Application: A.25-06-XXX
Exhibit No.:
Witness: Vijai Atavane

PREPARED DIRECT TESTIMONY OF

VIJAI ATAVANE

ON BEHALF OF

SOUTHERN CALIFORNIA GAS COMPANY

(CHAPTER 3 – MARKET ASSESSMENT STUDIES)

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

June 12, 2025

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PREPARED DIRECT TESTIMONY OF
VIJAI ATAVANE
(MARKET ASSESSMENT STUDIES)

I. PURPOSE AND OVERVIEW OF TESTIMONY

The purpose of my direct testimony on behalf of Southern California Gas Company (SoCalGas) is to demonstrate the prudent and reasonable execution of SoCalGas's Angeles Link Phase 1 Market Assessment Studies. In Application (A.) 22-02-007 (ALMA Application), SoCalGas requested authorization to track costs associated with Angeles Link, including stakeholder engagement, coordination with statewide hydrogen initiatives, and feasibility studies to develop a first-of-its-kind hydrogen pipeline transport system to deliver clean renewable hydrogen to end users across Central and Southern California, including into the Los Angeles Basin.[1] On December 15, 2022, the California Public Utilities Commission (Commission) issued Decision (D.) 22-12-055 (Phase 1 Decision), approving establishment of the Angeles Link Memorandum Account (ALMA) and authorizing SoCalGas to record costs associated with Phase 1 activities.[2] In authorizing the ALMA, the Commission concluded that "the public interest is served if SoCalGas studies whether Angeles Link is feasible, cost-effective, and viable"[3] and that "it serves the public interest for SoCalGas to perform feasibility studies of the Project immediately."[4]

In Phase 1, SoCalGas conducted over a dozen studies and produced an Environmental and Social Justice Community Engagement Plan (ESJ Plan)[5] and a Framework for Affordability Considerations (Affordability Framework) (collectively, the Phase 1 Studies).[6] The Phase 1 Studies examined Angeles Link's viability, feasibility, cost effectiveness, and potential public

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1 *See* A.22-02-007, Application of Southern California Gas Company for Authority to Establish a Memorandum Account for the Angeles Link Project (February 17, 2022), *available at:* https://www.socalgas.com/sites/default/files/A22-02-SOCALGAS-Angeles_Link_Memorandum_Account_Application.pdf

2 Phase 1 Decision at 73 (Ordering Paragraph (OP) 1).

3 *Id.* at 68 (Conclusion of Law (COL) 4).

4 *Id.* at 16, 61-62 (Findings of Fact (FOF) 1, 3, 6, 7).

5 *See* Chapter 2 (Direct Testimony of Frank Lopez) for additional details.

6 *See* Chapter 1 (Direct Testimony of Shirley Arazi and Amy Kitson) for additional details.

interest benefits to ratepayers and the broader community.[7] These activities were planned and executed in a manner that considered affordability and safety, integrated stakeholder input, and complied with the Phase 1 Decision.

My testimony describes the activities associated with the Market Assessment Studies conducted during Phase 1 to assess Angeles Link's viability. The costs associated with the Market Assessment Studies collectively amount to approximately $9 million in operating and maintenance (O&M) expenditures and support the $24.3 million recorded to the ALMA.[8] The Market Assessment Studies include:

- Demand Study (Demand Study)
- Production Planning & Assessment (Production Study)
- Project Options and Alternatives (Alternatives Study)
- High-level Economic Analysis and Cost Effectiveness (Cost-Effectiveness Study)

My testimony provides the description and cost components for each of the Market Assessment Studies, explains how the Market Assessment Studies were executed in compliance and accordance with the Phase 1 Decision,[9] and demonstrates how the studies were prudently managed to control costs and achieve the deliverables outlined in the Phase 1 Decision while engaging with key stakeholders throughout the process.

As demonstrated in my testimony and workpapers, these costs were prudently and reasonably incurred, and the associated revenue requirement is justified for rate recovery. To facilitate the review process and for ease of reference, additional information regarding the

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[7] In compliance with the Phase 1 Decision, SoCalGas made reports of the results and data of the Phase 1 Studies available to the public. The Decision recognized that sharing this information "should be beneficial to the development of the clean renewable hydrogen industry and thus serve the public interest." (Phase 1 Decision at 62). The Phase 1 reports are available at: https://www.socalgas.com/regulatory/angeleslink.

[8] Expenditures for these activities were incurred from January 2023 through December 2024, with some discrete trailing charges in 2025. *See* Chapter 6 (Direct Testimony of Jenny Chhuor and Michael W. Foster) for details on the ALMA balance and associated revenue requirement requested for rate recovery in this Application.

[9] *See* Phase 1 Decision at 73-77 (OP 3(a), 3(c), 3(e), 3(h), 5(a), 5(c)-(d), 5(e), 7). The studies were scoped and conducted in compliance with the Phase 1 Decision in its entirety, which includes broader requirements than those required for cost recovery, including OP 6(a), 6(b), 6(c), 6(d), and 6(j) (*id.* at 75-77). Phase 1 Decision OP 6 requirements to advance to Phase 2 are being addressed in A.24-12-011.

Market Assessment Studies is included in my supporting workpapers. The information in this testimony provides a summary of the activities and associated costs.

