Application: A.25-10-008
Witness: James Lucas and Dr. Matthew Summers
Chapter: 2
Exhibit: SCG-02R

CORRECTED REVISED PREPARED DIRECT TESTIMONY OF

JAMES LUCAS AND DR. MATTHEW D. SUMMERS

ON BEHALF OF SOUTHERN CALIFORNIA GAS COMPANY

(SELECTION OF PILOT PROJECT)

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

November 21, 2025

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I. PURPOSE

The purpose of my prepared direct testimony on behalf of Southern California Gas Company ("SoCalGas") is to provide the background and describe the process used to select one Senate Bill ("SB") 1440 gasification pilot project ("SB 1440 Pilot Project") that intends to interconnect to a SoCalGas pipeline. My testimony will provide an overview of the: (1) SB 1440 Pilot Project solicitation ("SB 1440 Solicitation"), and (2) SB 1440 Pilot Project's (i) eligibility criteria, (ii) anticipated benefits, (iii) use of Cap-and-Trade funding, and (iv) reporting requirements. My testimony will also discuss the foundational building blocks used to develop the requirements of the SB 1440 Solicitation, the use of an independent third party to assist with the assessment and selection of the SB 1440 Pilot Project, and an overview of the selected SB 1440 Pilot Project. Such overview includes a project description, the estimated ratepayer and environmental benefits, community benefits, and timelines.

The purpose of the SB 1440 Pilot Project is to demonstrate the production of bio-synthetic natural gas ("Bio-SNG")[1] from agricultural waste using gasification and methanation, and its injection into the SoCalGas pipeline system. In its Application to the California Public Utilities Commission ("Commission" or "CPUC"), SoCalGas is proposing one SB 1440 Pilot Project that appears financially sustainable in the long-term. SoCalGas recognizes gasification projects involve nascent technology and will collaborate with the applicant of the selected SB 1440 Pilot Project to support these investments with the goal of providing the expected environmental benefits to ratepayers and California.

[1] D.22-02-025 at 2, n.1 ("'Bio-SNG derives from non-combustion thermal conversion, such as pyrolysis and gasification, of exclusively organic material. The feedstocks generally consist of woody biomass, such as forest waste, agricultural waste, and urban wood waste. Bio-SNG is defined in the R.13-02-008 Phase 4A Staff Proposal as follows: 'A mixture composed primarily of methane, carbon dioxide, and water produced by chemical conversion (catalytic methanation) of purified and conditioned renewable syngas. Also contains low concentrations of carbon monoxide, hydrogen, and other minor constituents.'") For purposes of this Testimony, Bio-SNG, biomethane and renewable natural gas (RNG) are considered the same.

By its Application, SoCalGas proposes a gasification project[2] that will truck the Bio-SNG to an interconnection facility to accept the Bio-SNG to its pipeline system that will, among other things, (1) demonstrate the use of woody biomass to produce Bio-SNG, (2) have the potential to utilize carbon dioxide ("CO_2") in carbon capture, utilization, or storage ("CCUS") projects rather than venting to the atmosphere,[3] (3) utilize up to $19.704 million in Cap-and-Trade funding to support the SB 1440 Pilot Project to connect to the SoCalGas pipeline system, and (4) provide emission reductions to the local community and California.

II. OVERVIEW OF SB 1440 PILOT PROJECT SOLICITATION (WITNESS: JAMES LUCAS)

On December 18, 2017, the Commission issued D.17-12-004 ("SB 1383 Decision")[4] which established the necessary framework to direct SoCalGas and PG&E to implement dairy biomethane pilot projects ("SB 1383 Pilot Projects"). SoCalGas utilized this framework to successfully connect four dairy pilot projects to the SoCalGas pipeline system between 2021 and 2022. Given the Commission-approved framework and process worked very well for the SB 1383 Pilot Projects, SoCalGas is utilizing a similar framework and process for the assessment and selection of at least one SB 1440 Pilot Project.

A. Background - SB 1383 Pilot Projects

On September 19, 2016, Governor Brown signed SB 1383 into law. The bill requires the California Air Resources Board ("CARB") to approve and begin implementing a comprehensive strategy to reduce emissions of short-lived climate pollutants to achieve a reduction in methane by 40%, hydrofluorocarbon gases by 40%, and anthropogenic black carbon by 50% below 2013 levels by 2030. One of the requirements of SB 1383 requires the Commission, in consultation with CARB and the California Department of Food and Agriculture ("CDFA"), to direct utilities to implement no less than five dairy biomethane pilot projects to demonstrate interconnection to

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[2] At the time of this filing, there are no gasification or pyrolysis projects producing Bio-SNG and connected to the SoCalGas pipeline system.

[3] D.22-02-025 at 46.

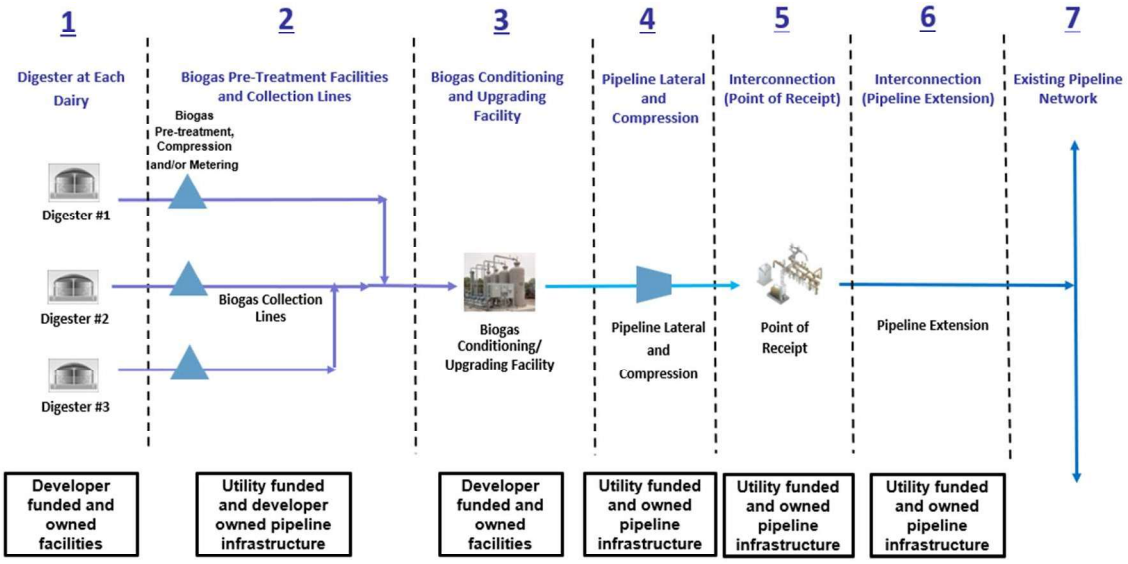
[4] D.17-12-004, Decision Establishing Implementation and Selection Framework to Implement the Dairy Biomethane Pilots Required By Senate Bill 1383 (December 14, 2017), *available at:* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M201/K352/201352373.PDF.

