



California Energy Commission Clean Transportation Program

## FINAL PROJECT REPORT

# Kings Canyon Unified School District Central California Air Restoration Project, Slow-Fill Compressed Natural Gas

Prepared for: California Energy Commission Prepared by: Kings Canyon Unified School District



Gavin Newsom, Governor March 2021 | CEC-600-2021-025

## **California Energy Commission**

Jason Flores Shaun L. Rodriguez **Primary Authors** 

Kings Canyon Unified School District 1801 10<sup>th</sup> Street Reedley, CA 93654 (559) 305-7069 <u>Kings Canyon Unified School District</u>, available at www.kcusd.com

#### Agreement Number: ARV-16-007

Micah Wofford Commission Agreement Manager

Charles Smith Office Manager TRANSPORTATION POLICY AND ANALYSIS

Hannon Rasool
Deputy Director
FUELS AND TRANSPORTATION

Drew Bohan Executive Director

#### DISCLAIMER

This report was prepared as the result of work sponsored by the California Energy Commission (CEC). It does not necessarily represent the views of the CEC, its employees, or the State of California. The CEC, the State of California, its employees, contractors, and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the use of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the CEC nor has the CEC passed upon the accuracy or adequacy of the information in this report.

## 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 GFO-16-602 to support the installation of new natural gas fueling infrastructure and upgrades to existing natural gas fueling infrastructure. In response to GFO-16-602, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards December 20, 2016 and the agreement was executed as ARV-16-007 on February 28, 2017.

ii

## ABSTRACT

Kings Canyon Unified School District is a K-12 school system that serves students from a 600 square-mile area and is geographically one of the largest school districts in California. The district serves the cities of Reedley, Orange Cove and the foothill and mountain communities of Navelencia, Squaw Valley, Dunlap and Miramonte. The district employs approximately 1,500 staff members and has a student population approaching 10,000. The district operates a school bus fleet currently consists of 74 vehicles, which includes 37 compressed natural gas buses and 33 diesel buses equipped with diesel particulate filters to meet the California Air Resources Board's Truck and Bus Regulation.

An important aspect of natural gas vehicle deployment in California is the lack of supporting infrastructure. There is limited access to this infrastructure in the surrounding regions of Kings Canyon Unified School District. This enormous barrier deters the adoption or expansion of advanced technologies by school bus fleets located in the Central Valley. As a result, the district sought to expand alternative fuel use and availability through the creation of the Central Valley Transportation Center. The Central Valley Transportation Center seeks to provide the City of Reedley and surrounding communities with green jobs, clean and low carbon energy and green education training. The Central Valley Transportation Center will also serve as the home of the district's fleet of school buses and service vehicles with alternative fuel dispensers located on site.

The newly compressed natural gas time-filled infrastructure has created more opportunities for our fleet to expand and help service the local municipalities and communities. The City of Reedley, where this project was implemented, is one of the largest disadvantaged communities of Latino/Hispanic residents in California with poor air quality and scarce economic development. The District seeks to better provide healthy living for its students and surrounding community members through the Central Valley Transportation Center by providing alternative fueling options rather than petroleum-based fuels.

**Keywords**: Kings Canyon Unified School District, K-12, school bus fleet, compressed natural gas, diesel, California Air Resources Board, alternative fuel, Central Valley Transportation Center,

Please use the following citation for this report:

Flores, Jason and Shaun L. Rodriguez. 2021. *Kings Canyon Unified School District Central Valley Air Restoration Project, Slow-Fill Compressed Natural Gas*. California Energy Commission. Publication Number: CEC-600-2021-025.

