CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

Campbell Hydrogen Station

Prepared for: California Energy Commission

Prepared by: FirstElement Fuel, Inc.

Gavin Newsom, Governor

November 2019 | CEC-600-2019-076

California Energy Commission

Tim Brown
Patti Kohler
Primary Author(s)

FirstElement Fuel, Inc.
5151 California Ave., Suite 220
Irvine, CA 92617
First Element Fuel Website www.firstelementfuel.com

Agreement Number: ARV-14-013

Mark Johnson
Agreement Manager

John P. Butler III
(Acting) Office Manager
ADVANCED VEHICLE INFRASTRUCTURE OFFICE

Kevin Barker
Deputy Director
FUELS AND TRANSPORTATION

Drew Bohan
Executive Director

ACKNOWLEDGEMENTS

The construction of the Campbell 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 its vision and fortitude; Air Products and Chemicals, Inc., Black & Veatch, and Electrical Tech Construction, Inc. for bringing the project together; Tyson Eckerle for helping push the lease over the goal line; and, of course, Jean Baronas, Sarah Williams, 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 fund hydrogen refueling stations. In response to PON-13-607, the recipient submitted an application that was proposed for funding in the Energy Commission's notice of proposed awards May 1, 2014. The Commission executed the agreement as ARV-14-013 on July 22, 2014.

ABSTRACT

FirstElement Fuel, Inc. designed, engineered, permitted, constructed, and commissioned a hydrogen refueling station at 2855 Winchester Blvd., Campbell (Santa Clara 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 grounded fueling position for fuel cell electric vehicle drivers.

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

Please use the following citation for this report:

Brown, Tim. FirstElement Fuel, Inc. 2019. Campbell Hydrogen Station. California Energy Commission. Publication Number: CEC-600-2019-076.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Page

EXECUTIVE SUMMARY

Hydrogen fuel cell electric vehicles and hydrogen refueling stations are expected to play key roles as California 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 fuel cell electric vehicles as a vehicle technology that will be available to meet the California Air Resources Board Zero Emission Vehicle Regulation and former Governor Edmund G. Brown Jr.'s Zero Emission Vehicle Mandate. More specific actions to bring fuel cell electric vehicles to California markets are specified in Brown's Zero Emission Vehicle Action Plan.

Fuel cell electric vehicles offer tremendous potential for the light-duty passenger vehicle market and medium- and heavy-duty truck and bus marketsFuel cell electric passenger vehicles can drive more than 300 miles on a tank of hydrogen, have zero tailpipe emissions, and 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 at home, fuel cell electric vehicles require a new network of refueling stations that dispense pressurized hydrogen for consumer use. This requirement has meant that the auto industry and station development industry have had to develop two new technologies in parallel: hydrogen fuel cell electric vehicles and hydrogen refueling infrastructure. Fuel cell electric vehicles 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 Assembly Bill 118 funding program (Núñez, Chapter 750, Statutes of 2007) and created new legal requirements for the Energy Commission's Clean Transportation Program. The bill directs the Energy Commission to allocate up to $20 million per year, or up to 20 percent of each fiscal year's available funding, to develop 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]).

The Energy Commission contributed $1,451,000 of the total $2,193,862 cost to design, engineer, permit, construct, and commission the station.

The site selected for this project was 2855 Winchester Blvd., Campbell (Santa Clara County). A hydrogen refueling station at this location will serve as a core station in Northern California for at least the next 10 years. FirstElement Fuel, Inc. accomplished this goal through the steps outlined below.

The owner of the Campbell property was excited to bring a clean, alternative fuel to his station. Lease terms were negotiated, and FirstElement Fuel, Inc. and the Campbell owner executed a lease on March 4, 2015.

FirstElement Fuel, Inc. developed the site configuration and design, and engineering firm Black & Veatch performed the detailed engineering design. The entitlement process in Campbell required both a public design review meeting and a public planning commission hearing and approval was granted July 28, 2015.

Permits for zoning, building, mechanical, electrical, plumbing, and fire were filed November 25, 2014 and finalized September 1, 2015. The permitting process from application to finalization took 280 days.

FirstElement Fuel, Inc. purchased hydrogen refueling station equipment from Air Products and Chemicals, Inc., and the remainder of materials were sourced from a variety of general and specialty vendors. Electrical Tech Construction, Inc. from Concord (Contra Costa County) was selected as the contractor for the project because of its relatively low bid, excellent safety record, good standing with Black & Veatch, and willingness to work with FirstElement Fuel, Inc. on multiple projects. Construction began October 5, 2015, and was complete February 25, 2016.

Commissioning began February 20, 2015 and was complete February 25, 2015. 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 Campbell 33 percent renewable hydrogen refueling station project to completion. The following synopsis highlights the most critical items.

Site Acquisition - Construction (Fall 2013 – February 2016)

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 historical vehicle sales data, academic publications, automakers, and the PON-13-607 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 on January 30, 2014. A binding 10-year lease was later executed on March 4, 2014.

FirstElement Fuel, Inc. selected Air Products and Chemicals, Inc. equipment because of the cost, capacity, reliability, and mature supply chain as detailed in the FirstElement Fuel, Inc. PON-13-607 application. 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 December 10, 2015.

FirstElement Fuel, Inc. and Black & Veatch surveyed the site to begin the site layout process 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 set. As shown, the drawing lacks specific detail and serves only to outline the site plan.

On October 24, 2014, Clark Land Surveying, Inc. performed a detailed engineering survey for the Campbell station site, as shown in Figure 2.

On June 23, 2015, Clark Land Surveying, Inc. also generated zoning drawings that provide an accurate but high level depiction of the project for review by planners at the jurisdiction. These drawings are signed and sealed by the professional engineer of record to ensure accuracy and completeness.