II. COST COMPONENTS FOR MARKET ASSESSMENT STUDIES

Table 1 below provides a summary of the fully loaded costs incurred by SoCalGas to support the Market Assessment Studies, totaling approximately $9 million. A combination of internal and external resources were utilized to effectively complete these activities. Direct costs reflect labor and non-labor costs. Labor costs include SoCalGas personnel who managed Phase 1 activities. Non-labor costs include third-party contractor costs incurred in the process of the development of the studies, as well as other miscellaneous costs.[10] Indirect costs reflect costs for overhead loaders.[11] As described in Chapter 6 (Direct Testimony of Jenny Chhuor and Michael W. Foster), the total ALMA balance of $24.3 million is the basis for the requested revenue requirement for cost recovery.

Table 1: Chapter 3 Total Costs (in millions)

Market Assessment Studies				
Study	**Labor**	**Non-Labor**	**Overheads**	**Total Loaded Costs**
Demand Study	$0.4	$2.4	$0.4	$3.2
Production Study	$0.2	$1.7	$0.2	$2.1
Alternatives Study	$0.2	$1.2	$0.2	$1.6
Cost-Effectiveness Study	$0.2	$1.7	$0.2	$2.1
Total Costs	**$1.0**	**$7.0**	**$1.0**	**$9.0**

III. COMPLIANCE WITH PHASE 1 DECISION AND DESCRIPTION OF MARKET ASSESSMENT STUDIES

In the Phase 1 Decision, the Commission provided that SoCalGas may seek recovery of Phase 1 costs if it satisfies conditions set forth in OP 3 and demonstrates how the recorded costs

[10] *See* Chapter 1 (Direct Testimony of Shirley Arazi and Amy Kitson) for additional details.

[11] *See* Chapter 6 (Direct Testimony of Jenny Chhuor and Michael W. Foster) for additional details on the ALMA balance.

and activities meet the project-specific standards identified in OP 5. The Market Assessment Studies demonstrate compliance with the following requirements in OP 3 and OP 5:

- 3(a): Feasibility studies for the Angeles Link Project shall be restricted to the service of clean renewable hydrogen that is produced with a carbon intensity equal to or less than four kilograms of carbon dioxide-equivalent produced on a lifecycle basis per kilogram and does not use any fossil fuel in its production process.
- 3(c): SoCalGas shall study a localized hydrogen hub solution, under the specifications required to be eligible for federal funding provided through the Infrastructure Investment and Jobs Act, as part of Phase One.
- 3(e): SoCalGas shall conduct quarterly stakeholder engagement meetings, including quarterly meetings with Planning Advisory Group members. SoCalGas shall also identify and invite participation from community-based organizations that may potentially be impacted by the Project, including disadvantage communities and environmental social justice groups, in either the quarterly Planning Advisory Group meetings or some other stakeholder engagement process.
- 3(h): SoCalGas shall submit to the Commission's Deputy Executive Director for Energy and Climate Policy quarterly reports to provide an update of the Angeles Link Project and the feasibility studies, and to report on any preliminary results and findings. The reports shall not include any redacted data or finding unless SoCalGas is granted confidentiality of the data in accordance with General Order 66-D. The reports shall be made available to the public. SoCalGas shall solicit feedback from parties and the Planning Advisory Group members and include this feedback in the reports. SoCalGas shall serve these reports on the service list of this proceeding.
- 5(a): How did the planning process address affordability concerns in the development of the Project?
- 5(c): How did the planning process consider California environmental law and public policies in the development of the Project?
- 5(d): How did the planning process gather and address stakeholder concerns?

- 5(e): How did the planning process consider and evaluate Project alternatives, including a localized hydrogen hub or other decarbonization options such as electrification, their costs, and their environmental impacts?

The description of each study and how it complies with the Phase 1 Decision are provided below in Section III A. through D. Moreover, the Market Assessment Studies considered clean renewable hydrogen as required by OP 3(a) and, in accordance with OP 3(e), 3(h), and 5(d), stakeholder feedback was gathered and incorporated where appropriate in the planning and execution of the studies.

A. Demand Study

In accordance with the Phase 1 Decision,[12] the Demand Study assessed potential hydrogen demand, end-uses, and end-users (including current natural gas customers and future customers) of Angeles Link. This study evaluated potential demand for clean renewable hydrogen across the mobility, power generation, and industrial sectors within SoCalGas's service territory through 2045, and projected various demand trajectories to be served by Angeles Link over time.

B. Production Planning and Assessment

In accordance with the Phase 1 Decision,[13] the Production Study assessed potential third-party sources of clean renewable hydrogen production[14] from renewable sources (such as solar and wind) to serve the projected demand over time. Three primary production areas were identified within SoCalGas's service territory (San Joaquin Valley, Lancaster area, and Blythe area) that could alone, or in some combination, meet the projected Angeles Link throughput range. The Production Study also highlighted specific production methods and assessed land availability.

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[12] Phase 1 Decision 73-75 (OP 3(a), 3(c), 3(e), 3(h), 5(a), 3(c)-(e), 6(a), 6(c)).

[13] *Id.* at 73-77 (OP 3(a), 3(e), 3(h), 5(a), 5(c), 5(d), 6(b), 6(j)).