## **TABLE OF CONTENTS**

	Page
Preface	i
Abstract	iii
Table of Contents	v
List of Figures	v
List of Tables	vi
Executive Summary	1
CHAPTER 1: Project Background, Objectives, and Approach	3
About the District	3
Current Fleet	3
Project Approach	4
CHAPTER 2: Scope of Work	6
Technical Tasks	6
Engineering, Design, and Equipment Procurement Specifications and Bid Documents	6
Equipment Procurement, Installation, and Operation	6
Site Preparation	7
Equipment Installation	7
Commissioning and Operations	10
Data Collection and Analysis	11
Start Up and Commission Phase	13
CHAPTER 3: Conclusions	16
Glossary	18

### **LIST OF FIGURES**

Page

Figure 1: New KCUSD Fleet Buses	4
Figure 2: CVTC Site Location	5
Figure 3: Preparation for Site Expansion	7
Figure 4: CVTC On-site Storage	8
Figure 5: Slow-fill Trenching Work	9
Figure 6: Operational Stations	.10
Figure 7: Refueling the Fleet	.11
Figure 8: Bauer C23 X-Series Model C26.12 Test Results	.13

Figure 9: View of CVTC from Testimonial Video	
Figure 10: The CVTC	

### LIST OF TABLES

Page

Table 1: Pressure Test Results	11
Table 2: KCUSD Supported Fleets	12
Table 3: CNG Usage from February 2017 to January 2019	14

### **EXECUTIVE SUMMARY**

The Kings Canyon Unified School District continues to aggressively work toward the reduction of pollution in the San Joaquin Valley. The district has spearheaded these efforts through the replacement of diesel-powered buses with buses and vehicles that are powered by engines that produce less pollution. The district has 37 compressed natural gas-powered buses and 5 compressed natural gas-powered service vehicles. The district constructed a compressed natural gas fueling station in 1996 and was one of the first school districts in the nation to order multiple all-electric school buses to transport students. The compressed natural gas station is open to the public during all district operating hours, five days a week, and the station is on call during the weekend. The district's progressive project, the Central Valley Transportation Center, was the first of its kind in the local rural community. The Central Valley Transportation Center has provided the City of Reedley and surrounding communities with "good jobs, clean energy and green education." In order to fulfill the Central Valley Transportation Center's and the District's mission of providing residents and students with green energy choices and sustainable transportation, the district needed to place alternative fueling infrastructure on the site. However, because of substantial financial hardships, the district sought grant funding for its time-filled project. This funding allowed the district, which services a predominately low-income Hispanic/Latino student population, to continue to keep the compressed natural gas station in operation.

The funding received through the California Energy Commission has allowed the district to continue providing clean-burning fuel for its transportation fleet and other communities that use the fueling stations. According to the California Department of Water Resources and the California Environmental Protection Agency, the City of Reedley, where the district resides, is also a largely disadvantaged community of Latino/Hispanic residents where the air quality is poor and economic development is scarce. The City of Reedley has a median household income of \$47,150, which is only 77 percent of the State's median household income, which qualifies it as a disadvantaged community since this number is less than 80 percent. Also, according to the California Environmental Protection Agency's CalEnviroScreen 2.0, the City of Reedley is a severely disadvantaged community, ranking among the "highest population characteristics scores of 91-100 percent."

The goal for this project was to expand the district's fleet with more compressed natural gaspowered school buses. The state of California is moving forward on a path toward clean transportation and the district is one of the pioneers of that work. John Clements began the district's efforts back in 2013. Through a US Department of Transportation Congestion Mitigation and Air Quality Improvement grant solicitation and California Energy Commission grants, the district was at the forefront of all school districts going green. Kings Canyon was the first school district in the world with two all-electric type-A school buses. The district continues to purchase compressed natural gas-powered type D Bluebird school buses to add to its existing fleet and believes that this solution works better for the community. The addition of 22 more compressed natural gas slow-fill stations will help the district to serve its ever-expanding service fleet. The average range on those buses average 250 miles when the bus tank capacity is at 3600 pounds per square inch. The cost to the district has dropped extensively in regard to the purchase of diesel fuel. The district will continue to work with funding from local Measure C dollars and federal grant program dollars for upcoming efforts to replace gross polluting buses.

## CHAPTER 1: Project Background, Objectives, and Approach

### **About the District**

Kings Canyon Unified School District (KCUSD) is a preschool through 12th grade public school system that serves students from a 600 square-mile area and is geographically one of the largest school districts in California. Diverse in geography and culture, KCUSD serves the cities of Reedley, Orange Cove and the foothill and mountain communities of Navelencia, Squaw Valley, Dunlap and Miramonte. KCUSD employs approximately 1,500 staff members and has a student population approaching 10,000.

