SoCalGas's Closed System Hydrogen Blending Project

Workpaper Supporting the Direct Testimony of Blaine Waymire

Joint Amended IOU Hydrogen Blending Demonstration Application
(A.22-09-006)

Explanation of Work Paper

This work paper (WP-1) includes all Level 5 cost estimates to support SoCalGas's proposed Closed System Hydrogen Blending Demonstration Project (Closed System Project) at the University of California, Irvine (UC Irvine). For information on the associated revenue requirement and rate impact, see the Direct Testimony of Nasim Ahmed and Marjorie Schmidt-Pines (Chapter 6).

Table 1 summarizes the O&M costs related to the Closed System Project. Tables 2 to 5 reflect the costs by project phase, as described in the Direct Testimony of Blaine Waymire (Chapter 1). Detailed cost estimates and assumptions to support the work paper are provided in WP-1 Appendix A.

Table 1: Project Cost Estimates (O&M)

2025	2026	2027	2028	Total
$16,357,612	$5,660,911	$ 949,936	$1,451,947	$24,420,406

Cost Mechanism Justification

The Closed System Project is a demonstration project that was designed to be in accordance with D.22-12-057 and D.21-07-005. Once the Closed System Project is planned, designed, constructed, and commissioned, SoCalGas will test various hydrogen blends on UC Irvine's campus over the course of approximately 18 months. After the testing, there are various options for decommissioning and equipment removal, however, cost estimates in this workpaper make a conservative assumption of full decommissioning and equipment removal. For the purposes of Cost Mechanism, the demonstration nature of the project planned at UC Irvine is different than most utility activities and closer to a research, development, and demonstration (RD&D) project than a typical capital project. For this reason, all of the equipment costs and related direct labor are being treated as O&M.

Project Description

The Closed System Project has been designed to blend hydrogen into an isolated section of the medium-pressure natural gas distribution pipeline system that will ultimately serve UC Irvine's Anteater Recreation Center. The equipment is slated to be located in the parking lot of UC Irvine's Police Department, on the southeast corner of E Campus Drive and E Peltason Drive. A new steel pipeline will be installed to connect the hydrogen blending equipment to existing plastic pipeline on California Avenue, and to demonstrate blending in a mixed-material pipeline system. All hydrogen-related equipment will be procured and deployed onsite. The Closed System Project will begin by observing 100% natural gas in the pipeline system. Once a baseline is established, SoCalGas plans to blend and inject electrolytic hydrogen produced onsite into the system, starting at 5% hydrogen by volume and up to 20% by volume over time. The blend

volume will be gradually increased based on safety and technical feasibility validated with testing throughout the project, including evaluating key impacts on pipes, meters, and end-use equipment. Upon conclusion of the estimated 18-month testing period, SoCalGas will move forward with decommissioning specifics that will be outlined in an agreement between SoCalGas and UC Irvine. A final report will be prepared and publicly disseminated to share the results and findings of the demonstration.

Project Plan

Table 2. Summary of Project Phases

Phase & Activity	Description	Estimated Duration
0. Pre-development	All efforts supporting this Amended Application submittal are considered "Pre-development." Upon Commission approval, the project will move on to subsequent phases	Pre-application submittal
1. Design, Construction, and Commissioning	Hydrogen production and blending equipment is designed; detailed safety and feasibility analyses are performed. Stakeholder engagement will be conducted throughout the project's lifespan. Following design and feasibility, equipment is procured, constructed, and commissioned on campus; pre-demo equipment and pipeline system inspections and any necessary remediation are conducted	18 months
2. Demonstration and Data Collection	Hydrogen is blended in system on a data analysis schedule; data is collected; periodic inspection of equipment and pipelines; test pipelines and components pre-, during, and post-hydrogen blend exposure	24 months (18 months live blending and 6 months asset inspection and validation)
3. Decommissioning, Equipment Removal, and System Restoration	Hydrogen equipment is removed from campus, unless otherwise agreed upon with UC Irvine	6 months
4. Data Analysis and Dissemination	Data from pilot is analyzed and a public report will be released	9 months

Forecast Methodology (Construction Costs and Labor)

SoCalGas's methodology for forecasting costs is discussed in Chapter 1 testimony. SoCalGas used a Level

5 Estimate for Total Installed Cost (TIC) estimate to implement the scope of work in Phases 1 and 3. The TIC estimate includes direct costs associated with project management, engineering and design, environmental permitting, material and equipment procurement, and construction. For programmatic, operational, and data collection-related expenses in Phases 2 and 4, the forecast method developed for this cost category is zero-based. This method is most appropriate because RD&D needs and activities will evolve with the project, and this is a new type of project with new technologies.