[14] The Phase 1 Decision restricts the hydrogen transported via Angeles Link to "clean renewable hydrogen that is produced with a carbon intensity equal to or less than four kilograms of carbon dioxide-equivalent produced on a lifecycles basis per kilogram and does not use any fossil fuel in its production processes." (*Id.* at 73 (OP 3(a))).

C. Project Options and Alternatives

In accordance with the Phase 1 Decision [15] the Alternatives Study identified hydrogen delivery alternatives and non-hydrogen delivery alternatives based on the requirements of the Phase 1 Decision, alignment with Angeles Link's purpose and objectives, and for the hydrogen delivery options, geographic alignment with the Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES) vision for clean renewable hydrogen in California. These alternatives (including a localized hydrogen hub in accordance with OP 3(c) and OP 5(e)) were compared for scalability, transport distances across Central and Southern California, and overall cost effectiveness. The Alternatives Study advanced hydrogen delivery alternatives and non-hydrogen delivery alternatives that met the selected criteria to be evaluated for cost effectiveness and potential environmental impacts appropriate at a feasibility stage. Information from the Cost Effectiveness Study and the Environmental Analysis[16] was incorporated into the Alternatives Study.

D. High-Level Economic Analysis and Cost Effectiveness Study

In accordance with the Phase 1 Decision,[17] the Cost Effectiveness Study evaluated alternatives identified in the Alternatives Study and developed a methodology for measuring the cost-effectiveness of Angeles Link (e.g. delivery of clean renewable hydrogen via pipeline) compared to those alternatives based on available information. The analysis specifically examined various hydrogen delivery (e.g., trucking, liquid hydrogen shipping, power transmission and distribution (T&D) with in-basin production, and localized hydrogen hub) and non-hydrogen delivery alternatives (e.g., electrification, carbon capture and sequestration).

IV. MANAGEMENT AND OVERSIGHT OF MARKET ASSESSMENT STUDIES

SoCalGas reasonably and prudently managed the Market Assessment Studies by leveraging resources, maintaining financial oversight, and controlling costs. As contemplated in

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[15] *Id.* at 73-77 (OP 3(a), 3(c), 3(e), 3(h), 5(a), 5(c)-(e), 6(d)).

[16] *See* Chapter 4 (Direct Testimony of Jessica Kinnahan Foley) for details regarding the Environmental Analysis.

[17] Phase 1 Decision at 73-77 (OP 3(a), 3(c), 3(e), 3(h), 5(a), 5(c)-(e), 6(d)).

the Phase 1 Decision, SoCalGas began conducting the feasibility studies immediately.[18] To facilitate a quick ramp up in selecting vendors, SoCalGas utilized existing Master Service Agreements (MSA), based on market rates stemming from previous competitive solicitations, as well as standalone agreements. These MSAs provide pre-negotiated terms, including market-based billing rates which offer cost predictability and typically do not escalate over the contract term. Additionally, the MSAs enabled SoCalGas to have greater certainty about the firm's capabilities, safety record, dedicated staff and staffing levels, insurance requirements, and commitment to engaging with diverse businesses. When SoCalGas did not have an existing MSA, SoCalGas solicited bids to engage selected contractors best suited to evaluate a particular topic area based on a set of assessment criteria.

As explained in Chapter 2 (Direct Testimony of Frank Lopez), throughout the development of the studies, in accordance with OP 3(e) and 5(d), SoCalGas presented opportunities for stakeholders to provide feedback at four key milestones while conducting each study: (1) initial description of the scope of work, (2) technical approach, (3) preliminary data and findings, and (4) draft study.[19] These milestones were selected because they represented critical points at which relevant feedback could meaningfully influence the Phase 1 Studies. SoCalGas considered stakeholder feedback and incorporated it where appropriate. Responses to stakeholder feedback were also provided in quarterly reports in accordance with OP 3(h) and 5(d).[20] Throughout the development of the studies, changes to scope, schedule, and/or cost resulted from stakeholder feedback, study development, as well as interdependencies with other Phase 1 studies.[21]

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[18] *Id.* at 63 (FOF 13) ("Given the confluence of current events, including recent federal statutes, regional initiatives, and local interest, public interest is served if SoCalGas begins conducting feasibility studies of the Angeles Link Project immediately.").

[19] *See* Chapter 2 (Direct Testimony of Frank Lopez) for further details regarding the stakeholder engagement process.

[20] The quarterly reports provided status updates on the feasibility studies during Phase 1, identified and responded to stakeholder feedback, and attached transcripts of PAG and CBOSG meetings and materials presented at these meeting held during that quarter. The quarterly reports were submitted to the California Public Utilities Commission (Commission) and are published on SoCalGas's website, *available at:* https://www.socalgas.com/regulatory/angeleslink.

[21] *See* Sections IV.A. through IV.D. describing the interdependencies for the Demand Study, Production Study, Alternatives Study, and Cost Effectiveness Study.

The following sections describe the reasonable and prudent management of the Market Assessment Studies.

