overages for the construction of applicant- or utility-owned infrastructure related to this project?

RESPONSE 8

Other than the $19.704 million in cap-and-trade funding, SoCalGas does not plan to utilize any ratepayer funding for the utility-owned and applicant-owned infrastructure.

a) No
b) Not applicable

QUESTION 9:

Did SoCalGas consider and/or quantify the potential wildfire prevention benefits associated with the diversion of biomass waste due to this pilot project?

a. If so, provide the analysis used to quantify those benefits in Excel format with active cells and formulas.

RESPONSE 9:

a) SoCalGas did not assess or quantify potential wildfire prevention benefits because no bids were received from projects proposing the use of forest woody biomass. However, WBF's technology is capable of utilizing forest woody biomass, making this demonstration relevant for that feedstock in future projects.

QUESTION 10:

Describe how the proposed pilot project, which would convert up to approximately 29,200 bone try dons (BDT) per year of agricultural waste into biomethane, aligns with SoCalGas's short-term target of procuring sufficient to divert approximately four million tons of organic waste from landfill by 2025, per D.22-02-025?

a. What parameters did SoCalGas consider in the sizing of this project?

b. How do the diversion rates and costs associated with this project compare to those of SoCalGas's other biomass diversion projects?

RESPONSE 10:

The woody biomass feedstock identified for the proposed pilot project does not meet the eligibility requirements under SB 1440's short-term target, as the material is not currently directed to landfill disposal.

a) The solicitation issued by SoCalGas for the selection of at least one woody biomass pilot project did not specify any sizing requirements.
b) As stated above, none of the woody biomass is currently directed for landfill disposal, so there is nothing to divert from landfills.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-001
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: December 8, 2025
RESPONSE DUE: December 22, 2025

QUESTION 11:

Explain how SoCalGas chose the proposed project's location of the gasification facility in Kerman, California and the new interconnection facility on a company-owned parcel in Visalia, California. Include in your explanation:

a. Other potential locations considered and selection criteria and scoring, if applicable; and

b. Communications between SoCalGas and the Department of Conservation, Natural Resources Agency, and Commission's Energy Division regarding the strategic placement of the pilot project. If SoCalGas is unable to provide the communications, provide a summary of the communications.

RESPONSE 11:

a)
WBF Gasification Facility - SoCalGas issued a Solicitation and WBF was the sole respondent whose proposal met the requirements under D.22-02-025 and D.24-12-032, to build, own, and operate a gasification facility which has a proposed location of Kerman, California.

SoCalGas Interconnection Facility - SoCalGas selected the Visalia site based on the following factors: (1) the parcel is owned by SoCalGas; (2) proximity to an existing SoCalGas operating base, facilitating monitoring of the interconnection facility; (3) prior use of the location as a compressed natural gas (CNG) refueling station with existing driveways; and (4) adjacent to a high-pressure pipeline with sufficient RNG takeaway capacity, thereby minimizing pipeline extension costs. SoCalGas also evaluated a parcel it owns in the City of Dinuba; however, the site does not offer the advantages identified in items (2) and (3) above

b) Because WBF was the sole respondent to SoCalGas's solicitation and proposed a gasification-to-biomethane facility in Kerman, located near the available woody biomass feedstock, SoCalGas's engagement with the Department of Conservation (DOC) and the Commission's Energy Division was limited to providing information rather than conducting strategic siting discussions for the proposed pilot project.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 1:

Has SoCalGas been in discussion with WBF regarding the cost of procurement of biosynthetic natural gas ("Bio-SNG") from the proposed Woody Biomass Project? If so, what are the expected or contracted costs of biomethane produced from the Woody Biomass Project in $/MMbtu?

RESPONSE 1:

No.

QUESTION 2:

D.22-02-025 Ordering Paragraph (OP) 1 and OP 2 at p. 57 required that SoCalGas "host a workshop on cost-effectiveness within 45 days of the effective date of this decision" and "include results of the workshop and address feedback received at the workshop in Tier 2 Advice Letters establishing a Standard Biomethane Procurement Methodology." SoCalGas submitted the Joint Tier 2 Advice Letter (AL) 6003-G on July 5, 2022, in response to this requirement.