During cost estimate preparation, this project was in the preliminary design stage. Further development of this project could reveal new information requiring some adjustments to the project plan in areas such as engineering, materials, permitting, environmental and land, staffing, and customer engagement, all of which could impact actual costs compared to this cost estimate. An average 30% contingency has been utilized.

Schedule

Implementation of the Closed System Project is proposed to be completed consistent with the overall prioritization and timing described in Chapter 1 testimony. The critical project deliverables were identified and incorporated into a work breakdown structure and durations were determined for each project phase.

PHASE 1 COSTS

Table 3: Phase 1 (O&M)

Phase 1	2025	2026	2027	2028	Total
Total	$16,357,612	$5,452,537	0	0	$21,810,149

Phase 1 Assumptions

Refer to WP-1 Appendix A for a detailed list of assumptions used to develop Phase 1 estimates.

PHASE 2 COSTS

Table 4: Phase 2 (O&M)

Phase 2	2025	2026	2027	2028	Total
Total	0	$208,373	$260,467	0	$468,840

Phase 2 Assumptions

The following assumptions were made to develop this cost estimate:

- Level 5 Estimate (- 50% / +100%);

- Monthly odorant sampling and analysis;
- Monthly leak surveys and leak detection equipment evaluation;
- Monthly equipment checks;
- Regular maintenance of major equipment (blending skid and electrolyzer);
- Program management; and
- 10% contingency built into hourly rate.

PHASE 3 COSTS

Table 4: Phase 3 (O&M)

Phase 3	2025	2026	2027	2028	Total
Total	0	0	$689,469	$1,378,939	$2,068,408

Phase 3 Assumptions

Refer to WP-1 Appendix A for a detailed list of assumptions to develop Phase 3 estimates.

PHASE 4 COSTS

Table 5: Phase 4 (O&M)

Phase 4	2025	2026	2027	2028	Total
Total	0	0	0	$73,008	$73,008

Phase 4 Assumptions

The following assumptions were made to develop this cost estimate:

- Level 5 Estimate (- 50% / +100%)
- An engineering and data team of 1, working 8 hours per week for 39 weeks
- A management team of 3, each employee working 2 hours per week for 39 weeks
- 30% contingency in alignment with Level 5 estimates is included

Phase 1:

UCI H2 Blending Estimate Phase 1

PROJECT SUMMARY

Summary Description	Bare Total		Contingency	Total Cost	Basis
Mechanical Contractor	$ 5,368,504		30%	$ 1,610,551	$ 6,979,056	See "Digs - Capital" Tab
Electrical Contractor	$ 2,840,131		30%	$ 852,039	$ 3,692,170	See "Elect - Capital" Tab
Material- Pipe	$ 108,132		30%	$ 32,440	$ 140,572	See "Digs - Capital" Tab
Material-Valves & Fittings	$ 130,335		30%	$ 39,101	$ 169,436	See "Digs - Capital" Tab
Material- Other	$ 5,647,190		30%	$ 1,694,157	$ 7,341,347	See "Elect - Capital" Tab
Sub-Total Construction and Materials	$ 14,094,292			$ 4,228,288	$ 18,322,580	

Summary Description	Bare Total		Override	Contingency	Total Cost	Basis
Bellhole Inspection Services	$ 20,974	3.9%		30%	$ 6,292	$ 27,266	See "Digs - Capital" Tab
SCG / SDG&E Labor - Mgmt. & Non Labor	$ 310,074	2.2%		30%	$ 93,022	$ 403,097	Historical %
SCG / SDG&E Labor - Union T/H	$ 320,000	0.1%	$ 320,000	30%	$ 96,000	$ 416,000	2 workers for project duration
SCG / SDG&E Labor - Outreach & Public Affairs	$ 112,754	0.8%		30%	$ 33,826	$ 146,581	Historical %
Engineering / Design Services	$ 425,000	0.8%	$ 425,000	30%	$ 127,500	$ 552,500	Based on Spec Estimate, added $50k for
PM / Project Services	$ 330,000	3.5%	$ 330,000	30%	$ 99,000	$ 429,000	Based on project duration and stage
Construction Management / Inspection	$ 545,000	2.1%	$ 545,000	30%	$ 163,500	$ 708,500	Based on project duration
Surveying / As-builts	$ 35,000	0.2%	$ 35,000	30%	$ 10,500	$ 45,500	Historical %
Environmental Services	$ 169,132	1.2%		30%	$ 50,739	$ 219,871	Historical %
Pressure Test Certification Services	$ 45,596	0.1%	$ 45,596	30%	$ 13,679	$ 59,275	Pipe size & duration of sub onsite
Water Storage	$ 28,189	0.2%		30%	$ 8,457	$ 36,645	Historical %
Weld X-Ray / NDE	$ 39,984	0.1%	$ 39,984	30%	$ 11,995	$ 51,979	Days of welding at $2200/dy
Land Services	$ 53,983	0.4%		30%	$ 16,195	$ 70,178	Laydown area for staging materials
CNG / LNG	$ -	1.2%	$ -	30%	$ -	$ -	Assumes not needed
Gas Capture / Cross Compression	$ -	0.8%	$ -	30%	$ -	$ -	Assumes not needed
Miscellaneous Services	$ 169,132	1.2%		30%	$ 50,739	$ 219,871	Historical %
Outreach & Public Affairs (Third Party)	$ 14,094	0.1%		30%	$ 4,228	$ 18,323	Historical %
Permits	$ 28,189	0.2%		30%	$ 8,457	$ 36,645	Historical %
Other Non-Labor Costs	$ 37,141		$ 37,141	30%	$ 11,142	$ 48,284	5% of SCG / SDG&E labor
Total Direct Estimated Cost (No Loaders)	$ 16,778,534			$ 5,033,560	$ 21,810,149	