A. Demand Study

As described in Section III.A., in accordance with the Phase 1 Decision, SoCalGas developed the Demand Study to evaluate potential clean renewable hydrogen demand across the mobility, power generation, and industrial sectors within SoCalGas's service territory through 2045 and to identify the ratepayers who would potentially be end-users, including current natural gas customers and future customers.[22] This study was foundational to Phase 1, providing throughput demand volumes as inputs to the Cost Effectiveness Study, Alternatives Study, Production Study, Preliminary Routing/ Configuration Analysis (Routing Analysis), Greenhouse Gas (GHG) Emissions Evaluation (GHG Study), Nitrogen Oxide (NOx) and other Air Emissions Assessment (NOx Study), Hydrogen Leakage Assessment (Leakage Study), Pipeline Sizing & Design Criteria (Design Study), and Water Resources Evaluation. The scope and activities of the Demand Study evolved over time, informed by stakeholder feedback and in alignment with the Phase 1 Decision. The O&M costs incurred to develop the Demand Study total $3.2 million and include labor and non-labor costs.[23]

The following sections describe the activities undertaken throughout the development of the Demand Study—from the initial contracting stage, to the integration of stakeholder feedback at four key milestones (scope, technical approach, preliminary findings, and draft study), to completion of the final study.

1. Initiation – Scope of Work

The Demand Study scope of work was developed to guide the structure, content, and execution of the Demand Study, confirming alignment with the Phase 1 Decision, incorporating

[22] The Demand Study identified both existing and future SoCalGas ratepayers who would be potential end-users of Angeles Link in the three sectors analyzed. Existing ratepayers include mobility customers such as bus fleet and other heavy-duty vehicle operators, power generation facilities, and industrial customers such as metal fabrication shops, food and beverage manufacturing/processing facilities, stone/glass/cement facilities, pulp and paper, chemicals, and refineries, among others. Future potential ratepayers, who are not currently served by SoCalGas but could be end users of Angeles Link include non-utility served heavy-duty vehicle operators, commercial harbor craft operators, ocean-going vessel operators, and locomotive operators. The study was limited to identification of certain, but not all potential end uses that may drive potential demand for clean renewable hydrogen, which is expected to occur in future phases.

[23] Refer to my accompanying Chapter 3 Workpapers for additional cost information.

other Phase 1 Studies, and considering stakeholder feedback pursuant to OP 5(d). The scope of work was developed by SoCalGas personnel with technical and project management expertise, in collaboration with internal SMEs (e.g., gas demand forecasting, customer services), as needed. The Demand Study was scoped in compliance with the Phase 1 Decision including identification of hydrogen demand, end uses, and potential end-users in accordance with the broader requirements in OP 6(a) and OP 6(c).

Following development of the initial scope of work, SoCalGas initiated a competitive bid process involving third-party contractors with existing MSAs. Through a request for proposal (RFP) process, SoCalGas received bids from several third-party contractors and ultimately selected Accenture International Limited (Accenture) and Electrical Power Research Institute (EPRI) based on their expertise, experience, and cost-effectiveness. Both contractors were able to begin work promptly, supporting timely delivery of demand forecasts to inform other Phase 1 Studies.

To align the contractors' efforts with Phase 1 objectives, SoCalGas initiated an onboarding process. This included developing a study plan with defined milestones and task assignments, recurring coordination meetings, and confirmation of data needs, key assumptions, and interdependencies with other Phase 1 Studies.

In accordance with OP 3(e) and OP 5(d), the draft scope of work was shared with stakeholders in July 2023. Stakeholders provided feedback on the criteria used to determine demand, demand locations or regions, and expected hydrogen demand over time. SoCalGas considered the largest potential users of hydrogen across three main sectors—mobility, power generation, and industrial—and various subsectors within each. The Demand Study used four main factors—technology feasibility, commercial feasibility, business readiness, and policy & legislation—to determine expected demand. The output of the study also included locational and timing aspects. Responses to stakeholder comments were provided in the quarterly report(s), consistent with OP 3(h) and OP 5(d).[24]

2. Planning – Technical Approach

The technical approach—jointly developed by SoCalGas, Accenture, and EPRI—established the analytical framework and methodologies for assessing hydrogen demand across

[24] *See* Q3 2023 Angeles Link Phase 1 Quarterly Report Appendices at 3-68.

sectors and scenarios. This included identifying relevant demand sub-sectors, defining adoption rate assumptions, and outlining the range of demand scenarios to be analyzed.

In alignment with OP 3(e) and OP 5(d), the draft technical approach was shared with stakeholders in August 2023. Because the Demand Study served as a foundational input to many Phase 1 Studies, SoCalGas prioritized its timing early in the process. This sequencing allowed for alignment with the overall Phase 1 schedule while still allowing for stakeholder input on scope, technical approach, and findings. Stakeholders provided feedback on the technical approach, which was incorporated where appropriate—for example, by including a non-exhaustive list of interviewees and developing a Technical Appendix that detailed key assumptions, data sources, methodologies, and calculations. Responses to stakeholder feedback were provided in the quarterly report in accordance with OP 3(h) and OP 5(d).[25]

3. Execution

a. Preliminary Findings

The preliminary findings reflected the initial outputs of the Demand Study, including preliminary demand estimates across multiple sectors and scenarios. These findings were developed through an iterative process involving demand modeling, alignment with the study's scope and technical approach, and incorporation of stakeholder feedback. Ongoing coordination with Accenture and EPRI included regular working sessions to analyze the mobility, power generation and industrial sectors. These meetings helped refine modeling assumptions, test scenarios, and integrate available market data. In addition, interviews and peer reviews with subject matter experts from industry, academia, and government agencies provided valuable insights to inform preliminary findings.