QUESTION 2a:

Provide the confidential version of AL 6003-G.

RESPONSE 2a:

SoCalGas objects to this request as irrelevant and not reasonably calculated to lead to the discovery of admissible evidence because SoCalGas has not entered into a procurement agreement with West Biofuels nor is it a requirement under D.22-02-025 pursuant to D.24-01-060.

QUESTION 2b:

Did SoCalGas follow their Standard Biomethane Procurement Methodology (SBPM) when developing the Woody Biomass Project?

i. If so, would Bio-SNG procurement form the Woody Biomass Project meet the standards set in SoCalGas's SBPM?

ii. If not, explain why.

RESPONSE 2b:

No, because SoCalGas does not have a procurement agreement with West Biofuels and is no longer mandated to procure biomethane from this project pursuant to D.24-01-060.

QUESTION 2c:

If SoCalGas did follow their SBPM when developing the Woody Biomass Project, provide the following information related to the SBPM conditions described in AL 6003-G.

i. The calculated Break-Even Price for renewable natural gas ("RNG"), including the components of the All-In Cost of RNG and of the All-In Cost of Conventional Natural Gas described in Appendix A of AL 6003-G at 4 and 5.

ii. The scored Monetary Costs of the project, calculated as the contract price, or procurement costs, divided by the Break-Even Price.

iii. A description of and monetized value assigned to each of the Other Environmental & Non-Monetary Factors associated with the project, including those listed in Appendix A of AL 6003-G at 5.

iv. The weights assigned to the Monetary Costs score and Non-Monetary Factor score used to determine the SBPM Project Score as described in Appendix A of AL 6003-G at 5 and 6.

RESPONSE 2c:

Not applicable because SoCalGas does not have a procurement agreement with West Biofuels and is no longer mandated to procure biomethane from this project pursuant to D.24-01-060.

QUESTION 3:

D.22-02-025 OP 43 at p. 68 requires that biomethane gasification pilot projects "study and report fugitive methane, pollutant, and particulate matter emissions and emissions reduction or elimination methods in the gasification or pyrolysis process, the methanation process, and pipeline infrastructure."

In the Prepared Direct Revised Testimony of James Lucas and Dr. Matthew D. Summers, SoCalGas
states that "SoCalGas and WBF meet this criterion by committing to thorough emissions documentation and reporting for the SB 1440 Pilot Project" (p. JLMS-11) and that "SoCalGas will work with the Commission and/or other state agencies to develop a reporting template for the SB 1440 Pilot Project" (p. JLMS-20).

QUESTION 3a:

Describe any methods SoCalGas and WBF have established or considered to document, study, and report fugitive methane, pollutant, and particulate matter emissions in the gasification or pyrolysis process, the methanation process, and pipeline infrastructure associated with the Woody Biomass Project.

RESPONSE 3a:

SoCalGas and WBF have not established or considered methods to document, study and report emissions. As provided in SoCalGas's Reply Comments Section II(A)(3) at pages 4 and 5.[1], "Section IV of the Application's Chapter 2 testimony (titled "Program Reporting") nonetheless provides a roadmap for studying and monitoring emissions.[2] This includes SoCalGas working "with the Commission and/or other state agencies to develop a reporting template for the SB 1440 Pilot Project."[3] This approach is similar to that undertaken in the SB 1383 Dairy Biomethane Pilot Projects. The Commission and its constituent agencies are leading the data reporting process in such projects.[4] The Application thus contemplates monitoring, studying, and reporting emissions by proposing to utilize the existing processes used by these pilot projects, pending determination by the Commission and its constituent agencies."

[1] https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M588/K915/588915254.PDF
[2] SoCalGas Chapter 2 (Lucas/Summers) at JLMS-20.
[3] *Id*.
[4] D.17.12-004, Attachment B at 4.

QUESTION 3b:

Provide any analyses SoCalGas and/or WBF have conducted regarding the feasibility and/or effectiveness of fugitive emission monitoring technologies or methodologies for the Woody Biomass Project.

