



**CALIFORNIA
ENERGY COMMISSION**



**CALIFORNIA
natural
resources
AGENCY**

California Energy Commission
Clean Transportation Program

FINAL PROJECT REPORT

Hollywood Hydrogen Station

Prepared for: California Energy Commission

Prepared by: FirstElement Fuel, Inc.

Gavin Newsom, Governor

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California Energy Commission

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Disclaimer

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ACKNOWLEDGEMENTS

The construction of the Hollywood hydrogen refueling station has been possible only because of the substantial efforts and funds provided by a number of stakeholders.

FirstElement Fuel, Inc. graciously thanks Toyota for their vision and fortitude; Air Products and Chemicals, Inc., Black & Veatch, and Vantage Company for bringing the project together; Tyson Eckerle for helping push the lease over the goal line; and, of course, Jean Baronas, Phil Cazal, Jim McKinney, Vice Chair Janea Scott, and many others at the California Energy Commission for tremendous, sustained confidence in clean, alternative transportation.

PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program, formerly known as the Alternative and Renewable Fuel and Vehicle Technology Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to \$20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about \$100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-13-607 to provide funding opportunities under the Clean Transportation Program for hydrogen refueling stations. In response to PON-13-607, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards May 1, 2014 and the agreement was executed as ARV-14-008 on July 22, 2014.

ABSTRACT

FirstElement Fuel, Inc. designed, engineered, permitted, constructed, and commissioned a hydrogen refueling station located at 5700 Hollywood Blvd., Los Angeles (Los Angeles County). FirstElement Fuel, Inc. plans to own and operate the hydrogen refueling station until at least 2025. The station consists of a concrete reinforced block compound that encloses hydrogen storage, compression, and cooling equipment; a dispenser with two fueling hoses; a customer payment interface; a canopy; and a dedicated concrete fueling position for fuel cell electric vehicle drivers.

Keywords: California Energy Commission, FirstElement Fuel, Inc., hydrogen refueling station, hydrogen infrastructure, fuel cell electric vehicle.

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EXECUTIVE SUMMARY

Hydrogen fuel cell electric vehicles (FCEVs) and hydrogen refueling stations are expected to play key roles in California as the state transitions to lower-carbon and zero-emission vehicle technologies for light-duty passenger vehicles, transit buses, and truck transport fleets. Numerous government regulations and policy actions identify FCEVs as a vehicle technology that will be available to meet the California Air Resources Board's zero emission vehicle regulation and the specific actions to bring the vehicles to California markets specified in former Governor Jerry Brown's Zero Emission Vehicle Action Plan.

FCEVs offer tremendous potential for the light-duty passenger vehicle market and medium- and heavy-duty truck and bus markets. Fuel cell electric passenger vehicles can drive more than 300 miles on a tank of hydrogen, they have zero tailpipe emissions, and they can be refueled in three to four minutes the way gasoline passenger vehicles are fueled. The technology can be readily scaled up for sport utility vehicles, family passenger vans, pick-up trucks, urban package and beverage delivery trucks, and even heavy-duty trucks and buses. Most auto industry analysts and agencies view fuel cell electric drive technology as a complement to battery electric drive technologies, rather than as a competing technology. Both battery and fuel cell electric vehicle technologies will be needed in California to achieve the zero-emission vehicle deployment goals.

In contrast to battery electric and plug-in hybrid electric vehicles that can be charged in home settings, FCEVs require a new network of refueling stations that dispense pressurized hydrogen for consumer use. This has meant that the auto industry and station development industry have had to co-develop two new technologies in parallel: hydrogen refueling infrastructure and hydrogen FCEVs. FCEVs cannot be widely marketed and sold to consumers without a minimum network of refueling stations available.

Assembly Bill 8 (AB 8, Perea, Chapter 401, Statutes of 2013) reauthorized the original AB 118 funding program (Núñez, Chapter 750, Statutes of 2007) and created new legal requirements for the CEC's Alternative and Renewable Fuel and Vehicle Technology Program. The bill directs the CEC to allocate up to \$20 million per year, or up to 20 percent of each fiscal year's available funding, for the development of hydrogen refueling stations "until there are at least 100 publicly available hydrogen-fueling stations in operation in California" (Health and Safety Code 43018.9[e][1]).

In response to PON-13-607 issued by the CEC, FirstElement Fuel, Inc. was awarded funding for 19 stations. The CEC contributed \$1,451,000 of the total \$2,314,463.63 cost to design, engineer, permit, construct, and commission the Hollywood station.

The site for this project is 5700 Hollywood Blvd., Los Angeles (Los Angeles County). The hydrogen refueling station at this location will serve as a core station in southern California for at least the next ten years. FirstElement Fuel, Inc. accomplished this goal through the steps outlined below.

The owner at Hollywood was excited to bring a clean, alternative fuel to his station. Lease terms were negotiated, and FirstElement Fuel, Inc. executed a lease with the Hollywood owner on December 31, 2014.

FirstElement Fuel, Inc. developed the site configuration and design, and Black & Veatch performed the detailed engineering design. The zoning process in Hollywood was administrative, and approval was given on July 15, 2015.

Permits for zoning, building, mechanical, electrical, plumbing, and fire were submitted on June 1, 2015 and finalized November 16, 2015 for a total period of 168 days. Because the Hollywood station is located within the jurisdiction of the City of Los Angeles, the zoning and permitting process was managed by the City. There were no major hurdles in either planning or permitting, but the process still took longer than in smaller jurisdictions.

Construction began on January 25, 2016 and was completed on June 6, 2016. Commissioning began on April 11, 2016 and was completed on April 30, 2016. The FirstElement Fuel, Inc. team performed the bulk of the commissioning tasks including cleaning, purging, and pressure testing, with Air Products and Chemicals, Inc., performing final start-up.

CHAPTER 1:

Station Design and Construction

There were many steps required to bring the Hollywood 33 percent renewable hydrogen refueling station project to completion. The following synopsis highlights the most critical items.

Site Acquisition - Construction (Fall 2013 – September 2015)

Beginning in the fall of 2013, FirstElement Fuel, Inc. took steps to identify and acquire appropriate sites for the station. FirstElement Fuel, Inc. worked with historic vehicle sales data, academic publications, automakers, and the CEC's station location areas to select desired market locations. FirstElement Fuel, Inc. then analyzed specific properties within the target locations to find sites that could meet the space requirements for hydrogen fueling equipment.

After selecting general locations and specific sites, FirstElement Fuel, Inc. contacted station owners and operators to negotiate lease opportunities. FirstElement Fuel, Inc. executed a letter of intent with the property owner at 5700 Hollywood Blvd., Los Angeles, on January 11, 2014. A binding ten-year lease was later executed on December 31, 2014.

FirstElement Fuel, Inc. and Black & Veatch surveyed the site to begin the site layout on August 12, 2014. They generated initial engineering drawings on October 8, 2014. These drawings are referred to as "Construction Drawing 30s" because they represent 30 percent complete construction drawings and contain only two pages. Figure 1 shows the equipment compound drawing from the Construction Drawing 30 drawing set. As shown, the drawing lacks detail and serves only to outline the site plan.

On October 28, 2014, Clark Land Surveying, Inc. performed a detailed engineering survey for the Hollywood station site, as shown in Figure 2.

On March 25, 2015, draft final construction drawings (or "Construction Drawing 90s") were completed that depict all of the minute details required for both construction and the permit review process. Final construction drawings (or "Construction Drawing 100s") were completed with 60 pages that depict all of the minute details required for both construction and the permit review on September 17, 2015. These drawings are similarly signed and sealed by the professional engineer of record to ensure accuracy and completeness. The equipment compound page of the Construction Drawing 100 set is shown in Figure 3.