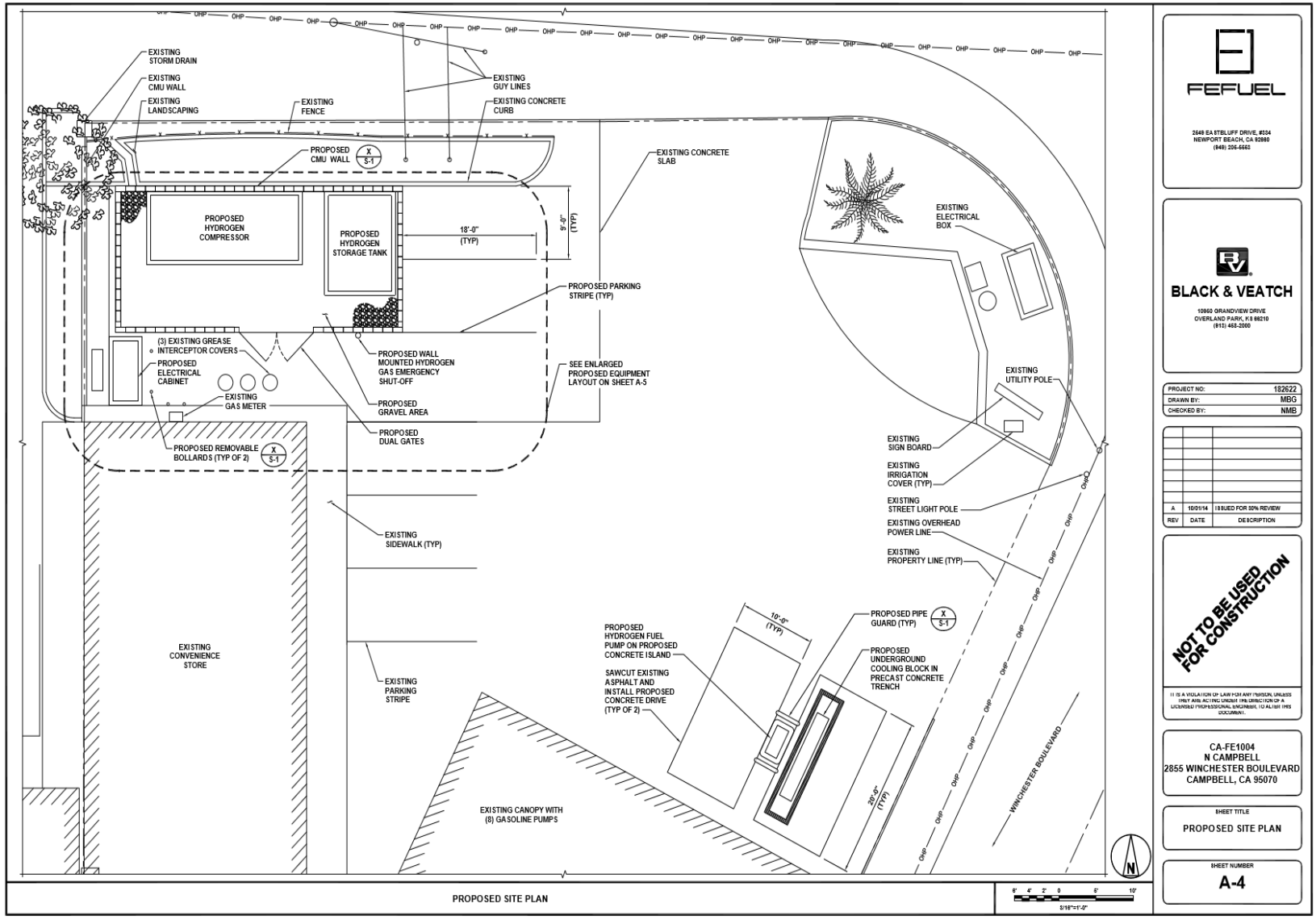
On May 21, 2015, draft final construction drawings (or "construction drawing 90s") were completed. They depict all the details required for both construction and the permit review. Final construction drawings (or "construction drawing 100s") were completed, with 60 pages that depict all the minute details required for both construction and the permit review on January 28, 2016. 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.

FirstElement Fuel, Inc. and Black & Veatch submitted the zoning application to the jurisdiction having authority on November 25, 2014. The local planning department must verify that the project meets the zoning requirements of the proposed location and approve any aesthetic, landscaping, or other details that are important to the community. The entitlement process in Campbell requires both a public design review meeting and a public planning commission hearing. FirstElement Fuel, Inc. has found that many planning commissions want to minimize the visual impact of hydrogen stations. Surprisingly, Campbell had an opposite viewpoint. They wanted to draw attention to the new, clean technology. As a result, the prescribed design of the exterior compound walls is bold in color and mimics the design that was built in South San Francisco. However, after construction began, adjacent neighbors were not pleased with the design. FirstElement Fuel, Inc. had to work to develop a compromise between the original city plans and the neighbors' wishes. Approval was received through public hearing process on July 28, 2015.

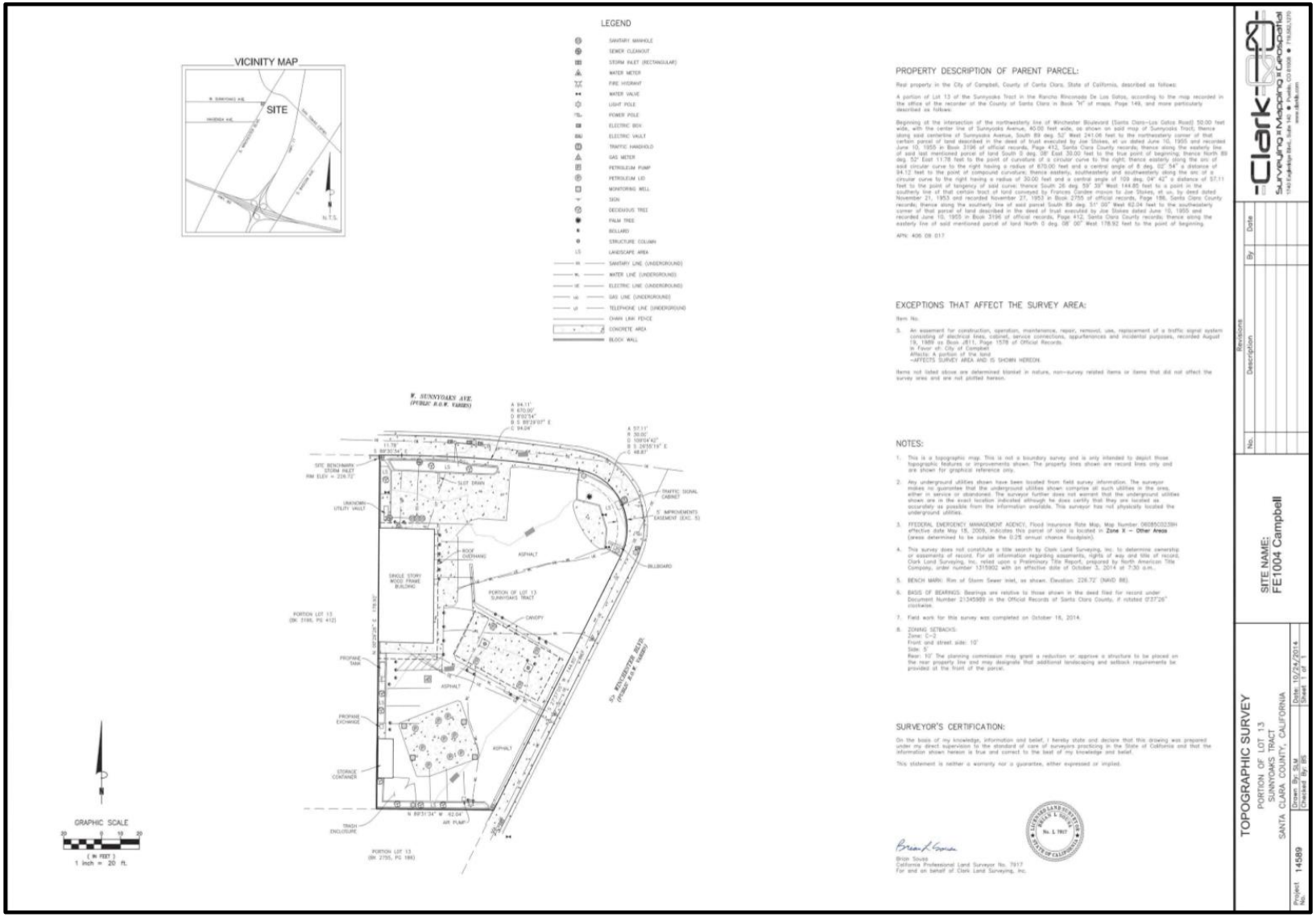
All building permit applications were submitted on July 1, 2015, and approved on September 4, 2015.

