CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

Del Mar 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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ACKNOWLEDGEMENTS

The construction of the Del Mar hydrogen refueling station has been possible only because of the substantial efforts and funds provided by stakeholders. FirstElement Fuel, Inc. graciously thanks Toyota for their vision and fortitude; Air Products and Chemicals Inc., Black and Veatch, and Aliantel for bringing the project together; Tyson Eckerle for helping push the lease over the goal line; and of course, Jean Baronas, Phil Cazel, 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 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 made operational a hydrogen refueling station at 3060 Carmel Valley Rd., San Diego (San Diego 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., fuel cell electric vehicles, hydrogen infrastructure, hydrogen refueling station

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TABLE OF CONTENTS

LIST OF FIGURES

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's zero-emission vehicle regulation and California's goal of 5 million zero-emission vehicles by 2030.

Hydrogen vehicles offer tremendous potential for the light-duty passenger vehicle market and medium- and heavy-duty truck and bus markets. However, these alternative 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 refueling infrastructure and hydrogen fuel cell electric vehicles. Fuel Cell Hydrogen Vehicles cannot be widely marketed and sold to consumers without a minimum network of refueling stations available.

In response to PON-13-607 issued by the California Energy Commission, FirstElement Fuel, Inc. was awarded funding for 19 stations. The Energy Commission contributed $1,451,000 of the total $2,314,876 cost to design, engineer, permit, construct, and commission this station.

FirstElement Fuel, Inc. worked with historical vehicle sales data, academic publications, automakers, and the California Energy Commission'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. The site selected for this project is 3060 Carmel Valley Road, Del Mar (San Diego County). A hydrogen refueling station at this location will serve as an early cluster station in southern California for at least the next 10 years.

The site owner at Del Mar was excited to bring an alternative fuel to his station and negotiated lease terms resulting in an executed lease with FirstElement Fuel, Inc. on December 31, 2014.

FirstElement Fuel, Inc. developed the site configuration and design, and engineering firm Black and Veatch performed the detailed engineering design. The zoning process in Del Mar did not require a public hearing and approval was granted November 9, 2015.

Permits for zoning, building, mechanical, electrical, plumbing, and fire were filed on October 21, 2015, and were finalized on June 16, 2016, over 239 days. There were no major hurdles with the permitting project in Del Mar, but because it fell within the large, methodical San Diego jurisdiction, the process took significantly longer than at most other locations.

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. Aliantel from Murrieta (Riverside County), California was selected as contractor for the project because of their relatively low bid, excellent safety record, good standing with Black and Veatch, and willingness to work with FirstElement Fuel, Inc. on multiple projects. Construction began on August 3, 2016 and was complete on October 20, 2016.

The process of making the station operational began on September 19, 2016 and was complete on September 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 Del Mar 33 percent renewable hydrogen refueling station project to completion. The following highlights the most critical items.

Beginning in the fall of 2013, FirstElement Fuel, Inc. took steps to identify and acquire the site by working with historical vehicle sales data, academic publications, automakers, and the station location areas in PON-13-607 to select desired market locations. FirstElement Fuel, Inc. then analyzed specific properties within target locations to find a site that could meet the space requirements for hydrogen fueling equipment and after selecting general locations and specific sites, FirstElement Fuel, Inc. negotiated the lease. A letter of intent was executed on January 27, 2014 and a binding 10-year lease was later executed on December 31, 2014.

FirstElement Fuel, Inc. selected Air Products and Chemicals Inc. equipment because of the cost, capacity, reliability, and more mature supply chain as compared to other suppliers as detailed in the FirstElement Fuel, Inc. agreement. 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 August 31, 2016.

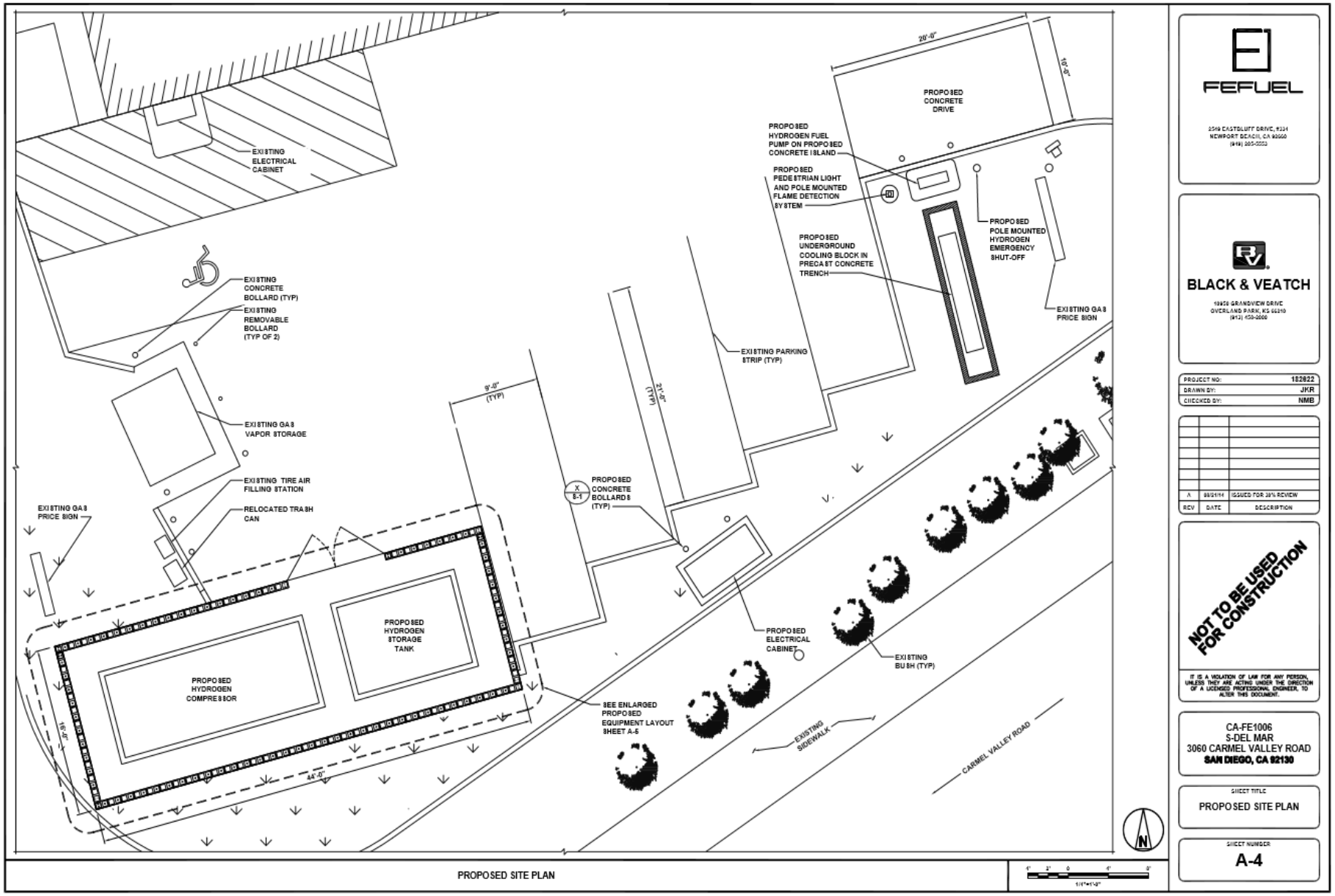
FirstElement Fuel, Inc. and Black and Veatch surveyed the site to begin the site layout process on August 12, 2014. Initial engineering drawings were generated on August 21, 2014. These drawings are referred to as "Construction Drawing 30s" because they represent 30 percent complete construction drawings and contain only two pages. Figure 1 shows the equipment compound drawing from the construction drawing 30 drawing set. As shown, the drawing lacks specific detail and serves only to outline the site plan.