The zoning application was submitted to the jurisdiction having authority on June 1, 2014. The local planning department verified that the project met the zoning requirements of the proposed location, and approved aesthetic, landscaping, or other details important to the community. Approval was received through an administrative review process on July 15, 2015. All building permit applications were submitted on June 1, 2015, and approved on November 16, 2015 for a total period of 168 days

Because the Hollywood station is located within the jurisdiction of the City of Los Angeles, the zoning and permitting process took extra time because of the size and complexity of the City's organization. A major delay in permitting of the Hollywood station was the result of antiquated

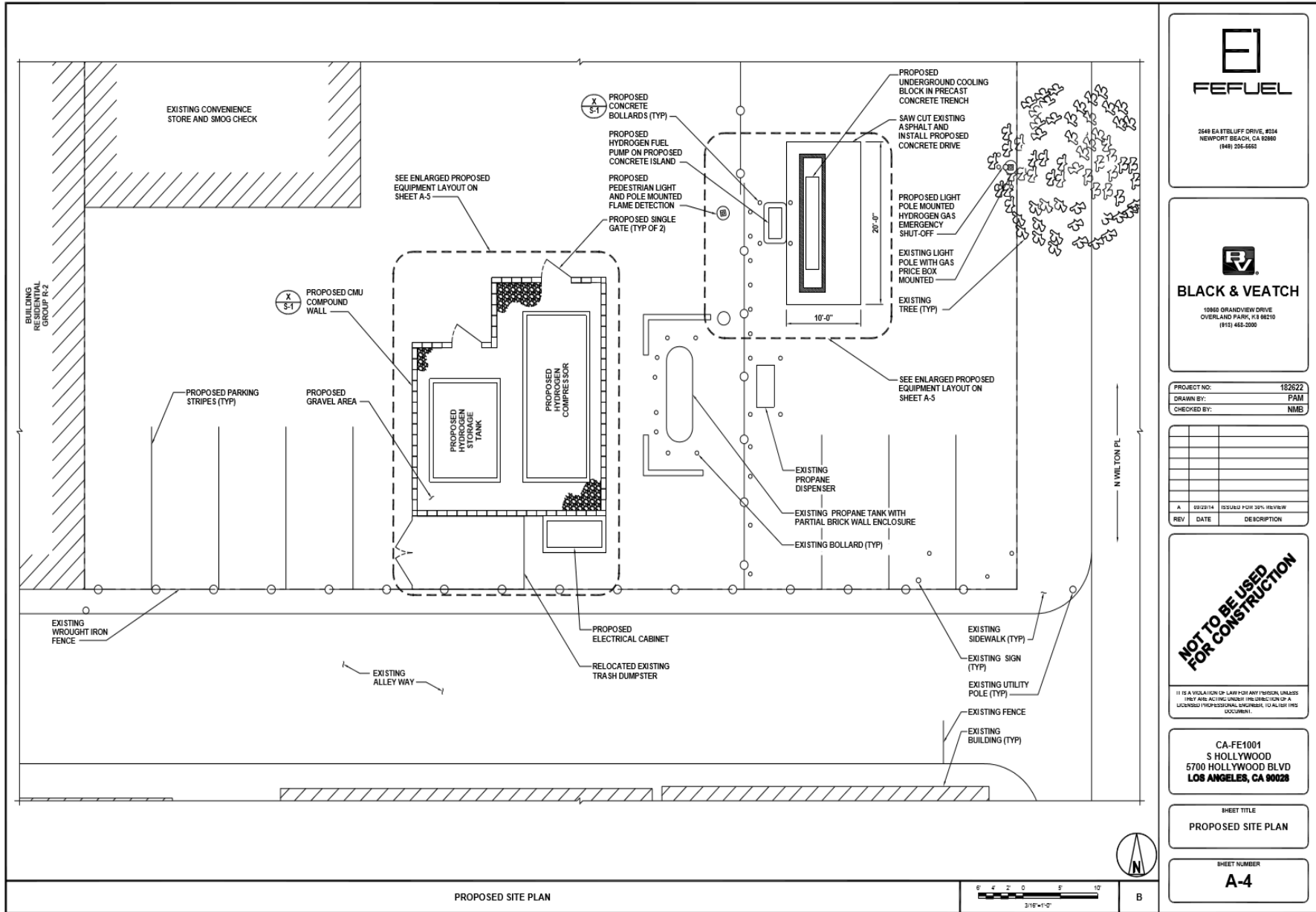
electrical equipment at the existing convenience store. FirstElement Fuel, Inc. was required to engineer and implement a new system (including asbestos removal) for the project to move forward.

Approval of the fire permit was facilitated by the National Fire Protection Association hydrogen technologies code. The code clearly defines fire safety guidelines that enabled FirstElement Fuel, Inc. and the City of Los Angeles to reach common ground and agree on the safety of the hydrogen station design.

FirstElement Fuel, Inc. selected equipment from Air Products and Chemicals, Inc., because of the cost, capacity, reliability, and more mature supply chain compared to other suppliers. FirstElement Fuel, Inc. executed a contract with Air Products and Chemicals, Inc. for the equipment on September 16, 2014 and equipment was delivered to the site on March 28, 2016.

FirstElement Fuel, Inc. and Black & Veatch submitted a detailed bid package to contractors on October 9, 2015. The contract was awarded to Vantage Company on November 16, 2015. The bulk of Vantage's construction experience lies in cell phone towers. Cell phone towers are roughly similar to hydrogen stations in size, have similar foundations and block walls, and have similar electrical requirements. Vantage provided a reasonable bid, had a desire to get involved with hydrogen projects, and was based in southern California. Construction started January 25, 2016.

Figure 1: Coarse Detail of Equipment Compound from Construction Drawing 30



2049 EASTBELLEVUE DRIVE, #204
 NEWPORT BEACH, CA 92660
 (949) 206-6665



BLACK & VEATCH
 10960 GRANDVIEW DRIVE
 OVERLAND PARK, KS 66210
 (913) 468-2000

PROJECT NO: 182622
 DRAWN BY: PAM
 CHECKED BY: NMB

REV	DATE	DESCRIPTION
A	02/21/14	ISSUED FOR 30% REVIEW

NOT TO BE USED FOR CONSTRUCTION

IT IS A VIOLATION OF LAW FOR ANY PERSON UNLESS THEY ARE ACTING UNDER THE SUPERVISION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT.

