

## Hydrogen Blending at UCI Plan Workpaper Supporting Chapter 2

### Joint IOU Hydrogen Blending Demonstration Application

#### **Explanation of Work Paper**

This work paper (WP-1) includes all Level 5 cost estimates to support the SoCalGas Hydrogen Blending Demonstration Project (Project) at the University of California, Irvine (UCI). For information on rates and bill impact, see Chapter 5 testimony.

Table 1 summarizes the O&M costs related to the project. Tables 2 to 5 reflect the costs by Project Phase, as laid out in Chapter 2 testimony. Detailed cost estimates and assumptions to support the work paper are provided in WP-1 Appendix A and WP-1 Appendix B.

**Table 1: Total Project Direct Cost (\$000's)**

Table 1: Total O&M (In Millions)						
	2023	2024	2025	2026	2027	Total
O&M	2.88	7.38	0.60	1.84	0.15	12.86
Total	2.88	7.38	0.60	1.84	0.15	12.86

#### **Cost Mechanism Justification**

The Project at UCI is designed to be a temporary installation. Once the Project is planned, designed, constructed and commissioned, SoCalGas will test various hydrogen blends over the course of 18 months on UCI's campus. At the conclusion of the testing, the equipment will be removed. The short term nature of the Project planned at UCI makes it unusual compared to most utility activities and is closer to a research field demonstration project than a typical capital project. For this reason, all the equipment costs and related direct labor are treated as O&M.

#### **Project Description**

The Project will be located on UCI's main campus in Irvine, California, and will blend hydrogen into an isolated section of the medium pressure<sup>1</sup> natural gas distribution pipeline system. The Project will begin by observing 100% natural gas in the pipeline system to establish a baseline. Once that baseline is established, SoCalGas plans to blend and inject electrolytic hydrogen produced onsite into the system, starting at 5% H<sub>2</sub> by volume<sup>2</sup> 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 duration, including evaluating key impacts on pipes, valves, meters, and unmodified common appliances that will receive the blended gas. Upon conclusion of the estimated 24 month testing period, all hydrogen related equipment deployed for the testing program and the temporary pressure regulator stations will be removed from the site and the campus will be restored to its original state. A final report will be

<sup>1</sup> Medium pressure is defined as 60 pounds per square inch gauge or lower.

<sup>2</sup> In this testimony, all blend percentages mentioned are by volume.

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prepared and publicly disseminated to share the results and findings of the study.

#### **Project Plan**

PHASE & ACTIVITY	DESCRIPTION	DURATION
1. Planning, Design, Construction and Commissioning	Hydrogen production and blending equipment is procured; system is designed, constructed, and commissioned on campus; pre-demo equipment and pipeline system inspections and any necessary remediation are conducted; stakeholder engagement; temporary pressure regulating stations installed and campus isolated	18 months
2. Testing and Demonstration	Hydrogen is blended in system on a testing schedule; data is collected; periodic inspection of equipment and pipelines; test samples of pipelines and components pre- 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; temporary pressure regulator stations removed and campus restored	5 months
4. Knowledge Sharing	Data from pilot is analyzed and a public report will be released	9 months

#### **Forecast Methodology (Construction Costs and Labor)**

SoCalGas' methodology for forecasting costs is discussed in the Direct Testimony of Kevin Woo (Chapter 2). SoCalGas used a Level 5 Estimate for Total Installed Cost (TIC) estimate to implement the above scope of work in Phases 1 and 3. The TIC Estimate includes direct costs associated with project management, engineering and design, environmental permitting, land acquisition, material and equipment procurement, and construction. For programmatic and RD&D related expenses in Phases 2 and 4, the forecast method developed for this cost category is zero-based. This method is most appropriate because

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RD&D needs and activities will evolve with the project and this is a new type of project with new technologies.

At the time of cost estimate preparation, this project stage was in preliminary site layout design level and scope. Further development of this project could reveal new information requiring some adjustments to the project plan in the areas such as engineering, materials, permitting, environmental and land, staffing, and customer engagement, all of which could impact actual costs compared this cost estimate. An average 25% contingency has been placed on all costs.

### **Schedule**

Implementation of this project is proposed to be consistent with the overall prioritization and timing described in Chapter 2 testimony. The key project deliverables were identified and incorporated into a work breakdown structure. This work breakdown structure was then sequenced, and predecessor and successor tasks were linked to each task. Durations were added to each task to provide a total project duration.