On October 21, 2014, Clark Land Surveying, Inc. performed a detailed engineering survey for the Del Mar station site, as shown in Figure 2.

On November 21, 2014, zoning drawings were also generated that provide an accurate but relatively 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 their accuracy and completeness. The equipment compound page of the zoning drawings is shown in Figure 3.

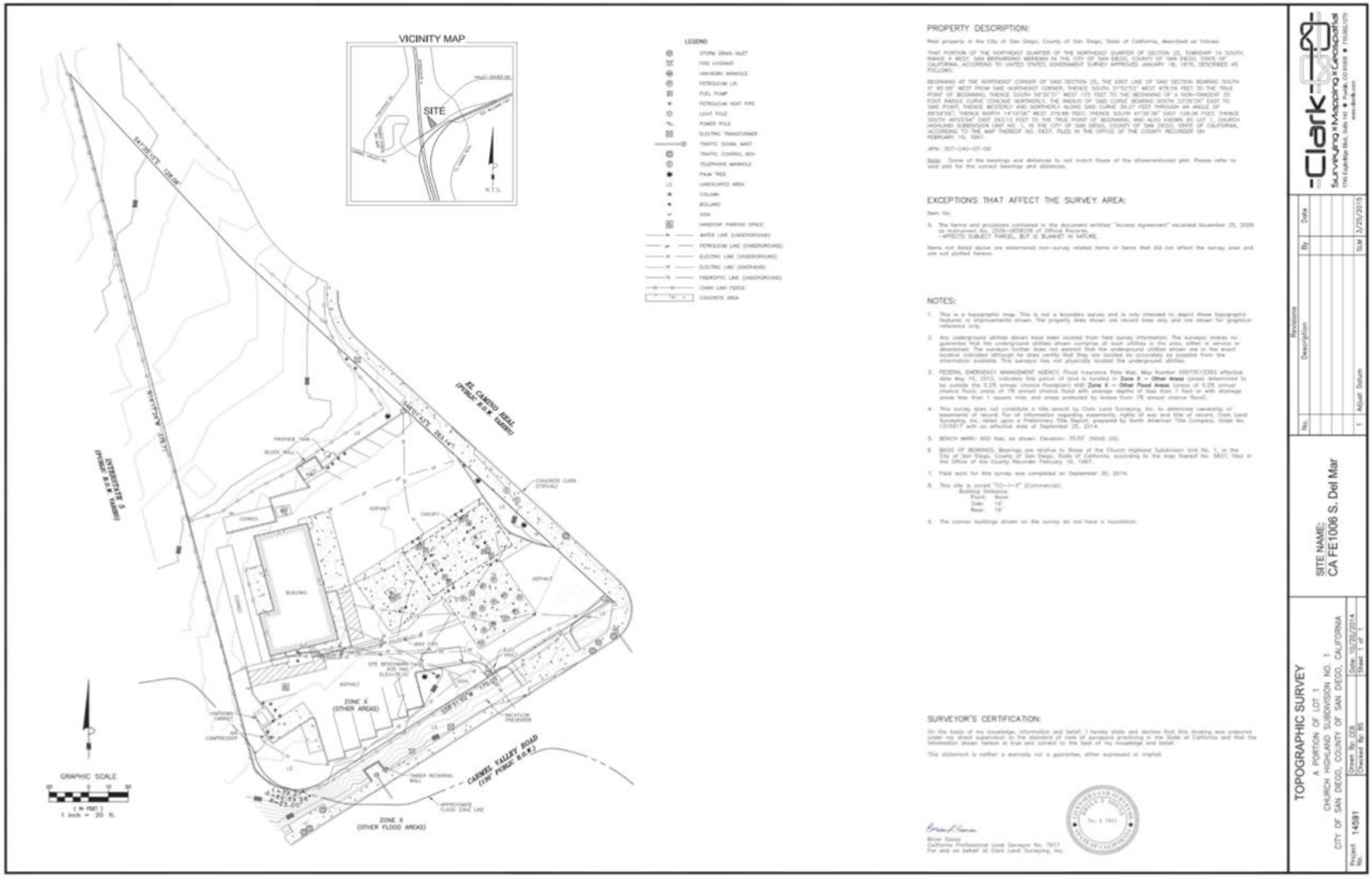
On September 10, 2015, draft final construction drawings (or "Construction Drawing 90s") were completed that depict all of the details required for both construction and the permit review. Final construction drawings (or "Construction Drawing 100s") were completed with 60 pages that depict all of the minute details required for both construction and the permit review process on October 19, 2015. These drawings are similarly signed and sealed by the professional engineer of record to ensure their accuracy and completeness. The equipment compound page of the construction drawing 100 Drawings is shown in Figure 4.