CA-FE1001
 S HOLLYWOOD
 5700 HOLLYWOOD BLVD
 LOS ANGELES, CA 90028

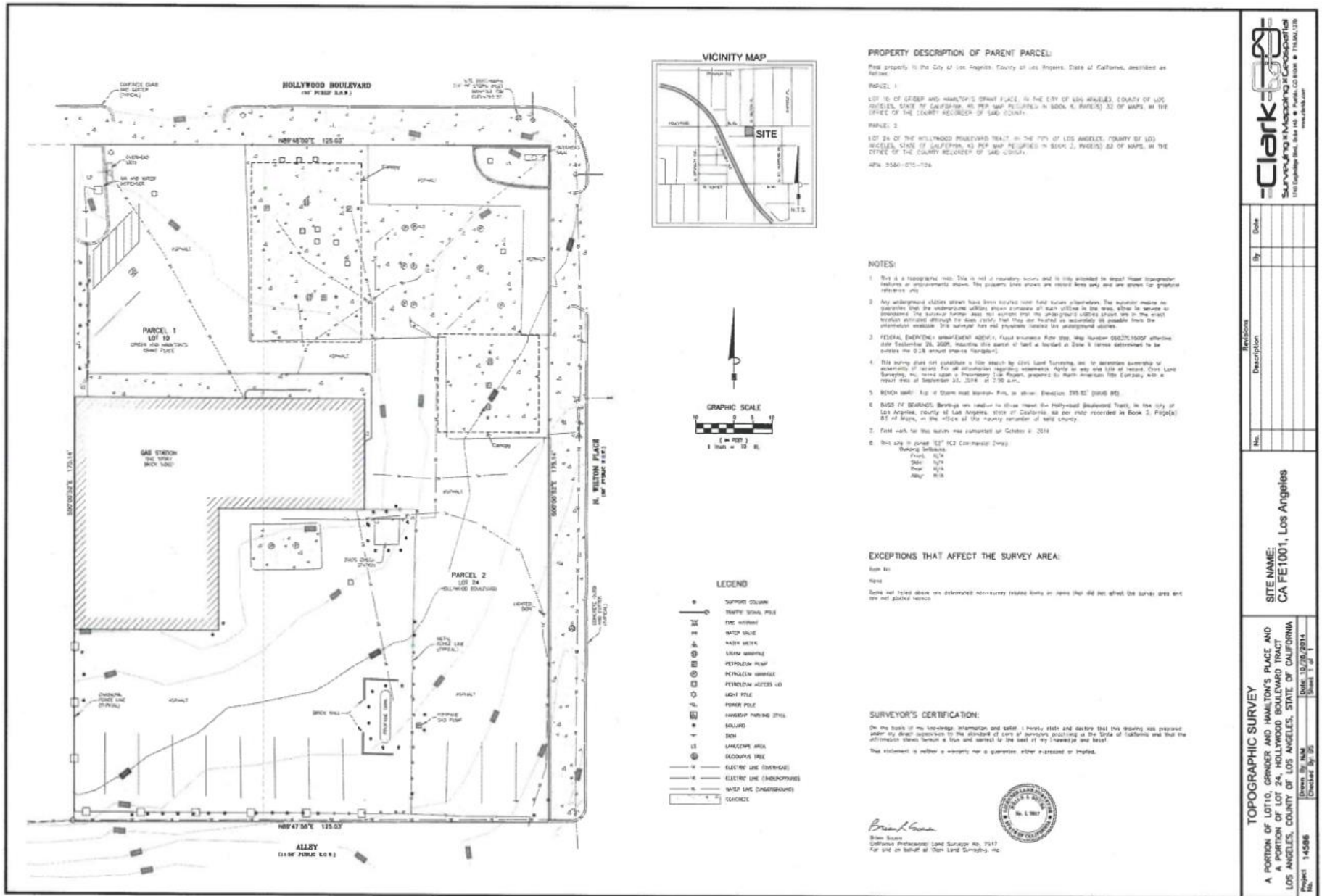
SHEET TITLE
PROPOSED SITE PLAN

SHEET NUMBER
A-4



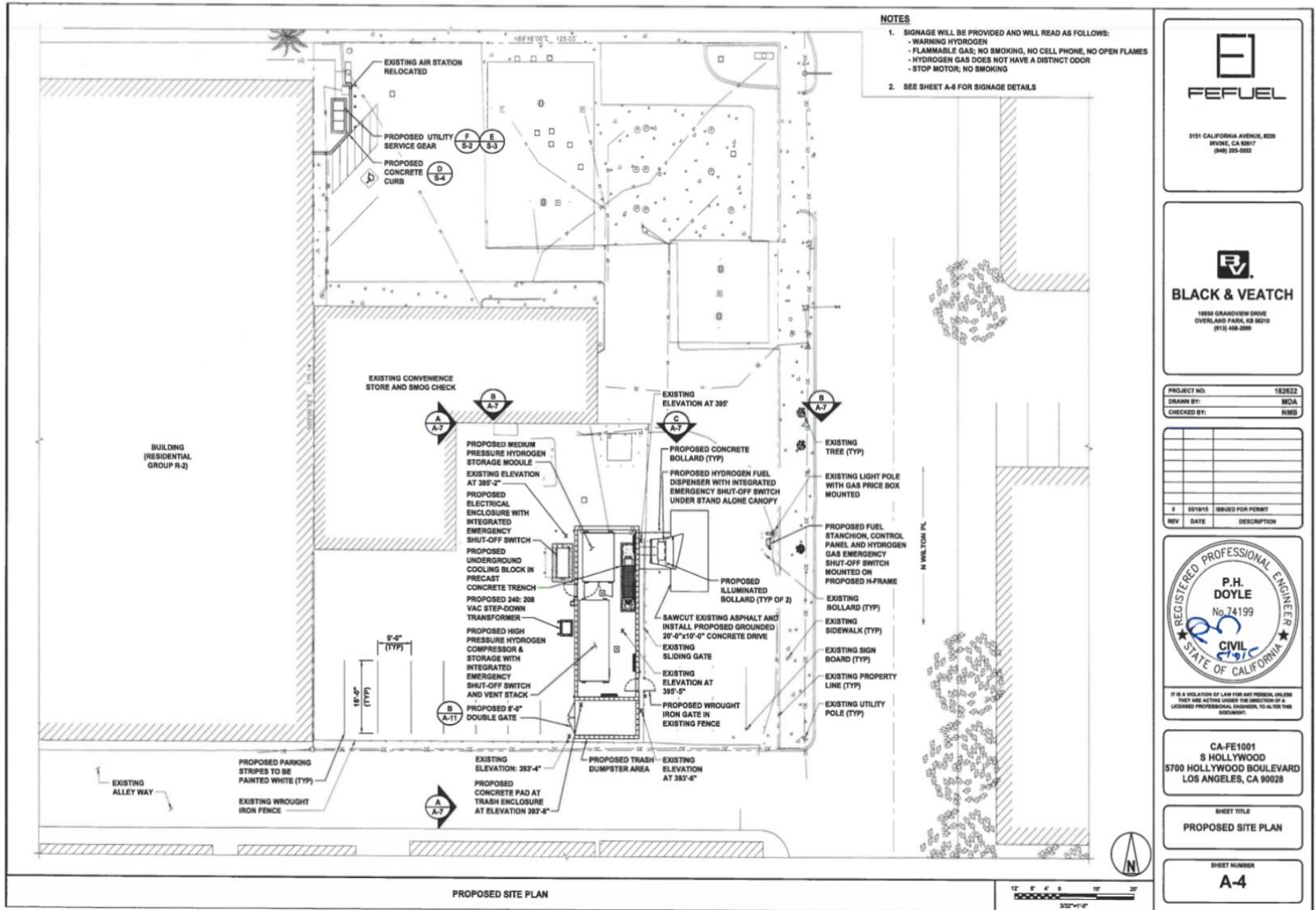
Source: FirstElement Fuel, Inc. Original figure is higher resolution.

Figure 2: Survey of Hollywood Hydrogen Station Location



Source: FirstElement Fuel, Inc. Original figure is higher resolution.

Figure 3: Equipment Compound from Construction Drawing 100 Set



Source: FirstElement Fuel, Inc. Original figure is higher resolution.

Figure 4 shows the equipment compound before completion.

Figure 4: Equipment Pier (Vertical Load Bearing) Foundations In Progress



Source: FirstElement Fuel, Inc.

Hydrogen storage unit, compression, cooling, and dispensing equipment was delivered to the site on March 28, 2016, as shown in Figure 5.

Figure 5: Crane Lifting Hydrogen Ground Storage Unit



Source: FirstElement Fuel, Inc.

Commissioning Process (April 11, 2016 – April 30, 2016)

The commissioning of the Hollywood hydrogen station included the cleaning and purging of lines, pressure testing, and hydrogen sampling.

Station Declared Operational (April 28, 2016)

The Hollywood hydrogen station met the definition of operational in PON-13-607 by completing installation of all station/dispenser components, obtaining all the required permits from the local jurisdiction, filling the station storage tubes with pressurized hydrogen gas Figure 6 successfully passing a hydrogen quality test Figure 7, and fueling one FCEV with hydrogen. FirstElement Fuel, Inc. declared the station operational on April 28, 2016.

Construction was completed June 6, 2016.

Figure 6: FirstElement Fuel, Inc. Technician Performing Pressure Check



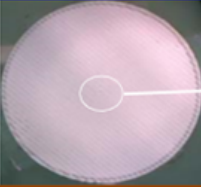
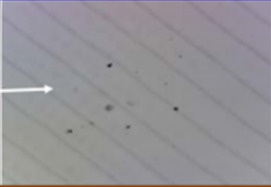
Source: FirstElement Fuel, Inc.

Figure 7 shows a passing test for the purity of the hydrogen dispensed at the Hollywood hydrogen station.