KCUSD operates 22 school campuses in configurations that include K-5, K-8, middle school, and high school. It also offers a robust selection of programs that include preschool education, adult education, alternative education, vocational education, and special education. A middle college and an online academy for high school students are also offered to meet a broad spectrum of student needs. Students enjoy stimulating and innovative curricula that align with state standards and effectively target student needs and interests.

### **Current Fleet**

The KCUSD school bus fleet currently consists of 74 vehicles, which includes 37 buses powered by compressed natural gas (CNG) and 33 diesel-powered buses equipped with diesel particulate filters to meet the California Air Resources Board's Truck and Bus Regulation. One of our CNG-powered buses can be seen in Figure 1. The KCUSD school bus fleet runs clean and meets all strict California emissions standards. The Transportation Department fleet also has five light-duty Ford Transit Connect support vehicles powered by CNG and four electric vehicles, one of which is an all-electric warehouse box truck for deliveries.

It was determined to be in the best interest for KCUSD to have a CNG fueling station that would have the ability to provide fuel for its fleet of CNG school buses and five support vehicles. The fueling station also serves as a backup for public entities that have CNG-powered vehicles in the area if ever their fueling station went out of service.

Figure 1: New KCUSD Fleet Buses

Source: KCUSD

### **Project Approach**

In a previous phase of the project, KCUSD brought an engineering company, Integrated Designs by SOMAM, Inc., on board and shared information regarding the construction of a new fueling station for its school bus fleet. Reb Guthrie the engineering consultant with Fuel Solutions, Inc., drew up the CNG portion of the drawings and gave KCUSD a cost estimate for the construction of the project. The approach for the expansion was to continue purchasing and using CNG to operate the bus fleet since KCUSD determined that CNG works better for the district as a whole.

KCUSD used many of the same contractors from previous projects, such as Revolution CNG, Inc. for the CNG mechanical and equipment, Valley Unique Electric as the electrical consultant, Kasco Fabrication for bollards, Nelson's Painting for painting the bollards, and Harris Construction for concrete work.

The work to be performed under this contract included, in general, to procure and install mechanical equipment required to support the expansion of KCUSD's existing CNG vehicle-fueling facility. The base CNG equipment included 11 time-filled post with two hoses per post and a micro motion flow meter to monitor fueling throughput. All hoses are rated at 3600 pounds per square inch. Installation of the CNG system also included 22 cement bollards to protect the time-fill posts, concrete gutter work, concrete pad work for 22 bus stalls, asphalt in front of all of the stalls, and other components required for a new CNG fueling system. The complete CNG system is within the Central Valley Transportation Center (CVTC) located at 1600 S. Apple Avenue, Reedley, CA 93654. The site location is depicted in Figure 2.

#### Figure 2: CVTC Site Location



#### Source: KCUSD

In 2016 as part of agreement ARV-16-007, KCUSD was awarded grant funding from the Energy Commission. With this funding, KCUSD was able to move forward with the construction of the new CNG slow fill fueling stations for their school district fleet.

## CHAPTER 2: Scope of Work

The scope of work under contract ARV-16-007 was to expand the CVTC's existing CNG slow-fill fueling capacity to support KCUSD's fleet of 37 CNG-powered buses. This objective included the design, installation, operation, data collection, and reporting on the new CNG slow-fill fueling facility. Revolution CNG was responsible for constructing the CNG refueling stations with new equipment.

All equipment meets all applicable requirements of the American Petroleum Institute, the American Society of Mechanical Engineers, the International Society of Automation, the American Gas Association, the National Electric Code, and the National Fire Protection Association. The work done for the station also included the installation of utility tie-ins and start-up, debugging, and stabilization of facility operations. Additional design, engineering, permitting, project management, and equipment purchasing was included in the project's scope of work. KCUSD's work on the project included fire protection, fire detection, methane detection, and all necessary safety elements identified with hazardous operations process safety.

