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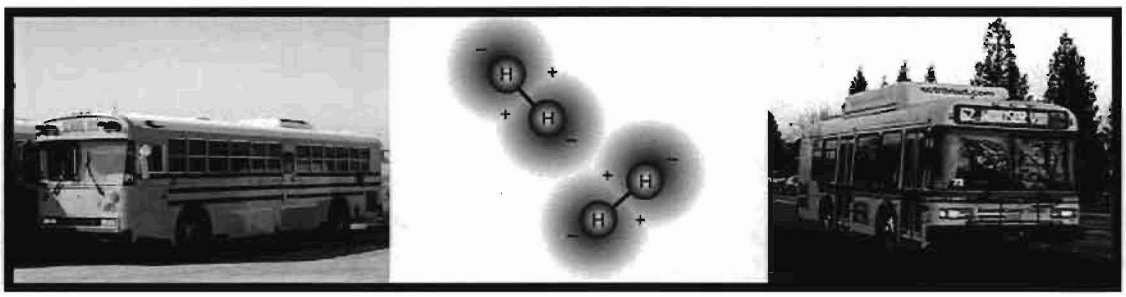
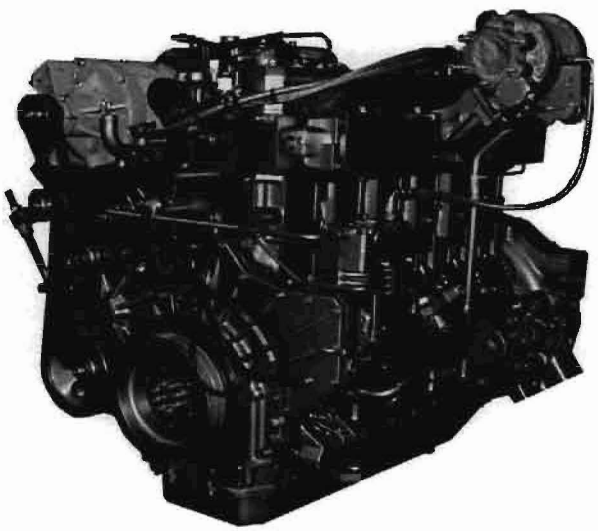
California Hydrogen Advancement Program





Doosan GK12TI HCNG Engine

Doosan Infracore America • Valley Power Systems

Executive Summary – California Hydrogen Advancement Program

Short Definitive Statement of the Problem

California's long-term *State Implementation Plan* (SIP) strategy is colloquially known as the "black box" commitment. The "black box" commitment consists of 13 measures that the California Air Resources Board (CARB) will roll out during the next few years to achieve over 60% of committed volatile organic compound and nitrogen oxide (NOx) state-wide emission reductions. Investing now in the next generation of vehicles, equipment, and emission controls are essential is California hopes to meet this commitment.

Approach to Solve the Problem

As part of a massive effort to support the SIP, the 'California Hydrogen Advancement Program (Program)' is embarking on a fundamental transformation of California's transportation system and heavy-duty on-road vehicle technologies that will substantially decrease greenhouse gas (GHG) emissions and petroleum use, and increase alternative fuel product diversity. This three-year program will fully develop and deploy an 8-liter and 11-liter Doosan GK12TI HCNG engines designed for transit, refuse, and school applications to achieve state and local air district rules and initiatives.

Specifically this program will demonstrate two 11-liter Doosan GK12TI HCNG engines in two transit buses, two 8-liter Doosan GK12TI HCNG engines in two refuse trucks, and two 8-liter Doosan GK12TI HCNG engines in school buses. The engines will be demonstrated within each vehicle application for two years while collecting data on blends of hydrogen beween 10-35% in order to determine the engine's emission 'sweet-spot'. Mobile and/or hydrogen infrastructure will be implemented during this project.

The Program will provide a foundation for sustainable hydrogen development, use of hydrogen transportation energy, and an economic stimulus to create California jobs and businesses by encouraging the production of a viable technology necessary for the future transportation system and heavy-duty on-road vehicle technologies.

