CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

Two Biodiesel Blending Terminals

Prepared for: California Energy Commission

Prepared by: RTC Fuels, LLC. DBA Pearson Fuels

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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-09-006 to provide funding opportunities under the Clean Transportation Program for projects which develop infrastructure necessary to store, distribute, and dispense electricity, E-85, Biomass-based diesel, and natural gas. In response to PON-09-006, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards May 17, 2010. The agreement was executed as ARV-10-008 on April 18, 2011 in the amount of $1,788,551.

ABSTRACT

Pearson Fuels partnered with two well-established petroleum distributors to develop new biodiesel blending facilities.

Pearson worked with Apex Fuels, LLC in Southern California to incorporate a biodiesel and renewable diesel blending facility into the Chemoil Terminal in Carson, California. Chemoil will make all blends of biodiesel available to customers within its 120-mile radius competitive distribution area, which includes Ventura, Los Angeles, Orange, Riverside, San Bernardino, and Imperial counties, and most of San Diego County, encompassing a population of approximately 21 million people.

Pearson worked with Interstate Oil Company in Northern California to up-fit one of its large diesel terminals with full biodiesel storage and blending capability in McClellan, California. Interstate Oil will make all blends of biodiesel available to its customers within its 120-mile radius competitive distribution area, which includes the San Francisco, San Jose, Sacramento and Stockton metropolitan areas, encompassing a population of approximately 4.6 million people. Combined, these facilities now serve approximately 26 million people or approximately 70 percent of the population of the state of California.

Both projects were completed within budget and substantial volumes of renewable fuels are being distributed through them.

Keywords: California Energy Commission, biodiesel, terminal, fuel, alternative fuels.

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EXECUTIVE SUMMARY

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Pearson worked with Interstate Oil Company in Northern California to up-fit one of its large diesel terminals with full biodiesel storage and blending capability in McClellan, California. Interstate Oil will make all blends of biodiesel available to customers within its 120 mile radius competitive distribution area, which includes the San Francisco, San Jose, Sacramento and Stockton metropolitan areas, encompassing a population of approximately 4.6 million people. Combined, these facilities now serve approximately 26 million people or approximately 70 percent of the population of the state of California.

Pearson and its contractors completed both projects within budget and substantial volumes of renewable fuels are being distributed through them. “Infill” projects within existing fuel distribution depots offer the ability to leverage and build upon existing fuel distribution infrastructure investments. If these projects had to be built from scratch, they would be much more expensive. This project had a very small administrative overhead as compared to alternative ways of developing such a project.

Actual throughput for the Northern and Southern California terminals will be 5.5 million gallons in their first year of operation. This is a 300 percent increase over the initial 1.8 million gallon estimate.

In the original proposal, the Pearson team projected that petroleum reduction in the first 10 years of operation would be 11.7 million diesel gallons equivalent. Based on the actual throughput, the petroleum reduction volume is now estimated to be 51.8 million diesel gallons equivalent, which represents an additional petroleum reduction of 440 percent.

In the original proposal, the projected greenhouse gas emissions benefit for the project on a wells-to-wheels basis was 16,000 metric tons over a 10-year period. Based on actual throughput during the test period, greenhouse gas emission reductions will total nearly 500,000 metric tons over a 10-year period. This is a 2,700 percent decrease from the original estimate.

CHAPTER 1: Project Overview

Purpose

According to the State of California's Alternative Fuels Plan,[1] the weakest link for expanding biodiesel distribution and sales is the lack of bulk terminal, bulk storage and terminal blending infrastructure for biodiesel. There are few biodiesel producers in California and they have struggled to stay in business. Issues with underground storage tank certifications, combined with the inconsistently available producers blend tax credit, has made it even more difficult for in-state biodiesel producers.

Seeking to alleviate the lack of biodiesel blending and storage infrastructure, the California Energy Commission (CEC) issued a solicitation to provide funding opportunities for projects that develop the infrastructure necessary to store, distribute, and dispense biomass-based diesel. Using the CEC grant funding, Pearson Fuels planned a progressive project to support expanded distribution and sales of biodiesel by installing two new in-line biodiesel blending facilities at two existing petroleum diesel-only facilities in California.

Market

In California, target market biodiesel is blended by a variety of inefficient and expensive processes. To achieve a biodiesel blend, a fuel truck drives to a biodiesel refinery or loading rack and loads biodiesel to the desired blend level, from 1 to 99 percent biodiesel (B20 is the market standard blend). It then drives to a diesel loading rack and fills the remainder of the tank. This loading process is called "splash blending" and is used to blend the two fuels together. Splash blending adds substantial cost to each fuel load in the form of truck time, driver time, fuel costs for the truck, blending inefficiencies and dispatch inefficiencies. If biodiesel is to better compete with diesel, it needs to be loaded fully blended in one stop, the way petroleum diesel is loaded.

Goals

The goal of this agreement is to develop and install new storage, blending and loading technologies to increase sales and distribution of biodiesel blends. Eliminating the biodiesel blending cost barrier for both diesel no. 2 and red-dye blended biodiesel will make biodiesel more cost competitive in California.

1 California Energy Commission and California Air Resources Board. 2007. *State Alternative Fuels Plan*. California Energy Commission Publication No: CEC-600-2007-011-CMF

Objectives

The objectives of this agreement are to build a Northern California biodiesel blending terminal and a Southern California biodiesel blending terminal.