Class 5 Basis Of Estimate

Project Details:

Project Location: UC Irvine - Southeast corner of E Peltason Dr. and Campus Dr.

High Level Schedule: N/A

Peak Load: None provided

Pipeline Extension Diameter: 2" - 3"

Pipeline Extension Length: 100 LF of 2" and 2,000 LF of 3"

Gas Source: Natural Gas

Collectable:

Scope Of Work:

Design and build a hydrogen blending site that will produce hydrogen onsite. A compound will be built in an existing parking lot that will utilize an Alkaline electrolyzer as the key component to producing hydrogen. Natural gas, water, sewer and electrical utilites will be extended from nearby sources to site compound equipment. Natural gas distribution system will feed UCI's Anteater Recreation Center (ARC).

Assumptions:

The following assumptions and clarifications were used in the creation of this estimate based on feedback from the project team:

- Estimating Benchmarking database was utilized to source comparable projects.
- Additional costs for closeout/commissioning to be assumed based on past projects
- Assumes 5x10s work schedule
- Assumes site will be closed to the public during construction
- Assumes equipment and materials will be staged in the same parking lot as the compound
- Rates are based on average union rates
- Includes installation of 100 LF of 2" and 2000 LF of 3" carbon steel pipe and associated appurtenances
- Assumes primary electrical connection is within 300 LF of compound
- Assumes equipment foundations will be scarified and compacted prior to pouring concrete
- Assumes water connection is within 200 LF of compound
- Assumes sewer connection is within 200 LF of compound
- Includes (1) flow meter and (2) gas analyzers
- Includes hydrogen detectors, fire detectors, and ESD system
- Assumes existing asphalt is up to 6" thick and no substructures
- Includes 50 bollards surround compound and surrounding equipment
- Project includes new SCADA enclosure that lies outside of Classs 1, Div 1 area with a raised foundation pad
- Assumes third party will be hired to design and build the blending skid, including its control systems
- Assumes pipe is 2" PE pipe and 3" carbon steel pipe with the same specifications as natural gas requirements
- Assumes site is currently asphalt and will be excavated using mechanical means
- Includes (10) days of contractor comissioning support for equipment
- Assumes mechanical and electrical work will be performed at the same time
- Assumes joint trenching can be utilitzed for pipe and conduits
- Includes 0 sac slurry for backfilling trenches
- Includes 1 MW Battery Energy Strorage System (BESS)
- Includes (1) PV inverter
- Assumes solar pannels will be mounted on top of parking lot canopy structures - see Vendor Quotes tabs
- Assumes 67,725 SF of solar panel installation (Roughly 315'x215')
- *Includes 30% contingency - per PM request*

Exclusions and Basis Of Estimate:

- Excludes seismic design considerations
- Excluding actuals spent to date
- Excludes Force Mejeur
- Excludes site drainage modifications
- Landscaping
- Estimate excludes any maintenance and utility costs that would be incurred after site is operational
- Ongoing electrical costs once site is operational
- Masonry walls
- Traffic control, assumes parking lot will be closed during construction
- Removal of trees or existing underground structures within site
- Geotechnical studies
- Overexcavation for equipment pads due to soil stability issues
- More than 1 mobilization
- Off-site work
- Site security
- Removal or relocation of unrelated owner equipment obstructing construction
- Permanent site fencing
- Site paving
- Demo/removal of any existing substructures
- Land leasing costs or Land Acquisition
- Equipment enclosures or sound mitigation methods
-Site lighting
- Handling, hauling, excavating contaminated soils
- Site grading
- Watertable controls/ Site dewatering
- Decommissioning/removal of site equipment
- Haz ops site assessment
- Demo/removal of any existing substructures
- Delays caused by road moratoriums