the common carrier pipeline system. SB 1383 also allows the utilities to seek cost recovery of the reasonable cost of pipeline infrastructure developed pursuant to the pilot projects.[5]

The SB 1383 Decision approved the investor-owned utilities ("IOUs") to recover in rates the cost of pipeline infrastructure ("SB 1383 Pipeline Infrastructure") for no less than five statewide SB 1383 Pilot Projects. The SB 1383 Decision defines SB 1383 Pipeline Infrastructure as follows (Figure 1):[6]

- Biogas collection lines and facilities for treatment, monitoring, metering, and compression of biogas before it enters the collection lines (lane 2);
- The pipeline ("Pipeline Lateral") and compression that delivers biomethane from a biogas conditioning facility to the point of receipt (lane 4);
- Point of receipt, where the utility receives gas that has been upgraded at a conditioning facility (lane 5); and
- Pipeline extension that delivers biomethane from point of receipt to the utility's existing gas pipeline system (lane 6).

Figure 1: Dairy Biomethane Pilot Primary Components



The SB 1383 Decision further created a committee comprised of the Commission as the lead agency, in consultation with the CARB and CDFA ("Selection Committee"), charged with

[5] SB 1383 (Lara, 2016), *available at:* https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383.

[6] D.17-12-004, Appendix A (Dairy Biomethane Pilot Implementation Framework) at 1.

issuing the final SB 1383 Dairy Pilot Solicitation ("SB 1383 Solicitation").[7] On March 7, 2018, the Selection Committee issued the SB 1383 Solicitation,[8] and on December 3, 2018, it selected six SB 1383 Pilot Projects.[9]

SoCalGas used the SB 1383 Solicitation as a general guide for preparing the SB 1440 Solicitation, including making modifications based on the different feedstocks used to produce Bio-SNG.

B. SB 1440 Pilot Project Eligibility Criteria

D.24-12-032 states that, consistent with the direction provided in D.22-02-025, if SoCalGas elects to submit a new woody biomass pilot project application by October 15, 2025, the proposal must meet the following criteria:[10]

- May focus on either forest or agricultural waste, as best serves its interests and the interests of its customers;
- Should have its procurement efforts and strategic placement coordinated with local and state authorities, including the Department of Conservation;
- Must include costs for pipeline extensions to the pilot facilities in the project costs;
- Should facilitate future potential extensions for additional projects;
- Should propose methods for using carbon dioxide in carbon capture and storage or use projects rather than venting carbon dioxide to the atmosphere;
- Should test technologies that are capable of extension and have significant potential to increase the renewable natural gas supply in the long term; and

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7 *Id.*, Appendix A at 4.

8 CPUC, *Solicitation for SB 1383 Dairy Pilot Projects*, by Selection Committee (March 7, 2018), *available at:* https://www.cpuc.ca.gov/-/media/cpuc-website/files/uploadedfiles/cpuc_website/content/utilities_and_industries/energy/energy_programs/gas/natural_gas_market/dairypilotssolicitation.pdf.

9 CPUC, Press Release: *CPUC, CARB, and Department of Food and Agriculture Select Dairy Biomethane Projects to Demonstrate Connection to Gas Pipelines* (December 3, 2018), *available at:* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M246/K748/246748640.PDF.

10 D.24-12-032 at 6-7.

- Must 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.

As provided in Section III.B of this testimony, the proposed SB 1440 pilot project meets all of the above requirements.

C. Eligible SB 1440 Pilot Project Costs

1. Background

D.22-02-025 directs California's four large gas IOUs, *i.e.*, SoCalGas, PG&E, SDG&E, and SWG (the "Joint Utilities") to collectively set aside $40 million[11] from their 2022 Cap-and-Trade allocated allowance auction proceeds so that additional funding is available to offset pipeline build-out costs and related expenses associated with the pilot projects.[12] To assist with determining the types of expenses to be eligible to offset pipeline build-out ("SB 1440 Pipeline Infrastructure"), SoCalGas considered two prior Commission-approved programs that utilize ratepayer funding to help off-set biomethane interconnection costs. Those programs are as follows:

Biomethane Monetary Incentive Program

In 2015, the Commission issued D.15-06-029 which, among other things, created a $40 million monetary incentive program for biomethane projects that successfully connect with an IOU-operated gas pipeline. Assembly Bill ("AB") 2313 (Williams, 2016) subsequently required the Commission to increase the program's monetary incentive from $1 million to $3 million for individual biomethane projects and from $3 million to $5 million for dairy cluster biomethane projects.[13]

In D.20-12-031, the Commission acknowledged that the $40 million funding approved in D.15-06-029 was fully subscribed along with a waitlist for an additional $38.5 million worth of

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[11] Of the $40 million, SoCalGas's allocation is $19.704 million.

[12] D.22-02-025 at 47.

[13] A "dairy cluster biomethane project" is defined in Public Utilities Code Section 399.19 as "a biomethane project of three or more dairies in close proximity to one another employing multiple facilities for the capture of biogas that is transported by multiple gathering lines to a centralized processing facility where the biogas is processed to meet the biomethane standards adopted by the commission pursuant to subdivisions (c) and (d) of Section 25421 of the Health and Safety Code and injected into the pipeline of the gas corporation through a single interconnection."

project funding.[14] After weighing the benefit of increased biomethane capture and use against the modest reduction in the California Climate Credit necessary to fully fund all existing biomethane projects, including those on the waitlist, the Commission found it appropriate to provide an additional $40 million in funding from Cap-and-Trade allowance proceeds for the monetary incentive program to fund the biomethane projects currently on the waitlist, bringing total funding to $80 million.[15]

Furthermore, SoCalGas Rule 45 states the monetary incentive is limited to eligible interconnection costs that include:[16]

- Engineering costs (Interconnect Screening, Preliminary Engineering Study, and Detailed Engineering Study costs).
- Costs associated with facilities downstream of the biomethane interconnector's processing plants used for delivering biomethane into the utility or third-party pipeline system.
- Total installed costs of receipt point facilities. These facilities include, but are not limited to meters, regulators, appurtenant facilities, quality measurement, odorization facilities, and auxiliary facilities.
- Facility enhancement costs. These enhancements include, but are not limited to, enhancements to gas pipelines and other related system upgrades that are required to enable continued safe and reliable operation of utility's system due to the addition of each biomethane interconnection.
- For dairy cluster biomethane interconnection, costs incurred for biogas gathering lines to help reduce emissions of short-lived climate pollutants ("SLCP") pursuant to Section 39730 of the Health and Safety Code shall be considered eligible costs.