Background

The petroleum distribution infrastructure in the U.S. is arguably one of the most developed, entrenched, ubiquitous, and most efficient vehicle fuel distribution systems ever created. The purpose of this project is to build on existing infrastructure and integrate storage and blending equipment to best serve existing and future biodiesel customers.

Pearson Fuels has been recognized nationally through Department of Energy funding and regionally through the California Air Resources Board as a leader in the provision of alternative fuels to the public. Pearson's unique business model involves serving as a facilitator between the extensively developed petroleum industry and the newly developing alternative fuels industry. Pearson has helped many retail gasoline fuel station owners enter the alternative fueling business.

The Plan

Pearson partnered with two well-established petroleum distributors who are both actively in the wholesale fuel distribution business to develop two new biodiesel blending facilities.

In Northern California, Pearson worked with Interstate Oil Company to up-fit one of its large diesel terminals with full biodiesel storage and blending capability in McClellan, California. Pearson also planned to work with The SoCo Group Inc. in Southern California to include a state of the art, modular biodiesel blending facility as part of its distribution center located in El Cajon, CA.

Subsequently a more attractive location became available with Apex Fuels in the Chemoil Terminal in Carson California. Ultimately, that was the location used for the development of the Southern California Terminal.

Figure 1: Pearson Fuels Headquarters, San Diego, CA

Photo Credit: Pearson Fuels

CHAPTER 2: Project Implementation

The Northern California Terminal was built as intended with Interstate Oil. The Southern California Terminal was relocated to a superior location with vastly more throughput capacity than originally projected.

Northern California Terminal

Interstate Oil is the largest independent petroleum distributor in the Sacramento area. Since 2006, Interstate Oil has operated a diesel distribution terminal in McClellan Park on the site of the former McClellan Air Force Base, in McClellan, California. This is an active wholesale diesel terminal which loads fuel trucks with diesel no. 2 at a through rate of approximately 650,000 gallons per month. Approximately 98 percent of the fuel distributed through this terminal is into trucks owned and operated by Interstate Oil. The terminal includes an operational fuel loading rack and blending interface. The most prominent feature of the terminal is the operational 633,000-gallon no. 2 diesel tank. Diesel no. 2 is the only product distributed from the fuel rack, although rail access is nearby and biodiesel is sometimes trucked in for resale. There is no off-road red diesel or blended biodiesel on site.

The development plan for the Interstate Oil terminal in McClellan is to transform it into a high volume, biodiesel, diesel no. 2 and red dye off-road diesel blending facility. When completed, Interstate Oil will retain the 633,000 gallon storage tank for diesel no. 2 on site and add a 75,600 gallon red-dye tank and two 88,200 gallon biodiesel tanks. This will allow the facility to stock two different types of biodiesel of two different blend stocks or producers. The result will be four different diesel products available in any requested blend. For example, a truck driver will be able to pull into the facility and key in the requested product. The blending mechanism will draw the appropriate quantities of the requested product and in-line blend them prior to dispensing into the fuel truck for delivery.

For example, assuming that the two biodiesel tanks contain biodiesel made from waste oil feedstocks (tank no. 1) and soybean feedstocks (tank no. 2), the fuel delivered into the tank can be either B1 – B99 soy diesel with either diesel no. 2 or red-dye off-road, or alternatively, B1 – B99 waste oil biodiesel with either diesel no. 2 or red-dye off-road. With one percent blend increments, this facility will be transformed from a two product facility to a facility that loads 100 different percentages of biodiesel no. 2 with soy feedstock, 100 different percentages of biodiesel no. 2 with waste oil feedstock, 100 different percentages of biodiesel red-dye off-road with soy feedstock and 100 different percentages of biodiesel red-dye off-road with waste oil feedstock. This is literally 400 different blends of fuel.

Most wholesale distributors agree that to be competitive, a fuel terminal needs to be within 120 miles of the vehicle fuel station. The strategic location of this facility allows for a competitive delivery range that includes all of the Sacramento, Stockton, San Francisco, San Jose, Santa Cruz areas, as well as Marin County.

Interstate Oil is contributing substantial infrastructure and other resources to the project. They have three tanks located across the nearby street that it will contribute to the project.

Interstate Oil's total contribution will include all four tanks, the land, the existing fuel loading rack, the existing driver blending interface, much of the existing piping, an existing secondary containment dike, operation of the facility and the permit fees. Interstate Oil will lease and operate this part of the proposed project. The objective is to develop Northern California's premier biodiesel blending rack.

Implementation

Pearson contracted with Interstate Oil to be the Prime Contractor on the Northern Terminal. Interstate contracted with subcontractors for the design, engineering and construction of the project. Interstate also facilitated the acquisition of all the permits for the facility.

The contractors excavated and poured three new-engineered footings in preparation for moving the tanks across the street to the new blending facility. After the footings were prepared, the tanks were tested, removed and then lifted with cranes over to the new footings. The tanks were bolted down to the new footings and tested again. New piping was then run to a central location where all four fuels can be blended to the customer specification. New loading arms were installed and the facility became operational in January 2013.

Figure 2: New Tank Footing at Interstate Oil Facility

Photo Credit: Pearson Fuels

Figure 3: Tank Being Lifted Across the Street

Photo Credit: Pearson Fuels

Figure 4: Tank Lowered onto New Footing

Photo Credit: Pearson Fuels

Figure 5: New Piping

Photo Credit: Pearson Fuels

Figure 6: Red Dye on the Left Arm, Clear on the Right Arm

Photo Credit: Pearson Fuels

Southern California Terminal

The Plan

The SoCo Group, Inc. located in Carlsbad, California, has been serving the petroleum needs of Southern California for over 80 years. The company offers a complete range of petroleum products and services, and works with a diverse range of customers, including retail service stations, agricultural customers, construction firms and heavy and light industrial companies.