WOA Summary

Type	Capital/Plant - New Install	Total Capital/Plant - Removal	TOTALS
Company Labor	$ 959,295	$ 6,382	$ 965,677
Contract Labor	$ 9,352,303	$ 113,126	$ 9,465,428
Pipe Costs	$ 140,572	$ -	$ 140,572
Other Stores Material	$ 567,111	$ -	$ 567,111
Purchased Material	$ 6,943,671	$ -	$ 6,943,671
Purchased Services	$ 2,422,790	$ 16,119	$ 2,438,909
Paving	$ 1,203,852	$ -	$ 1,203,852
Permits	$ 36,403	$ 242	$ 36,645
Other Direct Costs	$ 47,965	$ 319	$ 48,284
TOTAL DIRECT COSTS	$ 21,673,961	$ 136,188	$ 21,810,149

Phase 2:

		Occurrences	Number of Staff	Hours Per Year	Average Hourly Rate	Labor Estimate (Direct Dollars)	Non-Labor Estimate (Direct Dollars)	Total Per Year (Direct Dollars)	Total for Phase 2 (Direct Dollars)
Equipment Maintenance	Union	93	8.5	1140	$ 59.58	$ 67,920.00	$ 25,000.00	$ 92,920.00	$ 139,380.0
	Management	46	7	560	$ 90.00	$ 50,400.00	$ 20,000.00	$ 70,400.00	$ 105,600.0
	Third-Party	0	-	-	-	$ -	$ 57,000.00	$ 57,000.00	$ 85,500.0
Pipeline Leak Detection	Union	13	8.5	208	$ 50.00	$ 10,400.00	$ -	$ 10,400.00	$ 15,600.0
	Management	0	8	0	-	$ -	$ -	$ -	$ -
Appliance Inspection	Union	4	8.5	32	$ 45.00	$ 1,440.00	$ -	$ 1,440.00	$ 2,160.0
	Management	0	7	0	-	$ -	$ -	$ -	$ -
Odorant Testing and Sampling	Union	0	8.5	0	-	$ -	$ -	$ -	$ -
	Management	4	7	64	$ 90.00	$ 5,760.00	$ -	$ 5,760.00	$ 8,640.0
Data Collection and Monitoring	Union	16	9	172	$ 57.21	$ 9,840.00	$ -	$ 9,840.00	$ 14,760.0
	Management	65	7	560	$ 90.00	$ 50,400.00	$ -	$ 50,400.00	$ 75,600.0
Test Plan Management	Union	0	8.5	0	-	$ -	$ -	$ -	$ -
	Management	20	7	160	$ 90.00	$ 14,400.00	$ -	$ 14,400.00	$ 21,600.0
						$ 210,560.00	$ 102,000.00	$ 312,560.00	$ 468,840.0

Phase 3:

UCI H2 Blending Estimate Phase 3
PROJECT SUMMARY

Summary Description	Bare Total			Contingency		Total Cost	Basis
Mechanical Contractor	$ 891,455			30%	$ 267,437	$ 1,158,892	See "Digs - Capital" Tab
Electrical Contractor	$ 755,453			30%	$ 226,636	$ 982,089	See "Elect - Capital" Tab
Material- Pipe	$ -			30%	$ -	$ -	See "Digs - Capital" Tab
Material-Valves & Fittings	$ -			30%	$ -	$ -	See "Digs - Capital" Tab
Material- Other	$ -			30%	$ -	$ -	See "Elect - Capital" Tab
Sub-Total Construction and Materials	$ 1,646,909				$ 494,073	$ 2,140,981	