Consistent with OP 3(e) and OP 5(d), SoCalGas shared the preliminary findings, including scenario-based demand projections and sector adoption trends, with the PAG and CBOSG in August 2023. Stakeholders provided feedback, which was incorporated into the study where appropriate—for example, in response to comments on demand study estimates, SoCalGas compiled and presented third-party demand projections from various agencies to demonstrate that the Demand Study's forecasts were within the range of hydrogen demand

[25] *See* Q3 2023 Angeles Link Phase 1 Quarterly Report Appendices at 3-68; *see also* Q4 2023 Angeles Link Phase 1 Quarterly Report Appendices at 167-211.

projections for California. Responses to stakeholder feedback were provided in the quarterly report in alignment with OP 3(h) and OP 5(d).[26]

b. Draft and Final Study

The draft study compiled analyses and research, expanded on the preliminary findings, and incorporated stakeholder feedback where appropriate. To support stakeholder understanding, SoCalGas presented key findings from the draft study to the PAG and CBOSG in December 2023. In accordance with OP 3(e) and OP 5(d), the draft study was shared with stakeholders in January 2024. The Demand Study was the first of the draft studies to be published for stakeholder input considering the foundational elements to the other studies. Stakeholders provided feedback, which was incorporated into the study where appropriate—for example, in response to comments, the draft added a comparative analysis of SoCalGas's demand forecasts with projections from agencies including the California Resources Board (CARB), the California Energy Commission (CEC), Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES), and the National Petroleum Council (NPC)). Responses to stakeholder comments were provided in the quarterly report in alignment with OP 3(h) and OP 5(d).[27] The final study was published in December 2024 in accordance with the Phase 1 Decision.

B. Production Planning and Assessment

As described in Section III.B, in accordance with the Phase 1 Decision, SoCalGas developed the Production Study to evaluate potential primary sources of clean renewable hydrogen production within SoCalGas's service territory. The Production Study received information from the Demand Study (e.g., volumetric requirements for production), the Water Resource Evaluation (Water Evaluation) (e.g., expectations of water availability), and the Greenhouse Gas Emissions Evaluation (GHG Study) (e.g., carbon intensity information on different production pathways). The Production Study provided information to the Pipeline Sizing & Design Criteria (Design Study) (e.g., potential locations and volumes of hydrogen), Preliminary Routing/Configuration Analysis (Routing Analysis) (e.g., preliminary routing and

[26] *See* Q3 2023 Angeles Link Phase 1 Quarterly Report Appendices at 3-68; *see also* Q4 2023 Angeles Link Phase 1 Quarterly Report Appendices at 167-211.

[27] *See* Q1 2024 Angeles Link Phase 1 Quarterly Report Appendices at 327-418.

configuration across potential directional routes), GHG Study (e.g., potential production pathways), and the Cost Effectiveness Study (e.g., production cost inputs to calculate the levelized cost of hydrogen). The scope and activities of the Production Study evolved over time, informed by stakeholder feedback and in alignment with the Phase 1 Decision. The O&M costs incurred to prepare the Production Study totaled $2.1 million and include labor and non-labor costs.[28]

The following sections describe the activities undertaken throughout the development of the Production Study—from the initial contracting stage to integration of stakeholder input at four key milestones (scope, technical approach, preliminary findings, and draft study), to completion of the final study.

1. Initiation – Scope of Work

In accordance with OP 3(a), the Production Study evaluated potential primary sources of clean renewable hydrogen production. The Production Study scope of work was developed to guide the structure, content, and execution of the Production Study, confirming alignment with the Phase 1 Decision, incorporating other Phase 1 Studies, and considering stakeholder feedback pursuant to OP 5(d). The scope of work was developed by SoCalGas personnel with technical and project management expertise, in collaboration with internal SMEs. The Production Study was scoped in compliance with the Phase 1 Decision including identification of potential sources of clean renewable hydrogen production in accordance with the broader requirements in OP 6(b) and OP 6(j).

Following the development of the initial scope of work, SoCalGas initiated a competitive bid process involving third-party contractors with existing MSAs. Through a request for proposal process (RFP), SoCalGas received bids from several third-party contractors and ultimately selected Burns and McDonnell (BMcD) based on their expertise and experience. Given the interdependencies between the Production Study and certain other Phase 1 Studies (e.g., the Design Study and Routing Analysis were informed by potential production locations

[28] Refer to my accompanying Chapter 3 Workpapers for additional cost information.

and volumes in the Production Study), SoCalGas consolidated certain Phase 1 Studies under a single contract to support coordination, data sharing, and efficiency.[29]

Following contractor selection, SoCalGas initiated the feasibility work in alignment with the Phase 1 Decision, study deliverables, and timelines. Key activities included establishing a study plan with defined milestones and task assignments, recurring coordination meetings, confirmation of data needs, key assumptions, and interdependencies with other Phase 1 Studies. In accordance with OP 3(e) and OP 5(d), the draft scope of work was shared with stakeholders in July 2023. In accordance with OP 3(h) and OP 5(d), responses to stakeholder feedback were documented in the quarterly report.[30]

2. Planning – Technical Approach

The technical approach established the analytical framework and methodology for evaluating potential sources of clean renewable hydrogen that could be transported via Angeles Link. Developed jointly with BMcD, the technical approach integrated literature reviews, internal data, and market assessments to build a data-driven foundation for evaluating production feasibility, volumes, locations, costs, and interdependencies with other Phase 1 Studies.