SoCo operates a bulk diesel terminal in El Cajon California. It is an active wholesale diesel terminal that loads fuel trucks with diesel no. 2 at a through rate of approximately 300,000 gallons per month.

The goal for the Southern California Terminal was to transform the SoCo facility into a high volume, biodiesel, diesel no. 2 and red dye off-road diesel blending facility. The result would have been a terminal with diesel no. 2 on site and two 25,000 gallon tanks, which would initially be configured with both red-dye diesel and biodiesel compartments. The system would be modular in that biodiesel and red dye compartments could be increased as demand allows. This would have allowed the facility to stock biodiesel and red-dye off-road diesel and blend it with no. 2 diesel; the result would have been 3 different diesel products available in any requested blend. For example, a truck driver would have pulled into the facility and keyed in the requested product. The blending mechanism would have drawn the appropriate quantities of the requested product and in-line blended them before they would have been dispensed into the fuel truck for delivery.

Southern California Site Change

During project planning, it became apparent that the expected throughput volumes for the El Cajon terminal would not be as high as originally planned. All of the partner stakeholders were committed to building a Southern California blending terminal, but the team searched for another higher capacity site so that the Energy Commission and the taxpayers could make the biggest impact on alternative fuel infrastructure with the least amount of money.

Chemoil is one of the largest distributors of marine fuels in the world. They are the owner and operator of a large bulk fuel terminal located at 2365 East Sepulveda Blvd., Carson California. This terminal has pipeline access from their marine dock located at the Port of Long Beach approximately 5 miles away. There are four truck fuel-loading lanes at the terminal. There has never been any bulk biodiesel or renewable diesel stored or distributed on site.

Apex Fuels Inc. was to be a major distributor of over-the-road clean products from the facility. Pearson Fuels proposed to work with Apex to upgrade the existing facility to make it compatible with the storage, blending and distribution of both biodiesel and renewable diesel. Linking the existing tanks together would allow for storing biodiesel in both large and small quantities as market conditions dictate.

Pearson Fuels believed it would be in the best interest of the CEC and the California drivers who fund the Clean Transportation Program[2] to change locations for the Southern California terminal and reallocate funding categories to accomplish the project. The Pearson team traveled to Sacramento to discuss the proposed changes during a Critical Project Review Meeting. CEC staff agreed to the site and budget changes, and grant ARV-10-008 was amended on May 20, 2013.

Construction of New Facility

Pearson Fuels worked with Apex Fuels as the Prime Contractor. Apex Fuels reconfigured the piping for three large 4.2 million gallon tanks so that entire ship cargoes of renewable diesel could be delivered via pipeline from the LA Marine Terminal. This allows renewable diesel to be segregated from the other products and piped directly to the truck fuel racks. Apex also connected a 50,000 barrel tank to the rack to allow for direct delivery of biodiesel to the trucks. This tank connects to the pipelines that allow for deliveries from ships or other terminals. The biodiesel tank connects to the biodiesel blending system, which allows truck drivers to “dial a blend” of their preferred biodiesel or renewable diesel blend. The fuel racks were also upgraded to enable drivers to "dial a blend" and bill it properly. Drivers can punch in their desired mix of biodiesel blend in any percentage with diesel no. 2, red dye diesel, biodiesel and potentially renewable diesel. The facility became partially operational in September 2013 and completely operational on April 1st, 2014.

Figure 7: Proposed Piping Changes at the LA Marine Terminal

Photo Credit: Pearson Fuels

2 The AB 118 / AB8 / Clean Transportation Program is funded through small, annual surcharges on vehicle and small boat registration fees.