Figure 1: Coarse Detail of Equipment Compound



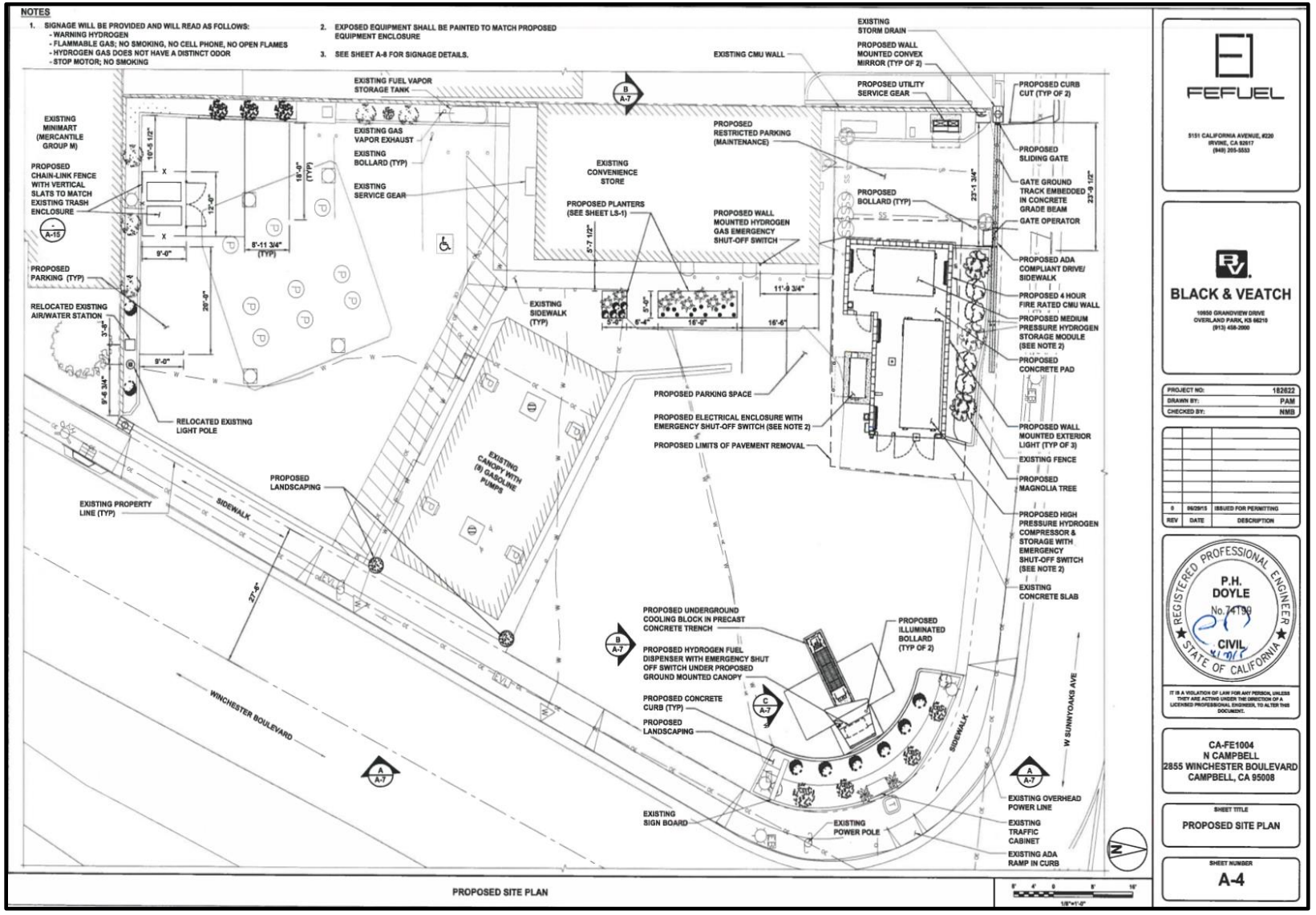
Source: FirstElement Fuel, Inc.

Figure 2: Survey of Campbell Hydrogen Station Location



Source: FirstElement Fuel, Inc.

Figure 3: Equipment Compound from Construction Drawing 100 Set



Source: FirstElement Fuel, Inc.

FirstElement Fuel, Inc. and Black & Veatch submitted a detailed bid package to contractors on September 4, 2015. The contract was awarded to Electrical Tech Construction, Inc. (E-Tech) on September 28, 2015. The bulk of E-Tech's construction experience is in cell towers. Cell towers are roughly similar to hydrogen stations in size, have similar foundations and block walls, and have similar electrical requirements. Aliantel provided a reasonable bid, had a desire to get involved with hydrogen projects, and is based in northern California. Construction started October 5, 2015. Hydrogen storage, compression, cooling, and dispensing equipment were delivered to the site December 10, 2015, as shown in Figure 4. Construction was completed February 25, 2016.

Construction progressed quickly, in part because of the time spent throughout the project to gain a common understanding of project requirements, especially those listed in the National Fire Protection Association hydrogen technologies code.

Figure 4: Crane Lifting Hydrogen Compressor Unit

Photo credit: FirstElement Fuel, Inc.

Making the Station Operational (February 20, 2016 – February 25, 2016)

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

Station Declared Operational (February 25, 2016)

The Campbell 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 jurisdiction having authority, filling the station's storage tubes with pressurized hydrogen gas, successfully passing a hydrogen quality test (Figure 5), successfully fueling one fuel cell electric vehicle (FCEV) with hydrogen, and opening to the public. FirstElement Fuel Inc. declared the station operational on February 25, 2016.