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



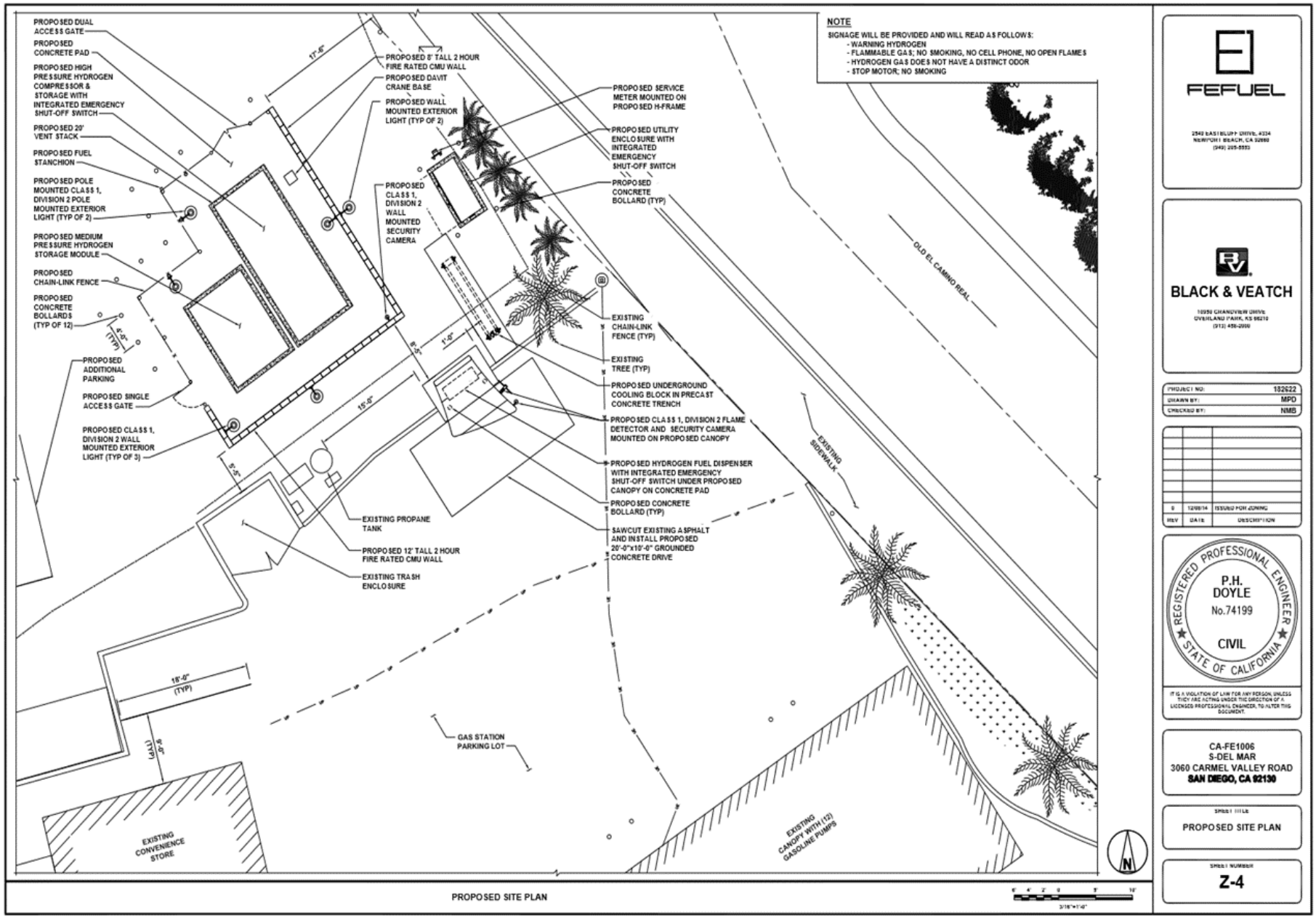
Source: FirstElement Fuel, Inc. Original figure is higher resolution.

Figure 2: Survey of Del Mar Hydrogen Station Location



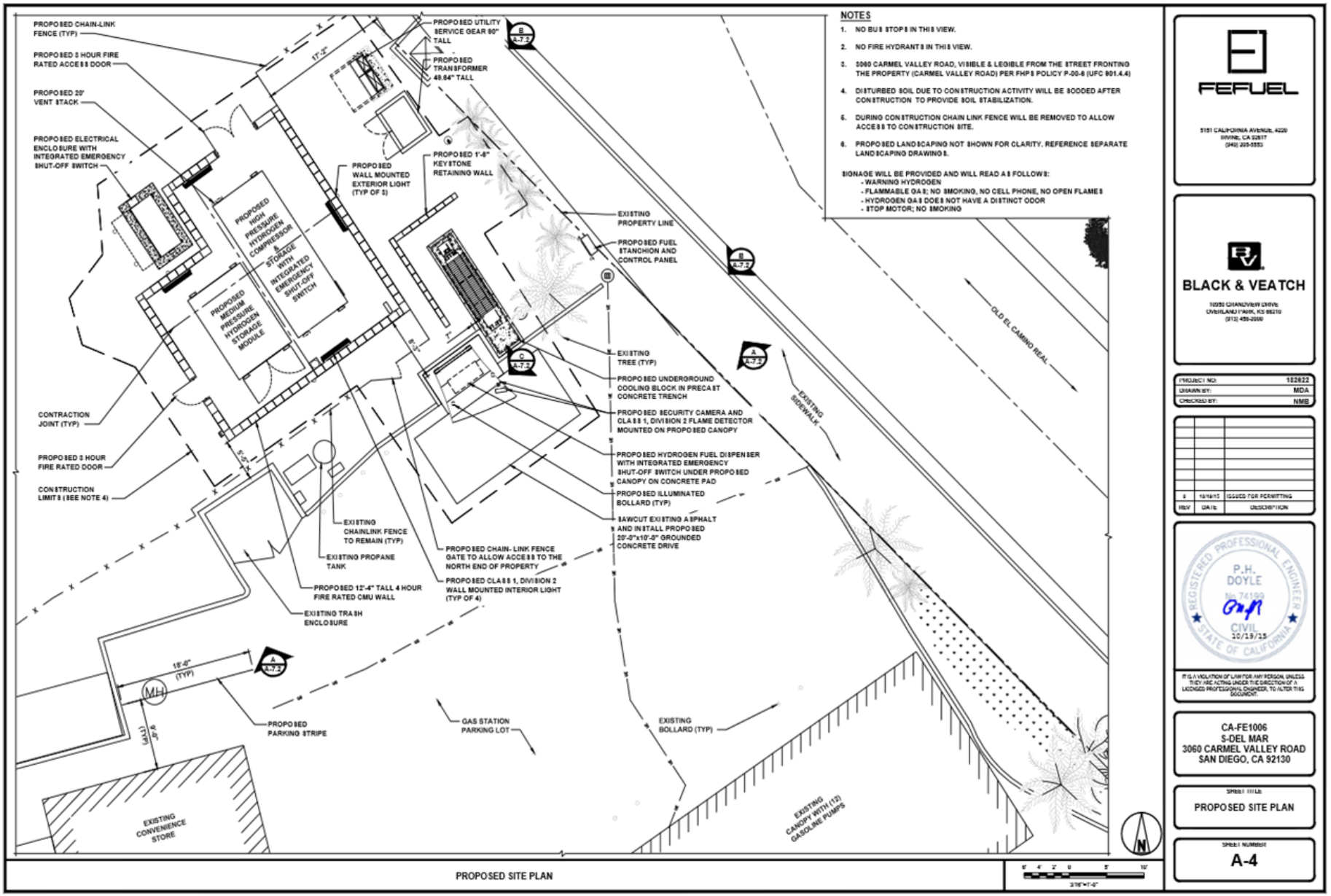
Source: FirstElement Fuel, Inc. Original figure is higher resolution.

Figure 3: Equipment Compound from Zoning Drawing Set



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

Figure 4: Equipment Compound Construction Drawing 100 Set



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

The zoning application was submitted to the appropriate authority having jurisdiction on December 8, 2014. The local planning department verified that the project meets the zoning requirements of the proposed location, and approve any aesthetic, landscaping, and other details that are important to the community. Approval was received on November 9, 2015.