Figure 8: Newly Reconfigured Tank

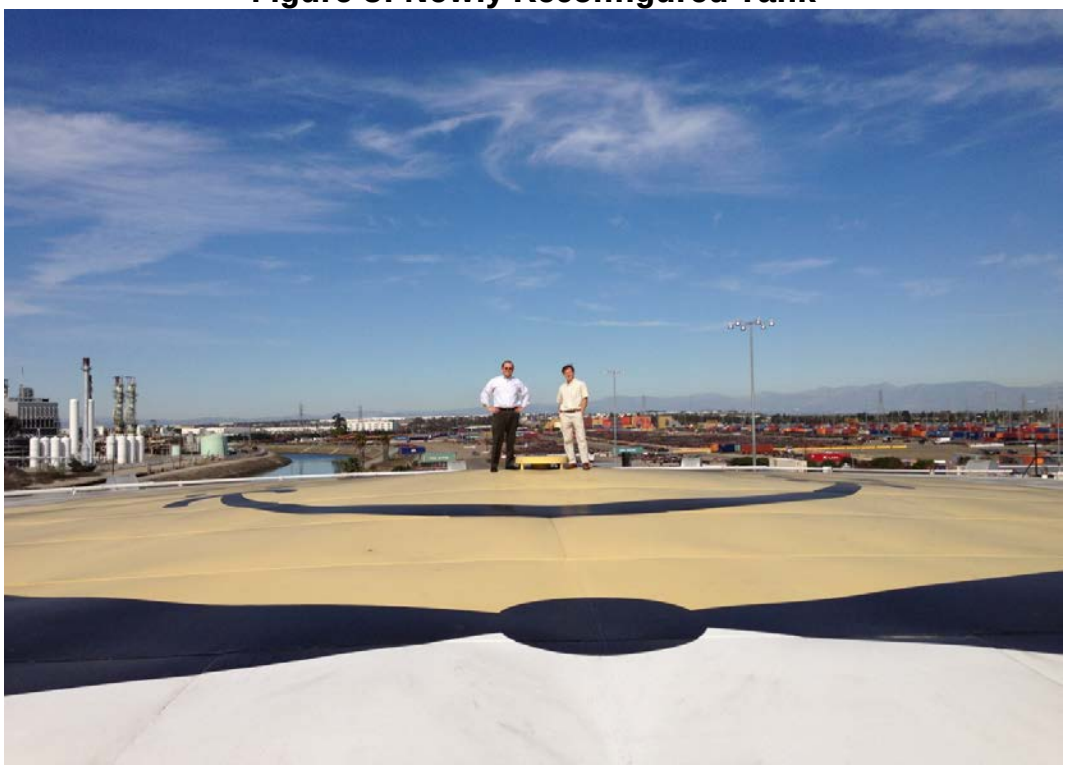

Photo Credit: Pearson Fuels

Figure 9: Pipe Welding to Link Tanks

Photo Credit: Pearson Fuels

Figure 10: New Piping

Photo Credit: Pearson Fuels

CHAPTER 3: Data Collection and Analysis

Northern Terminal Volume

The Northern Terminal project was built as planned, although there were a few setbacks in fuel throughput. Following completion, the new blending terminal experienced technical problems and operated well below design capacity. In addition, Interstate Oil changed its senior management team, who needed time getting up to speed. Most importantly, the Biodiesel Blender's Tax Credit,[3] which provided a $1.00 per gallon tax credit, expired at the end of 2013 and substantially reduced sales and throughput.[4] All of the technical issues have since been resolved at the facility, and the new management is in place. However, the expired federal tax credit remains a serious issue. Table 1 shows one year's worth of throughput figures for the northern biodiesel blending facility, from March 2013 to March 2014.

Over a year, the biodiesel portion of the blend was just over 10,000 gallons of biodiesel, or five percent of the nearly 200,000 gallons in sales. Monthly biodiesel sales were just 790 gallons per month. The feedstock used for the Northern Terminal has been soy oil (SME) with a Carbon Intensity (CI) value of 83.2 grams of CO2-equivalent per megajoule (MJ) (CO2e/MJ). The baseline CI value for California diesel is 98.03 gCO2e/MJ.[5]

3 The biodiesel tax credit was established in 2005 by the American Jobs Creation Act of 2004.

4 The biodiesel tax credit lapsed repeatedly between 2005 and 2017, but was re-instated retroactively each time.

5 LCFS Look-Up Table, California Air Resources Board.

Table 1: Blended Biodiesel Throughput at the Interstate Oil Facility

Month	Volume (gallons)
Mar, 2013	18,369
Apr, 2013	17,476
May, 2013	18,174
Jun, 2013	12,003
Jul, 2013	12,876
Aug, 2013	13,263
Sep, 2013	14,059
Oct, 2013	16,410
Nov, 2013	13,983
Dec, 2013	13,139
Jan, 2014	17,235
Feb, 2014	14,750
Mar, 2014	15,430
Total	**197,167**

Source: Pearson Fuels records.

Initially, it was the technical issues and the management transition that prevented this terminal from maximizing its potential throughput before the federal tax credit expired at the end of 2013. With those issues resolved, there is ongoing uncertainty around the federal blenders' tax credit. Moreover, the Air Resources Board's Low Carbon Fuel Standard (LCFS) targets for obligated parties has been delayed for two years.[6] This has dropped the price of LCFS credits by over 75 percent from their peak. The federal Renewable Fuels Standard includes mechanisms to address this issue, but the recent proposals by the U.S. Environmental Protection Agency (U.S. EPA) substantially reduced the target quantity for biodiesel blending.

6 The lawsuit against the LCFS was resolved in 2014. "[D]ecided in 2014 and known as *Rocky Mountain I*, an *en banc* panel of the Ninth Circuit held that the 2011 LCFS did not facially discriminate against interstate commerce in ethanol or crude oil, did not regulate extraterritorially, and did not discriminate in purpose or effect against crude oil. On remand, the district court dismissed plaintiffs' revised claims against the 2015 version of the LCFS as well as their claims against the 2011 and 2012 versions, leading to the appeal that resulted in *Rocky Mountain II."* National Law Review.com. November 6, 2019. (https://www.natlawreview.com/article/repeat-courts-again-uphold-low-carbon-fuel-standard-programs)

California's biodiesel industry has been hit with the triple threat of expiring tax credits, falling LCFS credit values, and reduced target volumes from U.S. EPA.

Southern Terminal Volume

Once the CEC approved the grant amendment, Pearson completed the southern project on budget and within the term of the agreement. In contrast to the Northern California Terminal, the throughput volumes at the Southern Terminal have met or exceeded planned throughput. Significant quantities of biodiesel and renewable diesel were distributed through the new system even before all phases of the project were complete. Table 2 shows throughput volumes for the Southern California biodiesel blending facility.

Table 2: Southern California Blended Biodiesel Throughput in Gallons

Month	B99	B50	B20
Sept. 2013	171,751	0	54,679
Oct. 2013	758,121	9,247	61,433
Nov. 2013	1,049,596	0	0
Dec. 2013	711,120	0	131,373
Jan. 2014	33,933	0	208,252
Feb. 2014	40,654	29,811	154,368
Mar. 2014	68,525	257,883	55,415
Total Blended Sales	2,833,700	296,941	665,520
Total Biodiesel Sales	**2,805,363**	**148,470**	**133,103**
-	**(99%)**	**(50%)**	**(20%)**

Source: Pearson Fuels records.