Figure 5: Hydrogen Fuel Quality Report on February 24, 2016

www.SmartChemistry.com

FIRSTELEMENT FUEL — CAMPBELL

SAE J2719	SAE J2719 Limits (µmol/mol)	Smart Chemistry Detection Limits (µmol/mol)	H70 H2 @Nozzle sampled on 02/24/2016 Concentration (µmol/mol)	Analytical Method
Water	5	1	1.4	
Total Hydrocarbons (C, Basis)	2	1	0.16	ASTM D7892
Methane			0.042	
Acetone			0.075	
Ethanol			0.040	
Isopropyl Alcohol			0.011	
Oxygen	5	1	2.6	ASTM D7649
Helium	300	10	15	ASTM D1946
Nitrogen, Argon	100			
Nitrogen		2	8.2	ASTM D7649
Argon		0.5	< 1	ASTM D7649
Carbon Dioxide	2	0.5	< 0.5	ASTM D7649
Carbon Monoxide	0.2	0.0005	0.0025	ASTM D5466
Total Sulfur	0.004	0.000001	0.000453	ASTM D7652
Hydrogen Sulfide		0.000001	0.00036	ASTM D7652
Carbonyl Sulfide		0.000001	0.000053	ASTM D7652
Methyl Mercaptan (MTM)		0.00001	< 0.00001	ASTM D7652
Ethyl Mercaptan (ETM)		0.00001	< 0.00001	ASTM D7652
Dimethyl Sulfide (DMS)		0.00001	< 0.00001	ASTM D7652
Carbon Disulfide		0.00001	0.00004	ASTM D7652
Isopropyl Mercaptan (IPM)		0.00001	< 0.00001	ASTM D7652
Tert-Butyl Mercaptan (TBM)		0.00001	< 0.00001	ASTM D7652
n-Propyl Mercaptan		0.00001	< 0.00001	ASTM D7652
n-Butyl Mercaptan		0.00001	< 0.00001	ASTM D7652
Tetrahydrothiophene (THT)		0.00001	< 0.00001	ASTM D7652
Formaldehyde	0.01	0.001	< 0.001	ASTM D7892
Formic Acid	0.2	0.001	< 0.001	ASTM D5466
Ammonia	0.1	0.005	< 0.005	ASTM D5466
Total halogenates	0.05		0.010	
Chlorine		0.0008	< 0.0008	ASTM D5466
Hydrogen Chloride		0.007	< 0.007	ASTM D5466
Hydrogen Bromide		0.003	< 0.003	ASTM D5466
Organic Halides (32 compounds in red and bold listed in "Other Hydrocarbons") Smart Chemistry limit is for each individual organic halide.		0.001	0.010	ASTM D7892
Tetrachloro-hexafluorobutanes			0.010	
Particulate Concentration - ASTM D7651			0.034 mg/kg	
Particulates Found & Size - ASTM D7634 (Images of particulates is in Table I)			Total 17 particulates found with the sizes in µm: 68, 57, 55, 54, 53, 47, 46, 36, 33 (2), 24 (2), 22 & 12 (4).	
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)			99.99730%	

SMART CHEMISTRY, 3401 La Grande Blvd, Sacramento, CA 95823, (916)391-3300, jphsu@smartchemistry.com

Source: FirstElement Fuel, Inc.

Automaker testing was performed at the Campbell hydrogen station to verify correct operation per *SAE J2601 Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles.*

Certification (March 15, 2016)

The California Department of Food and Agriculture's Division of Measurement Standards is responsible for enforcing California weights and measures laws and regulations and must certify any device used for metering the sale of commercial items within California.

Figure 6 shows that FirstElement Fuel, Inc. achieved certification by acting as the Registered Service Agent (RSA), 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 6: Dispenser with Certification Stickers, Campbell Hydrogen Station

Photo credit: FirstElement Fuel, Inc.

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

Station Use (February 25, 2016 – Present)

Figure 7 shows the first vehicle filled was a Hyundai Tucson on February 25, 2016. The station has been used regularly since then. The Campbell station dispensed 53.2 kilograms of hydrogen March 2016.

Figure 7: First Fueling at Campbell Hydrogen Station, February 25, 2016

Photo credit: FirstElement Fuel, Inc.

Station Operational Status System

The California Fuel Cell Partnership, Station Operational Status System is a website portal that provides hydrogen refueling station status for FCEV driver use.[2] 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 selling fuel before they depart. The Campbell hydrogen refueling station began sending automated updates (via FirstElement Fuel, Inc. software) on a regular basis, to Station Operational Status System on June 9, 2016.

Environmental Impacts

Hydrogen will be stored as a compressed gas in an above ground tank concealed behind a wall at this station. In accordance with the funding agreement with the Energy Commission, 33.3 percent of the hydrogen sold at the Campbell hydrogen refueling 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 that a leak occurs. No solid or liquid waste will be produced at this site.

2 California Fuel Cell Partnership (https://m.cafcp.org/)

Minimal water is consumed for this project. There was no additional landscaping for the construction of the hydrogen refueling station, and, 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 enhance evening fueling.

Campbell Station in the Network

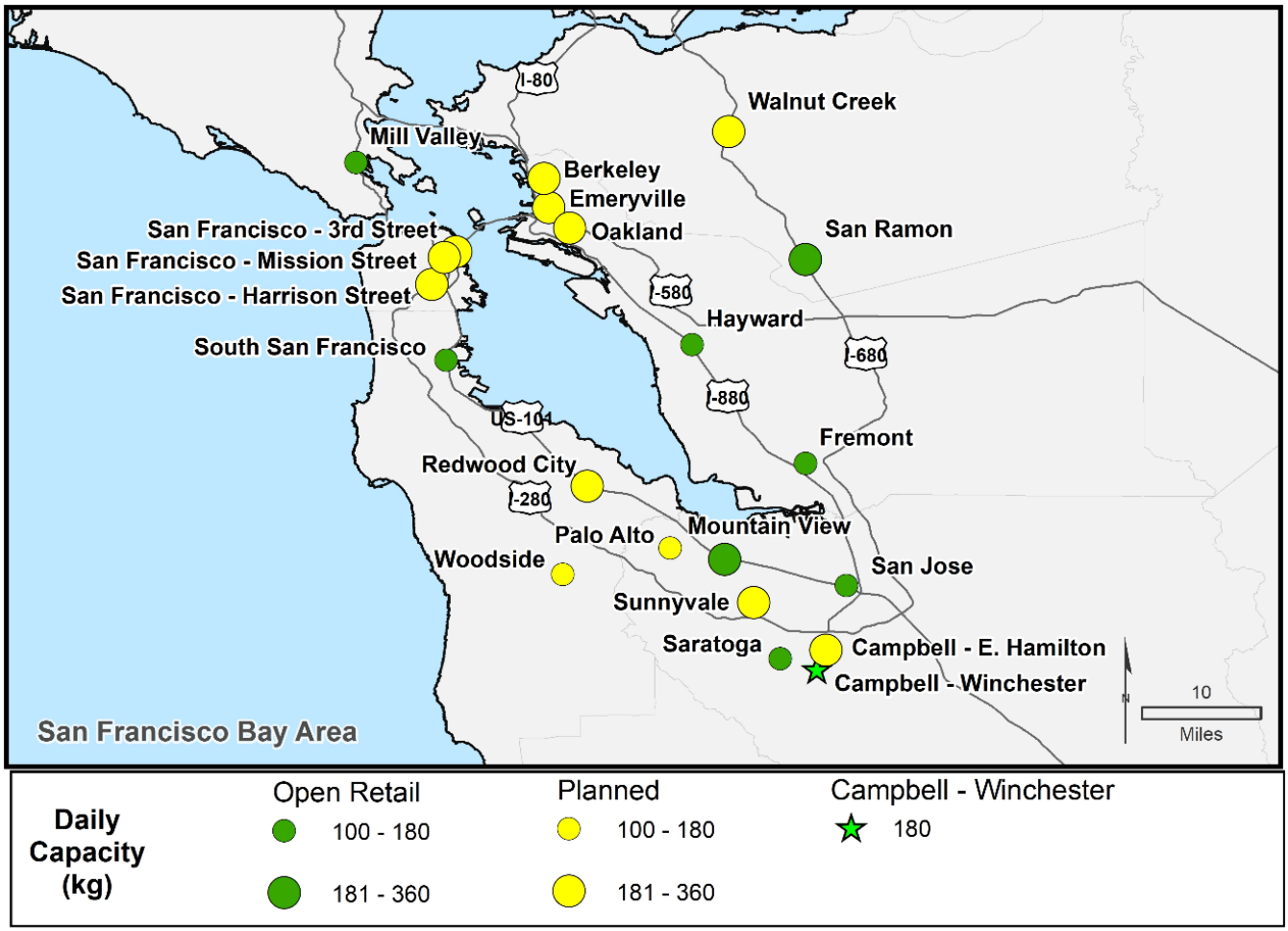
Figure 8 shows the station is open and ready for use.