All building permit applications were submitted on October 21, 2015, and approved on June 16, 2016 for a total of 239 days. Because the Del Mar station is located within the jurisdiction of San Diego, the permitting process took extra time because of the size and complexity of the City's organization.

FirstElement Fuel, Inc. and Black and Veatch submitted a detailed bid package to the contractors on June 30, 2016. The contract was awarded to Aliantel on July 14, 2016. The bulk of Aliantel's construction experience lies in cell towers. Aliantel provided a reasonable bid, had a desire to get involved with hydrogen projects, and had a willingness to work in northern California. Construction started August 3, 2016. Figure 5 shows the equipment compound before completion. Hydrogen storage, compression (Figure 6), cooling, and dispensing equipment was delivered to the site on August 31, 2016. Construction was completed on October 20, 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 5: Station Equipment Compound Before Completion

Source: FirstElement Fuel, Inc.

Figure 6: Crane Lifting Hydrogen Storage Unit

Source: FirstElement Fuel, Inc.

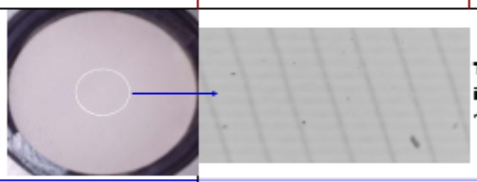
CHAPTER 2: Achieving an Operational Station

FirstElement Fuel, Inc. commissioned the Del Mar hydrogen station which included cleaning and purging lines and conducting pressure testing and hydrogen sampling (Figure 7). The station met the operational definition in PON-13-607 on September 30, 2016 when FirstElement Fuel, Inc. completed installing all station/dispenser components, obtained all of the required permits from the local jurisdiction, filled the station's storage tubes with pressurized hydrogen gas, passed a hydrogen quality test, and filled an FCEV with hydrogen. Automaker testing was performed to verify operation per *SAE J2601 Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles.* FirstElement Fuel, Inc. declared the station operational on September 30, 2016.

Figure 7: Hydrogen Fuel Quality Report on September 30, 2016

www.SmartChemistry.com

FIRST ELEMENT FUEL — **DELMAR HYDROGEN STATION**

SAE J2719 Constituents	SAE J2719 Limits - µmol/mol	Smart Chemistry Detection Limits -µmol/mol	H70 H2 @Nozzle sampled on 09/30/2016 Concentration (µmol/mol)
H_2O	**5**	0.5	< 0.5
Total Hydrocarbons (C1 Basis)	**2**		**0.071**
Methane		0.001	0.068
Acetone		0.001	0.0033
O_2	**5**	1	< 1
He	**300**	10	< 10
N_2 & Ar	**100**		
N_2		2	< 2
Ar		0.4	< 0.4
CO_2	**2**	0.1	< 0.1
CO	**0.2**	0.0005	**0.0017**
Total S	**0.004**		**0.000019**
Hydrogen Sulfide		0.000002	0.0000059
Carbonyl Sulfide		0.000002	0.000010
Methyl Mercaptan (MTM)		0.00001	< 0.00001
Ethyl Mercaptan (ETM)		0.00001	< 0.00001
Dimethyl Sulfide (DMS)		0.00001	< 0.00001
Carbon Disulfide		0.000002	0.0000034
Isopropyl Mercaptan (IPM)		0.00001	< 0.00001
Tert-Butyl Mercaptan (TBM)		0.00001	< 0.00001
n-Propyl Mercaptan		0.00001	< 0.00001
n-Butyl Mercaptan		0.00001	< 0.00001
Dimethyl Disulfide (DMDS)		0.00001	< 0.00001
Tetrahydrothiophene (THT)		0.00001	< 0.00001
Formaldehyde	**0.01**	0.001	< 0.001
Formic Acid	**0.2**	0.0008	< 0.0008
Ammonia	**0.1**	0.01	< 0.01
Total Halogenates	**0.05**		**0.0024**
Cl_2		0.0004	< 0.0004
HCl		0.0001	< 0.0001
HBr		0.0002	< 0.0002
Total Organic Halides (32 compounds in red and bold listed in "Non-Methane Hydrocarbons")		0.001 (Sinan Chemistry limits for each individual organic halide compound)	0.0024
Tetrachloro-hexafluorobutanes			0.0024
Particulate Concentration	**1 mg/kg**		**< 0.03 mg/kg**
Particulates Found & Size			**There are total 9 particulates found (sizes in micrometer) - 81, 53 (2), 94, 75, 100, 143, 133, 411.**
Hydrogen Fuel Index			**99.999992%**

Source: FirstElement Fuel, Inc.

CHAPTER 3: Station Use

The first Fuel Cell Electric Vehicle (FCEV) to fuel at the dispenser was a Hyundai Tucson on September 30, 2016 (Figure 8) and the station is used regularly. The Del Mar station dispensed 67 kilograms of hydrogen in October 2016 and 107 kilograms in November 2016 and began sending updates on the station status to the California Fuel Cell Partnership's Station Operational Status System website portal on December 2, 2016.[1]

Figure 8: First Use of the Hydrogen Station on September 30th, 2016

Source: FirstElement Fuel, Inc.

1 California Station Status Portal (https://m.cafcp.org/)

CHAPTER 4: Certifying the Station

The California Department of Food and Agriculture Division of Measurement Standards enforces California weights and measures laws and regulations and must certify any device used for metering the sale of commercial items within California. FirstElement Fuel, Inc. achieved certification (Figure 9) on October 26, 2016 by acting as the registered service agent. They dispensed a measured amount of fuel and confirmed that the quantity dispensed is accurately reflected by the dispenser in accordance with examination procedures (EPO NO. 40-A).[2] The process was witnessed by the local county weights and measures officer.

Figure 9: Dispenser with Certification Stickers at the Del Mar Hydrogen Station

Source: FirstElement Fuel, Inc.