In accordance with OP 3(e) and OP 5(d), the draft Technical Approach was presented to stakeholders in October 2023. Stakeholders provided feedback, which was incorporated where appropriate—for example, in response to stakeholder feedback, SoCalGas assumed that renewable power requirements would be met with incremental power generation that is not connected to the grid (i.e., not tied into high-voltage transmission lines). Responses to stakeholder input were provided in quarterly reports in alignment with OP 3(h) and OP 5(d).[31]

3. Execution

a. Preliminary Findings

The preliminary findings reflected the initial outputs of the Production Study, providing insight into the technologies, scale, and siting of clean renewable hydrogen production. These findings identified primary production areas within SoCalGas's service territory that could

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[29] The BMcD agreement also included the Engineering & Design Studies. *See* Chapter 5 (Direct Testimony of Katrina Reagan) for further details.

[30] *See* Q3 2023 Angeles Link Phase 1 Quarterly Report Appendices at 3-68.

[31] *See* Q3 2023 Angeles Link Phase 1 Quarterly Report Appendices at 3-68; *see also* Q4 2023 Angeles Link Phase 1 Quarterly Report Appendices at 167-211.

potentially produce clean renewable hydrogen at scale by 2045. The analysis incorporated assessments of various renewable power sources, hydrogen production technologies, land availability, and the role of storage in balancing supply and demand. To validate feasibility assumptions, such as costs and economics of pairing electrolyzers with behind-the-meter solar, SoCalGas also conducted interviews with third-party market participants.

Consistent with OP 3(e) and OP 5(d), the preliminary findings were shared with stakeholders in April 2024. Stakeholders provided feedback, which was incorporated into the study where appropriate—for example, in response to stakeholder feedback to clearly describe and analyze the role of curtailed grid generation that could support hydrogen production, the study was updated to expand on potential curtailments. Responses to stakeholder feedback were provided in the quarterly report in accordance with OP 3(h) and OP 5(d).[32]

b. Draft and Final Study

The draft study compiled analyses and research, expanded on preliminary findings, and incorporated stakeholder feedback where appropriate—for example, by refining cost assumptions, land availability analysis, and technology comparisons. SoCalGas collaborated with BMcD and internal SMEs involved in interdependent studies to confirm consistency and integration across studies. The draft study was structured to clearly present the purpose, objectives, assumptions, and results. Supporting appendices included detail of renewable energy feedstock assessments, the role and types of hydrogen storage, and various technical maps and data tables.

In accordance with OP 3(e) and OP 5(d), the draft study was shared with stakeholders in July 2024, followed by a presentation to the PAG and CBOSG. Stakeholders provided feedback regarding design assumptions and land availability, which was incorporated into the final study as appropriate—for example, in response to comments, SoCalGas expanded the discussion of land use constraints using data from the CEC. Responses to stakeholder feedback were provided in the quarterly report in alignment with OP 3(h) and OP 5(d).[33] The final study was published in December 2024 in accordance with the Phase 1 Decision.

[32] *See* Q2 2024 Angeles Link Phase 1 Quarterly Report Appendices at 396-556.

[33] *See* Q3 2024 Angeles Link Phase 1 Quarterly Report Appendix 3: SoCalGas Response to Comments.

C. Project Options and Alternatives

As described in Section III.C, in accordance with the Phase 1 Decision, SoCalGas prepared the Alternatives Study to evaluate project alternatives to Angeles Link, including hydrogen delivery and non-hydrogen alternatives such as localized hydrogen hub and electrification.. The scope and activities of the Alternatives Study evolved over time, informed by stakeholder feedback and in alignment with the Phase 1 Decision. The O&M costs incurred to prepare the Alternatives Study total $1.6 million and include labor and non-labor costs.[34] SoCalGas implemented financial oversight during the study development aligning payments with the work performed.

The following sections describe the activities undertaken throughout the development of the Alternatives Study—from the initial contracting stage to integration of stakeholder input at four key milestones (scope, technical approach, preliminary findings, and draft study), to completion of the final study.

1. Initiation – Scope of Work

The Alternatives Study scope of work was developed to guide the structure, content, and execution of the Alternatives Study, confirming alignment with the Phase 1 Decision, incorporating other Phase 1 Studies, and considering stakeholder feedback pursuant to OP 5(d). The scope of work was developed by SoCalGas personnel with technical and project management expertise, in collaboration with internal SMEs.

In accordance with stakeholder feedback and OP 3(c), OP 5(c), and OP 5(e), and the broader requirements in OP 6(d), the scope of work defined and included a localized hub and other decarbonization alternatives (e.g., in-basin production with power transmission and distribution and electrification alternatives). The Alternatives and Cost Effectiveness Studies were closely coordinated to confirm alignment on key assumptions and alternatives evaluated in Phase 1.