### **Technical Tasks**

KCUSD completed several technical tasks in order to successfully complete the expansion of the CNG slow-fill stations in an orderly and efficient manner. In particular, the following tasks were completed as part of this project.

### Engineering, Design, and Equipment Procurement Specifications and Bid Documents

The goal of this task was to engineer and design adequate CNG slow-fill fueling infrastructure for the CVTC expansion. After the design plan was completed, KCUSD finalized the specifications for the construction of the station and prepared the necessary bid documents. The approach the school district took was to find out how much gas flow would be needed for the expansion. KCUSD discussed with Pacific Gas & Electric (PG&E) to ensure the project would have the necessary amount of gas flow needed for the equipment. After requests were granted, KCUSD then made the requests to build and obtain permits from the City of Reedley, which were granted. Receiving notification from both PG&E and the City of Reedley, construction drawings were completed, approved, and finalized. After receiving approval from the City of Reedley and PG&E for gas flow needed, drawings and permits to construct to begin construction was approved.

### **Equipment Procurement, Installation, and Operation**

The goal of this task was to purchase the equipment needed for construction of the new fueling station expansion. The project equipment was procured via bid process through Harris Construction Co., Inc. The equipment was purchased by Harris Construction Co., Inc. from several vendors that were utilized on previous CVTC project phases, such as Revolution CNG and Valley Unique Electric.

### **Site Preparation**

The goal of this task was to prepare the expansion site for the new CNG fueling station. The approach for this task was to plan to prepare the site while bus activity would be low. Although enough time was given in the contract time frame to allow for anticipated down time, no down time was ever experienced. As a result, the site expansion was completed ahead of schedule. Figure 3 is a snapshot of the site during the removal of the pre-existing asphalt.



#### **Figure 3: Preparation for Site Expansion**

**Note: Removal of asphalt to prepare for trenching for the new CNG system** Source: KCUSD

### **Equipment Installation**

Installed equipment consists of one Micro Motion model CNG050 CNG Flowmeter with digital readout and 11 dual-hose time-fill posts. The goal of this task was to install the new CNG slow-fill fueling stations at the CVTC as per the expansion specifications. The time-fill fueling poles are used to fuel the buses when they are not in use. This is typically done over a 5 to 14-hour period. The fueling dispensers automatically shut off when the buses are full. For safety precautions, the dispensers can also be manually stopped by an operator with manual shutoff valves installed at the dispensers. Portable fire extinguishers are also located near the dispensers if needed in case of emergency. Bollards were also installed around the new fueling

poles to provide protection. A digital readout flow meter was installed to track fuel throughput of the 11 new slow-fill stations.

Our slow-fill stations are supplied with CNG by two dual-skid Bauer compressors with a 120inlet pressure gas line to the system. We have six 3,600 pounds per square inch capable storage vessels to supply gas to the fast- and slow-fill CNG stations. The compressors and storage tanks are shown in Figure 4. We also have a Xebec dryer to keep the oil and dirt out of our system.



Figure 4: CVTC On-site Storage

**Note: Bauer C23 X-Series C26.12 tanks and fuel compressors** Source: KCUSD

Figures 5 and 6 show two views of progress made toward the CVTC expansion. The trench work seen in the first photo was done by Harris Construction. Revolution CNG then installed the necessary infrastructure to support the new CNG slow-fill stations.

### Figure 5: Slow-fill Trenching Work



**Note: Trenching work for slow-fill station piping infrastructure** Source: KCUSD

#### **Figure 6: Operational Stations**



Source: KCUSD

#### **Commissioning and Operations**

The goal of this task was to commission the newly expanded fueling station. After final inspection of the new stations, Transportation staff communicated with Revolution CNG in regard to the pre-test procedures of fast-fill and slow-fill stations. Table 1 shows the result of those tests.