RESPONSE 3b:

SoCalGas and/or WBF have not conducted this type of specific analysis for the SB 1440 Woody Biomass Pilot Project. The response to Question 4 provides the procedures planned to be used by SoCalGas and WBF to address fugitive methane emissions.

QUESTION 4:

D.22-02-025 OP 49, p. 70-71 states, "in the procurement contract, the utilities shall establish a procedure for immediate methane leak remediation at the production facility or along that gas pipeline interconnection as the preferred response, and specify required actions if there is no immediate remediation, such as timeline for repair, a graduated fee schedule to promote timely repair, or payment reductions, etc." Provide the procedures for methane leak detection and remediation that SoCalGas and WBF have established for the production facility and associated operations (Lane 3 through Lane 6) and the pipeline point of receipt, interconnection, and pipeline extension (Lane 7 through Lane 9).

RESPONSE 4:

SoCalGas objects to the request on the grounds that SoCalGas does not have a procurement contract with West Biofuels and is no longer mandated to procure biomethane from this project pursuant to D.24-01-060.

Subject to and without waiving the foregoing objection, SoCalGas responds as follows:

SoCalGas and WBF plan to utilize the following for methane leak detection and remediation.

The following apply to the Lanes 3 to 6 (to be performed by WBF)

- **Methane Leak Detection:** WBF employs regular scheduled inspections using advanced methane detection technologies, such as handheld detectors, optical gas imaging cameras, and continuous monitoring systems within confined areas and buildings. Inspections are conducted at key points, including production equipment, pipeline connections, and transfer points.
- **Immediate Remediation Procedure:** Upon detection of a methane leak, field personnel are required to assess the severity and, where safe and practical, initiate immediate repairs to stop the leak. If immediate remediation is not possible due to operational or safety constraints, the incident is escalated for urgent scheduling of repairs.
- **Timelines and Escalation:** For leaks that cannot be immediately repaired, WBF will follow a defined escalation process. This includes documenting the leak, notifying responsible parties, and setting a timeline for repair based on the leak's size and potential impact. All leaks are tracked until resolution.
- **Verification and Reporting:** All leak detection and remediation activities are documented and reported as required by regulatory authorities. Verification of repair completion is performed before resuming normal operations at the affected site.

The following apply to Lanes 7-9 (to be performed by SoCalGas)

Leakage detection would be conducted in accordance with SoCalGas's most current gas standard for leakage survey. Frequency of monitoring will be based on location, material type, and operating pressure

QUESTION 5:

In reference to "A.25-10-008-01_Cal_Advocates-SCG-01_Response_to_Q1.pdf," methane leakage emission factors are not clearly delineated in the GREET model presented.1 Provide information about the "methane leak standard," methane leakage assumptions, or methane leakage emission factors included in the GREET life cycle emission modeling. Provide the leakage information for each Lane of the project and individual processes or equipment as applicable.

RESPONSE 5 (WBF)

The WBF Bio-SNG production infrastructure (Lanes 2-5) are not permitted to operate with leakage for safety reasons. The WBF Facility uses gas-tight reactor vessels, valves, and compressors and methane impervious stainless-steel piping that are not expected to have any leakage during normal operations. Therefore, no continuous leakage assumption was used in the GREET modeling.

As stated in Response to Question 4, the SoCalGas interconnection facility (Lanes 7-9) will adhere to SoCalGas's current gas standard for leakage survey and assumes no continuous leakage as this could be identified and addressed during the leakage survey process.

QUESTION 6:

In reference to "Cal Advocates-SCG-A2510008-01_Response_to_Q1_and_Q6.pdf", and the accompanying "Lanes 7-8-9 Cost Breakdown Draft.xlsx," the estimated sum cost of lanes 7, 8, and 9 would be $9.966 million.

QUESTION 6a:

Confirm that SoCalGas's estimate of $9.966 million of the authorized $19.704 million in Cap-and-Trade funds is allocated to utility-owned infrastructure.