Following development of the initial scope of work, to support both the Alternatives Study and Cost Effectiveness Study, SoCalGas solicited bids from third-party contractors based on the scope of work and expertise needed. SoCalGas selected Wood Mackenzie through a stand-alone agreement based on its qualifications, experience, and cost effectiveness.

[34] Refer to my accompanying Chapter 3 Workpapers for additional cost information.

To align the contractor's efforts with Phase 1 objectives, SoCalGas initiated an onboarding process which included developing a study plan with defined milestones and task assignments, recurring coordination meetings, and confirmation of data needs, key assumptions, and interdependencies with other Phase 1 studies. In accordance with OP 3(e) and OP 5(d), the draft scope of work was shared with stakeholders in July 2023. Responses to stakeholder comments were provided in the quarterly report in alignment with OP 3(h) and OP 5(d).[35]

2. Planning – Technical Approach

In accordance with OP 3(c), OP 5(c), and OP 5(e), the technical approach established a consistent and transparent framework for identifying, screening, and evaluating alternatives to Angeles Link. The technical approach included the following assessment criteria for comparing alternatives: state policy, technological maturity, range of deliverability (distance), reliability and resiliency, ease of implementation, end-user requirements, and scalability.

The technical approach was developed collaboratively by SoCalGas and Wood Mackenzie, using a structured six-step evaluation process supported by a rubric-based scoring framework to assess alternatives in a systematic and transparent manner. To confirm consistency across the Phase 1 Studies, data inputs from the Demand Study, Production Study, Design Study, and the Environmental Analysis were reviewed to align assumptions where applicable. For example, the Alternatives Study and Environmental Analysis aligned on air quality and biological resource assessment criteria.

In accordance with OP 3(e) and OP 5(d), the draft technical approach was presented to stakeholders in September 2023. Stakeholder feedback was incorporated into the study where appropriate—for example, the study expanded its discussion around the selection and assessment criteria. Responses to stakeholder comments were provided in the quarterly report, consistent with OP 3(h) and OP 5(d).[36]

[35] *See* Q3 2023 Angeles Link Phase 1 Quarterly Report Appendices at 3-68.

[36] *See* Q3 2023 Angeles Link Phase 1 Quarterly Report Appendices at 3-68; *see also* Q4 2023 Angeles Link Phase 1 Quarterly Report Appendices at 167-211.

3. Execution

a. Preliminary Findings

The preliminary findings presented the initial results of the Alternatives Study, providing insights into the hydrogen and non-hydrogen delivery alternatives. In accordance with OP 3(e) and OP 5(d), the preliminary findings were shared with stakeholders in May 2024. Stakeholders requested additional detail on alternatives that were screened out and not carried forward for further analysis. For example, nuclear power generation was not carried forward based on evaluation criteria such as state policy. Accordingly, SoCalGas included further clarification of the potential alternatives that were initially identified but not carried forward for further analysis. Responses to stakeholder feedback were provided in the quarterly report pursuant to OP 3(h) and OP 5(d).[37]

b. Draft and Final Study

The draft study compiled analyses and research, validated preliminary findings, and incorporated stakeholder feedback where appropriate. SoCalGas worked closely with Wood Mackenzie to organize the study in a way that clearly presented the purpose, objectives, assumptions, and results. In accordance with OP 3(e) and OP 5(d), the draft study was presented to the PAG and CBOSG stakeholders in June 2024 and released in July 2024. The final Study was published in December 2024, consistent with the Phase 1 Decision.

D. High Level Economic Analysis and Cost Effectiveness

As described in Section III.D., in accordance with the Phase 1 Decision, SoCalGas developed the Cost Effectiveness Study to evaluate the cost effectiveness of Angeles Link against alternatives, including a localized hydrogen hub or electrification option. The Cost Effectiveness Study was interdependent with other Phase 1 studies, drawing on Demand Study (e.g., volumetric demand requirements), Production Study (e.g., production and storage costs), the Design Study (e.g., routing, sizing and design assumptions), Water Evaluation (e.g., costs related to water supplies), and Alternatives Study (e.g., selected alternatives carried forward for further analysis). The scope and activities of the Cost Effectiveness Study evolved over time, informed by stakeholder feedback and in alignment with the Phase 1 Decision. The O&M costs incurred to prepare the Cost Effectiveness Study totaled $2.1 million and include labor and non-

[37] *See* Q2 2024 Angeles Link Phase 1 Quarterly Report Appendices at 396-556.

labor costs.[38] The following sections describe the activities undertaken throughout the development of the Cost Effectiveness Study—from the initial contracting stage, to integration of stakeholder input at four key milestones (i.e., scope, technical approach, preliminary findings and draft study), to completion of the final study.

1. Initiation – Scope of Work

The Cost Effectiveness Study scope of work was developed to guide the structure, content, and execution of the Cost Effectiveness Study, confirming alignment with the Phase 1 Decision, incorporating other Phase 1 Studies, and considering stakeholder feedback pursuant to OP 5(d). The scope of work was developed by SoCalGas personnel with technical and project management expertise, in collaboration with internal SMEs.