### **PHASE 1 COSTS**

<b>Phase 1</b>	2023	2024	2025	Total
O&M	2.88	7.22	0.05	10.15
Total	2.88	7.22	0.05	10.15

### **Phase 1 Assumptions**

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

### **PHASE 2 COSTS**

<b>Phase 2</b>	2024	2025	2026	Total
O&M	0.17	0.55	0.19	0.90
Total	0.17	0.55	0.19	0.90

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Refer to WP-1 Appendix B for a detailed estimate breakdown.

#### **Phase 2 Assumptions**

The following assumptions were made to develop this cost estimate:

- Class 5 Estimate (- 50% / +100%)
- Monthly odorant sampling and analysis
- Monthly leak surveys and leak detection equipment evaluation
- Monthly customer equipment checks
- Quarterly maintenance of major equipment (blending skid and electrolyzer)
- Pre-hydrogen blend exposure and post-hydrogen blend exposure pipeline sample analysis
- Customer Field Service (Customer Equipment Checks, Leak Surveys, Odorant Sampling and Data Analysis)
- Program management
- 25% contingency in alignment with Class 5 estimates is included

#### **PHASE 3 COSTS:**

Table 4: Phase 3 O&M (In Millions)			
Phase 3	2026	Total	
O&M	1.45	1.45	
Total	1.45	1.45	

#### **Phase 3 Assumptions**

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

#### **PHASE 4 COSTS**

Table 5: Phase 4 O&M (In Millions)			
Phase 4	2026	2027	Total
O&M	0.21	0.15	0.36
Total	0.21	0.15	0.36

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Refer to WP-1 Appendix B for a detailed estimate breakdown.

#### **Phase 4 Assumptions**

The following assumptions were made to develop this cost estimate:

- Class 5 Estimate (- 50% / +100%)
- An engineering and data team of 6, each employee working 15 hours per week for 27 weeks
- A management team of 2, each employee working 10 hours per week for 27 weeks
- 25% contingency in alignment with Class 5 estimates is included

**Workpaper Supporting  
Direct Testimony of Kevin Woo (WP-1)**

**Appendix A**

Hydrogen-Blending Demonstration-UCI							
Class 5 - Estimate							
Accuracy Range: - 50% / +100%							
PROJECT SUMMARY							
Summary Description	Bare Total		Contingency	Total Cost	Basis		% of Direct Costs
Mechanical Contractor	\$ 3,171,369		25% \$ 792,842	\$ 3,964,211	See "Estimate" Tab		39%
Electrical Contractor	\$ 500,000		25% \$ 125,000	\$ 625,000	Historical %		6%
Material- Pipe & Fittings	\$ 33,638		25% \$ 8,409	\$ 42,047	See "Estimate" Tab		0%
Material- Valves	\$ 40,430		25% \$ 10,108	\$ 50,538	See "Estimate" Tab		0%
Material- Other	\$ 2,144,689		25% \$ 536,172	\$ 2,680,861	See "Estimate" Tab		26%
Meter Replacement (CAP EX)	\$ -						
<b>Sub-Total Construction and Materials</b>	<b>\$ 5,890,125</b>		<b>\$ 1,472,531</b>	<b>\$ 7,362,657</b>			<b>73%</b>
Summary Description	Bare Total	% Factor	Override	Contingency	Total Cost	Basis	% of DC Hydrogen Supply
SCG Labor - Mgmt. & Non Labor	\$ 206,154	3.5%		25% \$ 51,539	\$ 257,693	Historical %	3%
SCG Labor - Union T/H	\$ 117,803	2.0%		25% \$ 29,451	\$ 147,253	Historical %	1%
SCG Labor - Outreach & Public Affairs	\$ 200,000	5.0%	\$ 200,000	20% \$ 40,000	\$ 240,000	Provided by outreach & public affairs	2%
Engineering / Design Services	\$ 800,000	0.0%	\$ 800,000	25% \$ 200,000	\$ 1,000,000	4 FT senior engineers	10%
PM / Project Services	\$ 176,704	3.0%		25% \$ 44,176	\$ 220,880	Historical %	2%
Construction Management / Inspection	\$ 294,506	5.0%		25% \$ 73,627	\$ 368,133	Historical %	4%
Surveying / As-built	\$ 58,901	1.0%		25% \$ 14,725	\$ 73,627	Historical %	1%
Environmental Services	\$ 29,451	0.5%		25% \$ 7,363	\$ 36,813	Historical %	0%
Pressure Test Certification Services	\$ 58,901	1.0%		25% \$ 14,725	\$ 73,627	Historical %	1%
Water Storage	\$ -	0.0%		25% \$ -	\$ -	Historical %	0%
Weld X-Ray / NDE	\$ 58,901	1.0%		25% \$ 14,725	\$ 73,627	Historical %	1%
Land Services	\$ 56,666	1.0%	\$ 56,666	15% \$ 8,500	\$ 65,166	Based on project of similar scope	1%
CNG / LNG	\$ -	0.0%		25% \$ -	\$ -	Historical %	0%
Gas Capture / Cross Compression	\$ -	0.0%		25% \$ -	\$ -	Historical %	0%
Miscellaneous Services	\$ 29,451	0.5%		25% \$ 7,363	\$ 36,813	Provided by outreach & public affairs	1%
Outreach & Public Affairs	\$ 100,000	0.0%	\$ 100,000	20% \$ 20,000	\$ 120,000	Provided by outreach & public affairs	1%
Permits	\$ 29,451	0.5%		25% \$ 7,363	\$ 36,813	Historical %	0%
Other Non-Labor Costs	\$ 26,198	5.0%	\$ 26,198	25% \$ 6,549	\$ 32,747	5% of SCG labor	0%
<b>Total Direct Estimated Cost (No Loaders)</b>	<b>\$ 8,133,212</b>			<b>24.75% \$ 2,012,636</b>	<b>\$ 10,145,848</b>		