RESPONSE 6a:

Yes.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 6b:

Has SoCalGas communicated with West Biofuels regarding the availability of potential funding for project infrastructure that would be owned by West Biofuels? If so, provide any and all such communications.

RESPONSE 6b:

The availability of potential funding for project infrastructure was communicated to all parties who received the SB 1440 Woody Biomass Pilot Project solicitation. The availability of potential funding was also included in Lucas/Summers Revised Testimony at JLMS-18. There was also some verbal communications with West Biofuels.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 6c:

Provide the historical data used from comparable Renewable Natural Gas Point-Of-Receipt facility projects, in designing your cost estimates. Include the details of your response in an Excel Spreadsheet.

RESPONSE 6c:

The most recently completed RNG project with comparable scope served as the historical benchmark for developing the Lane 8 and 9 Class 5 estimates. This project was selected as it reflects the most up-to-date design practices and provides the closest cost equivalency for benchmarking. The corresponding benchmark scope components are presented below:

Historical Benchmark - Pipeline vs POR			
			EAC
Estimate at Completion (EAC)	$10,050,000	Pipeline	$5,130,000
		Point of Receipt	$4,920,000

QUESTION 6d:

Provide the correlated historical data with each cost function, per line item.

RESPONSE 6d:

Below is the historical data for the tracked cost functions from the Simi Valley project the historical benchmark project of comparable scope. Each cost function includes both the pipeline and POR costs. The totals below are 2025 dollars with no applied escalation.

Historical Benchmark - Cost Analysis	
Cost Function	**Total**
Company Labor	**$580,000**
Engineering Contractor	**$740,000**
Material	**$1,650,000**
Construction Contractor	**$3,920,000**
Construction Management	**$880,000**
Other Purchased Services	**$730,000**
Total Direct Cost	**$8,500,000**
Total Non-Direct Cost	**$1,550,000**
Combined Total Cost	**$10,050,000**

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 6e:

How many full-time employees (FTEs) and/or contract staff are included in your cost estimates?

RESPONSE 6e:

The total FTEs are calculated based on a 36-month schedule for project initiation through closeout.

Cost Function	Total HRS	Total FTEs
Total FTE	3971.00	2.40

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 6f:

Provide the respective cost function and specific department where each FTE and/or contract staff is employed.

RESPONSE 6f:

FTEs are calculated based on a 36-month schedule for project initiation through closeout.

Cost Function	Total HRS	Total FTE	Resources
Project Management	3971	0.66	Portfolio Manager, Project Manager, Project Engineer, Project Coordinator
Engineering and Design	1896	0.31	Engineering Team Lead, Pipeline Engineer, Station Engineer, Civil Engineer, Pipeline Integrity Coordinator, Survey Manager, Survey Technician, Pipeline Integrity Team Lead
Material - Permanent	0	0	No labor assumed
Material - Consumable & Temp	0	0	No labor assumed
Fabrication	0	0	No labor assumed
Construction	2920	0.48	Chief Inspector, Welding Inspector, Utility Inspector, Field Construction Lead, Construction Team Lead, Field Engineer, Construction Manager, Safety Inspector
Commissioning	160	0.03	District Union Labor Manager
Operations	2334	0.39	District Union Manager, District Union Labor Manager, Construction Team Lead, Field Engineer, Safety Inspector, District Union Labor
Project Support Services	1386	0.23	Estimator, Permit Lead, Permit Coordinator, Public Affairs Manager, Material Coordinator, Supply Management Lead, Scheduler, Cost Controller, Outreach Specialist
Environmental	1096	0.18	Environmental Manager, Environmental Team Lead, Environmental Project Manager, Environmental Project Assistant, Certified Industrial Hygienist, Asbestos Consultant, Abatement Superintendent, Abatement Laborer, Abatement Warehouseman, Abatement Admin, Abatement Truck
Land & Right of Way	748	0.12	Administrative Assistant, Land Manager, Land Specialist, Project Manager
Land	0	0	Land purchase cost only, none assumed
-Permitting	0	0	Permit cost only (Labor included in project services)
Project Overhead	0	0	Indirect Costs

QUESTION 6g:

Provide the number of labor hours associated with each FTE and/or contract staff.