Figure 7: Hydrogen Fuel Quality Report on April 26, 2016

FIRST ELEMENT FUEL

HOLLYWOOD HYDROGEN STATION

SAE J2719	SAE J2719 Limits (μmol/mol)	Smart Chemistry Detection Limits (μmol/mol)	H70 H2 @Nozzle sampled on 04/26/2016 Concentration (μmol/mol)	Analytical Method
Water	5	0.5	< 0.5	
Total Hydrocarbons (C, Basis)	2	1	0.61	ASTM D7692
Methane			0.56	
Acetone			0.0057	
Ethanol			0.0046	
Propane			0.036	
Oxygen	5	1	< 1	ASTM D7649
Helium	300	10	13	ASTM D1946
Nitrogen, Argon	100			
Nitrogen		10	< 10	ASTM D7649
Argon		0.4	< 0.4	ASTM D7649
Carbon Dioxide	2	0.5	< 0.5	ASTM D7649
Carbon Monoxide	0.2	0.0005	0.0014	ASTM D5466
Total Sulfur	0.004	0.000001	0.000041	ASTM D7652
Hydrogen Sulfide		0.000001	0.000013	ASTM D7652
Carbonyl Sulfide		0.000001	0.000015	ASTM D7652
Methyl Mercaptan (MTM)		0.000001	< 0.00001	ASTM D7652
Ethyl Mercaptan (ETM)		0.000001	< 0.00001	ASTM D7652
Dimethyl Sulfide (DMS)		0.000001	< 0.00001	ASTM D7652
Carbon Disulfide		0.000001	0.000013	ASTM D7652
Isopropyl Mercaptan (IPM)		0.000001	< 0.00001	ASTM D7652
Tert-Butyl Mercaptan (TBM)		0.000001	< 0.00001	ASTM D7652
n-Propyl Mercaptan		0.000001	< 0.00001	ASTM D7652
n-Butyl Mercaptan		0.000001	< 0.00001	ASTM D7652
Tetrahydrothiophene (THT)		0.000001	< 0.00001	ASTM D7652
Formaldehyde	0.01	0.001	< 0.001	ASTM D7692
Formic Acid	0.2	0.001	< 0.001	ASTM D5466
Ammonia	0.1	0.005	< 0.005	ASTM D5466
Total halogenates	0.05		0.00078	
Hydrogen Bromide		0.001	< 0.001	ASTM D5466
Hydrogen Chloride		0.003	< 0.003	ASTM D5466
Chlorine		0.001	< 0.001	ASTM D5466
Organic Halides (32 compounds in red and bold listed in "Other Hydrocarbons"). Both Smart Chemistry and method limits is for each individual organic halide.		0.001	0.00078	ASTM D7692
Tetrachloro-hexafluorobutanes			0.00078	
Particulate Concentration			0.078 mg/kg	ASTM D7651
Particulates Found & Size			There are total 16 particulates found with the sizes 245, 179, 175, 159, 155, 120, 92, 91, 75, 69, 64, 64, 47, 34, 34, 17, 17.	ASTM D7634
Hydrogen Fuel Index	The hydrogen fuel index is the value obtained when the amount of aggregate impurities, as expressed as percent (μmole)/μmole, is subtracted from 100%. (Section 3.5 of SAE J2719)		99.99861%	

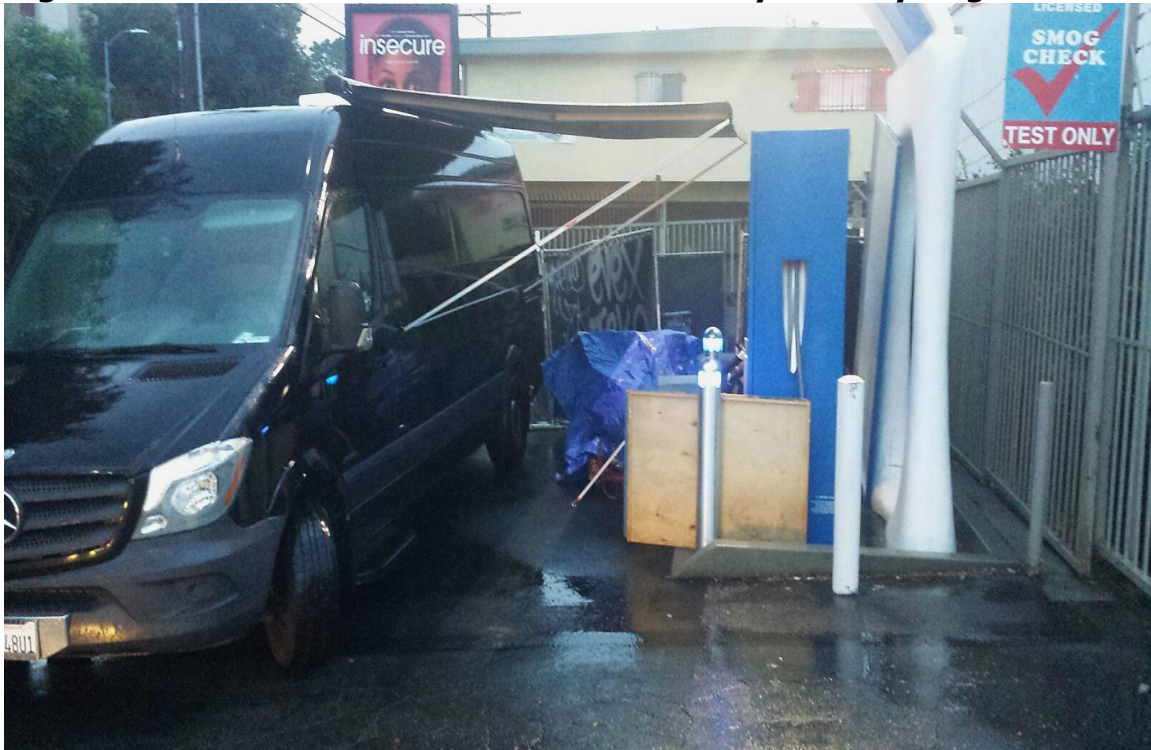
Source: FirstElement Fuel, Inc. Original figure is higher resolution.

Automaker testing was performed at the Hollywood hydrogen station to verify compliance with *SAE J2601 Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles*.

Certification (October 24, 2016)

The California Department of Food and Agriculture’s Division of Measurement Standards enforces California’s weights and measures laws and regulations and must certify any device used for metering the sale of commercial items within California. Figure 8 shows testing performed as FirstElement Fuel, Inc. achieved certification by acting as the registered service agent, dispensing a measured amount of fuel, and confirming the quantity dispensed is accurately reflected by the dispenser in accordance with examination procedures (EPO NO. 40-A) as witnessed by the local county weights and measures officer.¹

Figure 8: Certification Work in the Rain at Hollywood Hydrogen Station



Source: FirstElement Fuel, Inc.

¹ [California Department of Food and Agriculture](https://www.cdfa.ca.gov/dms/programs/devices/Hydrogen_Gas-Measuring_Devices_EPO-40.pdf) https://www.cdfa.ca.gov/dms/programs/devices/Hydrogen_Gas-Measuring_Devices_EPO-40.pdf

The first vehicle filled was a Hyundai Tucson on April 28, 2016 as shown in Figure 9, and the station has been used regularly since then.

Figure 9: First Fill, April 28th, 2016



Source: FirstElement Fuel, Inc.

The Hollywood station dispensed 48 kilograms of hydrogen in September 2016. Sales in October 2016 were 86.5 kilograms, and 234.8 kilograms in November 2016.

Station Operational Status System

The California Fuel Cell Partnership, Station Operational Status System is a website portal designed to provide hydrogen station status for motorist use². This system is important to FCEV drivers during the development phase of the hydrogen refueling station network because it lets drivers know that the hydrogen station they intend to use is operational before they depart. The San Jose hydrogen station began sending automated updates (FirstElement Fuel, Inc. software) on a regular basis, to Station Operational Status System on November 10, 2016.

Environmental Impacts

Hydrogen is stored as a compressed gas in an above-ground tank located behind a wall at this station. In accordance with the funding agreement with the CEC, 33.3 percent of the hydrogen sold at the Hollywood hydrogen station will be produced from renewable sources including biogas. Hydrogen is non-toxic, colorless, and odorless, so hydrogen station equipment is outfitted with appropriate sensors to provide immediate notification in case a leak occurs. No solid or liquid waste will be produced at the Hollywood station.

² [California Fuel Cell Partnership](https://m.cafcp.org/) <https://m.cafcp.org/>

Minimal water was consumed for this project. There was no additional landscaping added for the construction of the hydrogen refueling station; therefore, no additional irrigation water will be consumed.