Date	Average pressure (pounds per square inch)	Average temp (°F / °C)	Interval (seconds)				
10/7/2017	5542	73.4°F / 23°C	60				

#### **Table 1: Pressure Test Results**

Source: KCUSD

#### **Data Collection and Analysis**

The goal of this task was to collect operational data form the project and analyze that data for economic and environmental impacts. KCUSD has a total of 37 CNG-powered buses which utilize the slow-fill stations overnight. Depicted in Figure 7 are several KCUSD fleet buses filling up at the slow-fill posts. We also have four fast-fill dispensers on the CVTC site for public use. In addition to the District vehicles, vehicles from several other organizations also make use of the CNG stations at the CVTC. Table 2 shows statistics including diesel gallon equivalent (DGE) per year for other fleets in the community that depend on our station. The listed fleets are owned and operated by various local entities. The table includes the number of vehicles within each fleet, their estimated vehicle miles traveled per day and the amount of fuel that our station dispenses to each one.

### Figure 7: Refueling the Fleet



**Note: CNG-powered buses in the KCUSD fleet filling up at the new slow-fill stations** Source: KCUSD

Fleet Owner	Fleet Description	# Vehicles	Est. Miles per Day	Est. MPG in GGE	GGE / Day / Vehicle	Rollout Days / year	Est. DGEs / Fleet / year
Dinuba USD	40' CNG school buses (current)	2	45	5.5	8.2	200	2871
Dinuba USD	40' CNG school buses (future)	16	16 45 5.5		8.2	200	2296
City of Reedley	CNG refuse trucks	7	70	3.0	23.3	312	44701
PG&E	1-ton Service body	3	40	10.0	4.0	250	26312
Fresno Rural Transit	35' CNG paratransit buses	12	80	5.0	16.0	250	42105
Orange Cove Transit	35' CNG paratransit buses	4	80	5.0	16.0	250	14035
Clay USD	40' CNG school buses	1	55	5.5	10.0	175	1535
Immanuel High School (private)	40' CNG school buses	4	55	5.5	10.0	180	6316
AT&T	Service Support Vans	10	50	12.0	4.2	250	9138

#### Table 2: KCUSD Supported Fleets

Source: KCUSD

Altogether, the new stations have an overall capacity of 21,600 pounds per square inch of CNG storage. The Bauer C23 X-Series model C26.12 has the capability to handle a total capacity of 350 Standard Cubic Feet per Minute each. Figure 8 shows the product specifications for the Bauer C26.12.

All of KCUSD's 37 CNG-powered fleet buses are fueled every night by our slow-fill stations. We also have a small percentage of outside sales at our fast-fill station. The comparison of public versus fleet transactions per day are 5 percent to 95 percent, respectively. We are open for business five days a week from the hours of 6am to 9pm, Monday through Friday only. All of our fueling stations currently operate at full capacity.

#### Figure 8: Bauer C23 X-Series Model C26.12 Test Results

Model		iniet Pr	essure		Final Pr	ressure			Сара	acity			Number of Stages	Running Speed	Mot	tor
	PS	SIG	B/	AR	PSIG	BAR										
	min	max	min	max	max	max	CFM	M³/H	DGE/H	DLE/H	GGE/H	GLE/H		RPM	hp	kW
C26.2	10	15	0.7	1	5000	345	200	340	86	325.5	100	378.5	4	1500	150	110
C26.10	45	65	3.1	4.5	5000	345	360	612	154	583	180	681.4	4	1500	175	132
C26.12	90	145	6.2	10	5000	345	425	722	182	689	213	806.3	4	1500	175	132
C26.13	150	215	10.3	15	5000	345	440	748	189	715.4	220	832.8	4	1500	175	132
Note: All capac	lote: All capacities are based on pipeline quality natural gas supplied at the maximum allowable inlet pressure to the compressor and 3600 psig discharge pressure. For all models lower inlet pressure is possible but with educed capacity and possibly reduced discharge pressure. Motor power is reference to maximum allowable inlet pressure and 4500 psig discharge pressure. Consult BALIER for performance at other conditions															

Source: KCUSD

By using CNG in our district fleet of 37 buses, we estimate to have displaced approximately 94,000 gallons of diesel fuel while having traveled approximately 334,800 miles. Our expected overall air emissions of harmful substances, including non-methane hydrocarbons, oxides of nitrogen, particulate matter, and formaldehyde, has experienced an estimated reduction of 55 percent. KCUSD plans to increase future vehicle acquisitions by purchasing ten more CNG-powered buses as well as electric and hybrid vehicles over the next two years.