For the Southern California Terminal, the total biodiesel throughput has been over three million gallons in just seven months, or 440,990 gallons per month. The feedstock used for the Southern Terminal has been 90 percent used cooking oil (UCO), which has a very low CI value of 15 gCO2e/MJ, and 10 percent canola oil (CME). Pearson Fuels estimates that they distributed 396,891 gallons of UCO and 44,099 of CME each month.

Estimated Carbon Intensity and Greenhouse Gas Reductions

This section develops a quantified estimate of the project's carbon intensity values for life cycle greenhouse gas (GHG) emissions. Specifically, GHG emissions are evaluated on a life cycle Wells-to-Wheels (WTW) basis using the CEC's AB 1007 pathway (CA GREET) from the State Alternative Fuel Plan.[7]

Following are Pearson's calculations using the Energy Commission's AB 1007 pathway (CA GREET based) steps for estimating WTW greenhouse gas performance with predominant demand from heavy-duty passenger vehicles:

1. **Determine Fueling Station Throughput Over the Station Design Life**.

   Pearson Fuels believes that estimations of throughput for these terminals are dependent on many factors outside the control of the project team. Future demand will depend largely on the demand for biodiesel fuel, and the demand for biodiesel fuel will demand largely on the relative costs of biodiesel vs. petroleum diesel. An important regulatory driver will be the future viability of the Low Carbon Fuel Standard and the level of mandates from State and Federal agencies that mandate certain percentages of biodiesel.

   Even at this early stage of operations, the two terminals have been distributing a total of 441,780 gallons of biodiesel per month or an estimated 5,300,000 gallons of biodiesel per year.

   Assume that each gallon of biodiesel will replace 0.98 gallon of petroleum diesel.[8] Multiply that by 10 years to get 51,847,300 diesel gallons equivalent (dge).

   (5,301,360 x .978 x 10) = 51,847,300 dge

2. **Determine Vehicle Class and Type Likely to Fuel at the Terminal.**

   A fossil-fueled internal combustion engine vehicle is the assumed vehicle type to use biodiesel blends.

3. **Use AB 1007 Full Fuel Cycle Analysis-Based Carbon Intensity Well-to-Wheels Values.**

   The 2012 values for fuel carbon intensities are derived from the AB 1007 Full Fuel Cycle Analysis for the vehicle technology and class. Table 3 identifies the fuel type and pathway for the project and selects the applicable carbon intensity. The analytic team is using the CI value from the feedstocks and multiplying the CI value by the number of gallons to calculate an average CI value for the fuel used at the terminal. The total weighted average CI is 19.8 gCO2e/MJ.

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7 California Energy Commission and California Air Resources Board. 2007.

8 The U.S. Energy Information Agency (U.S. EIA) cites a 2.2 percent mpg reduction.

Table 3: Total Project Weighted Carbon Intensity Throughput

Feedstock	Volume/Month (gallons)	CI (gCO2e/MJ)	Weighted CI (gallons)
UCO	396,891	15.0	5,957,333
CME	44,099	62.1	2,738,547
SME	790	83.2	65,767
Total	441,780		8,761,647
Average CI (gCO2e/MJ)			**19.8**

Table Notes: UCO= Used Cooking Oil, CME= Canola Oil, SME= Soy Oil

Source: Pearson Fuels records.

4. Convert the Diesel Gallon Equivalent Facility Volume to British Thermal Unit (BTU) Energy Units

(Using 127,500 Btu/gallon for diesel) *51,847,300 dge x 127,500 = 6,610.5 billion Btu*

5. Convert Diesel Gallon Equivalent to Joules.

Multiply Btu's calculated in step 4 to joules by multiplying with a factor of 961. Divide the joules obtained by 1,000,000 to get megajoules of energy throughput.

6,610.53075 billion Btu x 961/1,000,000 = 6,353 million MJ

6. Convert Carbon Emissions to Grams.

Multiply the WTW carbon intensity by the energy throughput to determine the carbon emissions in grams. Divide result by 1,000,000 to convert MJ to metric tons.

Using the Biodiesel average from Step 3 above:

6,353 million MJ x 19.83 grams CO2e/MJ divided by 1,000,000 = 125,980 metric tons

7. Convert the Displaced Diesel Volume to Energy-to-Energy Units (Btu's)

51,847,300 dge x 127,500 = 6,610.53075 billion btu

8. Convert the Energy Units to MJ Using Procedure in Step 5

6,610.53075 billion Btu x 961/1,000,000 = 6,353 million MJ

9. Calculate Avoided Carbon Emissions

Multiply the Displaced Diesel Energy Units by the Diesel Carbon Intensity (91 gCO2e/MJ)

6,353 million MJ x 91 grams CO2e/MJ divided by 1,000,000= 578,098 metric tons

10. Calculate Total GHG Benefits

Subtract the results in Step 6 from the results in Step 9.

Fueling Station Project GHG Benefit*: 578,098 metric tons – 125,980 metric tons = about 452,000 metric tons.*

This figure is for two terminals over 10 years.

A grant of $1.8m divided by anticipated petroleum reduction of 51,847,300 is 3.5 cents per gallon.

A grant of $1.8m divided by a greenhouse gas reduction of 452,000 metric tons is nearly $4.00 per ton.