The use will not cause any unsightly appearances, such as noise, glare, dust, or odor. The facility is a modern addition to an existing gasoline station. No outdoor sound amplification systems were installed; however, lighting was installed at the facility to ease evening fueling.

The Hollywood hydrogen station can dispense 180 kilograms of hydrogen per day. Assuming that FCEVs average 52 miles per kilogram, and consume 180 kilograms of hydrogen from the station per day for the next 10 years, the station will offset 12,025 metric tons of total greenhouse gases compared to equivalent gasoline vehicles. Data on the operation of the station will be collected and reported to the CEC throughout the term of operations and maintenance grant ARV-15-028. Data collected and reported will include throughput, vehicle usage, gallons of gasoline displaced, and a comparison of the actual performance of the project to proposed expectations.

Hollywood Station in the Network

Figure 10 shows the station is open and ready for use.

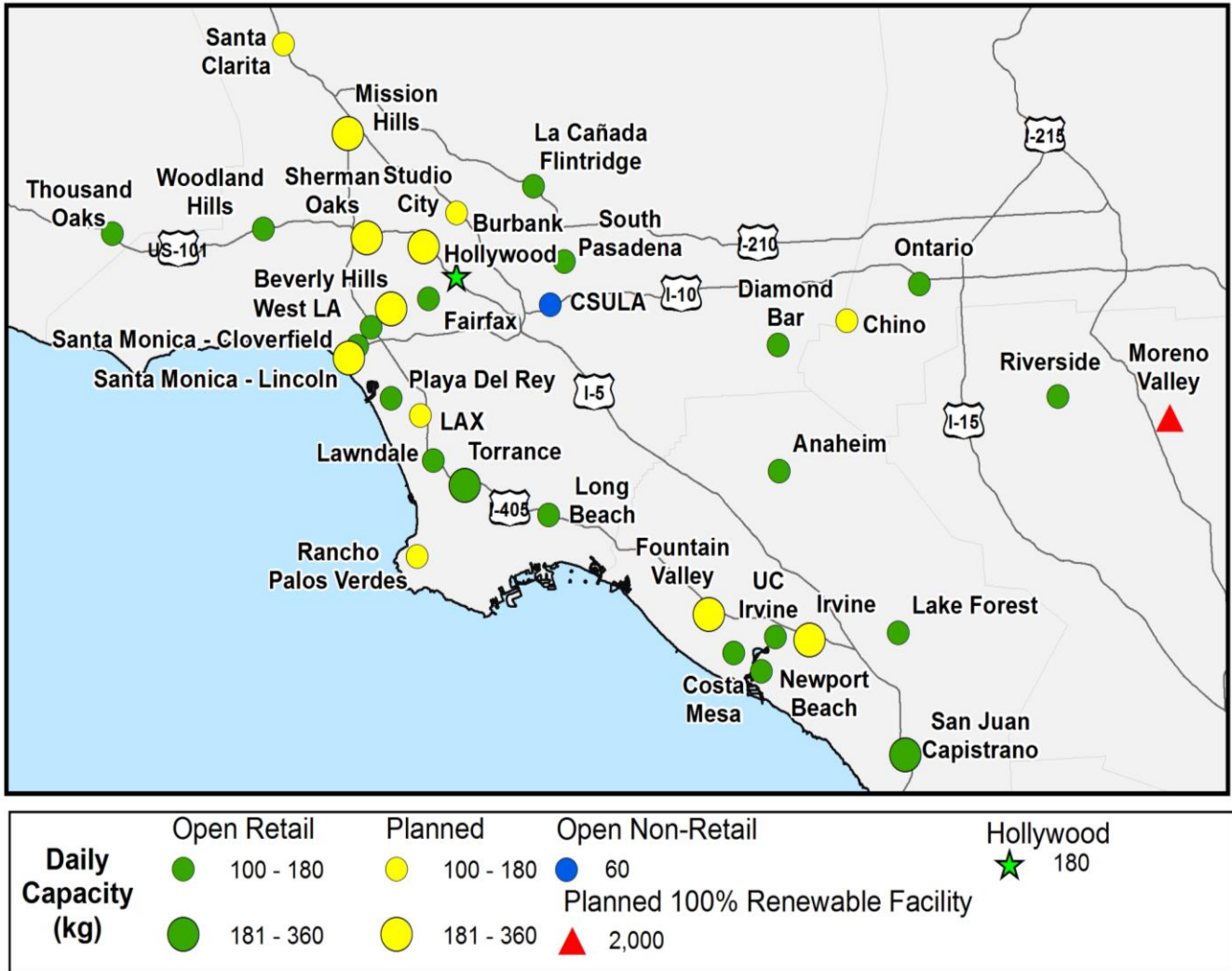
Figure 10: Hollywood Hydrogen Station



Source: The California Fuel Cell Partnership

Figure 11 shows the greater Los Angeles area map which shows the location of the Hollywood hydrogen station at 5700 Hollywood Blvd., Los Angeles in Southern California. The station is just off the U.S. Route 101 near many world famous attractions along on Hollywood Boulevard.

Figure 11: Southern California Hydrogen Stations: Open Retail and Planned



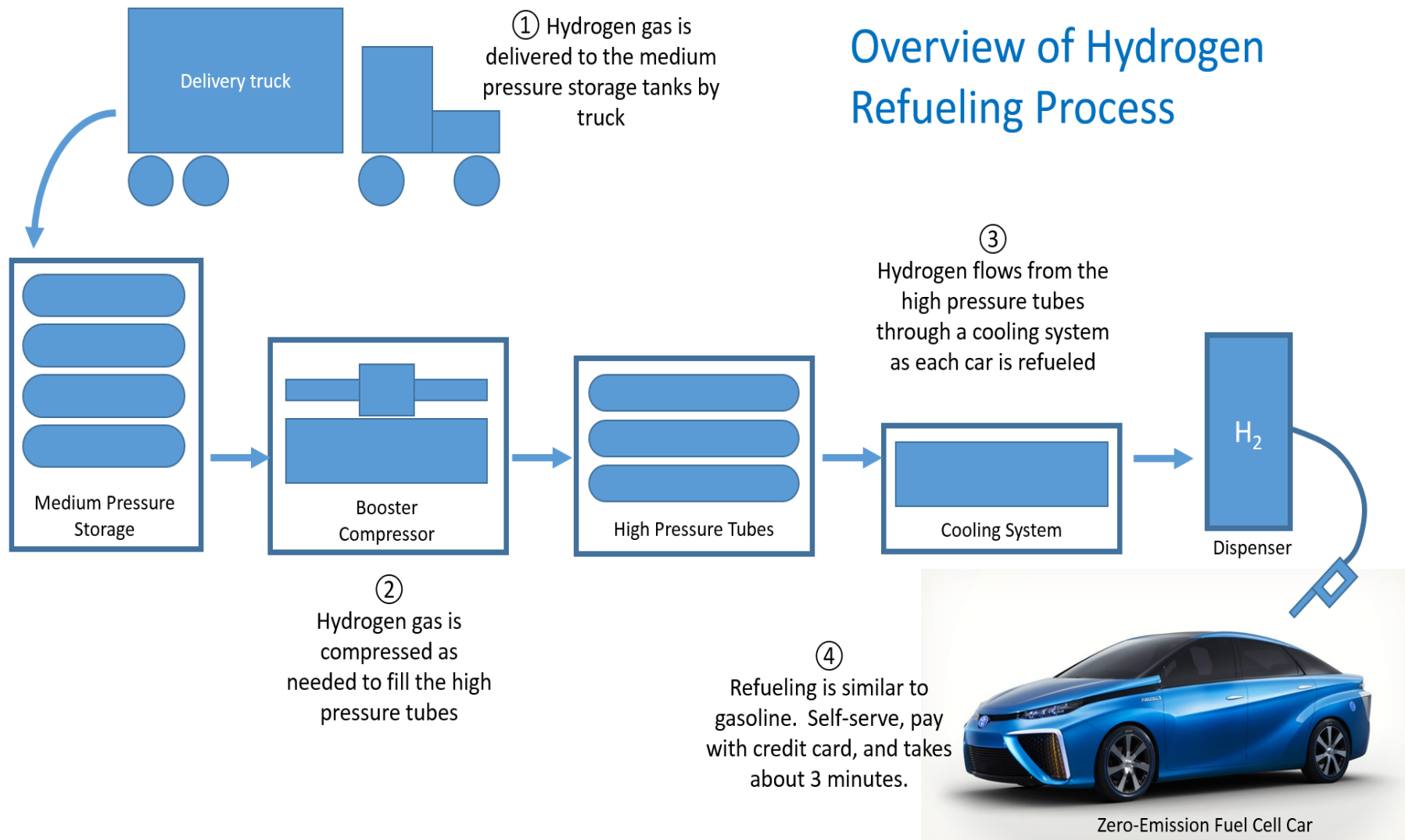
Source: California Energy Commission Staff.