Summary Description	Bare Total		Override	Contingency		Total Cost	Basis
Bellhole Inspection Services	$ 4,033	3.9%		30%	$ 1,210	$ 5,244	See "Digs - Capital" Tab
SCG / SDG&E Labor - Mgmt. & Non Labor	$ 16,469	1.0%		30%	$ 4,941	$ 21,410	Historical %
SCG / SDG&E Labor - Union T/H	$ 104,000	0.1%	$ 104,000	30%	$ 31,200	$ 135,200	2 workers for project duration
SCG / SDG&E Labor - Outreach & Public Affairs	$ 24,704	1.5%		30%	$ 7,411	$ 32,115	Historical %
Engineering / Design Services	$ 15,000	0.8%	$ 15,000	30%	$ 4,500	$ 19,500	Minimal
PM / Project Services	$ 123,750	3.5%	$ 123,750	30%	$ 37,125	$ 160,875	Based on project duration and stage
Construction Management / Inspection	$ 66,625	2.1%	$ 66,625	30%	$ 19,988	$ 86,613	Based on project duration
Surveying / As-builts	$ 20,000	0.2%	$ 20,000	30%	$ 6,000	$ 26,000	Historical %
Environmental Services	$ 41,173	2.5%		30%	$ 12,352	$ 53,525	Minimal
Pressure Test Certification Services	$ -	0.1%	$ -	30%	$ -	$ -	Pipe size & duration of sub onsite
Water Storage	$ 3,294	0.2%		30%	$ 988	$ 4,282	Historical %
Weld X-Ray / NDE	$ -	0.1%	$ -	30%	$ -	$ -	Days of welding at $2200/dy
Land Services	$ -	0.0%		30%	$ -	$ -	Assumes not needed
CNG / LNG	$ -	1.2%	$ -	30%	$ -	$ -	Assumes not needed
Gas Capture / Cross Compression	$ -	0.8%	$ -	30%	$ -	$ -	Assumes not needed
Miscellaneous Services	$ 49,407	3.0%		30%	$ 14,822	$ 64,229	Historical %
Outreach & Public Affairs	$ -			30%	$ -	$ -	Historical %
Permits	$ 8,235	0.5%		30%	$ 2,470	$ 10,705	Historical %
Other Non-Labor Costs	$ 7,259		$ 7,259	30%	$ 2,178	$ 9,436	5% of SCG / SDG&E labor
Total Direct Estimated Cost (No Loaders)	$ 2,130,857				$ 639,257	$ 2,770,114	

Class 5 Basis Of Estimate

Project Details:

Project Location: UC Irvine - Southeast corner of E Peltason Dr. and Campus Dr.

High Level Schedule: N/A

Peak Load: None provided

Pipeline Extension Diameter: 2" - 3"

Pipeline Extension Length:

Gas Source: Natural Gas

Collectable:

Scope Of Work:

Phase 3 includes the decomissioning and removal of site equipment and foundations installed during phase 1 with the exception of the blending skid. The blending skid will be relocated to a more central location.

Assumptions:

The following assumptions and clarifications were used in the creation of this estimate based on feedback from the project team:

- Estimating Benchmarking database was utilized to source comparable projects.
- Assumes 5x10s work schedule
- Includes demolition of:
  - Concrete equipment foundations
  - Compound Fencing
  - Bollards
- Includes disposal of debris according to city codes
- Includes asphalt paving at compound location after equipment removal
- Includes disconnecting power lines
- Includes trucking/hauling equipment needed to lift and transport skids and equipment
- Includes removing all underground PE gas piping installed in phase 1
- Assumes UG Natural gas piping will be capped and abandoned in place from H2 compound to tie in locations
- Assumes parking canopy will remain
- Includes removaing solar panels and associated equipment
- Includes 30% contingency - per PM request

Exclusions and Basis Of Estimate:

- Excluding actuals spent to date
- Excludes Force Mejeur
- Excludes site drainage modifications
- Permanent fencing
- Landscaping
- Handling/removing hazardous materials
- More than 1 mobilization
- Site security
- Excludes water & sewer work
- Canopy demo
- Re-installing removed equipment and future sites
- Relocation /Storage of Solar Panels
- Electronic Waste Disposal and/or Solar Panels disposal
- Disposal of electrical waste

-Long Term Storage of Used Equipment

WOA Summary

Type	O&M Project	Capital/Plant - New Install	Total Capital/Plant - Removal	TOTALS
Company Labor	$ 188,725			$ 188,725
Contract Labor	$ 1,957,678			$ 1,957,678
Pipe Costs	$ -			$ -
Other Stores Material	$ -			$ -
Purchased Material	$ -			$ -
Purchased Services	$ 420,267			$ 420,267
Paving	$ 183,304			$ 183,304
Permits	$ 10,705			$ 10,705
Other Direct Costs	$ 9,436			$ 9,436
TOTAL DIRECT COSTS	$ 2,770,114			$ 2,770,114

Phase 4:

Tasks	# of Staff	Occurrence	Hours Per Staff	Hourly Rate	Estimate	with 30% Contingency
Hydrogen Engineering and Data Team	1	39	8	$ 90.00	$ 28,080.00	$ 36,504.00
Management	3	39	2	$ 120.00	$ 28,080.00	$ 36,504.00
Reporting (Contractor/Third Party)						Tracked through subaccount
					Total	$ 73,008.00