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[14] D.20-12-031 at 11.

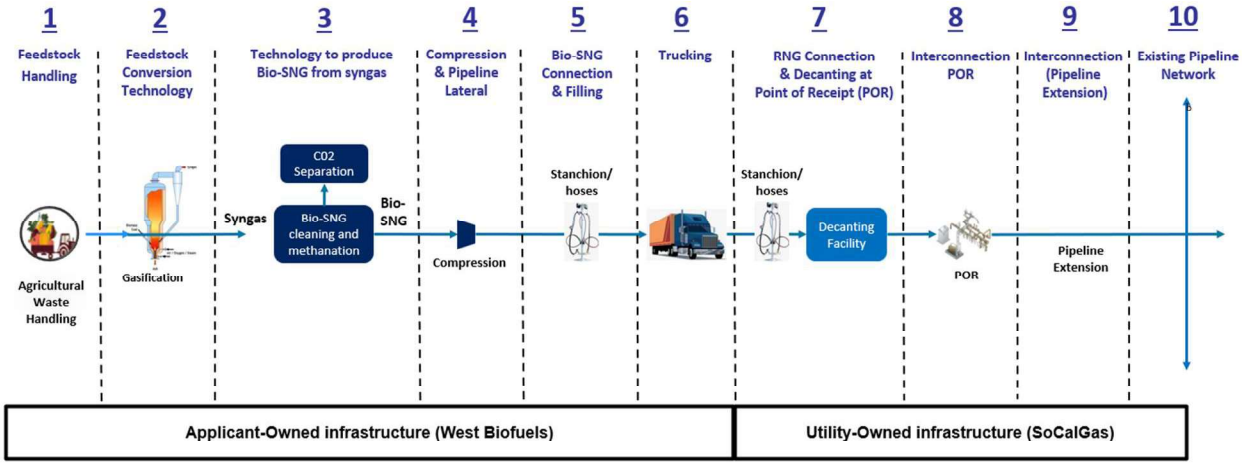
[15] *Id*. at 14-15 (noting, "This is an appropriate use of gas utility Cap-and-Trade allowance proceeds since every unit of biomethane injected into gas utility pipelines displaces a unit of fossil fuel that would otherwise disperse GHG emissions into the atmosphere").

[16] SoCalGas, Rule No. 45: Standard Renewable Gas Interconnection at Sheet 22, *available at:* https://tariffsprd.socalgas.com/view/tariff/?utilId=SCG&bookId=GAS&tarfKey=600.

2. SB 1440 Pipeline Infrastructure Eligible Costs

A gasification or pyrolysis project consists of stages and components similar to those in a SB 1383 Pilot Project. For example, dairy projects require digester(s) to produce biogas from the manure. The biogas is then cleaned and processed to produce pipeline quality biomethane. For a SB 1440 Pilot Project, gasification or pyrolysis equipment produces syngas from woody biomass. The syngas is then cleaned and methanated to produce pipeline quality Bio-SNG. Figure 2 illustrates and defines the high-level components of the proposed SB 1440 Pilot Project to produce Bio-SNG and connect to a utility pipeline.

Figure 2: Proposed Woody Biomass Pilot Primary Components



After consideration of the existing Commission programs which provide ratepayer funding to offset the cost of biomethane interconnections, SoCalGas proposes the following facilities be considered eligible costs for the SB 1440 Pilot Project:

SB 1440 Utility-Owned Pipeline Infrastructure

- Stanchions/hoses and decanter facility owned and operated by SoCalGas (lane 7 of Figure 2), where Bio-SNG will be trucked from a project site.
- Point-of-receipt owned and operated by SoCalGas, where SoCalGas receives gas that has been upgraded at a syngas cleaning and methanation Facility (lane 8 of Figure 2).
- Pipeline extension owned and operated by SoCalGas that delivers biomethane to the SoCalGas existing gas pipeline system (lane 9 of Figure 2).

SB 1440 Applicant-Owned Pipeline Infrastructure

- If there is Cap-and-Trade program funding remaining after funding lanes 7, 8, and 9, SoCalGas is proposing to use Cap-and-Trade program funding to offset selected SB 1440 Pilot Project costs in lane 4 of Figure 2. Taking this approach mirrors existing Commission policy, as lane 4 infrastructure components are eligible costs under the biomethane monetary incentive program and the SB 1383 Pilot Projects.
    - All lane 4 infrastructure components will be owned and operated by the Applicant, with SoCalGas reimbursing the Applicant for eligible costs.[17]

III. OVERVIEW OF SELECTED SB 1440 PILOT PROJECT

A. Overview (Witness: James Lucas)

SoCalGas selected West Biofuels LLC ("WBF"), the sole Applicant whose proposal met the requirements under D.22-02-025 and D.24-12-032, to build, own, and operate a gasification facility ("WBF Facility") in Kerman, California, that will convert agricultural waste biomass into biomethane. The Bio-SNG will then be trucked to SoCalGas's decanter and pipeline point of receipt facility where the biomethane will then be injected into the SoCalGas pipeline and can be used or sold for a variety of potential end uses, *e.g.*, vehicle fuel, utility biomethane procurement, etc.

The WBF Facility plans to process up to 80 bone dry tons ("BDT") per day of agricultural waste biomass into approximately 750 MMBTU per day of biomethane. The WBF Facility will be co-located adjacent to the Central California Almond Growers Association ("CCAGA") almond processing facility and the Bio-SNG produced will be transported by compressed natural gas powered trucks (using renewable natural gas) to SoCalGas's interconnection in Visalia, CA.

SoCalGas proposes to site the new interconnection facility on a company-owned parcel located directly across from its operating base in the City of Visalia. This parcel previously functioned as a compressed natural gas ("CNG") refueling station until the early 2000s. There is a high-pressure pipeline across the street from the former CNG station parcel which will minimize the pipeline extension costs (lane 9).

[17] SoCalGas will utilize the same process and procedure used to reimburse SB 1383 Pilot Project lane 2 costs.