RESPONSE 6g:

Refer to response 6f.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 6h:

Provide the budgetary vendor quotes used in your cost estimates.

RESPONSE 6h:

The attached documents contain Confidential and Protected Materials Pursuant to PUC Section 583, General Order 66-D, D.21-09-020."

While the estimates for Lanes 8 and 9 were developed using historical data, the estimate for Lane 7 was developed with a vendor high-level budgetary quote.
The estimate for Lane 7, Decanter and Offloading system, was developed with the use of a vendor quote.
Please see attachment DR-02 Q6h Lane 7 Vendor Quote_CONFIDENTIAL.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 6i:

i. Provide the specific line-item costs associated with:

i. The approximate number of feet of pipeline needed for installation.
ii. Construction materials.
iii. Meter Assembly (MSA).
iv. SCADA Panel.
v. Equipment Shelter.

RESPONSE 6i:

Line Item	Cost*	Notes
i. The approximate number of feet pipeline needed for installation	$700k	Total installed cost of approximately 200 Linear Feet of Pipe from Point of Receipt to Tie-In of existing pipeline.
ii. Construction Materials		Construction materials are procured by contractors during construction.
iii, iv and v. Point of Receipt Equipment	$1.361M	
Electrical Shelter	$227k	The Meter Set Assembly (MSA), SCADA panel, and Equipment Shelter are integrated components of the Point of Receipt (POR) and are essential to supporting its operation. The specialty material costs are provided in response to questions iii, iv and v.
Total Flow Computer	$12k	
Analyzer shelter	$262k	
Analyzer Fittings	$23k	
O2 Analyzer	$21k	
Gas Chromatograph	$29k	
YZ odorant skid	$257k	
Filter Separator	$106k	
RTU Panel	$81k	
Magnetic Level Gauge	$41k	
Orifice Plate	$42k	
Control Valves & Cabinet	$155k	

Sampling Bottle	$7k
Gas Analyzer	$75k
Sample Probe	$2k
Pressure Transmitter	$21k

* The material line-item costs are presented with escalation.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 7:

In reference to SoCalGas's General Rate Case (GRC) A.22-05-015, et al., as found in Decision (D). 24-12-074, Table 10.3, Line A at 187. Provide the specific workpapers presented in its GRC as it relates to new construction pipeline capital improvement expenditures. In the response include pipeline sizing, length, and system use, including the differentials of SoCalGas's zero-based forecast and Class 5 estimate.

RESPONSE 7:

Below is the link to SoCalGas' GRC workpapers in relation to new construction pipeline capital improvement expenditures.

SCG-06-CWP-R_Rick_Chiapa_and_Aaron_Bell_and_Steve_Hruby-Gas_Transmission_Operations_and_Construction_49453.pdf

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 8:

In reference to "Cal Advocates-SCG-A2510008-01_Response_to_2-5_8-11.pdf," SoCalGas states that "other than the $19.704 million in cap-and-trade funding, SoCalGas does not plan to utilize any ratepayer funding for the utility-owned and applicant-owned infrastructure."

QUESTION 8a:

How does SoCalGas plan to fund ongoing maintenance and operations associated with the new utility-owned pipelines and/or associated infrastructure?

RESPONSE 8a:

SoCalGas is not proposing to fund ongoing maintenance and operations for Lanes 7-9. Within A.25-10-008, under Attachment A Renewable Gas Interconnection Agreement, Section 9(a) titled "O&M FEES: INVOICING AND PAYMENT TERMS", it states that "Utility shall collect operation and maintenance fees associated with the operation and maintenance of the Utility Facilities necessary to accept Renewable Gas from Interconnector in accordance with Utility's Gas Rules, tariffs, schedules, and ordinary business practices."

QUESTION 8b:

Does SoCalGas plan to fund ongoing maintenance and operations associated with pipelines and/or associated infrastructure owned by West Biofuels?