Schematic Layout of the Hollywood Station

Figure 12 depicts an overview of the Hollywood hydrogen station equipment and the steps in the refueling process.

Figure 12: Diagram of the Refueling Process

Overview of Hydrogen Refueling Process

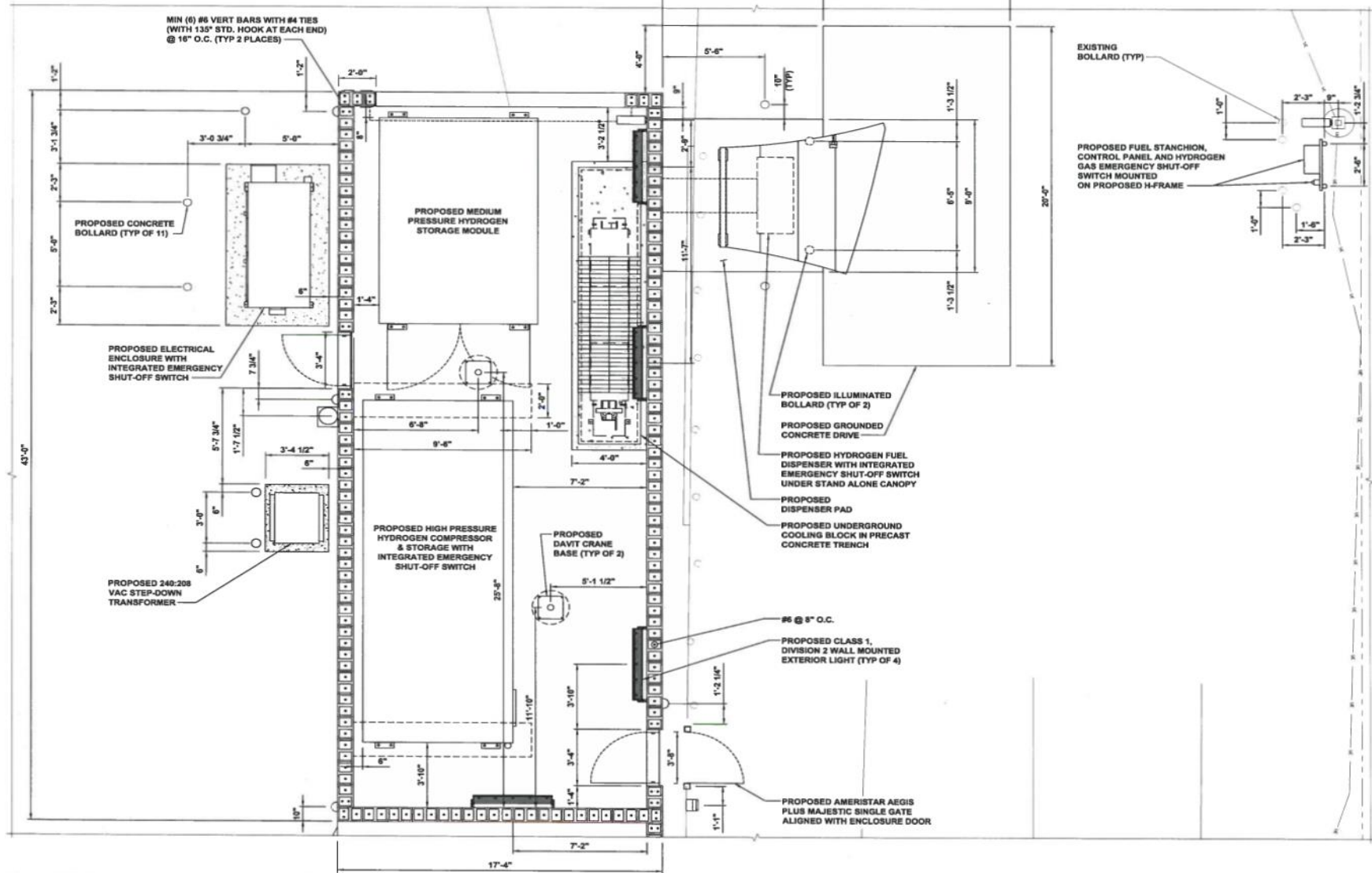


Source: FirstElement Fuel, Inc.

Final Configuration and Budget

Figure 13 shows a detailed view of the Hollywood station.

Figure 13: Hollywood Hydrogen Refueling Station Layout



Source: FirstElement Fuel, Inc. Original figure is higher resolution.

Figure 14 shows the budget to construct the Hollywood hydrogen station.

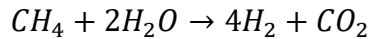
Figure 14: The Project Grant Funding and Match Funding

Air Products and Chemicals, Inc., Allentown , PA	
H2 station equipment	\$1,480,192.21
Black & Veatch, Overland Park, KS	
Construction	\$542,708.64
Engineering	\$74,395.47
Permitting	\$25,300.30
Project Management	\$20,910.62
Various Vendors	
Construction Materials (tubing, wire, etc.)	\$74,152.09
Fixtures (doors, lights, etc.)	\$76,955.58
MSI Tech, Irvine CA	
Data Collection Tool	\$2,353.56
Karen Calhoun, Newport Beach, CA	
Legal services	\$13,150.03
Vertical Advisors LLP, Newport Beach, CA	
Financial services	\$4,345.13
Total Project Costs	\$2,314,463.63
California Energy Commission Grant	\$1,451,000.00
Remaining match funding provided by <u>FirstElement Fuel, Inc.</u>	\$863,463.63
Total California Energy Commission cost share	62.7%

Source: FirstElement Fuel, Inc.

CHAPTER 2: Energy Analysis

The Hollywood hydrogen refueling station is supplied by hydrogen generated via steam methane reformation that converts methane (CH₄) and water (H₂O) to hydrogen (H₂) and carbon dioxide (CO₂):



One hundred percent of the hydrogen sold at the Hollywood hydrogen station is produced from renewable sources. Hydrogen is supplied to the Hollywood hydrogen fueling station from production facilities in Wilmington/Carson (Los Angeles County) belonging to Air Products and Chemicals, Inc. Renewable biogas will be procured as feedstock for the facility, resulting in delivered hydrogen product that is 100% renewable. Table 1 shows the supply sources, data gathered from Shell Energy North America (U.S.), L.P.

Air Products and Chemicals, Inc. has a contract for sourcing the renewable biogas that meets Public Resources Code Section 2574(b)(1); documentation is provided in

Figure 15: Biogas Supply Contract


SELF-GENERATION INCENTIVE PROGRAM DIRECTED BIOGAS FUEL SUPPLIER ATTESTATION

I, Shell Energy North America (US), L.P., hereby attest that Directed Biogas will be supplied to Air Products and Chemicals, Inc. by nomination and will comply with all applicable rules of the Self-Generation Incentive Program (SGIP) including but not limited to;

- a) Contract will include term (minimum of 5 years), cost, amount of renewable fuel injected on a monthly basis for the length of the contract, address of renewable fuel facility, and facility address of Host Customer.
- b) Documentation will be provided that shows that the third party gas provider can inject the renewable fuel into the natural gas pipeline.
- c) The Renewable Fuel Supplier facility must produce fuel that meets the SGIP definition of renewable fuels.
- d) The gas must be injected into a natural gas pipeline system that is either within the Western Electricity Coordinating Council (WECC) region or interconnected to a natural gas pipeline in the WECC region that delivers gas into California.