CHAPTER 4: Project Evaluation

Project Goals

In the original proposal, Pearson Fuels stated that their involvement would assure the project's successful completion. Pearson Fuels believed their experience developing fuel projects would prevent the waste of time and material resources that can occur when alternative fuel projects are managed by organizations that have little experience in designing, permitting and developing alternative fuel projects. Pearson Fuels, with its own staff and the support of outside consultants, planned to collect and report for a period of at least six months data on the performance of the project as it relates to the achievement of operational goals and objectives.

Pearson Fuels completed both the Northern and Southern California projects within the term of the amended agreement and on budget.

Project Performance

Volume vs. Projections

In the original proposal, the operational goal for the Northern Terminal was to blend and distribute 1,000,000 gallons of biodiesel the first operational year with annual increases of 6 percent for the following 5 years. As described earlier, the actual throughput numbers fall far short of this goal. Pearson Fuels described the reasons for this shortfall in Chapter 3, but remains optimistic that this is an indication of the long-term volume potential of this site. Although management turnover and market forces negatively affected the initial volumes of this site, Pearson expects the volumes to increase substantially in the future. For evaluation purposes for this Final Report, Pearson will use the actual throughput volume of 181,737 gallons for the first year.

As described, the original site proposal for the Southern Terminal was changed to a higher capacity fuel distribution depot near the Port of Los Angeles. The original goal for the Southern Terminal was to blend and distribute 800,000 gallons of biodiesel the first operational year, with annual increases of 10 percent for the following five years. As described in Chapter 3, the monthly volumes during the test period are 440,990 gallons per month, which extrapolates to an annual volume throughput of 5,291,880 gallons per year.

The two terminals were projected to distribute 1.8 million gallons of biodiesel blend in the first year; actual throughput for the two terminals will be 5.5 million gallons in their first year of operation. This is an increase of over 300 percent.

Greenhouse Gas Reduction vs. Projection

In the original proposal, the projected greenhouse gas emissions benefit for the project on a Wells-to-Wheels basis was 16,364 metric tons over a 10-year period.o0 Based on actual throughput during the test period, greenhouse gas emission reductions will total 452,117 metric tons over a 10-year period. This is a 2,700 percent decrease from the original estimate.

Petroleum Reduction vs. Projection

In the original proposal, the Pearson team projected the petroleum reduction in the first 10 years of the operation of these terminals would be 11,736,000 diesel gallons equivalent. The revised estimate based on the actual throughput volume is now 51,847,300 dge, which represents an additional petroleum reduction of 441 percent.

Job Creation and Retention

When this project began in 2011, there were many fuel terminal commercial contractors without work throughout California due to the recession. This project kept multiple fuel station contractors working at Prevailing Wages during lean times.

Attempts to estimate the number of jobs saved or created is fraught with differences in estimation methodologies. When considering development, permitting and construction jobs, it is estimated that these projects supported:

Table 4: Estimated Job Creation Benefits

Job Title	Jobs Supported Over Project Life
Construction Workers	36
Equipment Manufacturers	12
Accountants	5
Project Managers and Staff	9
Total	**62**

Source: Pearson Fuels

During the project development and construction period from 2011 to 2014, the entire state of California was an economically distressed area. The Northern terminal was built on land formally occupied by McClellan Air Force base; due to the 1995 Base Realignment and Closure Commission Action, McClellan AFB was closed and the area never fully recovered economically.

Transition from Petroleum

According to the state's Alternative Fuels Plan, California's weakest link for biodiesel lies in its lack of bulk terminal, bulk storage and terminal blending facilities for biodiesel, palm oil, and other bio-oils. Today's capital markets and the current marginal economic case for biodiesel make it unlikely that venture capital money will be injected into this industry in the medium future. With this project, the CEC invested in an opportunity to further the transition from a dependence on petroleum fuels to this viable alternative and renewable fuels market.

Before this project, biodiesel was blended with a variety of inefficient and expensive processes. If biodiesel is to compete with diesel, it must be fully blended and loaded in one step. This project promotes and drives new technology advancement by eliminating cost barriers for both diesel no. 2 and red-dye blended biodiesel in a geographic market that

includes 70 percent of the state's population. This technology will be an important component of the transportation market in 2020 and 2050.

Most semi-trucks, delivery vehicles, large commercial vehicles and agricultural equipment use diesel fuel. According to the Oak Ridge National Laboratory,[9] diesel fuel accounted for about 25 percent of total transportation energy in 2011.

With very few exceptions, all of these medium and heavy-duty vehicles are compatible with blends of up to 20 percent biodiesel, or B20. Notwithstanding that statement, many fleets and vehicle manufacturers are hesitant to endorse a blend of greater than B5 due to warranty concerns and inconsistent fuel quality. At present, biodiesel occupies a niche market in California. In our view, biodiesel blends have the potential to serve most diesel markets and vehicles.

The petroleum distribution infrastructure in this country is arguably one of the most developed and most efficient vehicle fuel distribution systems ever created. These two terminal projects were built within that infrastructure with state funding and the technical expertise of petroleum distributors. This was one of the most effective ways for the State to accomplish the goals of the Clean Transportation Program.

Benefits to California Firms

Pearson Fuels was the recipient for this grant agreement. Founded in 2001, Pearson Fuels headquarters are located in the San Diego Regional Enterprise Zone, which is a California Enterprise Zone. The support that Pearson received through this grant helped Pearson survive through the last several years of challenging economic times in the alternative fuel industry and the shaky economy overall. This project not only secured Pearson's existing position of an established developer of retail alternative fuels site, but expanded that expertise to larger wholesale bulk terminals.