2 Examination Procedures for New Station (https://www.cdfa.ca.gov/dms/programs/devices/Hydrogen_Gas-Measuring_Devices_EPO-40.pdf)

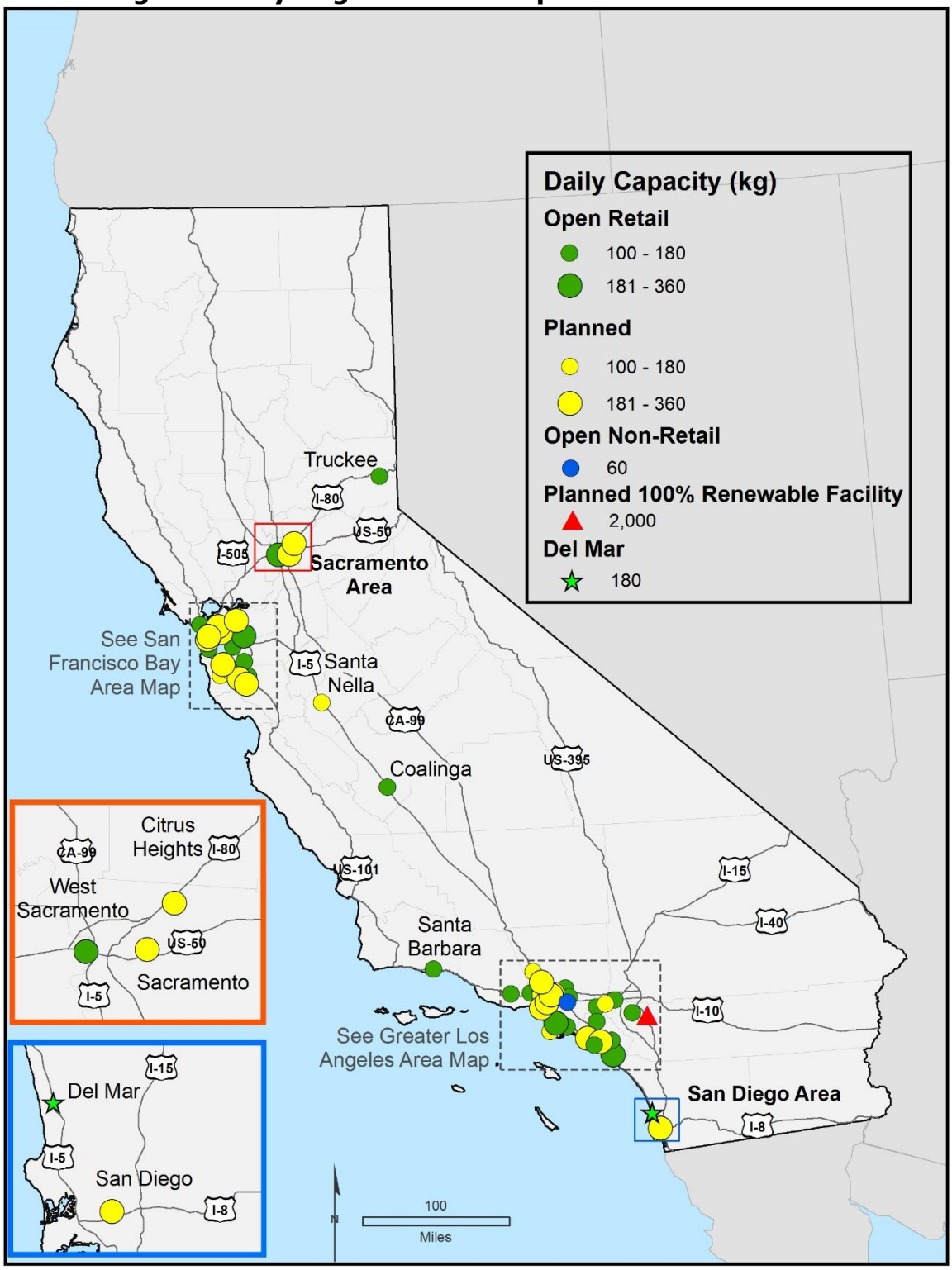
CHAPTER 5: Completing the Station

Figure 10 shows the Del Mar station, well-lit, and ready for use, and Figure 11 shows the Del Mar station in the California network of hydrogen refueling stations. The star in Figure 11 indicates the location of the Del Mar hydrogen station at 3060 Carmel Valley Road along Interstate 5 near the Torrey Pines State Reserve.

Figure 10: Del Mar Hydrogen Station at Night

Source: FirstElement Fuel, Inc.

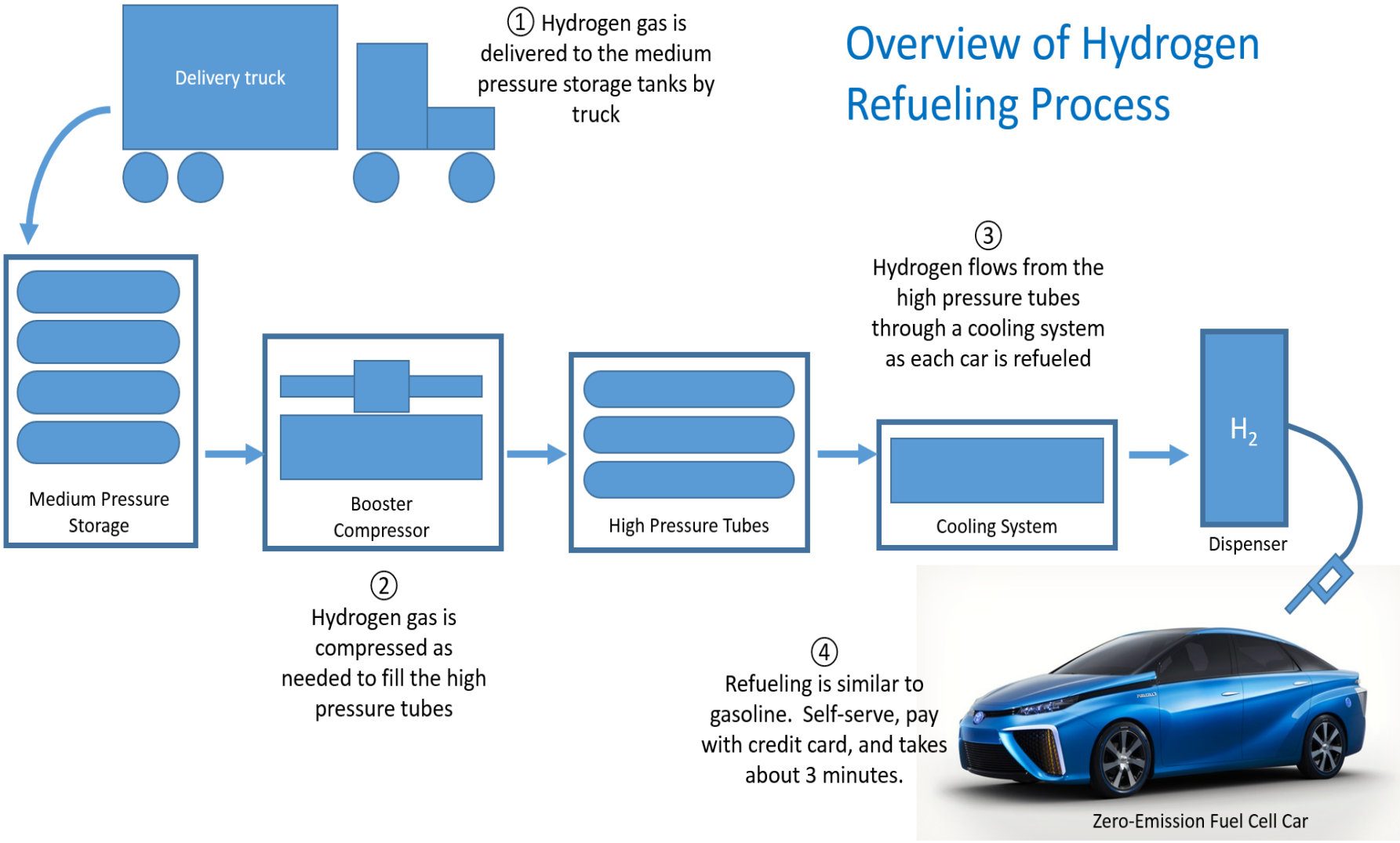
Figure 11: Hydrogen Stations: Open Retail and Planned



Source: CEC Staff.