B. The Proposed SB 1440 Woody Biomass Pilot Project Meets the Project Eligibility Criteria (Witness: James Lucas)

In accordance with the guidance outlined in D.22-02-025, D.24-12-032 specifies that if SoCalGas chooses to submit a new woody biomass pilot project application by October 15, 2025, the proposal must satisfy specific criteria. The following demonstrates how the SB 1440 Pilot Project has fulfilled each of these requirements. [18]

Criteria: May focus on either forest or agricultural waste, as best serves its interests and the interests of its customers

The proposed WBF Facility meets this criterion by sourcing woody biomass from agricultural feedstock. The feedstock is primarily almond residual biomass, which includes orchard removals, shells, and sticks generated within the California central valley.

Criteria: Should have its procurement efforts and strategic placement coordinated with local and state authorities, including the Department of Conservation

SoCalGas meets this criterion through its engagement with various local and state authorities, including the Department of Conservation, regarding the proposed SB 1440 Woody Biomass Pilot Project.

- On April 1, 2025 and September 18, 2025, SoCalGas discussed with the Department of Conservation ("DOC") if SB 155 and the SB 1440 Pilot Projects could be strategically placed to qualify under both pilot projects.
- On September 5, 2025, SoCalGas met with the Commission's Energy Division to discuss the Application requirements and potential SB 1440 Pilot Project.
- On September 16, 2025, SoCalGas met with the City of Visalia to discuss the proposed project and the use of SoCalGas's former CNG station parcel in the City of Visalia.

Criteria: Must include costs for pipeline extensions to the pilot facilities in the project costs

SoCalGas satisfies this criterion by including the cost of the pipeline extension (lane 9) within the overall project budget, which is covered under the $19.7 million in Cap-and-Trade

[18] D.24-12-032 at 6-7.

funding. Also, the cost of the utility owned infrastructure in lanes 7 and 8 (Figure 2) is also included under the $19.7 million in Cap-and-Trade funding.

Criteria: Should facilitate future potential extensions for additional projects

SoCalGas's proposal meets this criterion by including an interconnection facility designed to potentially transition into an open access/virtual pipeline, thereby enabling connectivity for other RNG producers in the area. According to WBF, there are many other potential feedstock suppliers which could be contracted with in the future to truck additional Bio-SNG to the interconnection facility. There are other farms which have already contacted WBF about building similar Bio-SNG facilities at their locations to utilize their waste biomass.

Also, if the interconnection facility is later converted into an open-access/virtual pipeline, additional nearby feedstock sources – such as landfill and wastewater treatment facilities – could decide to produce RNG. Furthermore, the development of new facilities will be necessary to manage the organic waste diverted from landfills in compliance with SB 1383, creating further opportunities for RNG production and infrastructure expansion.

Criteria: Should propose methods for using carbon dioxide in carbon capture and storage or use projects rather than venting carbon dioxide to the atmosphere

The WBF Facility satisfies this criterion by incorporating carbon dioxide removal (CDR) technologies into its proposal, enabling the capture of carbon dioxide emissions rather than releasing them into the atmosphere (see Section III.C for additional detail).

Criteria: Should test technologies that are capable of extension and have significant potential to increase the renewable natural gas supply in the long term

The WBF Facility meets this criterion by offering the potential to scale beyond its initial 15 MW capacity. While traditional fossil fuel-based methanation facilities have operated at scales up to 1,500 MW, biomass-based systems[19]—once successfully demonstrated at the WBF Facility—can also be expanded. Although reaching such large-scale capacity may not be practical for biomass, increasing the size beyond 15 MW could enhance process economics

[19] U.S. Department of Energy (DOE), *Final Environmental impact Statement – Great Plain Gasification Project – Mercer Count, North Dakota* (August 1980), *available at:* https://www.energy.gov/sites/prod/files/2014/12/f19/EIS-0072-FEIS-volume1.pdf (125 million cubic ft/day of natural gas calculated to 1,500MW).

through scale efficiencies. WBF estimates that future biomass collection systems in California could support facilities up to 100 MW, indicating significant room for growth.

Criteria: Must 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

SoCalGas and WBF meet this criterion by committing to thorough emissions documentation and reporting for the SB 1440 Pilot Project (see Section IV for additional detail).

C. WBF Technology Overview (Witness: Dr. Matthew Summers)

The WBF Facility will utilize a Fast Internally Circulating Fluidized Bed ("FICFB") gasifier technology, a gasification system that produces versatile high-hydrogen syngas ideal for catalytic conversion to Bio-SNG. The following provides a description of the primary equipment used to produce Bio-SNG from woody biomass.

Gasification Facility

The FICFB gasifier is a dual fluidized bed gasification system using synthetic bed material to transfer heat from the combustion zone to the gasification zone. Biomass is fed into the gasification zone via a screw auger where it is thermochemically converted to raw syngas through contact with the hot fluidized bed material and steam. The bed material and the remaining char are transported to the combustion side by gravity where air is injected and the char is combusted to heat the bed material. The hot bed material is lifted up the riser with the combustion flue gases into a cyclone where the bed material and flue gases are separated. The re-heated bed material is reintroduced into the fluidized bed gasification chamber while the flue gases continue through the flue gas treatment system. The raw syngas, extracted on the gasification side, is conditioned to remove impurities before becoming available for methanation.

Syngas Cleaning Facility

Syngas is generally a mixture of hydrogen, carbon monoxide, CO_2, nitrogen, methane, water vapor, and trace compounds, including other light hydrocarbons. While syngas is a combustible gas suitable for some end-use energy applications, it can also be purified and upgraded for use in various synthesis processes, including the production of biomethane.

The syngas formed in the gasifier is first cooled in the syngas cooler and then cleaned of bulk contaminants. A filter removes char particles that may have been transported along with the syngas. The filter is operated at an elevated temperature and periodically backflushed to remove

solids. The second stage is a structured media scrubber with a Rapeseed Methyl Ester ("RME") liquid, an economical solvent also known as Canola oil biodiesel, to remove tars, water, and other condensates from the syngas operated. Another scrubbing column is then run at a lower temperature (operated with RME solution) to further reduce the water and light hydrocarbon content to acceptable levels for fuel synthesis operations. The clean gas is then compressed and heated before being sent through a final conditioning process. This adsorption process removes sulfur compounds from the syngas to protect the methanation catalyst from deactivation.

Methanation Facility

Conversion of the syngas into Bio-SNG is accomplished through a catalytic methanation process. After the reaction, water and small impurities of unreacted hydrogen and carbon monoxide will be removed to purify the Bio-SNG stream for pipeline injection. The Bio-SNG product is purified to meet the SoCalGas pipeline quality specifications. The Bio-SNG product is compressed for filling to the Bio-SNG tube trailer. Recovered impurity gases from the process are recycled back to the methanation unit for further conversion to Bio-SNG product. The methanation unit would include gas monitoring system to ensure that Bio-SNG produced will meet SoCalGas's Rule 30 and 45 gas quality specifications prior to trucking the Bio-SNG to the interconnection facility.