The undersigned understands that non-compliance to any SGIP requirements will be grounds for partial or complete incentive refund.

Shell Energy North America (US), L.P.

Signature: 

Name Printed: Edward Brown

Title: Vice President

Company Shell Energy North America (US), L.P.

Date: 3/21/2011

Although California has a substantial amount of biogas, local supply cannot be injected into California pipelines under California Health and Safety Code Section 25420. Air Products and Chemicals, Inc.'s biogas supply for this project is sourced outside California and transported to

California with connection to a natural gas pipeline within the Western Electricity Coordinating Council region that delivers gas into California³.

Table 1: Renewable Biomethane Supply Sources

Supply Source	Address	Pipeline/LDC	Receipt	Delivery
Greentree Landfill	635 Toby Road Kersey, PA 15846	National Fuels Gas TETCO NGPL EPNG Socal Gas FAR	Landfill meter Nat Fuel-Bristoria Tetco-Sweet Lake 3825 EPNG Jal 3083 Topock	Bristoria NGPL-Sweet Lake EPNG Jal 3083 Topock Socal Citygate
Imperial Landfill	11 Boggs Road Imperial, PA 15126	National Fuels Gas TETCO NGPL EPNG Socal Gas FAR	Landfill meter Nat Fuel-Bristoria Tetco-Sweet Lake 3825 EPNG Jal 3083 Topock	Bristoria NGPL-Sweet Lake EPNG Jal 3083 Topock Socal Citygate

Source: FirstElement Fuel, Inc.

³ [Western Electricity Coordinating Council](https://www.wecc.biz/Pages/AboutWECC.aspx) <https://www.wecc.biz/Pages/AboutWECC.aspx>

Figure 15: Biogas Supply Contract

SELF-GENERATION INCENTIVE PROGRAM DIRECTED BIOGAS FUEL SUPPLIER ATTESTATION

I, Shell Energy North America (US), L.P., hereby attest that Directed Biogas will be supplied to Air Products and Chemicals, Inc. by nomination and will comply with all applicable rules of the Self-Generation Incentive Program (SGIP) including but not limited to;

- a) Contract will include term (minimum of 5 years), cost, amount of renewable fuel injected on a monthly basis for the length of the contract, address of renewable fuel facility, and facility address of Host Customer.
- b) Documentation will be provided that shows that the third party gas provider can inject the renewable fuel into the natural gas pipeline.
- c) The Renewable Fuel Supplier facility must produce fuel that meets the SGIP definition of renewable fuels.
- d) The gas must be injected into a natural gas pipeline system that is either within the Western Electricity Coordinating Council (WECC) region or interconnected to a natural gas pipeline in the WECC region that delivers gas into California.

The undersigned understands that non-compliance to any SGIP requirements will be grounds for partial or complete incentive refund.

Shell Energy North America (US), L.P.

Signature: 

Name Printed: Edward Brown

Title: Vice President

Company Shell Energy North America (US), L.P.

Date: 3/21/2011

Source: FirstElement Fuel, Inc.

Hydrogen is delivered to the Hollywood hydrogen refueling station by a U.S. Department of Transportation-certified high-pressure delivery trailer.

The Hollywood hydrogen refueling station can dispense 180 kilograms of hydrogen per day. Based on average hydrogen use by FCEVs, this station's dispensing capacity is enough to support up to 260 FCEVs, depending on driver habits. Assuming that FCEVs average 52 miles per kilogram according to *The Greenhouse Gases, Regulated Emissions, and Energy Use in*

Transportation Model,⁴ and consumption of 180 kilograms per day for the next ten years, the station will offset 12,000 metric tons of total greenhouse gases compared to equivalent gasoline vehicles. Furthermore, the Hollywood hydrogen station will eliminate more than 1.54 million gallons of gasoline, assuming the 2013 national passenger fleet average fuel economy of 21.6 miles per gallon⁵. Data on the operation of the station will be collected and reported to the CEC throughout the term of operations and maintenance grant ARV-15-028. Data collected and reported will include throughput, vehicle usage, gallons of gasoline displaced, and a comparison of the actual performance of the project to proposed expectations.

4 [GREET® Model](https://greet.es.anl.gov/) <https://greet.es.anl.gov/>

5 [U.S. Department of Transportation, Bureau of Transportation Statistics \(Table 4-23: Average Fuel Efficiency of U.S. Light Duty Vehicles\)](http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html)
http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html

CHAPTER 3:

Future Activities

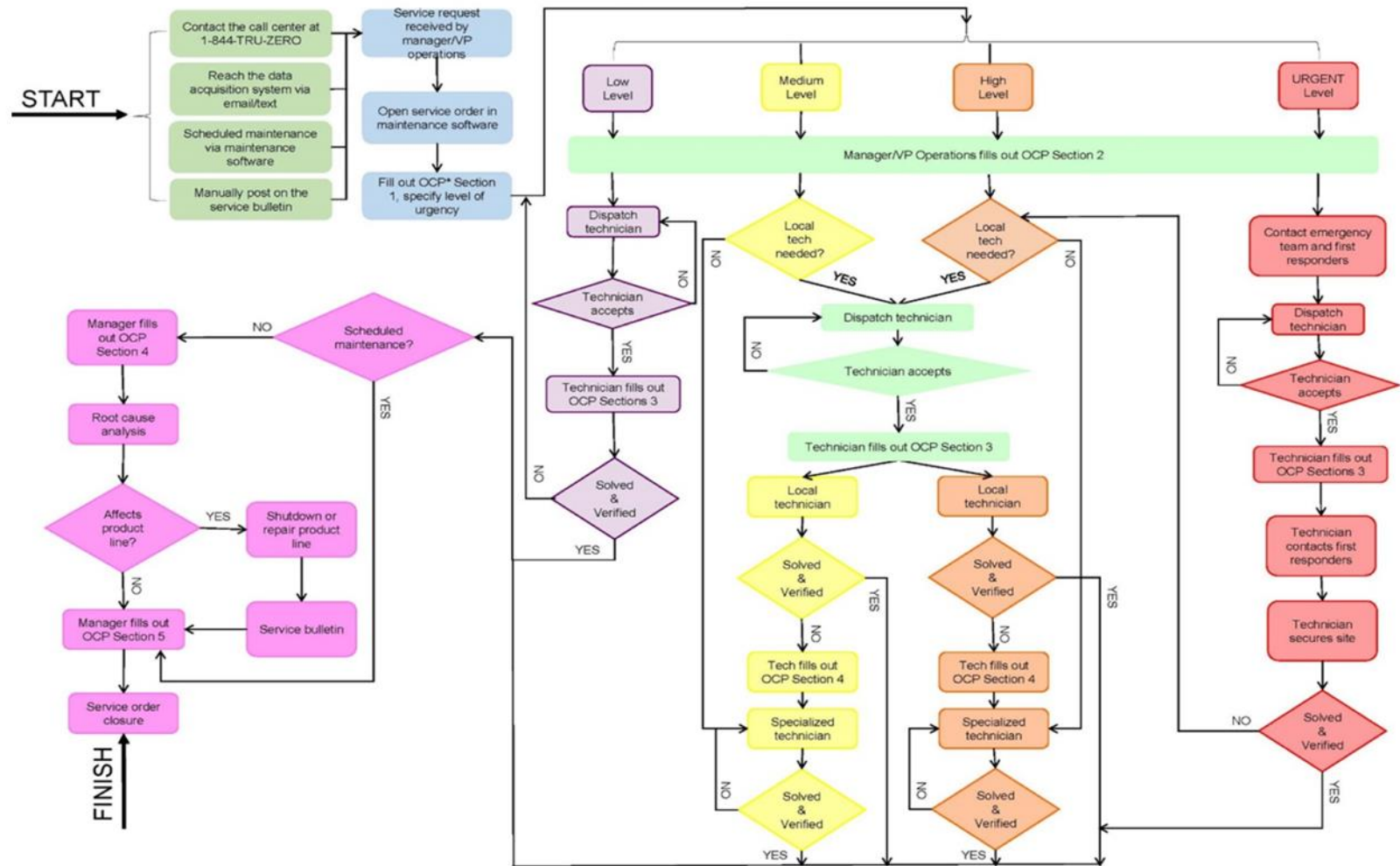
FirstElement Fuel, Inc. intends to own and operate the Hollywood refueling station for at least ten years. FirstElement Fuel, Inc. has invested substantial capital to build the station and will require many years of operation to recoup the development costs. FirstElement Fuel, Inc. has executed an initial ten-year lease with the landowner with the possibility for extension.