Hydrogen-Blending Demonstration-UCI							
Class 5 - Estimate							
Accuracy Range: - 50% / +100%							
PROJECT SUMMARY							
Summary Description	Bare Total		Contingency	Total Cost	Basis		% of Direct Costs
Mechanical Contractor	\$ 778,827		25% \$ 194,707	\$ 973,534	See "Estimate" Tab		67%
Electrical Contractor	\$ 31,200		25% \$ 7,800	\$ 39,000	See "Estimate" Tab		3%
Material- Pipe & Fittings	\$ 15,574		25% \$ 3,894	\$ 19,468	See "Estimate" Tab		1%
Material- Valves	\$ -		0% \$ -	\$ -	N/A		0%
Material- Other	\$ 2,102		25% \$ 526	\$ 2,628	See "Estimate" Tab		0%
<b>Sub-Total Construction and Materials</b>	<b>\$ 827,704</b>		<b>\$ 206,926</b>	<b>\$ 1,034,629</b>			<b>71%</b>
Summary Description	Bare Total	% Factor	Override	Contingency	Total Cost	Basis	% of DC Hydrogen Supply
SCG Labor - Mgmt. & Non Labor	\$ 66,216	8.0%		25% \$ 16,554	\$ 82,770	% of Subtotal Construction and Materials	6%
SCG Labor - Union T/H	\$ 16,554	2.0%		25% \$ 4,139	\$ 20,693	% of Subtotal Construction and Materials	1%
SCG Labor - Outreach & Public Affairs	\$ 24,831	3.0%		25% \$ 6,208	\$ 31,039	% of Subtotal Construction and Materials	2%
Engineering / Design Services	\$ 33,108	4.0%		25% \$ 8,277	\$ 41,385	% of Subtotal Construction and Materials	3%
PM / Project Services	\$ 24,831	3.0%		25% \$ 6,208	\$ 31,039	% of Subtotal Construction and Materials	2%
Construction Management / Inspection	\$ 20,693	2.5%		25% \$ 5,173	\$ 25,866	% of Subtotal Construction and Materials	2%
Surveying / As-built	\$ 12,416	1.5%		25% \$ 3,104	\$ 15,519	% of Subtotal Construction and Materials	1%
Environmental Services	\$ 8,277	1.0%		25% \$ 2,069	\$ 10,346	% of Subtotal Construction and Materials	1%
Pressure Test Certification Services	\$ -	0.0%		25% \$ -	\$ -	N/A	0%
Water Storage	\$ -	0.0%		25% \$ -	\$ -	N/A	0%
Weld X-Ray / NDE	\$ -	0.0%		25% \$ -	\$ -	N/A	0%
Land Services	\$ 74,493	9.0%		25% \$ 18,623	\$ 93,117	Assumed Storage fee for one year	6%
CNG / LNG	\$ -	0.0%		25% \$ -	\$ -	N/A	0%
Gas Capture / Cross Compression	\$ 16,554	2.0%		25% \$ 4,139	\$ 20,693	Assumed Isolation	1%
Miscellaneous Services	\$ 4,139	0.5%		25% \$ 1,035	\$ 5,173	% of Subtotal Construction and Materials	0%
Outreach & Public Affairs	\$ 20,693	2.5%		25% \$ 5,173	\$ 25,866	% of Subtotal Construction and Materials	2%
Permits	\$ 4,139	0.5%		25% \$ 1,035	\$ 5,173	% of Subtotal Construction and Materials	0%
Other Non-Labor Costs	\$ 5,380	5.0%	\$ 5,380	25% \$ 1,345	\$ 6,725	5% of SCG labor	0%
<b>Total Direct Estimated Cost (No Loaders)</b>	<b>\$ 1,160,026</b>			<b>25.00% \$ 290,007</b>	<b>\$ 1,450,033</b>		