This "bridging" technology that blends up to 30% hydrogen with natural gas fuels will produce positive emission and operation results in trucks, and buses. Hydrogen-fueled internal combustion engines offer another bridging technology with the potential to reduce GHG and criteria emissions. This is a viable transition option from existing conventional vehicle technology.

Emission Control Objectives or Goals to be Achieved

In this landmark program, the 'California Hydrogen Advancement Program' will accelerate the development and deployment of a clean, efficient low-carbon technology that will achieve several key policy objectives including:

- Surpass of CARB/EPA 2010 heavy-duty on-road engine emissions standard.
- Support of the state's AB 32 *Global Warming Solutions Act* by making available an engine that implements low carbon fuel to assist the state to reduce GHG emissions to the 1990 levels by 2020 and 80% below 1990 levels by 2050, reduce petroleum fuel use to 15% below 2003 levels by 2020; and increase alternative fuel use to 20% of on-road fuel demand by 2020 and 30% by 2030.
- Support of the state's AB 118 *California Alternative and Renewable Fuel, Technology, Clean Air, and Carbon Reduction Act of 2007* by making available a next generation alternative fuel, heavy-duty engine that will lower emissions from school, refuse, and transit buses and create an overall emission reduction in the most impacted parts of California.
- Support of California Energy Commission's *Investment Plan* by developing and improving alternative and renewable low-carbon fuels; optimizing alternative and renewable fuels for existing and developing engine technologies; producing alternative and renewable low-carbon fuels in California; decreasing the overall impact of an alternative and renewable fuel's life-cycle carbon footprint and increase sustainability; installing alternative and renewable fuel infrastructure, fueling stations, and equipment; improving heavy-duty vehicle technologies to provide for better fuel

efficiency and lower GHG emissions, alternative fuel use and storage, or emission reductions; accelerating the commercialization of vehicles and alternative and renewable fuels including pre-commercial demonstrations, and development of market niches; retrofit heavy-duty on-road vehicle fleets with technologies that create higher fuel efficiencies, including alternative and renewable fuel technologies.

- Support CARB's *Air Quality Improvement Program Funding Plan for Fiscal Year 2010-11* by implementing an engine that demonstrates cost-effective emissions reductions that is near commercialization which is economically viable in its own right that can be deployed into the market place within 3 years; and has tremendous potential for use in California's marketplace.

Reference to Applicable AQMD and/or CARB Rules and Regulations

- CARB –Fleet Rule for Transit Agencies – Urban Bus Requirements

  This rule requires transit agencies with 30 or more buses to choose an alternative-fuel path or a diesel-fuel path when purchasing or leasing vehicles. Transit agencies on the diesel path will meet NOx and particulate matter (PM) fleet average requirements; transit agencies on the alternative fuel path will implement an 85% minimum purchase until 2015 of alternative fuel buses.

  The Doosan GK12TI HCNG engine will provide fleets on the alternative fuel patch an alternative to the Cummins ISL G engine to increase product diversity, and provide the state and local air district with additional GHG emission reductions. Additionally, increased implementation of hydrogen infrastructure at an earlier date will encourage a wider spread adoption of hydrogen fuel cell buses from fleets with less than 200 buses when the technology becomes more shelf-ready for fleets to incorporate.

- CARB – Zero Emissions Bus Regulation

  This regulation requires transit fleets with more than 200 buses to participate in a zero-emission bus demonstration project, and a zero-emission bus purchase requirement. Zero-emission buses include hydrogen fuel cell buses, electric trolleys with overhead twin-wire power supply, and battery electric buses. Transit fleets on the diesel path are required to a 15% minimum purchase for model year 2011 through 2026 buses. Transit fleets on the alternative fuel path are required to a 15% minimum purchase for model year 2012 through 2026 buses. The purchase requirement portion of this rule is currently being considered for modification due to the current status of zero-emission technologies and is taking comments on suggested program changes that would enhance successful commercialization of zero-emission buses and promote reductions in smog and green house gas (GHG) emission from transit fleets.

  The Doosan GK12TI HCNG engine repower (replacing a CNG engine) cost is approximately one fifth of the price of a hydrogen fuel cell bus. This engine will assist fleets on the alternative fuel path that are required to purchase zero-emission buses by increasing the quantity of fuel used will provide the hydrogen industry with necessary fuel buy-in to drive the overall cost of infrastructure and fuel down for transit fleets. Additionally, increased use of this engine will provide the state and local air districts additional GHG emission reductions, and the potential option of modifying the purchase requirement of this rule to give credit to transit fleets for implementing hydrogen fuel blends.