Figure 12 overviews the Del Mar hydrogen station layout and the station components. The figure includes the steps involved in the FCEV refueling process.

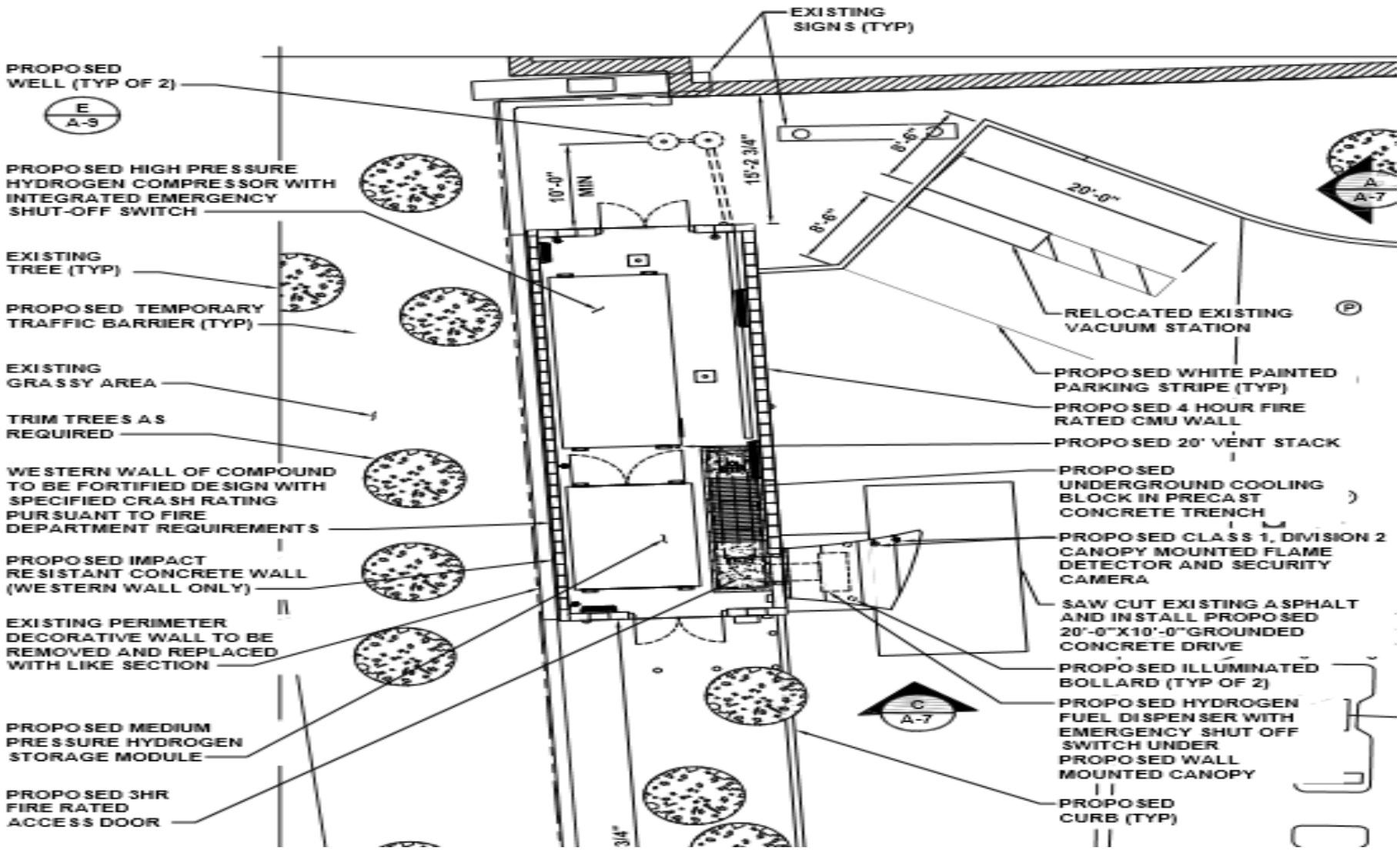
Figure 12: Schematic Depicting Hydrogen Station Equipment and Refueling Process



Source: FirstElement Fuel, Inc.

Figure 13 shows a detailed view of the actual final, as-built configuration of the Del Mar station.

Figure 13: Enlarged View of Final Del Mar Layout



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

Figure 14 shows budget for the Del Mar hydrogen refueling station.

Figure 14: The Project Grant Funding and Match Funding

Air Products and Chemicals, Inc., Allentown , PA	
H2 station equipment	$1,483,691.18
Black and Veatch, Overland Park, KS	
Construction	$593,000.49
Engineering	$50,601.47
Permitting	$64,085.92
Project Management	$20,910.62
Various Vendors	
Construction Materials (tubing, wire, etc.)	$34,624.61
Fixtures (doors, lights, etc.)	$48,113.40
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	$2,314,876.41
California Energy Commission Grant	$1,451,000.00
Remaining match funding provided by FirstElement Fuel, Inc.	$863,876.41
Total CEC cost share	62.7%

Source: FirstElement Fuel, Inc.

The Del Mar hydrogen refueling station is supplied by hydrogen generated via the Steam Methane Reformation process 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) and PON-13-607, which funded this project, 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 33 percent

renewable requirements. Figure 15 shows the biogas supply sources and bio-gas fuel supplier agreement documentation is provided in Figure 16.