Hydrogen-Blending Demonstration-UCI - Installation Phase 1

WO#  
WR#

Total Sheet

ELEMENTS OF ESTIMATED COSTS	TOTAL PLANT	TOTAL ABD.	TOTAL O&M	TOTAL EST. COSTS
Miles	0.00	0.00	0.00	
LENGTH OF PIPE (in feet)	-	-	-	
CONTRACT COSTS	\$ -	\$ -	\$ 4,589,211	\$ 4,589,211
COMPANY LABOR	\$ -	\$ -	\$ 644,946	\$ 644,946
<b>TOTAL COMPANY LABOR &amp; CONTRACT COST</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 5,234,157</b>	<b>\$ 5,234,157</b>
PIPE COSTS				
OTHER STORES MATERIAL				
PURCHASED MATERIAL	\$ -	\$ -	\$ 2,773,446	\$ 2,773,446
PURCHASED SERVICES	\$ -	\$ -	\$ 2,068,685	\$ 2,068,685
PAVING	\$ -	\$ -	\$ -	\$ -
PERMITS	\$ -	\$ -	\$ 36,813	\$ 36,813
OTHER DIRECT COSTS	\$ -	\$ -	\$ 32,747	\$ 32,747
<b>TOTAL DIRECT COSTS</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 10,145,848</b>	<b>\$ 10,145,848</b>
<b>% of TOTAL</b>	<b>0.00%</b>	<b>0.00%</b>	<b>100.00%</b>	<b>100.00%</b>

	TOTAL PLANT	TOTAL ABD.	TOTAL O&M	
CONTRACT AND MATERIAL COSTS	\$ -	\$ -	\$ 7,362,657	\$ 7,362,657
<b>% of Total</b>	<b>0.00%</b>	<b>0.00%</b>	<b>100.00%</b>	<b>100.00%</b>

	TOTAL PLANT	TOTAL ABD.	TOTAL O&M	
CONTRACT COSTS	PCC	ACC	OCC	
COMPANY LABOR	CL	CL	CL	
<b>TOTAL COMPANY LABOR &amp; CONTRACT COST</b>				
PIPE COSTS				
OTHER STORES MATERIAL				
PURCHASED MATERIAL	PM	AM	OM	
PURCHASED SERVICES	S	S	S	
PAVING	Pav	Pav	Pav	
PERMITS	Perm	Perm	Perm	
OTHER DIRECT COSTS	ODC	ODC	ODC	
<b>TOTAL DIRECT COSTS</b>				