The Prime Contractor for the Northern Terminal was Interstate Oil. A California corporation, Interstate Oil was founded in 1970 by Terry Andrews; the company began as a bulk oil distributor and has grown to be a fuel distributor that delivered 185 million gallons of vehicle fuel in 2009. Interstate Oil is a diversified fuel and lubricants distributor servicing California from Bakersfield north to the Oregon border and all of Northern Nevada, with corporate headquarters in Sacramento. It specializes in advising businesses in effectively managing their petroleum product needs with service offerings that fit each industry segment. Interstate Oil offers Pacific Pride commercial fueling, on-site fueling, fuel storage tanks on location, delivery of bulk lubricants and equipment, and a variety of other automotive and commercial products. Its mission is to distribute high quality products while proving the absolute best in customer satisfaction.

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9 Oak Ridge National Laboratory, Transportation Energy Data Book: Edition 32, page 2-7. 2011

This project allowed Interstate to leverage its existing McClellan terminal and tankage facility to expand into in-line biodiesel blending. The full economic benefits have not yet been realized, but this terminal will be in operation for many years beyond this grant period

The Prime Contractor for the Southern Terminal was Apex Fuels, LLC. Apex Fuels, LLC was founded by Greg Cunningham and is headquarters are located in Murrieta, California. This project allowed Apex Fuels, LLC to expand its terminal agreement with the international distribution company ChemOil Terminals.

In addition to the above firms, many California-based firms benefited by working on this project. Following is a partial list of the subcontractors used for the two terminals:

Company	**Headquarters**
PFT Alexander, Inc.	Signal Hill, CA
Goldsmith Construction Company, Inc.	Signal Hill, CA
Long Beach Metals	Signal Hill, CA
Elite Power Inc.	Sacramento, CA
Corey Delta Construction	Benicia, CA
TRC Companies, Inc.	17 Locations in California

CHAPTER 5: Observations and Conclusions

Observations

The Pearson's Fuel team recorded observations throughout the course of the project.

The way the project was structured proved to be a major benefit. The fact that the recipient was experienced with grants and had the flexibility to contract with various contractors allowed the project to be accomplished within the term of the agreement, on budget, with a small percentage of the funds allocated to administrative and management payrolls. This maximized spending on hardware, materials and contracting expenses that contribute directly to the physical project.

At present, most of the demand for biodiesel is a function of economics. The triple threat of expiring tax credits, falling LCFS credit values and reduced target volumes from the U.S. EPA will affect the future throughput volumes of both terminals. These three incentives make a critical difference in how much biodiesel will be distributed through these terminals in the future.

Conclusions

Based on this project experience, Pearson Fuels concludes that this is a good structure for biodiesel infrastructure projects. Landowners and terminal operators are unlikely to learn how to prepare, execute and manage the grant application process themselves. Opening grant eligibility to third party contractors such as Pearson Fuels creates opportunities for successful teaming on biodiesel infrastructure projects.

Pearson Fuel's strategy has been to develop the project with as much potential volume as possible in order to maximize the value of the CEC project funds. The originally approved Southern California terminal proved to be too small and it was not located in a central area to maximize the potential distribution range. It was also not located on a pipeline or near rail service that could facilitate large volume deliveries of both regular and biodiesel products. In the future, Pearson Fuels would only propose a biodiesel blending facility that had rail or pipeline access for at least one of the two fuels, and preferably both.

Reduced costs are one of the primary benefits of integrating biodiesel bulk storage and fueling infrastructure into an existing fuel distribution facility. For example, Pearson and its subcontractors were able to re-purpose infrastructure previously dedicated to diesel for biodiesel storage and blending. Using facilities and infrastructure built for diesel is also far less expensive that planning, permitting and constructing a dedicated greenfield facility.

GLOSSARY

BIODIESEL—a biodegradable transportation fuel for use in diesel engines that is produced through the transesterification of organically- derived oils or fats. It may be used either as a replacement for or as a component of diesel fuel.

BIODIESEL TAX CREDIT—established in 2005 by the American Jobs Creation Act of 2004. It was extended by the Energy Policy Act of 2005, amended by the Energy Improvement and Extension act of 2008, and extended again by the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010.1 The American Taxpayer Relief Act of 2012 (Pub. L. 112-240) retroactively extended the tax credits for biodiesel and renewable diesel for 2012, and extended them through 31 December 2013. Producers of pure biodiesel and renewable diesel that meet ASTM specifications are eligible for a $1.00 per gallon tax credit upon use or sale or said fuel.[10]

BRITISH THERMAL UNIT (Btu)—The standard measure of heat energy. It takes one Btu to raise the temperature of one pound of water by one degree Fahrenheit at sea level. For example, it takes about 2,000 Btu to make a pot of coffee. One Btu is equivalent to 252 calories, 778 foot-pounds, 1055 joules, and 0.293 watt-hours. Note: In the abbreviation, only the B is capitalized.

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.