In accordance with OP 3(c), OP 5(c), and OP 5(e), and the broader requirements in OP 6(d), the scope of work was designed to provide a consistent framework for evaluating cost effectiveness of Angeles Link and alternatives using standardized cost metrics, uniform assumptions, defined study objectives, evaluation metrics, and the levelized cost assessment methodology. The Cost Effectiveness Study and Alternatives Study were closely coordinated to confirm alignment on key assumptions and shared inputs, such as which alternatives would be carried forward for further analysis. As previously noted, Wood Mackenzie was selected to support both the Cost Effectiveness Study and Alternatives Study.

Following contractor selection, SoCalGas initiated the feasibility work by aligning with Wood Mackenzie on objectives, deliverables, and timelines. Key activities included developing a study plan with defined milestones and task assignments, recurring coordination meetings, and confirmation of data needs, key assumptions, interdependencies with other Phase 1 Studies. In accordance with OP 3(e) and OP 5(d), the draft scope of work was shared with stakeholders in July 2023. Responses to stakeholder feedback were provided in the quarterly report in alignment with OP 3(h) and OP 5(d).[39]

2. Planning – Technical Approach

The technical approach was designed to enable transparent, like-for-like comparison of hydrogen and non-hydrogen alternatives using industry standard cost metrics. Developed in

[38] Refer to my accompanying Chapter 3 Workpapers for additional information.

[39] *See* Q3 2023 Angeles Link Phase 1 Quarterly Report Appendices at 3-68.

collaboration between SoCalGas and Wood Mackenzie, the approach provided a consistent structure for assessing levelized costs, applying common inputs across technologies, and tailoring the analysis to key end-use sectors. The Cost Effectiveness Study also integrated inputs from other Phase 1 Studies including the Water Evaluation, Project Options & Alternatives, Production Study, Demand Study, and Pipeline Sizing & Design Criteria. For example, throughput volumes from the Demand Study and production costs from the Production Study were inputs to the Cost-Effectiveness Study.

The study adopted a cost evaluation process to systematically assess the cost effectiveness of Angeles Link vis-a-vis the selected alternatives. In accordance with OP 3(e) and OP 5(d), the draft technical approach was presented to stakeholders in September 2023. Responses to stakeholder feedback was provided in the quarterly report in alignment with OP 3(h) and OP 5(d).[40]

3. Execution

a. Preliminary Findings

The preliminary findings presented initial cost effectiveness results across the alternatives and provided an early opportunity to assess key assumptions, incorporate stakeholder feedback, and refine the analysis. These findings were developed through an iterative, evaluation process and regular coordination meetings between SoCalGas and Wood Mackenzie. In accordance with OP 3(e) and OP 5(d), the preliminary findings were shared with PAG and CBOSG in May 2024. Stakeholders provided feedback, which was incorporated into the study where appropriate—for example, in response to stakeholder feedback, the study expanded on the levelized cost of hydrogen and levelized cost of electricity comparison metrics. Responses to stakeholder feedback was provided in the quarterly report pursuant to OP 3(h) and OP 5(d).[41]

b. Draft and Final Study

The draft study compiled analyses and research, validated the preliminary findings, and incorporated stakeholder feedback where appropriate. SoCalGas and Wood Mackenzie worked collaboratively to organize the study in a manner that clearly presented the purpose, objectives, assumptions, and results. In accordance with OP 3(e) and 5(d), the draft study was presented to

[40] *Id.*; *see also* Q4 2023 Angeles Link Phase 1 Quarterly Report Appendices at 167-206.

[41] *See* Q2 2024 Angeles Link Phase 1 Quarterly Report Appendices at 396-556.

the PAG and CBOSG stakeholders in June 2024 and was released in July 2024. Stakeholders provided feedback, which was incorporated into the study where appropriate. For example, stakeholders commented on assessing alternative modes of power transmission systems such as High Voltage Direct Current (HVDC) transmission systems. In response to stakeholder feedback, an Appendix was added to the study discussing the HVDC electric transmission systems. Responses were provided in the quarterly report in accordance with OP 3(h) and OP 5(d).[42] The final study was published in December 2024 in accordance with the Phase 1 Decision.

V. CONCLUSION

SoCalGas prudently executed the Market Assessment Studies in compliance with the Phase 1 Decision. The costs presented in my testimony were reasonably incurred to complete these Studies, reflect the incorporation of stakeholder feedback, and are supported by the accompanying workpapers. Accordingly, based on my testimony and workpapers, the Commission should find the Phase 1 Market Assessment Studies costs to be reasonable.

This concludes my prepared direct testimony.

[42] *See* Q3 2024 Angeles Link Phase 1 Quarterly Report Appendix 3: SoCalGas Response to Comments.

VI. WITNESS QUALIFICATIONS

My name is Vijai Atavane. My business address is 555 West 5th Street, Los Angeles, CA 90013. My title is Clean Energy and Strategic Partnerships Manager for SoCalGas. My role at SoCalGas involves leading initiatives in market assessments such as hydrogen technologies and infrastructure solutions. With more than twenty-four years of experience in the energy, business consulting, and utility sectors, I am responsible for developing strategies to promote innovations in clean energy and fostering collaborative partnerships for SoCalGas.

I have been employed by SoCalGas since 2016. I hold an MBA and an MS in Industrial Engineering from Arizona State University (Tempe, AZ), as well as a BS in Mechanical Engineering from Bangalore Institute of Technology (Bangalore, India).

I have not previously testified before the Commission.