Hydrogen-Blending Demonstration-UCI - Decommission Phase 3

WO#  
WR#

Total Sheet

ELEMENTS OF ESTIMATED COSTS	TOTAL PLANT	TOTAL ABD.	TOTAL O&M	TOTAL EST. COSTS
Miles	0.00	0.00	0.00	
LENGTH OF PIPE (in feet)	-	-	-	
CONTRACT COSTS	\$ -	\$ -	\$ 1,012,534	\$ 1,012,534
COMPANY LABOR	\$ -	\$ -	\$ 134,502	\$ 134,502
<b>TOTAL COMPANY LABOR &amp; CONTRACT COST</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 1,147,036</b>	<b>\$ 1,147,036</b>
PIPE COSTS				
OTHER STORES MATERIAL				
PURCHASED MATERIAL	\$ -	\$ -	\$ 22,096	\$ 22,096
PURCHASED SERVICES	\$ -	\$ -	\$ 269,004	\$ 269,004
PAVING	\$ -	\$ -	\$ -	\$ -
PERMITS	\$ -	\$ -	\$ 5,173	\$ 5,173
OTHER DIRECT COSTS	\$ -	\$ -	\$ 6,725	\$ 6,725
<b>TOTAL DIRECT COSTS</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 1,450,033</b>	<b>\$ 1,450,033</b>
<b>% of TOTAL</b>	<b>0.00%</b>	<b>0.00%</b>	<b>100.00%</b>	<b>100.00%</b>

	TOTAL PLANT	TOTAL ABD.	TOTAL O&M	
CONTRACT AND MATERIAL COSTS	\$ -	\$ -	\$ 1,034,629	\$ 1,034,629
<b>% of Total</b>	<b>0.00%</b>	<b>0.00%</b>	<b>100.00%</b>	<b>100.00%</b>

	TOTAL PLANT	TOTAL ABD.	TOTAL O&M	
CONTRACT COSTS	PCC	ACC	OCC	
COMPANY LABOR	CL	CL	CL	
<b>TOTAL COMPANY LABOR &amp; CONTRACT COST</b>				
PIPE COSTS				
OTHER STORES MATERIAL				
PURCHASED MATERIAL	PM	AM	OM	
PURCHASED SERVICES	S	S	S	
PAVING	Pav	Pav	Pav	
PERMITS	Perm	Perm	Perm	
OTHER DIRECT COSTS	ODC	ODC	ODC	
<b>TOTAL DIRECT COSTS</b>				

## Basis Of Estimate

### Project Details:

Project Location: site 1 is adjacent to UCI's central plant (33.647524, -117.847254), which is on UCI's campus. The site is located within pressure district 42023.

Purpose: Hydrogen Demo 1 will investigate the potential role of hydrogen in the future energy mix by utilizing a single-fed pressure district to test the effect of having a 5% up to 20% hydrogen to natural gas blend by volume in our distribution pipeline.

High Level Construction Schedule:

Peak Load: 44 psig. Electrolyzer output pressure is 435 psig.

Equipment:

- Electrolyzer, C30 (NEL Electrolyzer)
- BI Enclosure, Chiller
- Pressure vessel (10 ft by ft 4ft Vessel, Non-Bulk Hydrogen Storage)
- Blending skid
- Pressure regulators (5)
- Temperature transmitters (1)
- Gas analyzer
  - oGas Chromatograph
- Gas detectors/leak detectors (2)
- Fire detectors (2)
- Valves (9)
- Pressure transmitters (3)
- Communications
- Utility systems
  - oConnection to Water
  - oConnection to Sewer
  - oConnection to electricity
- Supervisory Control and Data Acquisition (SCADA) RTU
- Human Machine Interface (HMI)
- Temporary pressure regulating stations (2)
- Retaining wall
- Ballards in front of facility

Gas Source: Hydrogen to be generated by electrolyzer

### Scope Of Work:

In support of the Company's ASPIRE 2045 climate commitment, SoCalGas is planning a hydrogen blending demonstration project to test the feasibility and design of injecting hydrogen into existing natural gas distribution pipeline infrastructure. The UCI Hydrogen Blending Distribution Demonstration Project will investigate the potential role of hydrogen in the future energy mix by blending hydrogen (5 to 20% hydrogen by volume) with natural gas to meters that will feed UC Irvine end users. Prior to hydrogen injection, two aboveground temporary regulator stations need to be installed and two locations on the pipeline system need to be cut and capped in order to isolate the project location. The first cut and cap location is the 8" main along West Peltason Drive between Campus Drive and Pereira Drive. The second cut and cap location is the 6" main at Academy Way and West Peltason Drive. Note: the two temporary regulator stations must be installed prior to cut and cap of mains. After the two locations are cut and capped, the hydrogen blending skid can then be operational.

The first temporary regulator station to be installed will be tapped from the 4" supply line (SL) 35-20-A4 and have outlet pipe tapped into the 8" main on West Peltason Drive at Mesa Drive.