KCUSD has identified a need for renewable energy at the CVTC and will consider planning for its use in the near future. We are committed to continued use of CNG in our fleet of buses as well as supporting electric vehicle charging infrastructure. The CVTC has various electric vehicle chargers such as one level 2 Clipper Creek charger, two level 2 AeroVironment chargers, and one level 3 Nissan charger.

Prior to the expansion of the CVTC CNG facility, the bus and white fleet mechanics that service the vehicles were separated in different locations. However, since the expansion was completed those mechanics are now housed in one large shop which provides better efficiency for vehicle maintenance. KCUSD mechanics service 74 buses and 100 vehicles, trailers, and golf carts. KCUSD has plans to build additional buildings such as training classrooms that the City of Reedley and District staff can use for training purposes. We also plan to incorporate green jobs into our operations in the future.

KCUSD has provided a quantified estimate of the project's carbon intensity values for lifecycle greenhouse gas emissions. For fossil-based North American Natural Gas to California CNG with 97 percent compression efficiency (CNGF205), the tabulated carbon intensity is 79.5 grams of carbon dioxide equivalent per megajoule. For Ultra Low Sulfur Diesel (ULSD001), the tabulated carbon intensity is 102 grams of carbon dioxide equivalent per megajoule. This means that KCUSD has achieved a 22 percent reduction in carbon intensity by using CNG over diesel.

### **Start Up and Commission Phase**

Once installation of the CNG infrastructure was complete, a startup and commission phase was conducted to test the functionality of the CNG fueling station. Table 4 below is a brief overview of the consumption of CNG that KCUSD experienced for the period covering February 2017 through January 2019.

		<u></u>			
Period	Season	Therms Used	Cost		
February 2017	Winter	14,877	\$2,506.09		
March 2017	Winter	19,248	\$3,229.14		
April 2017	Summer	12,707	\$2,136.33		
May 2017	Summer	17,794	\$3,007.20		
June 2017	Summer	11,004	\$1,858.04		
July 2017	Summer	6,000	\$1,016.02		
August 2017	Summer	11,868	\$1,998.51		
September 2017	Summer	16,937	\$2,832.84		
October 2017	Summer	19,736	\$3,315.00		
November 2017	Summer	14,240	\$2753.12		
December 2017	Winter	11,992	\$2220.05		
January 2018	Winter	14,957	\$2512.10		
February 2018	Winter	16,401	\$2701.08		
March 2018	Winter	16,927	\$2720.26		
April 2018	Summer	17,615	\$2830.83		
May 2018	Summer	20,069	\$3174.27		
June 2018	Summer	12,897	\$1964.22		
July 2018	Summer	6614	\$987.57		
August 2018	Summer	13,658	\$1981.11		
September 2018	Summer	18,067	\$2578.67		
October 2018	Summer	22,263	\$2921.96		
November 2018	Summer	16,042	\$2016.14		
December 2018	Winter	12,363	\$1566.77		
January 2019	Winter	16,588	\$1976.57		

Table 3: CNG Usage from February 2017 to January 2019

Source: KCUSD

During this period, a total of 360,860 therms were used. Based on the data in Table 4, the average cost per therm of CNG used comes out to be approximately \$0.158/therm, with a total cost of \$56,800. This amount of CNG is equivalent to approximately 259,800 gallons of diesel fuel. Assuming a cost of \$2.07 per diesel gallon, the total cost of using an equivalent amount of diesel would be \$537,760. In summary, for the period of February 2017 through January 2019, by using our fleet of 37 CNG-powered buses instead of diesel-powered ones, we were able to displace the use of a substantial amount of diesel fuel and we saved \$480,960 on fuel costs alone.

Once the CVTC expansion project was completed, Bauer Compressors, Inc. released a testimonial video for CNG use that features the CVTC. A snapshot of the CVTC can be seen in Figure 9.