Carbon Capture Facility

For the WBF Facility, CO2 is collected from both the gasification and the methanation sections of the process using established CDR technologies. The flue gas from the regenerator section of the gasifier is partially recycled, and the unrecycled fraction is purified using adsorbent and membrane technologies to remove nitrogen, water and other condensable compounds, sulfur containing compounds, and inert gases, to yield a purified CO2 stream meeting the quality standards for sequestration. CO2 selective membranes and adsorbent technologies are commercially available from multiple suppliers.

In addition, the product gas from the methanation reactor uses another established membrane system to yield a purified Bio-SNG stream and a rejected CO2 stream. The project will rely on a commercially available membrane technology which allows efficient selective separation processes to concentrate the methane while residual gases are routed back to the reactor and CO2 is concentrated to the desired levels for sequestration. In addition to the gas streams, there is also solid ash which will result from the biomass gasification process. The ash

ranges from 2-4% of the biomass and is generated from the non-organic parts of the biomass. This material can be utilized as a soil amendment or in cement production.

These CDR systems are not required for operating the plant, as they are simply extra process steps to improve the overall carbon intensity of the produced Bio-SNG. The gasification, cleaning, and methanation steps can still operate without the carbon capture steps. Continuously capturing CO2 for long term onsite storage will not be practical so implementation of CDR will be dependent on having an offtake partner for carbon dioxide.

D. Permitting (Witness: Dr. Matthew Summers)

While the permitting process for this project has not yet begun, WBF is well-versed in permitting similar-scale biomass power plant projects, having successfully completed several in California. WBF estimates that it will take 8 to 12 months to obtain all required permits after submitting finalized facility drawings and a detailed description of planned operations with an application for a Conditional Use Permit with Fresno County.

The expected permits and associated environmental review for the WBF Facility include:

- Conditional Use Permit from Fresno County
- Applicable Air Quality Permit(s) from the San Joaquin Air Pollution Control District
- Building Permit from Fresno County
- Applicable CEQA review initiated by Fresno County

E. Benefits (Witness: Dr. Matthew Summers)

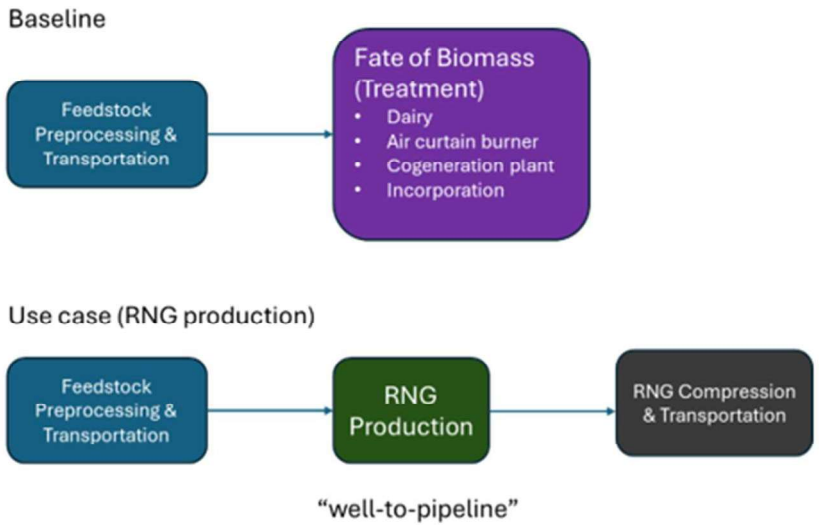
1. Ratepayer and Environmental Benefits

Ratepayers will benefit from the SB 1440 Pilot Project because the WBF Facility is expected to provide emission reductions compared to typical biomass disposal practices from the almond industry (without the SB 1440 Pilot Project). The National Renewable Energy Laboratory analyzed the project-specific GHG and criteria pollutant emissions using the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation ("GREET") model originally developed by Argonne National Laboratory ("ANL") and used by the California Air Resources Board ("CARB") and others to quantify and compare the emissions of fuel production pathways (see Attachment 1). Specifically, CARB has developed its own adaptation called CA-GREET, which is based on ANL's GREET model. 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.

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 baseline emissions are then compared to the Bio-SNG production use case, which is illustrated in Figure 3.

Figure 3: Comparison of Baseline Emissions to Bio-SNG Production



The baseline disposal practices for each type of biomass to be used at the WBF Facility are shown below (Table 1) along with their corresponding emissions. Almond shells, which make up approximately 20% of the feedstock, are normally delivered to dairies as feed and bedding. Of the stick piles generated from the sorting and hulling process, which accounts for approximately 10% of the total feedstock to the pilot facility, approximately half are disposed of at biomass power facilities and half are burned in air curtain incinerators ("ACI"). Of the orchard removals (older low yielding trees), which are approximately 70% of the facility feedstock, about 90% are incorporated into the soil and 10% are disposed of at biomass power facilities. Incorporation, sometimes referred to as "whole orchard recycling," is not always feasible because some fields require removal of the dead wood to prevent the transfer of disease to new plantings. The almond industry and CCAGA expect the need for off-site removal of this biomass will continue to increase with time. The WBF Facility will provide a beneficial outlet for this removed material, offsetting less desirable forms of disposal, such as air curtain burning. Table 1 shows the baseline CI's expressed in grams of carbon dioxide equivalent per potential megajoule

of Bio-SNG production (gCO2e/MJ) for each of the current disposal alternatives for the biomass. The criteria pollutant emissions associated with the disposal methods are expressed in milligrams per potential megajoule of Bio-SNG production (mg/MJ). Criteria pollutants include oxides of nitrogen ("Nox"), particulate matter less than 10 microns ("PM10"), volatile organic compounds ("VOC"), carbon monoxide ("CO"), and sulfur oxides ("Sox").

Table 1

Baseline Carbon Intensity and Criteria Pollutant Emissions

Biomass type	**%**	**Base case disposal method**	**Qty**	**CI**	**NOx**	**PM 10**	**VOC**	**CO**	**SOx**
			kg/hr	gCO2e /MJ	mg/MJ				
Almond shells	20%	100% dairy bedding	608	16.5	0.87	0.06	0.09	0.64	0.01
Sticks	10%	50% air curtain inc.	152	6.8	3.95	18.01	0.98	16.26	1.14
		50% biomass plant	152	8.2	5.07	0.12	0.07	0.90	9.32
Orchard removal	70%	90% incorporation	1914	100.9	2.73	0.18	0.29	2.00	0.04
		10% biomass plant	213	11.5	7.08	0.17	0.10	1.25	13.00
Total	100%		3038	143.9	19.69	18.55	1.53	21.05	23.53

For the use case of processing the biomass to Bio-SNG on a "well-to-pipeline" basis, the emissions include the feedstock logistics (feedstock gathering, chipping/grinding, loading, truck transport), Bio-SNG plant electricity (electric grid power), the Bio-SNG plant direct emissions, and Bio-SNG compression and transportation to the point of injection into the pipeline. Two use cases were analyzed: (1) Bio-SNG production, and (2) Bio-SNG production with carbon capture and storage (CCS). While the CCS requires energy, it captures about 80% or more of the plant CO2 emissions. Table 2 below shows the results of the two use case scenarios for Bio-SNG production.