The second temporary regulator station to be installed will be tapped from the 12" SL 35-20-A and have outlet pipe tapped into the 4" main on California Ave and Academy Way. Approximately 700 feet of 4" steel pipe will need to be installed to connect the high pressure pipeline, pressure regulating station, and the medium pressure system. The regulator station needs to support a demand of 31.0 msch.

The project will install a PEM electrolyzer on the UCI campus with a hydrogen storage vessel on site to store up to estimated 11 kg H2 to feed into the natural gas by the blending skid. The water to the electrolyzer will be supplied from the water line at the facility site. The blending skid will mix the natural gas from the medium pressure gas line and blend with the onsite produced hydrogen.

A hydrogen blending skid will tap into a 6" medium pressure pipeline and use regulators to inject hydrogen into the natural gas stream to create a hydrogen-natural gas blend. The project will install a normally closed valve on existing 6" medium pressure steel line along W. Peltason Dr., between the blending skid inlet and outlet to prevent mixing between the streams. A third party will be hired to design and build the blending skid, including its control systems. The mixed gas composition will be tested downstream of the blending skid to ensure that composition limits are not surpassed. This blended gas will then be injected downstream of the blending skid natural gas inlet, into the pressure district where it will be used by 4 meters.

The hydrogen blending skid will be controlled by a remote terminal unit (RTU) which will monitor and regulate line pressures, temperatures, flow rate, valve statuses and gas composition. Power will need to be brought into the site for the blending skid, SCADA, and offloading skid.

### Assumptions:

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

- Crews will mobilize to construction yard and job site
- Compressed hydrogen to be produced by electrolyzers
- Company purchase of Blending Skid
- Foundations are required for the site equipment
- Pressure vessel and blending skid will have its own press and temp transmitters
- Mechanical contractor duration anticipated at approximately 5 months for site facilities and field supervision
- Additional site excavation included Site location on side of hill, CMU Wall Footer, Foundations pads and conduit, blending skid pad, and water/sewer trench
- Assumed reg stations are above ground and outside of the intersection. - Sheltered reg station
- Assumes beam and plate for shoring of hillside.
- Install C30 Electrolyzer, Chiller, and Deionizer cost at 25% factored off Equipment Cost. Includes: equipment install, foundations, E&I bulks, piping to tie-in
- Install Blending Skid at 30% factored off Equipment Cost. Includes: equipment install, foundations, E&I bulks, piping to tie-in
- Installation of 200 LF of electrical Ductbank
- Assuming 757 CY of Coat Welds & Backfill Excavations
- Restoration includes repavement of concrete, 102 LF of retaining wall, 250 LF of chain link fence and associated fence, man gates, and shelter foundation.
- Assuming 10 days of commissioning support
- Assume 2 days of traffic control
- Class 5 Estimate - 50% / +100%
- Assumes 5% freight cost
- Assumes 8% sales tax
- Additional contingency for material due to current material market volatility
- Electrical scope includes; Install SCADA/RTU, Install Shelter, Natural Gas Fuel Cell Generator, Re-Install Coriolis Meter, Re-Install Flame Detector, Cost for power drop from Edison, install switchgear and install of transformer

### Stakeholder Estimate Assumptions:

\*Non-construction and non-material costs are based on top-down estimating approach consistent with an AACE Class 5 estimate. Cost ranges development are based on considerations of historical cost estimate ranges and/or similar size and scope projects.

### Exclusions:

- Estimate excludes any maintenance and utility costs that would be incurred after site is operational
- Excludes ongoing electrical costs once site is operational

### Location:



## Basis Of Estimate

### Project Details:

Project Location: site 1 is adjacent to UCI's central plant (33.647524, -117.847254), which is on UCI's campus. The site is located within pressure district 42023.

Purpose: Hydrogen Demo 1 will investigate the potential role of hydrogen in the future energy mix by utilizing a single-fed pressure district to test the effect of having a 5% up to 20% hydrogen to natural gas blend by volume in our distribution pipeline.