### Figure 9: View of CVTC from Testimonial Video



Source: Bauer Compressors, Inc.

## CHAPTER 3: Conclusions

KCUSD has been aggressive in working to reduce air pollution in the Central Valley by replacing its diesel-powered buses with buses and support vehicles that are powered by CNG engines that produce less pollution. The Energy Commission funding through agreement ARV-16-007 has made it possible to continue providing CNG for KCUSD's transportation fleet and the various community organizations that utilize the fueling station. Through the completion of this project, we have addressed and achieved our goal of expanding the CVTC.

We have made the station more accessible which encourages its use, we have reduced our fleet's emissions by replacing the old diesel buses with CNG buses, and we continue to increase local knowledge of the facility to the public. KCUSD has also increased its CNG bus fleet which now currently stands at 37 CNG buses. We have a total of 52 new stalls to support our current fleet and possible expansion. We had 33 existing stalls from a previous project.

In the last two years, six gross polluting diesel buses were decommissioned. This has led to reductions in vehicle miles traveled that equate to approximately 192,000 miles in the diesel-powered buses. As a result, an estimated 27,430 gallons of diesel fuel consumption is avoided assuming that diesel-powered buses get approximately 7 miles per gallon. Additionally, with the added capacity of the expanded CVTC, KCUSD can consider acquiring additional CNG-powered buses for further expansion. Previously, KCUSD could not do this as its previous station's slow-fill lines were at capacity.

The benefit of the CNG-powered buses using slow-fill stations is that it is more economical for them to be fueled late at night when electricity costs are at low peak compared to fast-fueling those buses during the day when electricity costs are at high peak times. In regard to maintenance to our upkeep on our CNG station and slow fill. We have a 10-year warranty in place for the compressor and dryer systems. KCUSD also has a maintenance agreement with Revolution CNG to routinely visit the facility and provide maintenance to keep it fully operational. KCUSD is now also able to receive mobile communication alerts whenever there are issues or power outages at the station. These notifications help us to avoid situations where fleet vehicles may not have filled overnight because we can address these issues much sooner than we could in the past.

The drivers really enjoy the new buses. Reliability is not an issue for them because the fleet's 3600 pounds per square inch tanks last all day. The students and community also like the new buses. The buses are much quieter and have less particulate matter coming from the tail pipe as compared to their diesel-powered counterparts. These buses generate less pollution in the air for our walking students which benefits them by making it easier for them to breathe as they walk to school. The challenge of bad air and asthma in Fresno County is very hard on our students so we are trying to do everything we can to help them.

The completion of the CVTC, shown in Figure 10, was a dream come true for the district and the community. Any community member with a CNG-powered vehicle could use our facility. The expansion project in agreement ARV-16-007 only helps KCUSD and its neighboring districts and communities to use our facility. The CVTC also helps them get great ideas to

solicit for future Energy Commission infrastructure grants so that they could create their own CNG fueling stations. Until that time comes, the community is welcome to use our station.



Figure 10: The CVTC

Source: KCUSD

## 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 CEC'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.

Funding for the CEC's activities comes from the Energy Resources Program Account, Federal Petroleum Violation Escrow Account, and other sources.

CENTRAL VALLEY TRANSPORTATION CENTER (CVTC) - The CVTC seeks to provide the City of Reedley and surrounding communities with green jobs, clean and low carbon energy and green education training.<sup>1</sup>

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.

KINGS CANYON UNIFIED SCHOOL DISTRICT (KCUSD) is located in California's central San Joaquin Valley in the center of an agricultural engine that helps feed the world. KCUSD is a preschool through 12th grade public school system that serves students from a 600 squaremile area and is geographically one of the largest school districts in California.<sup>2</sup>

PACIFIC GAS AND ELECTRIC (PG&E) - The acronym for Pacific Gas and Electric Company an electric and natural gas utility serving the central and northern California region.

<sup>1 &</sup>lt;u>City of Reedley website</u>, available at http://www.reedley.com/

<sup>2</sup> Kings Canyon Unified School District website, available at https://www.kcusd.com/