Figure 8: Campbell Hydrogen Refueling Station

Photo credit: FirstElement Fuel, Inc.

Figure 9 shows the greater San Francisco area and indicates where the Campbell station is situated in relationship to other facilities in the northern part of the state.

Figure 9: San Francisco Area Hydrogen Stations: Open Retail and Planned

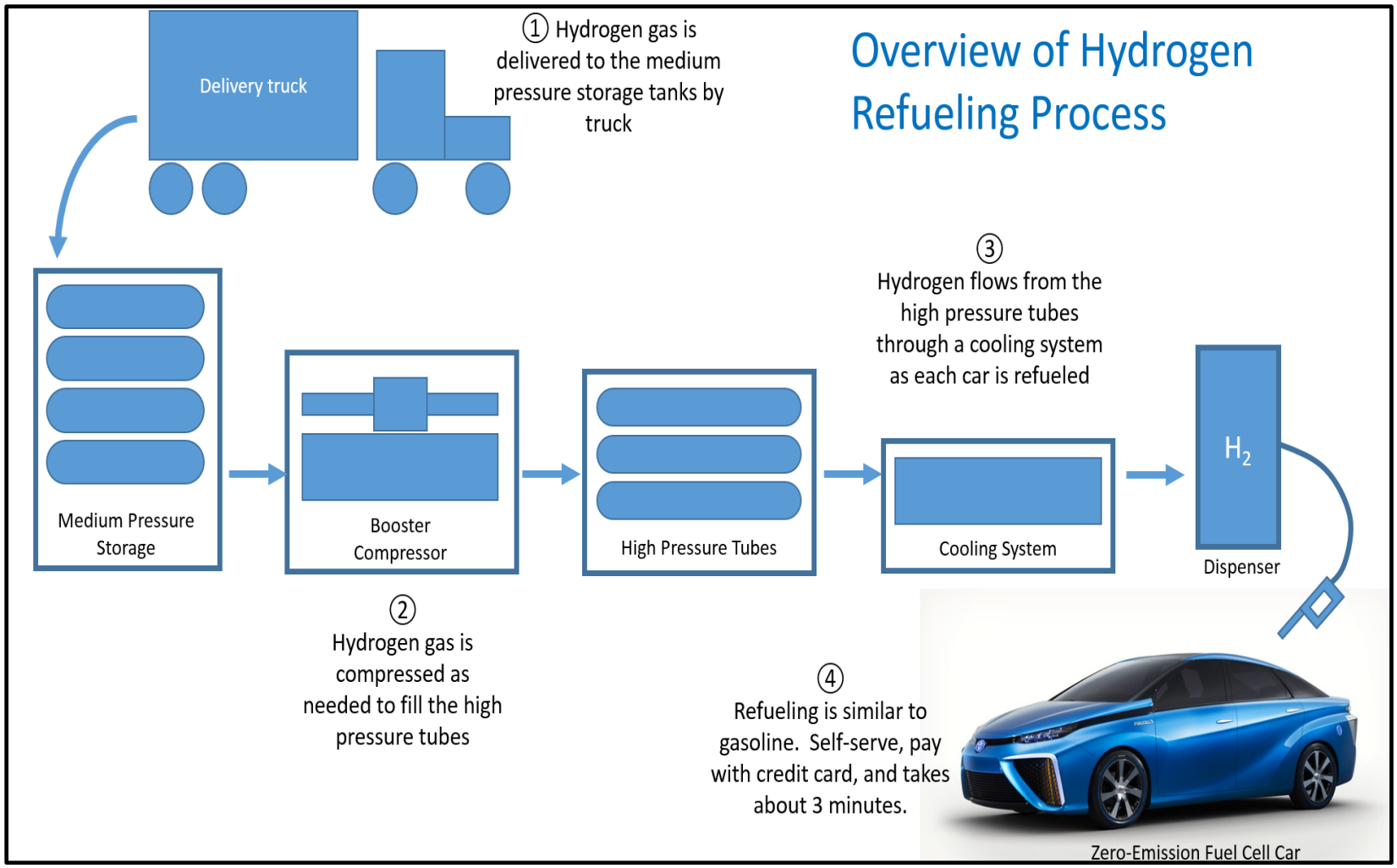


Source: CEC

Schematic Layout of the Campbell Station

Figure 10 depicts an overview of the Campbell hydrogen refueling station components and the steps in the refueling process.