High Level Construction Schedule: 1 Month for Decommissioning Scope

Peak Load:

**Decommission the following above ground equipment:**

Equipment:

- Electrolyzer, C30 (NEL Electrolyzer)
- DI Enclosure, Chiller
- Pressure vessel (10 ft by ft 4ft Vessel, Non-Bulk Hydrogen Storage)
- Blending skid
- Pressure regulators (5)
- Temperature transmitters (1)
- Gas analyzer
- Gas Chromatograph
- Gas detectors/leak detectors (2)
- Fire detectors (2)
- Valves (9)
- Pressure transmitters (3)
- Communications
- Supervisory Control and Data Acquisition (SCADA) RTU
- Human Machine Interface (HMI)
- Temporary pressure regulating stations (2)
- Valve caps for isolation (2)
- Bollards in front of facility

Gas Source: Hydrogen to be generated by electrolyzer

### Scope Of Work:

The decommissioning of the project will remove the two temporary pressure regulating stations, electrolyzer, hydrogen storage vessel, DI enclosure, blending skid, chiller, and SCADA unit. The water line connection will be capped. The hydrogen blending skid will be removed from the site and repurposed for another project.

Note: the two locations that were cut and capped will need to be reconnected with the medium pressure system prior to the removal of the two temporary pressure regulating stations.

The site of the project will need to be restored to its original state. The approximate 700 feet of new pipe will be removed after the project. The power line needs to be disconnected and conduit needs to be removed for the electrical work. The foundation for the equipment needs to be demolished and debris will be removed and disposed of according to the city codes. Construction and demolition debris needs to be removed from the site and either recycled or disposed of according to UCI Facilities Management.

After the completion of the demonstration, a 5 ft section of steel pipeline and a 5 ft section of plastic pipe will be removed for mechanical integrity testing in the laboratory. Two meters will be removed and sent out for mechanical integrity testing. Two new meters will need to be installed as well as 5 ft sections of steel pipe and 5 ft of plastic that was removed.

### Assumptions:

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

- This Estimate is for a Class 5 TIC To Decommission / Remove H2 UCI Facility
- Assumption is to remove all above ground equipment, structures, and piping. This does not include excavation or removal of existing buried piping, conduits, Retaining wall, and foundations unless specifically called out later in assumptions like water and sewer pipe.
- Assumption is to leave retaining wall in place
- Skid & Equipment Foundations and buried pipe are going to be left in place except for the 700' pipe, removal is not included
- No hazardous materials assumed
- Estimate includes decommissioning, removal, hauling, and storage of: Electrolyzer, Blending Skid, Storage Tank, Deionizer, Chiller, SCADA, and reg station skids.
- Construction Estimate is calculated using parametric values and historical crew rates
- Crew rate includes crane and trucking/hauling equipment needed to lift and transport skids and equipment
- Estimate includes replacement of 5 LF of steel pipe, 5 LF of plastic pipe, and remove and replacement of 2 meters
- Estimate includes removal of buried water and sewer pipe
- Estimate includes hydrotesting any new pipe
- Crews will mobilize to construction yard and job site
- Assume 2 days of traffic control
- Mechanical contractor duration anticipated at approximately 1 month for site facilities and field supervision
- Assumes 5.5% freight cost
- Assumes 8% sales tax
- Class 5 Estimate (-50%, +100% accuracy)

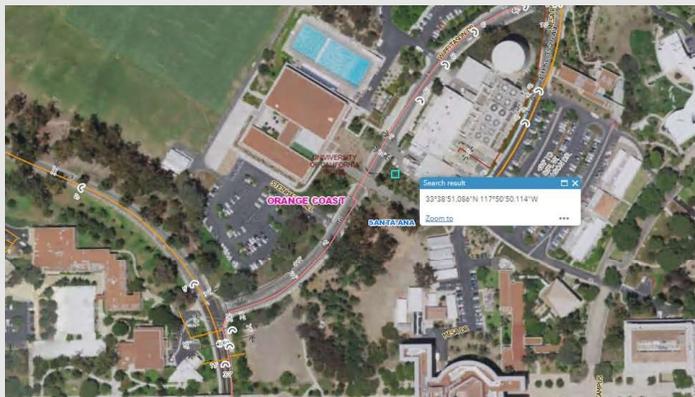
### Stakeholder Estimate Assumptions:

\*Non-construction and non-material costs are based on top-down estimating approach consistent with an AACE Class 5 estimate. Cost ranges development are based on considerations of historical cost estimate ranges and/or similar size and scope projects.