- CARB – Diesel Particulate Control Measure for On-Road Heavy-Duty Diesel-Fueled Residential and Commercial Solid Waste Collection Vehicles (SWCV)

  Although the SWCV Measure controls up to 85% of the PM emissions in model year 1988 – 2006 engines, this measure does not control the carbon content and petroleum usage of 2007 and newer diesel engines that will continue to be purchased by SWCV operators. The Doosan GK12TI HCNG engine will provide SWCV operators a low carbon alternative to be implemented within their fleet that will provide the state and local air districts additional emissions reductions.

- South Coast Air Quality Management District's (SCAQMD) Rule 1193 'Clean On-Road Residential and Commercial Refuse Collection Vehicles'

  This rule requires public and private SWCV operators with 15 or more vehicles to acquire alternative-fuel vehicles when procuring or leasing vehicles to further reduce air toxic and criteria pollutants. The Doosan GK12TI HCNG engine will provide SWCV operators in the South Coast Air Basin an alternative to the Cummins ISL G engine to increase product diversity, and provide the state and local air district with additional GHG emission reductions.

- CARB – In-Use On-Road Truck and Bus Regulation

  Although this rule currently controls up to 85% of PM emissions in model year 1988 and newer diesel school buses, this measure does not control the carbon content and petroleum usage of 1988 and newer diesel engines that school bus fleets will continue to purchase. The Doosan GK12TI HCNG engine will give state and local air districts additional GHG emission reductions and reduce petroleum usage. At present, school districts only have one option for alternative fuel repowers, the Cummins ISL G engine. The Doosan GK12TI HCNG engine will provide school districts an alternative to the Cummins ISL G engine by increasing product diversity.

Unique Qualifications of the Bidder to Solve the Problem

- Valley Power Systems (Valley)

  Valley is well positioned to conduct all engineering, monitoring, and reporting related to this project and to distribute the Doosan GK12TI HCNG engine in the state of California once the engine is CARB/EPA certified. For over ten (10) years, Valley has developed and maintained a strong relationship with many of the major transit agencies, SWCV fleets, and school bus fleets in California, and has worked with CARB and local air districts to develop and promote cleaner technologies and troubleshoot related obstacles. Valley has nine (9) facilities in the state of California fully capable of performing expansive research and development projects. Facilities are equipped with a full functioning service yard that include a dynamometer, a hands-on training facility, on-site engineers and technicians, administrative support staff, with an annual sales volume over $180 million. This project represents a systematic continuation of prior Valley efforts in the cleaner technology area with state and local air districts making Valley well postured to effectively conduct this project.

- Doosan Infracore America (DIA)

  DIA is uniquely suited to manufacture and CARB/EPA certify the Doosan GK12TI HCNG engine for the U.S., specifically the state of California. DIA is headquartered in Suwanee, Georgia and maintains offices and technical service centers throughout North America where its' products are sold through a large network of independent distributors. DIA's Suwanee facility anticipates manufacturing a minimum of 1000 Doosan GK12TI HCNG engines each year for the United States to meet 2009 product demand. Doosan Infracore, DIA's parent company in Korea has invested over $25 million in DIA to support manufacturing of the Doosan GK12TI HCNG engine in the U.S. Doosan Infracore specializes in construction machinery, industrial vehicles, defense product manufacturing, natural gas and diesel fuel systems, and has over 60 engine models for construction equipment, machine shops, generators, and ships. Doosan Infracore has over 5,000 employees, has plants located around the world, and is Korea's largest manufacturer of construction machinery.

Summary of Cost

- The speculated total project cost is $2,489,569.50. A detailed line-item budget and work plan is available upon request.

California Hydrogen Advancement Program Contact Information

- Please contact Suzanne Seivright, Government Affairs Coordinator – Valley Power Systems, Inc., for additional information related to the 'California Hydrogen Advancement Program' at (626) 934-6226 or at suzanne.seivright@valleypsi.com.