Figure 10: Depiction of Hydrogen Station Equipment and Refueling Process

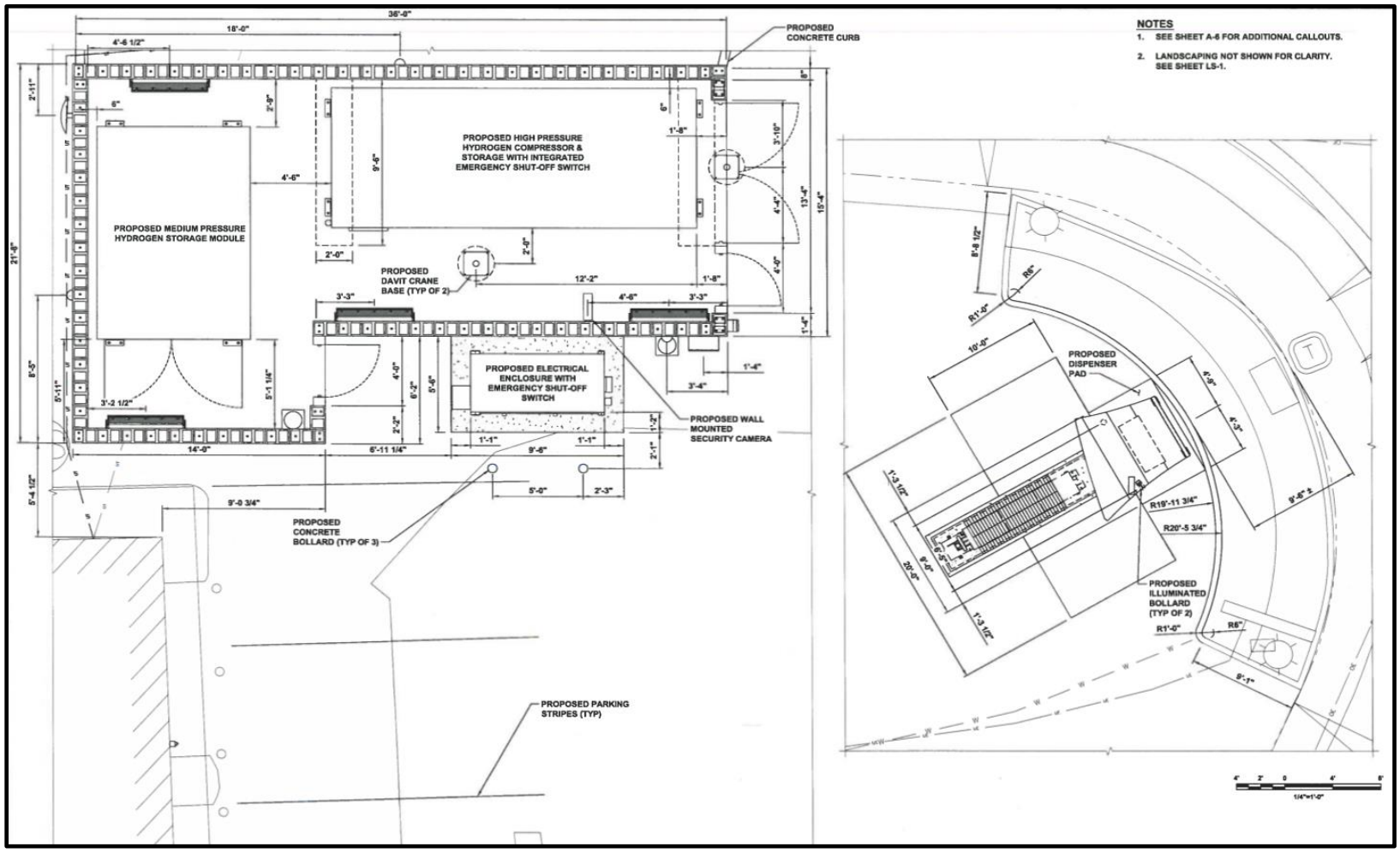


Source: FirstElement Fuel, Inc.

Final Configuration and Budget

Figure 11 shows an enlarged view of the final, as-built configuration of the Campbell station.

Figure 11: Enlarged View of Final Campbell Layout



Source: FirstElement Fuel, Inc.

Table 1 shows a detailed view of the budget to construct the Campbell hydrogen station.

Table 1: Project Grant Funding and Match Funding

Air Products and Chemicals, Inc., Allentown , PA	
H2 station equipment	$1,479,873.54
Black & Veatch, Overland Park, KS	
Construction	$486,533.66
Engineering	$56,838.80
Permitting	$39,092.56
Project Management	$18,197.53
Various Vendors	
Construction Materials (tubing, wire, etc.)	$24,864.96
Fixtures (doors, lights, etc.)	$67,533.20
MSI Tech, Irvine CA	
Data Collection Tool	$3,432.87
Karen Calhoun, Newport Beach, CA	
Legal services	$13,150.03
Vertical Advisors LLP, Newport Beach, CA	
Financial services	$4,345.13
Total Project Costs	$2,193,862.28
California Energy Commission Grant	$1,451,000.00
Remaining match funding provided FirstElement Fuel, Inc.	$742,862.28
Total Energy Commission cost share	66.1%

Source: FirstElement Fuel, Inc.

CHAPTER 2:
Energy Analysis

The Campbell hydrogen refueling station is supplied by hydrogen generated via steam methane reformation that converts methane (CH_4) and water (H_2O) to hydrogen (H_2) and carbon dioxide (CO_2):

$$CH_4 + 2H_2O \rightarrow 4H_2 + CO_2$$

Per California Senate Bill 1505 (Lowenthal, Chapter 877, Statutes of 2006), at least one third of the hydrogen sold by FirstElement Fuel, Inc.'s state funded hydrogen refueling stations will be produced from renewable sources. Hydrogen is supplied to the hydrogen fueling stations from Air Products and Chemicals, Inc.'s hydrogen production facilities in Wilmington/Carson, California. Renewable biogas will be procured as feedstock for the facilities, resulting in delivered hydrogen product that meets the requirements of PON-13-607 and the 33.3 percent renewable hydrogen requirements of Senate Bill 1505 as shown in Table 2. Renewable hydrogen at 100 percent is achievable through the same supply pathway, however at a higher cost.

Table 2: Renewable Biomethane Supply Sources

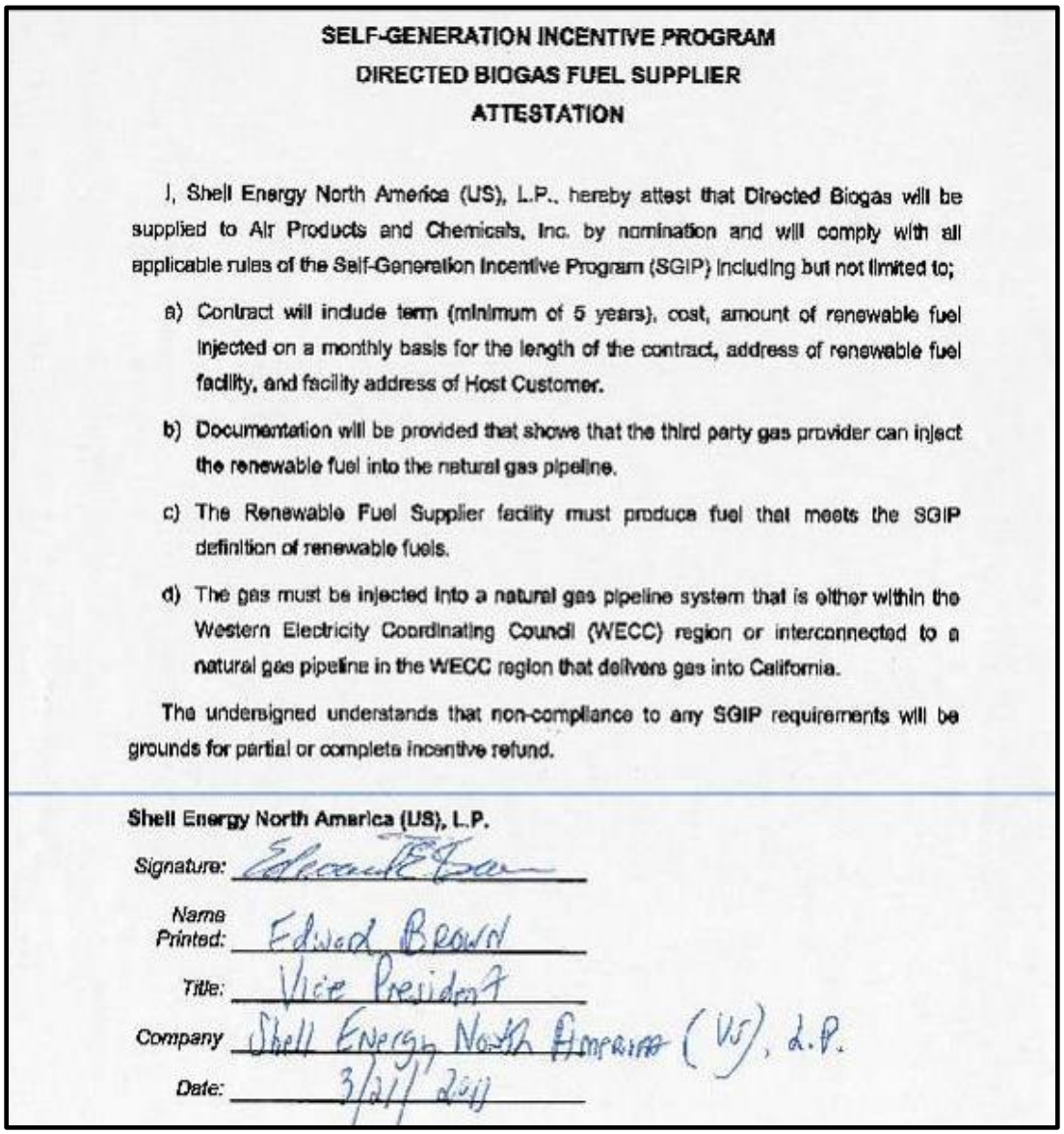
Supply Source	Address	Pipeline/LDC	Receipt	Delivery
Greentree Landfill	635 Toby Road Kersey, PA 15846	National Fuels Gas TETCO NGPL EPNG Socal Gas FAR	Landfill meter Nat Fuel-Bristoria Tetco-Sweet Lake 3825 EPNG Jal 3083 Topock	Bristoria NGPL-Sweet Lake EPNG Jal 3083 Topock Socal Citygate
Imperial Landfill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