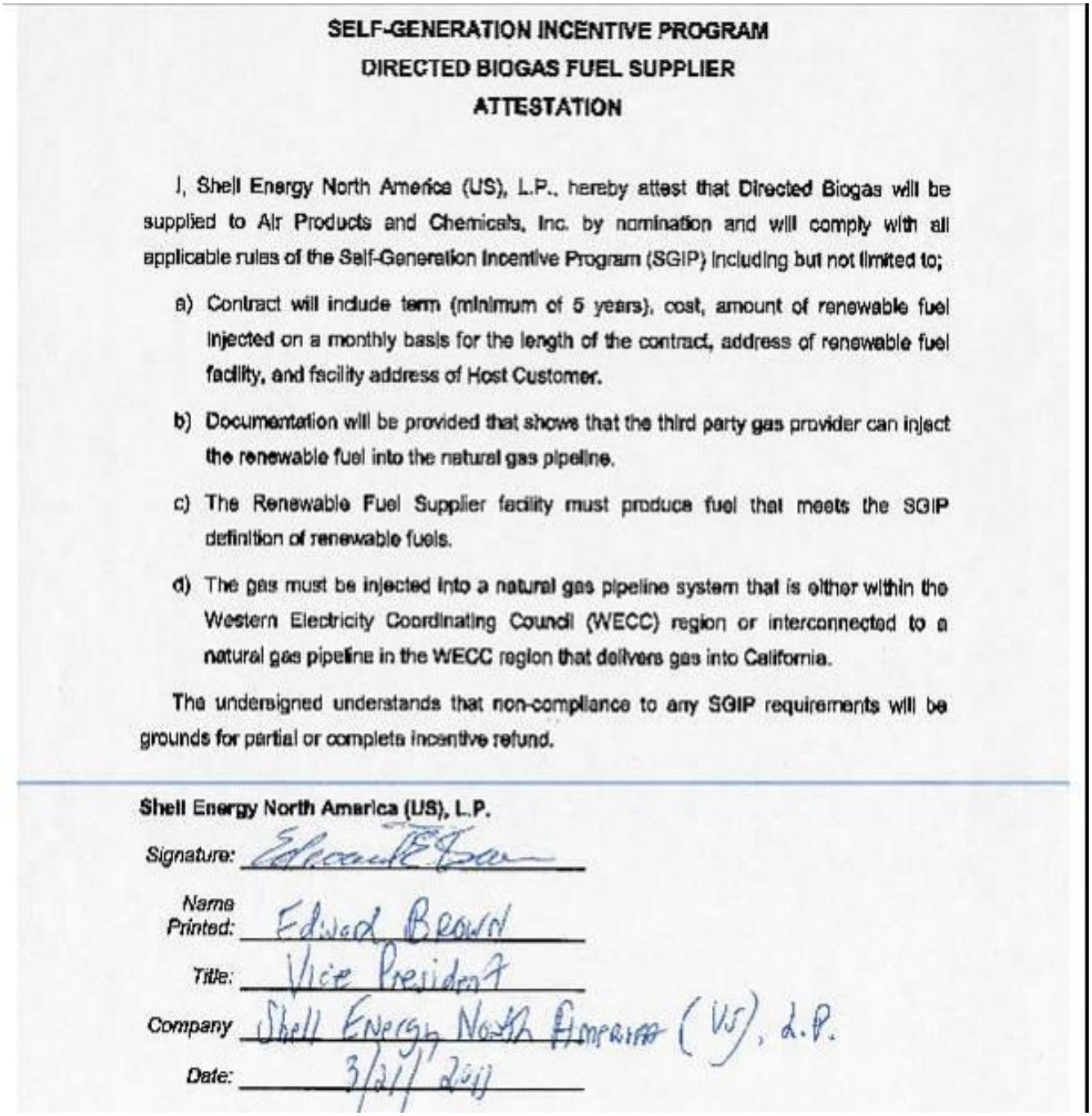
Figure 15: Renewable Biomethane Supply Sources

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

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.

Figure 16: Biogas Fuel Supplier Attestation



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 E Beard

Name Printed: Edward Beard

Title: Vice President

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

Date: 3/21/2011

Source: FirstElement Fuel, Inc.

Although California has biogas resources, local supply cannot be injected into California pipelines per California Health and Safety Code Section 25420. Air Products and Chemicals Inc.' biogas supply for this project is being sourced outside of 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] Hydrogen is delivered to the Del Mar hydrogen refueling station by a Department of Transportation-certified high-pressure delivery trailer.

The Del Mar hydrogen station is 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, depending on driver habits. Assuming that FCEVs average 52 mile/kilograms (according to the *Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model),*[4] and consumption of 180 kilograms/day for the next 10 years, the station will offset 8,384 metric tons of total Greenhouse gas compared to equivalent gasoline vehicles. Furthermore, the Del Mar hydrogen station will eliminate more than 1.54 million gallons of gasoline, assuming the 2013 national passenger fleet average fuel economy of 21.6 mpg.

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

There was no additional landscaping added 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 aid in evening fueling.

FirstElement Fuel, Inc. developed an effective customer service organization and approach. The related flow chart is in Figure 17. The firm also has a remote monitoring system for the stations. A screenshot is shown in Figure 18.

As part of a separate grant agreement for operations and maintenance funding through the Energy Commission (ARV-17-025), data on the operation of the station will be collected and reported quarterly for three years (March 1, 2018 to February 28, 2021). Data collected and reported will include the fuel log, dispensing, compression, storage and delivery, maintenance, and other monthly operating costs such as rent, electricity, property tax, and license and permit fees.

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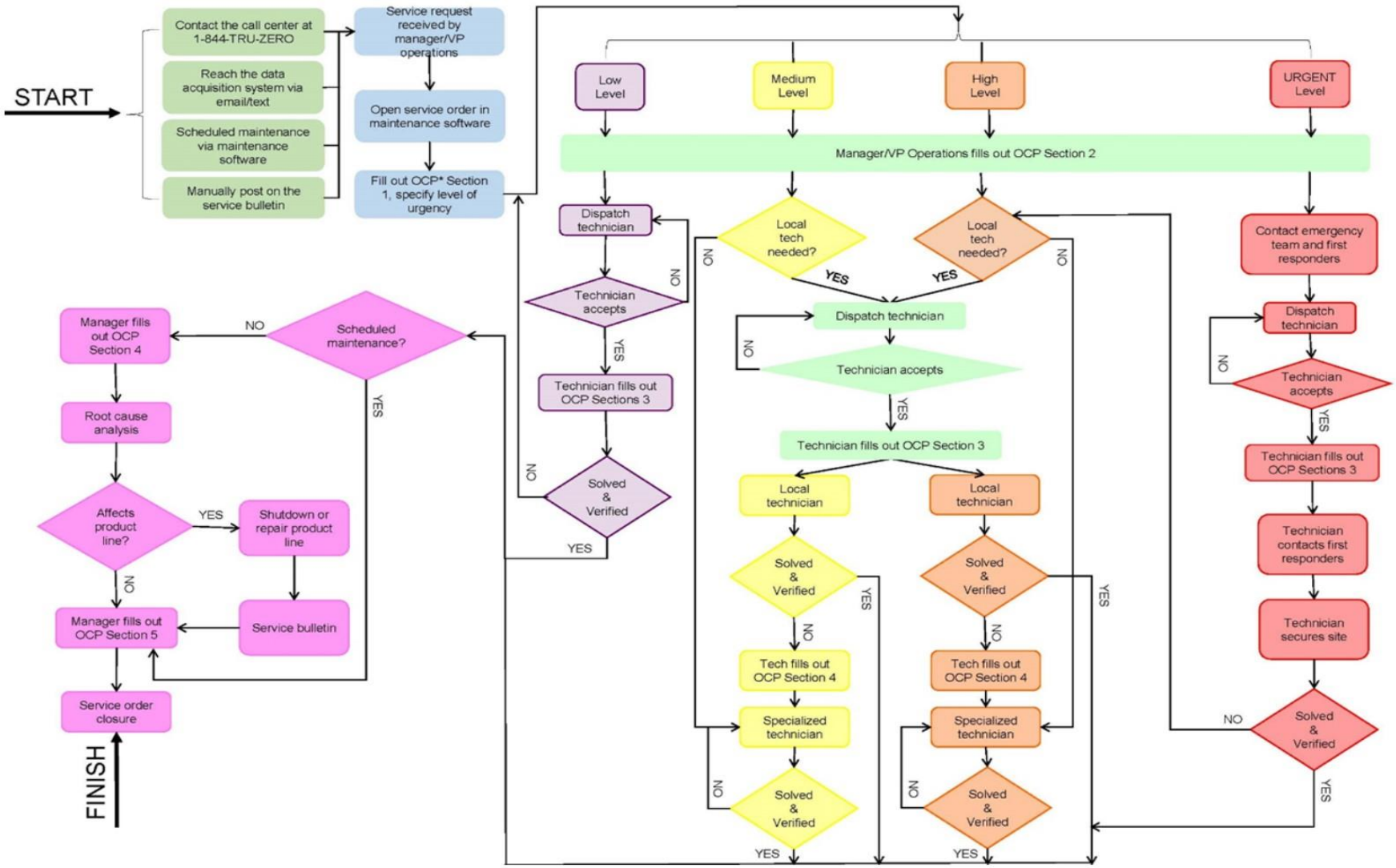
3 The Western Electricity Coordinating Council promotes Bulk Electric System reliability in the Western Interconnection (https://www.wecc.biz/Pages/AboutWECC.aspx)

