



**CALIFORNIA
ENERGY COMMISSION**



California Energy Commission
Clean Transportation Program

FINAL PROJECT REPORT

Lindsay Unified School District Compressed Natural Gas Fueling Station Upgrade

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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-14-608 to fund projects that establish infrastructure necessary to store, distribute and dispense compressed or liquefied natural gas. In response to PON-14-608, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards November 12, 2015 and the agreement was executed as ARV-15-012 on January 7, 2016.

ABSTRACT

The Lindsay Unified School District features a school bus fleet of nine buses. Of the nine school buses, two are Compressed Natural Gas buses. Lindsay Unified School District also has a Compressed Natural Gas Cargo Van, in which their technology staff serves the community. The Compressed Natural Gas fueling infrastructure at Lindsay Unified School District became inoperable, rendering the district unable to fuel their vehicles on-site. The parts to repair the compressor were no longer being manufactured leaving the district to fully replace their fueling infrastructure.

After being awarded funding from the California Energy Commission, Lindsay Unified School District seized the opportunity to upgrade their existing Compressed Natural Gas station. The School District went through a formal bidding process to obtain a qualified contractor. The submitted project bids were reviewed and the project was awarded to the lowest bidder, Fastech.

There were several obstacles during the project, but Lindsay Unified School District is thankful to have the Compressed Natural Gas station replaced.

Keywords: Compressed Natural Gas, California Energy Commission, Lindsay Unified School District, Fastech

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EXECUTIVE SUMMARY

Lindsay Unified School District provides 4,121 preschool through twelfth grade students the support they need to be successful. Lindsay Unified is located in Tulare County within the San Joaquin Valley. The District consists of six elementary schools, a continuation school and one high school.

The pollution levels in the San Joaquin Valley are amongst the highest in the nation. We as a district strive to help reduced the emissions in our state. The School District's priority has always been our students' well-being as well as their educational success. We embrace continuous improvements to help keep them safe and healthy. The School District makes sure we are doing all we can for the environment to ensure that we provide the students a safe area to learn and grow.

The Compressed Natural Gas fueling infrastructure at Lindsay Unified School District became inoperable, rendering the district unable to fuel their vehicles on-site. The parts to repair the compressor were no longer being manufactured leaving the district to fully replace their fueling infrastructure.

After notification of awarded funding from the California Energy Commission, Lindsay Unified School District seized the opportunity to upgrade their existing Compressed Natural Gas station. The School District went through a formal bidding process to obtain a qualified contractor. The submitted project bids were reviewed and the project was awarded to the lowest bidder, Fastech.

The construction was delayed several times and had to overcome multiple obstacles, but construction of the Compressed Natural Gas fueling infrastructure was successful. We are saving nearly \$14,000 a year with Compressed Natural Gas fuel according to projections. Other benefits include the numerous positive effects on the environment by reducing the distance these buses have to travel to refuel.

Chapter 1:

Introduction

Background

Lindsay Unified School District is school district in Tulare County in California's San Joaquin Valley. Lindsay Unified School District, shown in Figure 1, provides 4,121 preschool through twelfth grade students the support they need to be successful. Lindsay is located in Tulare County within the San Joaquin Valley. The District consists of six elementary schools, a continuation school and one high school.

Figure 1: District Office at Lindsay Unified School District



Source: Lindsay Unified School District

Our schools' student population are comprised of 94 percent Latino, 4 percent White, 1 percent Asian, and 1 percent Other. English speaking students make up approximately 46 percent of the student body with the predominant language being Spanish. Of this subset of students, 15 percent are from migrant families. 90 percent of students in Lindsay Unified School District are from socio-economically disadvantaged families and 100 percent of our students receive our Free and Reduced Meal Program. We take advantage of as many funding opportunities as we can to help our disadvantaged community.

The pollution in the San Joaquin Valley is evident as it features some of the worst air quality in the nation. One of the goals of our district is to help reduce greenhouse gas emissions. Our priority is our students, and we embrace continuous improvements to help keep them safe and healthy, as well as reducing emissions emitted into our environment.

Current Fleet

Lindsay Unified School District contracts with Transportation Department of Visalia Unified School District, located 20 miles away and comprised of eight times as many students. The contract hired Mid Valley Transportation to run the fleet. The nine buses in the fleet are owned by Lindsay Unified School District, two of which are operated with compressed natural gas

(CNG). These two buses are shown in Figure 2. The District also owns one CNG cargo van. During construction, staff drove the cargo van 11 miles to Porterville in order to refuel, as there are no other CNG fueling stations in Lindsay. The buses were taken to Visalia Unified's Transportation Yard and would be left overnight to fuel. When our fuel station was complete, it conserved precious time and resources wasted in traveling roughly forty miles round-trip to fuel. The District's plan is to replace one diesel bus for one CNG bus every year.

Figure 2: Lindsay Unified School District CNG Buses



Source: Tomas Ortiz

Lindsay Unified have also received two electric buses through a grant program with the California Energy Commission. The Charge Ready Infrastructure for the electric buses is being installed by Edison at no cost. Soon, nearly half of the bus fleet will be zero or low emission, helping to reduce emissions that are harmful to the environment as well as our student population.