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

In comparing the base case to the Bio-SNG production cases, there is an overall reduction in CO2e emissions (carbon intensity) for both cases on a well-to-pipeline basis. The 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. In addition, the overall emissions are expected to decline steadily over time as California's electric grid continues to transition toward more decarbonized, renewable energy sources.

The CI of the Bio-SNG can be compared with other transportation fuels. It can be compared with fossil CNG and other "well-to-wheel" ("WTW") fuel pathways. The WTW analysis expands the well-to-pipeline analysis to include the GHG emissions from the vehicle operation. Because fossil CNG is the chemical equivalent of Bio-CNG, vehicle emissions are the equivalent. However, in the case of Bio-CNG, these emissions are offset by the biogenic content

of the Bio-CNG. In addition, this analysis also credits the avoided emissions from the "business as usual" disposal fate of the biomass from the baseline case (aka counterfactual credit).

With these pathway factors considered, the GREET analysis shows the Bio-SNG facility can make Bio-CNG that has a negative CI of -18.9 gCO2e/MJ and -104 gCO2e/MJ for Bio-CNG and Bio-CNG with CCS respectively (Table 3). Producing and utilizing the Bio-CNG fuel from this project will be a net carbon sink over its lifecycle. This compares very favorably to average lower sulfur diesel and North American Compressed Natural Gas ("NA-CNG"), which both have a positive CI of +90.54 gCO2e/MJ and +70.12 gCO2e/MJ respectively from the 2024 R&D GREET model.[20] WBF has plans to utilize this GREET analysis to apply for a Low Carbon Fuel Standard ("LCFS") fuel pathway with CARB to certify the Bio-SNG/Bio-CNG carbon intensity.

Table 3: WTW Carbon Intensity for Bio-CNG

	CI LS-Diesel	**CI NA-CNG**	**CI Bio- CNG**	**CI Bio-CNG with CCS**
	Units in gCO2e /MJ			
Feedstock	7.31	11.3	1.6	1.6
Fuel production	7.57	2.7	122.3	36.5
Vehicle operation	75.66	56.1	56.1	56.1
Biogenic CO2 (VO)	0	0	-55.0	-55.0
Avoided emissions	0	0	-143.9	-143.9
WTW (gCO2e /MJ)	**90.54**	**70.12**	**-18.9**	**-104.7**

2. Community Benefits

In addition to the emission reductions, WBF plans to support the local community through inclusive community engagement, workforce development, and environmental stewardship. The project will offer opportunities to small and diverse businesses by collaborating with community and labor stakeholders, creating clean energy job opportunities, and encouraging participation from disadvantaged communities. Examples of anticipated community benefits include job creation in Fresno County, partnerships with local organizations, educational outreach, and the responsible use of agricultural waste to reduce pollution. Building on WBF's

[20] Argonne National Laboratory, *R&D GREET 2024 Rev1 Release* (May 23, 2025), *available at:* https://greet.anl.gov/.

long-standing presence in California since 2007, the project will foster sustainable development and accessible knowledge sharing to ensure broad and lasting community impact.

F. Timeline (Witness: James Lucas)

The WBF Facility plans to initiate the project after Commission approval of this application and will take between two and three years to complete, which includes design, permitting, equipment procurement, and construction. The start date is contingent on a variety of factors (*e.g.*, permitting, contract execution, etc.). SoCalGas will work closely with the WBF project team to develop the schedule for the design, procurement, construction, and commissioning of SB 1440 Utility-Owned Pipeline Infrastructure. SoCalGas estimates it will take approximately 18 to 24 months from the start of the detailed engineering study to commission the SB 1440 Utility-Owned Pipeline Infrastructure, which will be done concurrently with the buildout of the WBF Facility.

G. SB 1440 Pipeline Infrastructure Costs (Witness: James Lucas)

SoCalGas will utilize the Cap-and-Trade program funding for lanes 7-9. If there are funds remaining, SoCalGas is initially proposing to use Cap-and-Trade program funding to offset selected SB 1440 Pilot Project costs in lane 4 of Figure 2. Taking this approach follows existing Commission policy because lane 4 infrastructure components are eligible costs under the biomethane monetary incentive program and the SB 1383 Pilot Projects.[21]

If there is Cap-and-Trade program funding remaining after funding the previously mentioned infrastructure (lanes 4, 7, 8, and 9), SoCalGas proposes to utilize the remaining funding to support the costs for WBF's Bio-SNG connection and filling facilities (lane 5) and methanation and CDR facilities (lane 3). For any funding made available to WBF, SoCalGas intends to follow the invoicing and payment procedures for eligible costs as outlined in Schedule C of the SB 1440 Gasification/Pyrolysis Pilot Project Funding Agreement.

Pursuant to Ordering Paragraph (OP) 46 of D.22-02-025, $19.704 million of Cap-and-Trade allowance proceeds were set aside to fund the SB 1440 Pilot Project costs. The $19.704 million in funds plus $3.018 million of interest recorded as of August 2025 reside in the Biomass Project Fund Subaccount within the Green House Gas Balancing Account ("GHGBA"). Pursuant

[21] Specifically, D.20-12-031 authorized the use of $40 million in Cap-and-Trade funds to further fund the biomethane incentive program. D.20-12-031 at 28 (OP 3).

to OP 3 of D.24-12-032, SoCalGas will refund to ratepayers the amount accrued through October 15th, 2025 in rates effective January 1, 2026. Additionally, SoCalGas proposes to return to ratepayers any additional interest that accrues on the $19.704 million of funds through the next available annual regulatory account update advice letter filing after a final decision on the Application. Pursuant to OP 48 of D.22-02-025, any unspent Cap-and-Trade allowance proceeds shall be returned to ratepayers in the California Climate Credit by December 31, 2032 pursuant to Cap-and-Trade Regulation Section 95893 (d)(8). There is no anticipated revenue requirement that is being proposed for recovery from ratepayers associated with the Utility-Owned Pipeline Infrastructure presented herein.