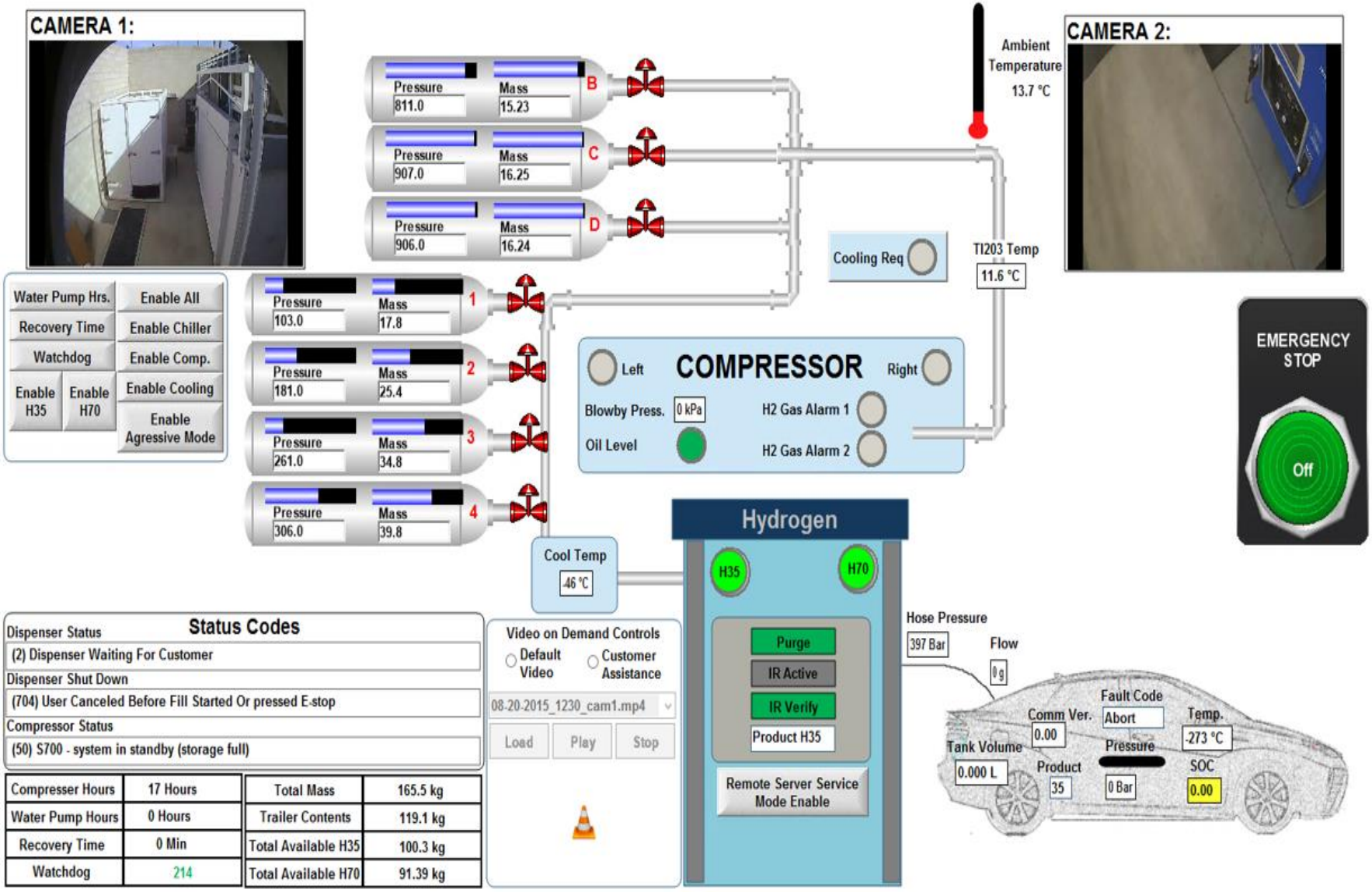
4 GREET® Model (https://greet.es.anl.gov/)

Figure 17: FirstElement Fuel, Inc. Response Flow Chart



Source: FirstElement Fuel, Inc.

Figure 18: Screenshot of FirstElement Fuel, Inc.'s Remote Monitoring System



Source: FirstElement Fuel, Inc.

CHAPTER 6: Conclusions

The hydrogen refueling station, at 3060 Carmel Valley Rd. in San Diego, is now open and providing 33.3 percent renewable hydrogen to the general public traveling along Interstate 5 near the Torrey Pines State Reserve.

The Del Mar hydrogen refueling station administrative entitlement and zoning permit process progressed with no major hurdles and no public hearing requirements but from start to finish the total time was nearly a year. In addition, the permitting process took approximately eight months. Future projects in large jurisdictions such as San Diego, should include extra time in the schedule to assure that station construction starts and operational status follows as quickly as possible to avoid extra costs and assure that stakeholders confidence remains high.

Once again project staff found that the 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 appropriately apply the content of National Fire Protection Association hydrogen technologies code.

Beginning in the fall of 2013, FirstElement Fuel, Inc. took steps to identify and acquire the site for this hydrogen refueling station. This new facility is now one of many on a growing list of refueling stations serving the residents of California that are collectively helping to attain the state's climate change policies.

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).

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), per fluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

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.