Chapter 2:

The Project

Project Background

Lindsay Unified's CNG station compressor became completely inoperable, rendering the school district unable to fuel their CNG vehicles on site. The parts to repair the compressor were no longer being manufactured forcing the School District to travel to neighboring cities to fuel. When the Lindsay Unified School District received notification they would be eligible for reimbursement for the upgrade of the compressed natural gas station, the advertised bid for construction was placed. Multiple contractors placed a bid, but Fastech, as the lowest bidder, was awarded the bid and began the construction at the Lindsay Unified Transportation Yard. Construction had several delays, but ultimately the project was completed.

Equipment

Fastech began the permitting process and site preparation. The skid-mounted equipment system was designed to facilitate possible future expansion of compression and the addition of storage capacity. The Compressed Natural Gas Fueling system consists of:

- One CNG compressor (shown in Figure 3) with a 240 Volts Alternating Current, 3-phase electric motor drive, capable of delivering 30 standard cubic feet per minute. The compressor is equipped with the following:
 - Closed-loop gas recovery system with American Society of Mechanical Engineers-rated blow-down tank.
 - Electric motor, air-cooled intercooler and after cooler, condensate separator for the after cooler with automatic dump system, emergency shutdown valve, inlet particulate filter, pulsation dampener, one high-pressure discharge coalescing filters, programmable logic control and other accessories.

Figure 3: Compressor Installed at Lindsay Unified School District Transportation Yard



Source: Tomas Ortiz

The newly installed compressor has several main features including:

- Installed on a steel skid
- Time-fill system (shown in Figure 4) is controlled by a clock with the ability for adjustment
- Electrical motor control panel was designed for remote mounting in the non-hazardous area of the station
- Two dual-hose time-fill posts. Each time-fill post is installed on a new K-rail. Each time fill post includes a vent cap, two hose retractors, two retractor breakaways, two nozzle docks, two 15' hose assemblies complete with vent and CNG hose breakaways, manual 3-way shut off/vent valve, and NGV-1 nozzle, bleed valve, 1/4 turn isolation ball valve, and pressure distribution manifold

Figure 4: Time-Fill Post at Lindsay Unified School District Transportation Yard



Source: Tomas Ortiz

The compressor, shown in Figure 5, also includes:

- A high-pressure dryer
- Free standing canopy to protect the equipment for the weather elements

Figure 5: Compressor Housing at Lindsay Unified School District Transportation Yard



Source: Tomas Ortiz

Construction Obstacles

The CNG infrastructure installation project faced several issues that helped to delay its completion. Fastech notified the district that it needed to pour concrete before the project started in order to have the compressor on a permanent slab. Rain delays held up the concrete installation for weeks, which pushed back the fueling infrastructure construction start date. The concrete slab was poured and is shown in Figure 6.

Figure 6: Concrete Slab Poured for Compressor Housing



Source: Lindsay Unified School District

The next delay occurred when the gas company notified our district that that they would be unable to connect the gas line to the fueling infrastructure. Fastech had not accounted for the existing gas line which was too small in order to be functional with the fueling station. Fastech had to return to run a bigger line which caused a delay in the station start-up by several months.

After the completion of the construction occurred, an attempt to fuel our vehicles was unsuccessful. When backing up the buses and van to the time-fill posts, the barricades were too far forward and needed to be pushed back to be able to fuel. Fastech returned to the site and moved the barricades back roughly a foot in length in order for the fueling station to be able to properly fuel our CNG vehicles.

Chapter 3: Conclusion

Results

Table 1 shows the data collection of Therms provided by the Southern California Gas Company. The CNG buses travel roughly 56 miles per day, Monday through Friday. In our contract, Visalia Unified School District bills us for our diesel usage. From this billing, we are able to subtract out the displaced fuel from what the Southern California Gas Company charged us for that month and calculate our savings. In this 6-month research study, shown in Table 1, we saved nearly \$7,000! Included alongside the financial savings are the reduction in environmental emissions as well as the decrease in emissions exposed to the student population.

Table 1: Six Months of Data Collection

	Sept. 2018	Oct. 2018	Nov. 2018	Dec. 2018	Jan. 2019
Therms	844	939	818	616	726
Average Number of Times Bus #13 Fueled per Month	19	22	16	10	17
Average Number of Times Bus #14 Fueled per Month	19	22	16	10	17
Average Number of Days Cargo Van Fueled per Month	0	1	2	0	3
Gallons of Gasoline and/or Diesel Fuel Displaced by Using Natural Gas	609	676	589	443	526
Amount of Money Saved by Using CNG	\$1,474	\$1,718	\$1,428	\$981	\$1,199

Source: Lindsay Unified School District

The construction of this CNG fueling station was vital to the long-term success and health of the Lindsay Unified School District transportation department. Not only is it saving the district time and money, it is helping to reduce the amount of emissions placed into our environment. We are striving to contribute to our state's overall goals of decreasing greenhouse gas emissions. We are scheduled to receive two electric buses with help of grant funding by April 2020. Through Proposition 39, the School District had the installation of energy efficiency lighting, HVAC units and solar panels. We have worked with CEC on multiple Electric Vehicles to be more energy efficient as well. Our next goal is to switch out our Grounds Department tools from gas and diesel to electric power. Lindsay Unified School District is dedicated to doing their part to help California achieve cleaner air.

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:

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

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.