In addition, FirstElement Fuel, Inc. is building an in-house maintenance team that will have the personnel and equipment resources to maintain and repair any of our stations as quickly as possible throughout California. Figure 16 shows a flow diagram for response from the FirstElement Fuel, Inc. operations and maintenance team.

To augment onsite personnel across the FirstElement Fuel, Inc. network, a comprehensive data collection and monitoring system has been implemented. Figure 17 shows a screenshot of one page of the system. FirstElement Fuel, Inc. maintenance personal can access a breadth of real-time performance and sensor data, live video feeds, and historic usage data, and can control some features of the station remotely, 24 hours a day.

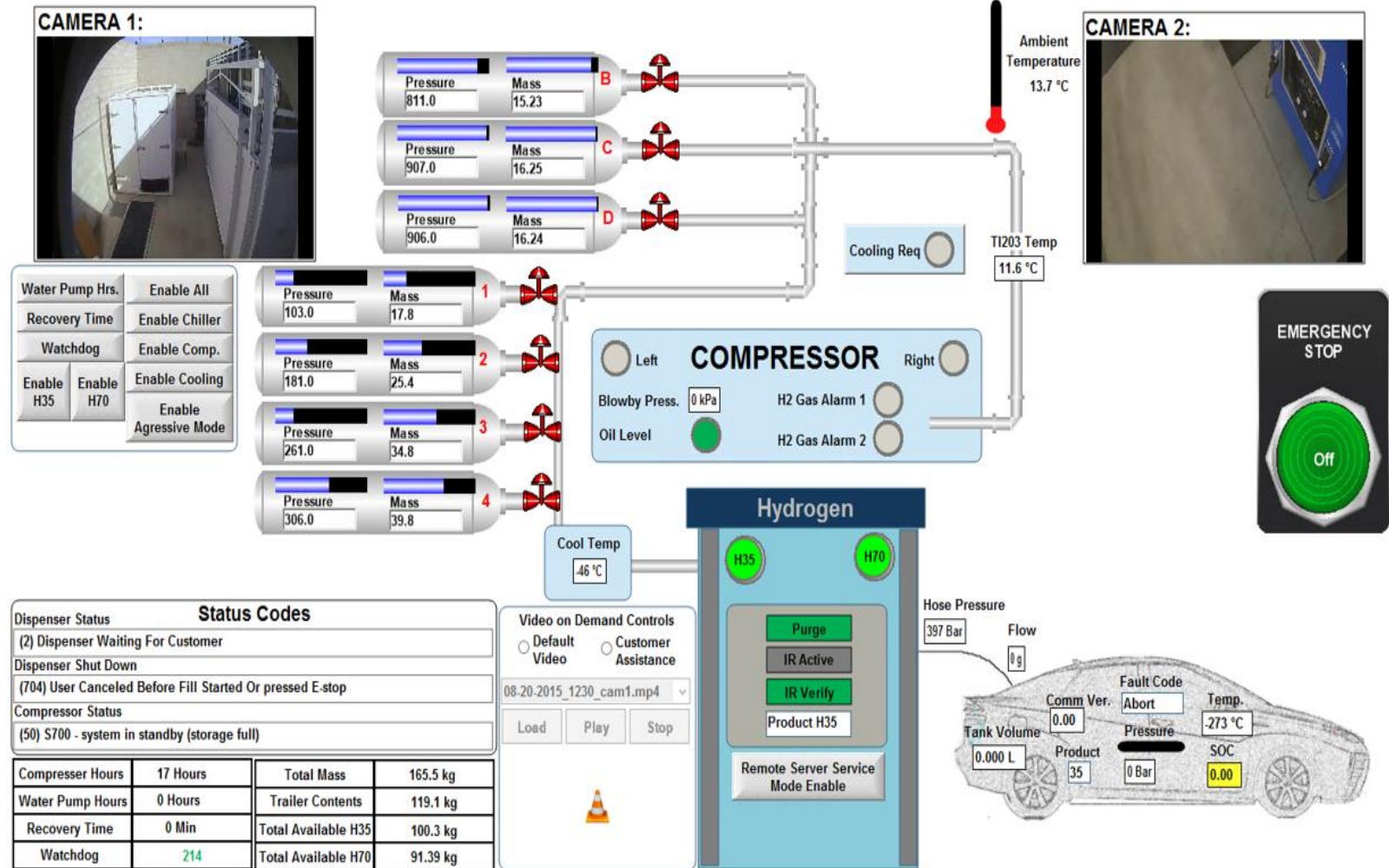
In addition to remote monitoring, FirstElement Fuel, Inc. has implemented rigorous computerized maintenance management systems and enterprise asset management systems to schedule and track maintenance, repairs, and inventory. The work orders will be generated, completed, and logged for all maintenance and repair activities in the computerized maintenance management systems and enterprise asset management systems. This will help maximize station up-time and enable tracking of key performance indicators.

Figure 16: FirstElement Fuel, Inc. Response Flow Chart



Source: FirstElement Fuel, Inc.

Figure 17: FirstElement Fuel, Inc.'s Remote Monitoring System



Source: FirstElement Fuel, Inc.

CHAPTER 4: Conclusions

The following considers findings from the 33.3 percent renewable hydrogen Hollywood hydrogen refueling station project.

Because the Hollywood station is located within the jurisdiction of the City of Los Angeles, the zoning and permitting process was burdened by the size and complexity of the City's organization. There were no major hurdles in either planning or permitting, but the process still took significantly longer than in other, smaller, jurisdictions.

A major delay in permitting of the Hollywood station was the result of antiquated electrical equipment at the existing convenience store. FirstElement Fuel, Inc. was required to engineer and implement a new system (including asbestos removal) for the project to move forward.

National Fire Protection Association hydrogen technologies code is a critical tool for working with permit agencies. The code clearly defines fire safety guidelines that enable local jurisdictions and builders to reach common ground, while ensuring safety via the rigorous code writing process.

GLOSSARY

CALIFORNIA ENERGY COMMISSION (CEC) - The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The Energy Commission's five major areas of responsibilities are:

- Forecasting future statewide energy needs
- Licensing power plants sufficient to meet those needs
- Promoting energy conservation and efficiency measures
- Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels
- Planning for and directing state response to energy emergencies.

CARBON DIOXIDE (CO₂) - A colorless, odorless, non-poisonous gas that is a normal part of the air. Carbon dioxide is exhaled by humans and animals and is absorbed by green growing things and by the sea. CO₂ is the greenhouse gas whose concentration is being most affected directly by human activities. CO₂ also serves as the reference to compare all other greenhouse gases (see carbon dioxide equivalent).

CLEAN TRANSPORTATION PROGRAM) (formerly known as the ALTERNATIVE AND RENEWABLE FUELS AND VEHICLE TECHNOLOGY PROGRAM) - Created by Assembly Bill 118 (Nunez, Chapter 750, Statutes of 2007), the program with an annual budget of about \$100 million supports projects that develop and improve alternative and renewable low-carbon fuels, improve alternative and renewable fuels for existing and develop engine technologies, expand transit and transportation infrastructures, and establishing workforce training programs, conduct public education and promotion, and create technology centers, among other tasks.

FUEL CELL ELECTRIC VEHICLE (FCEV) -- A zero-emission vehicle that runs on compressed hydrogen fed into a fuel cell "stack" that produces electricity to power the vehicle.

GREENHOUSE GASES (GHG) – Any gas that absorbs infra-red radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), halogenated fluorocarbons (HCFCs), ozone (O₃), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

HYDROGEN (H₂) - A colorless, odorless, highly flammable gas, the chemical element of atomic number 1.

METHANE (CH₄) - A light hydrocarbon that is the main component of natural gas and marsh gas. It is the product of the anaerobic decomposition of organic matter, enteric fermentation in animals and is one of the greenhouse gases.