Air Products and Chemicals, Inc. has a contract for sourcing of the renewable biogas that meets Public Resources Code Section 2574(b)(1); documentation is provided in Figure 12. Although California has a substantial amount of biogas, local supply cannot be injected into California pipelines under California Health and Safety Cost Section 25420. Air Products and Chemicals, Inc.'s biogas supply for this project is being sourced outside California and transported to California with connection to a natural gas pipeline in the Western Electricity Coordinating Council region that delivers gas into California.[3]

3 The Western Electricity Coordinating Council promotes Bulk Electric System reliability in the Western Interconnection. Western Electricity Coordinating Council https://www.wecc.biz/Pages/AboutWECC.aspx

Figure 12: 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: Edward Beard

Name Printed: Edward Beard

Title: Vice President

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

Date: 3/21/2011

Source: FirstElement Fuel, Inc.

Hydrogen is delivered to all FirstElement Fuel, Inc. stations (including Campbell) by a Department of Transportation-certified high-pressure delivery trailer.

The Campbell hydrogen station can dispense 180 kilograms/day. Based on average hydrogen use by FCEVs, this station's dispensing capacity is enough to support up to 260 FCEVs, although this number can vary depending on actual FCEV geographical deployment relative to other open retail station locations and FCEV driver habits. Assuming that FCEVs average 52 mile/kilograms (taken from *Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model*),[4] and consumption of 180 kilograms/day for the next 10 years, the

4 GREET® Model (https://greet.es.anl.gov/)

station will offset 8,384 metric tons of total greenhouse gas compared to equivalent gasoline vehicles. Furthermore, the Campbell 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 gallon.[5]

Data on the operation of the station will be collected and reported to the Energy Commission throughout the term of grant. Data collected and reported will include throughput, vehicle usage, gallons of gasoline displaced, and a comparison of the project to proposed expectations.

5 U.S. Department of Transportation, Bureau of Transportation Statistics; Table 4-23: Average Fuel Efficiency of U.S. Light Duty Vehicles; Department of Transportation, Bureau of Transportation Statistics (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

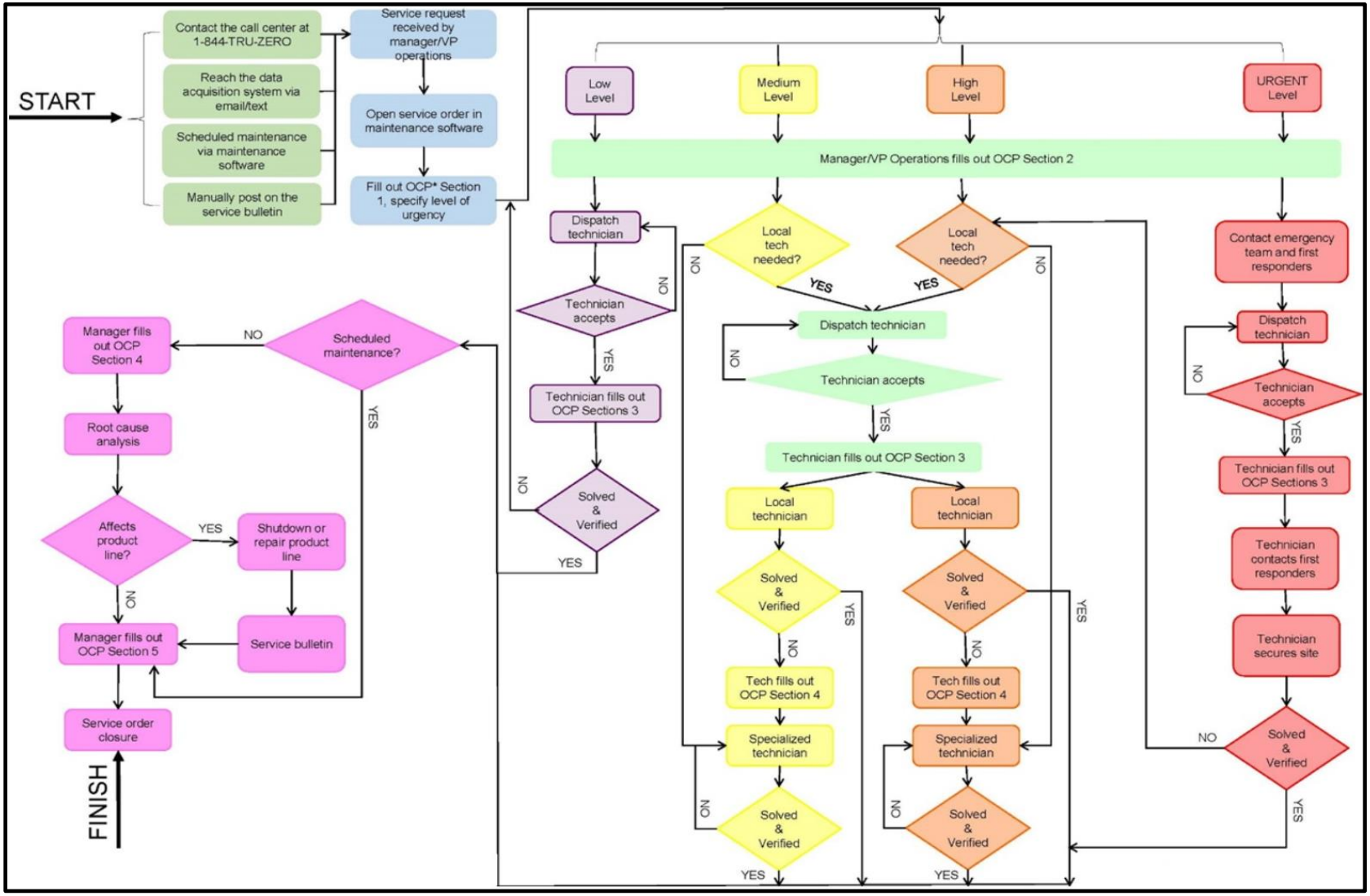
FirstElement Fuel, Inc. intends to own and operate the Campbell refueling station for at least 10 years. FirstElement Fuel, Inc. has invested substantial capital to build the station and will require many years of operation to recoup the development costs. FirstElement Fuel, Inc. has executed an initial 10-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 13 shows a flow diagram for response from the 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 14 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.