### Exclusions:

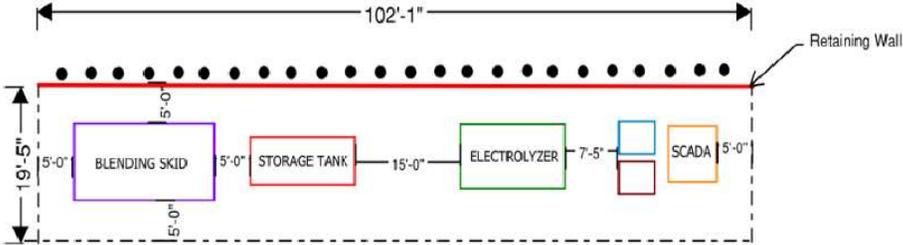
- Estimate excludes any maintenance and utility costs that would be incurred after site is Decommissioned

### Location:



### Site Mockup (Draft) - 5.13.2022

- Electrolyzer 15'x8'
- DI Enclosure 6'x4'
- Storage Tank 15'x6'
- Blending Skid 20'x10'
- SCADA 7'x7'
- Chiller 6'x4'
- Bollard 4' Apart



**Workpaper Supporting  
Direct Testimony of Kevin Woo (WP-1)**

**Appendix B**

PHASE 2

Task	Occurrence	# Staff	Hours Per Staff	Hourly Rate	Estimate	With 25% contingency	Union	Management	Contractor/Third Party
Odorant Sampling and Analysis	18	1	8	\$59.86	\$8,619.84	\$10,774.80	\$10,774.80		
Leak Surveys and Equipment	18	2	8	\$55.00	\$15,840.00	\$19,800.00	\$9,900.00	\$9,900.00	
Pipe Sampling (Excavation - Plastic)	1	-	-	-	\$25,000.00	\$31,250.00			\$31,250.00
Pipe Sampling (Excavation - Steel)	1	-	-	-	\$25,000.00	\$31,250.00			\$31,250.00
Pipe Sample Prep & Analysis (Plastic)	2	-	-	-	\$2,882.06	\$7,205.15	\$3,142.65	\$4,062.50	
Pipe Sample Prep & Analysis (Steel)	2	-	-	-	\$7,698.60	\$19,246.50	\$1,496.50	\$2,750.00	\$15,000.00
Customer Feedback	18	1	2	\$50.00	\$1,800.00	\$2,250.00		\$2,250.00	
Blending Skid Operation, Gas Usage, Customer Meters Comparison	18	1	8	\$50.00	\$7,200.00	\$9,000.00		\$9,000.00	
Customer Equipment Checks	18	1	8	\$59.86	\$8,619.84	\$10,774.80	\$10,774.80		
Water - non-labor	18	-	-	-	\$100.05	\$2,251.19			\$2,251.19
Electricity - non-labor	18	-	-	-	\$17,198.39	\$386,963.71			\$386,963.71
Program Management Costs - Direct Labor (50% FTE @ \$125K/year for four years)	-	1	-	-	\$250,000.00	\$312,500.00		\$312,500.00	
Blending Skid Maintenance (Internal)	6	1	8	\$ 59.86	\$2,873.28	\$3,591.60	\$3,591.60		
Electrolyzer Maintenance (Internal)	6	1	8	\$ 59.86	\$2,873.28	\$3,591.60	\$3,591.60		
Service Agreements for Major Equipment					\$40,000.00	\$50,000.00			\$50,000.00
					<b>Total</b>	<b>\$900,449.36</b>	<b>\$43,271.95</b>	<b>\$340,462.50</b>	<b>\$516,714.91</b>

	2024	2025	2026
Union	\$6,014.79	\$28,847.97	\$8,409.19
Management	\$56,743.75	\$226,975.00	\$56,743.75
Contractor/Third Party	\$103,619.15	\$292,809.94	\$120,285.82
<b>Total Direct</b>	<b>\$166,377.69</b>	<b>\$548,632.90</b>	<b>\$185,438.76</b>

**PHASE 4**

Tasks	Occurrence	# Staff	Hours Per Staff	Hourly Rate	Estimate	With 25% contingency
Hydrogen Engineering and Data Team	27	6	15	69.35	\$ 168,523	\$ 210,653.55
Management	27	2	10	78.37	\$ 42,317	\$ 52,896.63
Reporting (Contractor/Third Party)						\$100,000
					<b>Total</b>	<b>\$ 363,550.18</b>

	2026	2027
<b>Management</b>	\$ 175,700.12	\$ 87,850.06
<b>Contractor/Third Party</b>	\$33,333.33	\$66,666.67
<b>Total Direct</b>	\$209,033.45	\$154,516.73