H. SB 1440 Pilot Project Agreements (Witness: James Lucas)

There are three SB 1440 Pilot Project agreements to be executed by SoCalGas and WBF pertaining to pipeline interconnection, and the reimbursement of SB 1440 Applicant-Owned Pipeline Infrastructure. WBF will have 120 calendar days from a Commission decision approving the Application and SB 1440 Pilot Project to execute the relevant agreements. The three agreements are as follows:

1) Renewable Gas Interconnection Agreement ("RGIA"), which is a slightly modified version of SoCalGas's Standard Renewable Gas Interconnection Agreement to account for the Cap-and-Trade allowance proceeds. The RGIA is included as Attachment A of the Application.
2) California Producer Operational Balancing Agreement ("CPOBA").[22]
3) SB 1440 Gasification/Pyrolysis Pilot Project Funding Agreement (*see* Attachment B of the Application).

WBF will be responsible for ensuring its own compliance with all of its obligations arising out of or in connection with Rule 30, Rule 45 and the SB 1440 Pilot Project. More specifically, WBF must enter into all requisite agreements to enable SoCalGas to proceed with full project implementation. Prior to SoCalGas incurring significant costs by the procurement of materials and constructing the facilities in lanes 7-9 in Figure 2, WBF will be required to demonstrate project readiness by providing the required documentation to show compliance with

[22] SoCalGas, California Producer Operational Balancing Agreement – Form 6452, *available at:* https://tariffsprd.socalgas.com/view/tariff/?utilId=SCG&bookId=GAS&tarfKey=416.

each of the requirements set forth in Schedule D of the SB 1440 Gasification/Pyrolysis Pilot Project Funding Agreement. The 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 the Application.

IV. PROGRAM REPORTING (Witness: James Lucas)

Pursuant to D.22-02-025, OP 43, the SB 1440 Pilot Project is required to participate in data reporting and evaluations, which shall be submitted to the Commission, its sister agencies, or SoCalGas upon request. The SB 1440 Pilot Project must also agree to allow these agencies to monitor and evaluate the data. Commercially sensitive data may be submitted to the Commission with a request for limits on disclosure pursuant to D.21-09-020's processes and Commission General Order 66-D's additional requirements. SoCalGas will work with the Commission and/or other state agencies to develop a reporting template for the SB 1440 Pilot Project.

V. CONCLUSION

Biomethane is poised to play an important role in decarbonizing California's economy in the years ahead.[23] Since 2015, the Commission has approved and/or implemented several programs utilizing ratepayer funding to help offset the cost for developers to successfully develop their projects and connect to the utility pipeline. The recent SB 1383 Pilot Projects demonstrate how state agencies, IOUs, and project developers can actively work together to successfully implement projects, achieve significant emission reductions to California, and provide benefits to the local community.

Similar to the SB 1383 Pilot Projects, the WBF Facility proposes to provide emission reduction benefits for ratepayers, the state, and local community, and create approximately 20 full time jobs within the local community. SoCalGas is looking forward to working closely with the Commission and WBF team to connect the first woody biomass project to the SoCalGas pipeline system.

This concludes my prepared direct testimony.

[23] R.13-02-008, Phase 4A Staff Proposal at 55, *available at:* https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M386/K579/386579735.PDF.

VI. QUALIFICATIONS

James Lucas

My name is James Lucas. My business address is 555 West Fifth Street, Los Angeles, in California. I am currently employed by SoCalGas as a Manager, Market Development. Since starting with SoCalGas over 30 years ago, I have held various positions in the areas of Product Development, Project Management, Program Management, Energy Efficiency, Financial Analysis, Pipeline Operations, and Engineering. I hold a Bachelor of Science degree in Mechanical Engineering from the University of California Santa Barbara and a Master of Business Administration from California State University Fullerton. I am a registered Professional Mechanical Engineer in the State of California.

I have previously provided testimony before the Commission.

Dr. Matthew D. Summers

My name is Dr. Matthew D. Summers. My business address is 14958 County Road, Woodland, in California. I am currently the Chief Operating Officer of West Biofuels, LLC. I am in charge of all day-to-day operations of a technology company developing commercial biomass gasification systems for North America. Part of my responsibilities include supervising staff and contractors and all aspects of technology development at West Biofuels including developing technical partnerships in the US and Europe to bring biomass conversion technologies to the marketplace. I also managed the planning, engineering, and construction of Woodland Biomass Research Center that includes the construction of a 1-MW thermal biomass-to-energy system that was built to demonstrate advanced fluidized-bed conversion process from Austria. I am also responsible for managing the development and construction of several commercial biomass powerplant facilities.

I have many years of experience as a technical consultant on the engineering, economic and environmental performance of biomass-to-energy technologies. I have earned a Ph. D. in Biological and Agricultural Engineering from University of California, Davis and hold a M. S. in Mechanical Engineering from Stanford University. I am a California Professional Engineer and General Engineering Contractor.

I have not previously provided testimony before the Commission.

ATTACHMENT 1

Memorandum

Date: 11/20/2025

From: Eric C. D. Tan, Ph.D., LCACP, AIChE Fellow Eric Tan
Senior Research Engineer
National Renewable Energy Laboratory (NREL)
15013 Denver West Parkway
Golden, CO 80401

To: Matthew D. Summers, Ph.D, P.E.
Chief Operating Officer
West Biofuels, LLC
14958 County Road 100B
Woodland, CA 95776

RE: GREET Analysis for Bio-SNG project at CCAGA facility

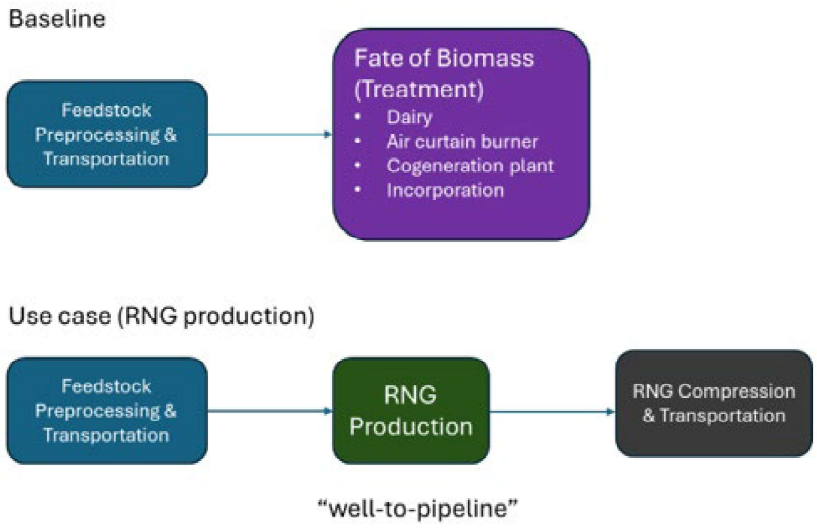
At the request of West Biofuels (WBF), the project-specific greenhouse gas and criteria pollutant emissions were analyzed for the proposed Bio-SNG project at the Central California Almond Growers Association (CCAGA) facility located at 8325 S Madera Ave, Kerman, CA 93630. The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET)[1] model was used for the analysis. GREET was originally developed by Argonne National Laboratory (ANL) and used by the California Air Resources Board (CARB) and others to quantify and compare the life-cycle emissions of fuel production pathways. Specifically, CARB has developed its own adaptation called CA-GREET[2], which is based on ANL's GREET model. 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 (Figure 1). 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.