RESPONSE 8b:

SoCalGas does not plan to fund the ongoing maintenance and operation of assets owned by WBF, as referenced in Attachment B (Page 6, Chapter 3, Section a-iv) of the Application.

QUESTION 9:

Regarding SoCalGas and West Biofuels historical business relationship:

QUESTION 9a:

Has SoCalGas contracted with West Biofuels for biomethane projects prior to the solicitation made in compliance with D.22-02-025? If so, provide a list of the projects, including for each:

- The project name and location;
- The date the contract was signed;
- If the contract is still active; and,
- A brief description of the products and/or services provided.

RESPONSE 9a:

SoCalGas has participated in one project with WBF in which SoCalGas contracted with the Alliance for Sustainable Energy, LLC, a manager and operator of the National Renewable Energy Laboratory (NREL) to fund an RD&D project performed by WBF.

- Project Name: West Biofuels Renewable Gas Separation System and Techno-Economic Assessment
- Location: Woodland, CA
- Contract Execution Date: December 10, 2019
- Contract Status: Not active
- Project Description: WBF was to conduct research demonstrating production and gas-separation technologies capable of converting forest biomass residuals into pipeline-quality renewable gas and value added byproducts.

QUESTION 9b:

Has West Biofuels contacted SoCalGas in response to previous solicitations or on its own initiative? If so, provide a list of project proposals, including for each:

- The project name;
- The date SoCalGas received the proposal; and,
- A brief description of the proposed products and/or services to be provided.

RESPONSE 9b:

Other than the project referenced in the Response to Question 9a, neither SoCalGas nor WBF recalls any instance in which WBF contacted SoCalGas.

SoCalGas also notes that, in responding to this question, it provided this question to the current business unit personnel most likely to have information relevant to this response. SoCalGas's response relies on the memories of individuals and therefore may not capture the information requested in this question.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 10:

In reference to “Cal Advocates-SCG-A2510008-01_Response_to_Q1_and_Q6.pdf” and Cal Advocates-SCG-A2510008-01_Response _ to_Q7.pdf,” roughly $9.966 million might be contributed to fund Lanes 7, 8, and 9. And the estimated cost of infrastructure that will be owned by West Biofuels is $34.97 million. Aside from owners or shareholders of West Biofuels, are there any other third-party sources of financing contributing to the applicant-owned costs of the proposed Woody Biomass Project such as grants, awards, independent investors, etc.? If so, provide a list of each funding source, including organizational and/or individual names, the business relationship arrangement, and total estimated funding amounts to be contributed.

RESPONSE 10:

Currently, only West Biofuels owners and shareholders are confirmed as funding sources for this project. West Biofuels may pursue debt financing for the project, pending the CPUC's decision on the application.

SOUTHERN CALIFORNIA GAS COMPANY (SOCALGAS)
Cal Advocates-SCG-A2510008-002
Woody Biomass Pilot Project application (A.25-10-008)
DATE REQUESTED: February 11, 2026
RESPONSE DUE: February 26, 2026

QUESTION 11:

In reference to "Cal Advocates-SCG-A2510008-01_Response_to_2-5_8-11.pdf," SoCalGas states, "SoCalGas and WBF have not entered into any agreements regarding the vehicles to be used for producing BioSNG or -BioCNG." However, the direct Revised testimony of James Lucas and Dr. Matthew D. Summers at lines 18-23, p. JLMS-8 states, "the Bio-SNG produced will be transported by compressed natural gas-powered trucks (using renewable natural gas) to SoCalGas's interconnection in Visalia, CA."

QUESTION 11a:

Confirm if compressed natural gas-powered trucks using RNG will be used to transport the biomethane produced at the WBF facility to SoCalGas's operating base in the City of Visalia for injection and transport to SoCalGas's pipelines.

RESPONSE 11a:

Yes.

QUESTION 11b:

If compressed natural gas-powered trucks using RNG will not be used to transport the biomethane produced at the WBF facility to SoCalGas's operating base in the City of Visalia, describe in detail, the methodology SoCalGas will utilize to transport and quality measure the syngas produced by the WBF facility.

RESPONSE 11b:

Not applicable.