CANOLA OIL (CME)—Canola is the world's only "Made in Canada" crop. It was developed by researchers from Agriculture and Agri-Food Canada and the University of Manitoba in the 1970s, using traditional plant breeding techniques. The plant belongs to the Brassica genus, the botanical family that includes cauliflower and cabbages. The seeds are 44% oil - more than double the oil content of soybeans. Biofuel feedstock is one of the newer uses for canola. Compared to fossil diesel, canola biodiesel reduces lifecycle greenhouse gas emissions by 90%.[11]

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10 TransportPolicy.net (https://www.transportpolicy.net/standard/us-fuels-biofuel-tax-credits/)

11 Canola Council of Canada website (https://www.canolacouncil.org/oil-and-meal/what-is-canola/)

CARBON INTENSITY (CI)—The amount of carbon by weight emitted per unit of energy consumed. A common measure of carbon intensity is weight of carbon per British thermal unit (Btu) of energy. When there is only one fossil fuel under consideration, the carbon intensity and the emissions coefficient are identical. When there are several fuels, carbon intensity is based on their combined emissions coefficients weighted by their energy consumption levels.

COMPRESSED NATURAL GAS (CNG)—Natural gas that has been compressed under high pressure, typically between 2,000 and 3,600 pounds per square inch, held in a container. The gas expands when released for use as a fuel.

DIESEL GALLON-EQUIVALENT (DGE)—is the amount of alternative fuel it takes to equal the energy content of one liquid gallon of diesel gasoline.

DIESEL NO. 2—A fuel that has distillation temperatures of 500 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 975. It is used in high-speed diesel engines that are generally operated under uniform speed and load conditions, such as those in railroad locomotives, trucks, and automobiles.

GREENHOUSE GAS (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).

GREENHOUSE GASES, REGULATED EMISSIONS, AND ENERGY USE IN TRANSPORTATION (GREET)—is a full life-cycle model sponsored by the Argonne National Laboratory (U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy). It fully evaluates energy and emission impacts of advanced and new transportation fuels, the fuel cycle from well to wheel and the vehicle cycle through material recovery and vehicle disposal need to be considered. It allows researchers and analysts to evaluate various vehicle and fuel combinations on a full fuel-cycle/vehicle-cycle basis.

LOW CARBON FUEL STANDARD (LCFS)—A set of standards designed to encourage the use of cleaner low-carbon fuels in California, encourage the production of those fuels, and therefore reduce greenhouse gas emissions. The LCFS standards are expressed in terms of the carbon intensity of gasoline and diesel fuel and their respective substitutes. The LCFS is a key part of a comprehensive set of programs in California that aim cut greenhouse gas emissions and other smog-forming and toxic air pollutants by improving vehicle technology, reducing fuel consumption, and increasing transportation mobility options.

MEGAJOULE (MJ)—A Joule is a unit of work or energy equal to the amount of work done when the point of application of force of 1 newton is displaced 1 meter in the direction of the force. It takes 1,055 joules to equal a British thermal unit. It takes about 1 million joules to make a pot of coffee. A megajoule itself totals 1 million Joules.

SOYBEAN OIL (SME)—Soy is a bushy, leguminous plant, native of South-East Asia that is grown for the beans, which are used in the food industry, for protein in cattle feed and for oil production. Soybeans are the world’s largest oilseed crop, with a production of about 56 % of

the world's total oilseeds. The United States is the largest single producer of soybeans (FAO, 2016).[12]

STATE ALTERNATIVE FUELS PLAN—Governor Schwarzenegger, in his response to the California Energy Commission's (Energy Commission) 2003 Integrated Energy Policy Report, called for a workable long-term plan to increase the use of alternative fuels. Subsequent legislation, AB 1007, signed into law by the Governor, further directed the Energy Commission, in partnership with the California Air Resources Board, to develop a State Alternative Fuels Plan to increase the use of alternative fuels without adversely affecting air quality, water quality, or causing negative health effects. The State Alternative Fuels Plan presents clear strategies and steps California must take to increase the use of alternative fuels. The Plan identifies actions that California must take to keep alternative fuels as a significant option to meet the state's transportation energy needs in an environmentally sound and sustainable manner.[13]

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA)—A federal agency created in 1970 to permit coordinated governmental action for protection of the environment by systematic abatement and control of pollution through integration or research, monitoring, standards setting, and enforcement activities.

USED COOKING OIL (UCO)—Used Cooking Oil, tallow, lard, yellow grease, chicken fat, and the by-products of the production of Omega-3 fatty acids from fish oil are used as biodiesel fuel feedstocks.[14]

WELL TO WHEEL (WTW)—a specific LCA (Life-cycle Assessment) used for transport fuels and vehicles. The analysis is often broken down into stages entitled "well-to-station", or "well-to-tank", and "station-to-wheel" or "tank-to-wheel", or "plug-to-wheel". The first stage, which incorporates the feedstock or fuel production and processing and fuel delivery or energy transmission, and is called the "upstream" stage, while the stage that deals with vehicle operation itself is sometimes called the "downstream" stage. The well-to-wheel analysis is commonly used to assess total energy consumption, or the energy conversion efficiency and emissions impact of marine vessels, aircraft and motor vehicles, including their carbon footprint, and the fuels used in each of these transport modes. WTW analysis is useful for reflecting the different efficiencies and emissions of energy technologies and fuels at both the upstream and downstream stages, giving a more complete picture of real emissions.

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12 "Waste Oils and Fats as Feedstocks for Biofuel Production." ETIP Bioenergy – European Technology and Innovation Platform. ETIP Bioenergy website (http://www.etipbioenergy.eu/value-chains/feedstocks/waste/waste-oils-and-fats)

13 *State Alternative Fuels Plan*. Joint Report from the California Air Resources Board and California Energy Commission. Publication No. CEC-600-2007-011-CMF. December 2007.

14 ETIP Bioenergy website (http://www.etipbioenergy.eu/value-chains/feedstocks/waste/waste-oils-and-fats)