[1] Greenhouse gases, Regulated Emissions, and Energy use in Technologies Model ® (2024 Excel) Available: https://doi.org/10.11578/GREET-Excel-2024/dc.20241203.1

[2] CA-GREET4.0 Model and Tier Calculators. Available: LCFS Life Cycle Analysis Models and Documentation | California Air Resources Board

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 baseline emissions are then compared to the Bio-SNG production use case, which is illustrated in Figure 1.

Figure 1: Comparison of Baseline Emissions to Bio-SNG Production



The baseline disposal practices for each type of biomass to be used at the WBF Facility are shown below (Table 1) along with their corresponding emissions. Almond shells, which make up approximately 20% of the feedstock, are normally delivered to dairies as feed and bedding. Of the stick piles generated from the sorting and hulling process, which accounts for approximately 10% of the total feedstock to the pilot facility, approximately half are disposed of at biomass power facilities, and half are burned in air curtain incinerators (ACI). Of the orchard removals (older low-yielding trees), which comprise approximately 70% of the facility’s feedstock, about 90% are incorporated into the soil, and 10% are disposed of at biomass power facilities.

Table 1 shows the baseline CI’s expressed in grams of carbon dioxide equivalent per potential megajoule of Bio-SNG production (gCO2e/MJ) for each of the current disposal alternatives for the biomass. The criteria pollutant emissions associated with the

disposal methods are expressed in milligrams per potential megajoule of Bio-SNG production (mg/MJ). Criteria pollutants include oxides of nitrogen (NOx), particulate matter less than 10 microns (PM10), volatile organic compounds (VOC), carbon monoxide (CO), and sulfur oxides (SOx).

Table 1
Baseline Carbon Intensity and Criteria Pollutant Emissions

Biomass type	**%**	**Base case disposal method**	**Qty**	**CI**	**NOx**	**PM 10**	**VOC**	**CO**	**SOx**
			kg/hr	gCO2e /MJ	mg/MJ				
Almond shells	20%	100% dairy bedding	608	16.5	0.87	0.06	0.09	0.64	0.01
Sticks	10%	50% air curtain inc.	152	6.8	3.95	18.01	0.98	16.26	1.14
		50% biomass plant	152	8.2	5.07	0.12	0.07	0.90	9.32
Orchard removal	70%	90% incorporation	1914	100.9	2.73	0.18	0.29	2.00	0.04
		10% biomass plant	213	11.5	7.08	0.17	0.10	1.25	13.00
Total	100%		3038	143.9	19.69	18.55	1.53	21.05	23.53

For the use case of processing the biomass to Bio-SNG on a “well-to-pipeline” basis, the emissions include the feedstock logistics (feedstock gathering, chipping/grinding, loading, truck transport), Bio-SNG plant electricity (California electric grid power), the Bio-SNG plant direct emissions, and Bio-SNG compression and transportation to the point of injection into the pipeline. Two use cases were analyzed: (1) Bio-SNG production, and (2) Bio-SNG production with carbon capture and storage (CCS). While the CCS requires energy, it captures about 80% or more of the plant’s CO2 emissions. Table 2 shows the results of the two use case scenarios for Bio-SNG production.

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

In comparing the base case to the Bio-SNG production cases, there is an overall reduction in CO2e emissions (carbon intensity) for both cases on a well-to-pipeline basis. The 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. In addition, the overall emissions are expected to decline steadily over time as California's electric grid continues to transition toward more decarbonized, renewable energy sources.

The CI of the Bio-SNG can be compared with other transportation fuels. It can be compared with fossil CNG and other "well-to-wheel" (WTW) fuel pathways. The WTW analysis expands the well-to-pipeline analysis to include the GHG emissions from the vehicle operation. Because fossil CNG is the chemical equivalent of Bio-CNG, vehicle emissions are equivalent. However, in the case of Bio-CNG, these emissions are offset

by the biogenic content of the Bio-CNG. In addition, this analysis also credits the avoided emissions from the "business as usual" disposal fate of the biomass from the baseline case (aka counterfactual credit).

With these pathway factors considered, the GREET analysis shows the Bio-SNG facility can make Bio-CNG that has a negative CI of -18.9 gCO2e/MJ and -104 gCO2e/MJ for Bio-CNG and Bio-CNG with CCS, respectively (Table 3). Producing and utilizing the Bio-CNG fuel from this project is estimated to be a net carbon sink over its lifecycle with avoided emissions considered. This compares favorably to average lower sulfur diesel and North American Compressed Natural Gas (NA-CNG), which both have a positive CI of +90.54 gCO2e/MJ and +70.12 gCO2e/MJ, respectively, from the 2024 R&D GREET model.[3]

Table 3: WTW Carbon Intensity for Bio-CNG with Counterfactual Credit

	CI LS-Diesel	**CI NA-CNG**	**CI Bio- CNG**	**CI Bio-CNG with CCS**
	Units in gCO2e /MJ			
Feedstock	7.31	11.3	1.6	1.6
Fuel production	7.57	2.7	122.3	36.5
Vehicle operation	75.66	56.1	56.1	56.1
Biogenic CO2 (VO)	0	0	-55.0	-55.0
Avoided emissions	0	0	-143.9	-143.9
WTWc (gCO2e /MJ)	**90.54**	**70.12**	**-18.9**	**-104.7**

Please note that this analysis relied on the best available process and emissions factor data for the baseline and use case scenarios, as well as the latest R&D version of the GREET model. To qualify this fuel pathway with CARB's Low Carbon Fuel Standard or other Federal tax incentives, the analysis will need to be updated to utilize the incentive program specific GREET model and requirements at the time of application.

If you have any questions about this analysis or need further assistance, please don't hesitate to contact me.

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[3] Argonne National Laboratory, *R&D GREET 2024 Rev1 Release* (May 23, 2025), *available at:* https://greet.anl.gov/.