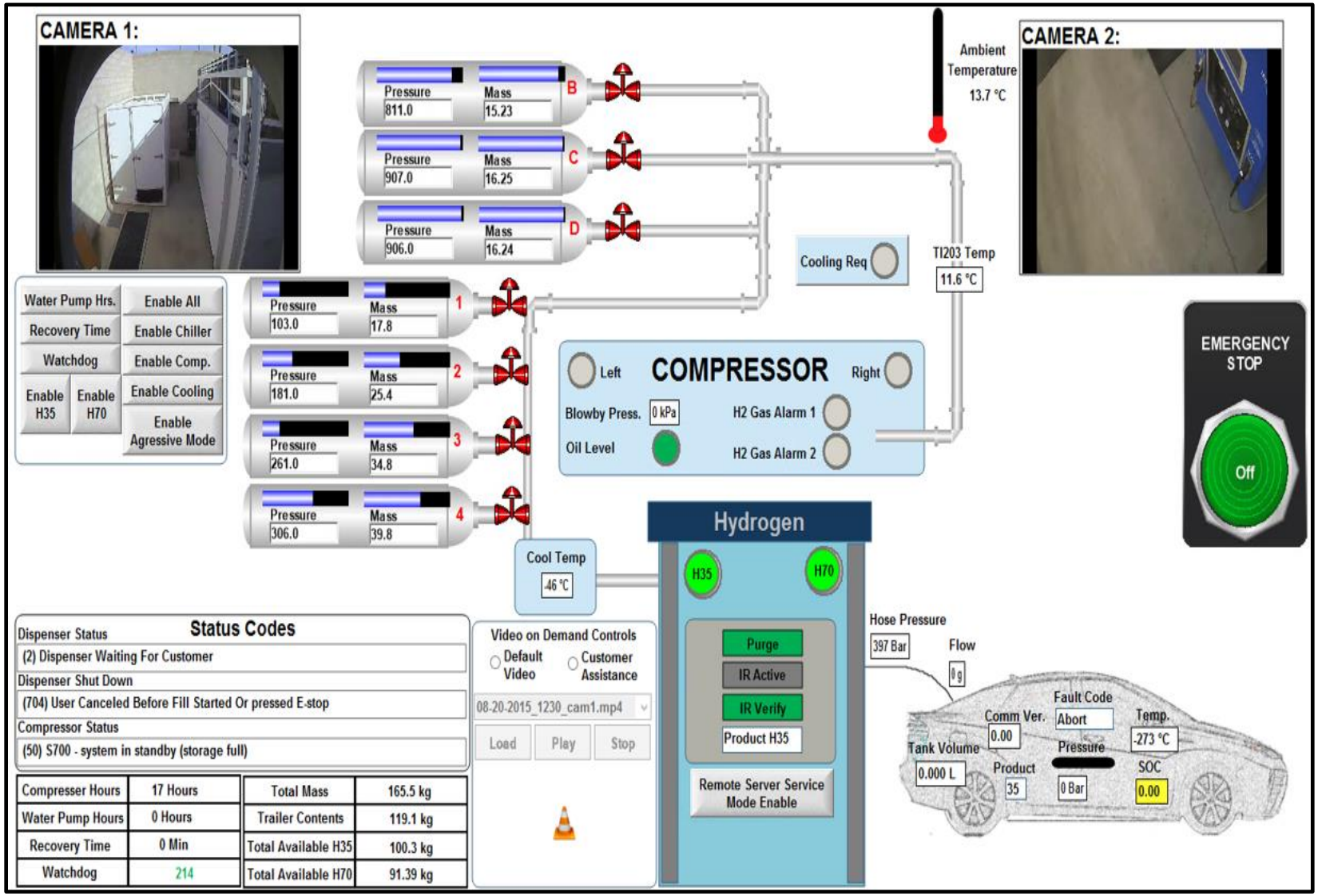
In addition to remote monitoring, FirstElement Fuel, Inc. has implemented rigorous Computerized Maintenance Management Systems and Enterprise Asset Management systems to schedule and track maintenance, repairs, and inventory. Work orders will be generated, completed, and logged for all maintenance and repair activities. This will help to maximize station up-time and enable tracking of key performance indicators.

Figure 13: FirstElement Fuel, Inc. Response Flow Chart



Source: FirstElement Fuel, Inc.

Figure 14: FirstElement Fuel, Inc.'s Remote Monitoring System



Source: FirstElement Fuel, Inc.

CHAPTER 4:
Conclusions

The following considers findings from the 33 percent renewable hydrogen Campbell hydrogen refueling station project.

FirstElement Fuel, Inc. has found that many planning commissions want to minimize the visual impact of hydrogen stations. Surprisingly, Campbell had an opposite viewpoint. They wanted to draw attention to the new, clean technology. As a result, the prescribed design of the exterior compound walls is bold in color and mimics the design built for the FirstElement Fuel, Inc. hydrogen refueling station in South San Francisco. However, after construction began, adjacent neighbors were not pleased with the design. FirstElement Fuel, Inc. had to work to develop a compromise between the original city plans and the neighbors' wishes.

National Fire Protection Association hydrogen technologies code is a critical tool for technical projects of this nature. The code clearly defines fire guidelines that enable local jurisdictions and contractors to uniformly construct hydrogen facilities and ensure safety. The key is for both station builders and station permit agencies to fully understand and appreciate the content of National Fire Protection Association hydrogen technologies code.

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).

ELECTRICAL TECH CONSTRUCTION, INC. (E-Tech) - Electrical Contracting company servicing the western hemisphere of the United States. E-Tech offers a multi-dimensional list of services ranging from the cell towers in the telecommunications industry, to large commercial Solar Systems.

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.

HYDROGEN (H_2) - 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.