



Natural Gas Transportation Research and Development



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California Energy Commission

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Energy Commission Natural Gas Research Process





Policy Drivers for Energy Commission Transportation Research

Executive Order B-32-15	Directs the development of the Sustainable Freight Action Plan to improve freight efficiency, transition to ZEV technologies, and increase California freight system competitiveness.
Low Carbon Fuel Standard	Encourages the use and production of cleaner low-carbon fuels in California to reduce GHG emissions.
Assembly Bill 118 / 8 (ARFVTP)	Authorizes the Energy Commission to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change goals.
Assembly Bill 32	Calls for approximately 36 percent of the state's 2020 GHG reduction targets to come from the transportation sector.
Executive Order B-30-15	Sets statewide GHG emission reduction goals to 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050.



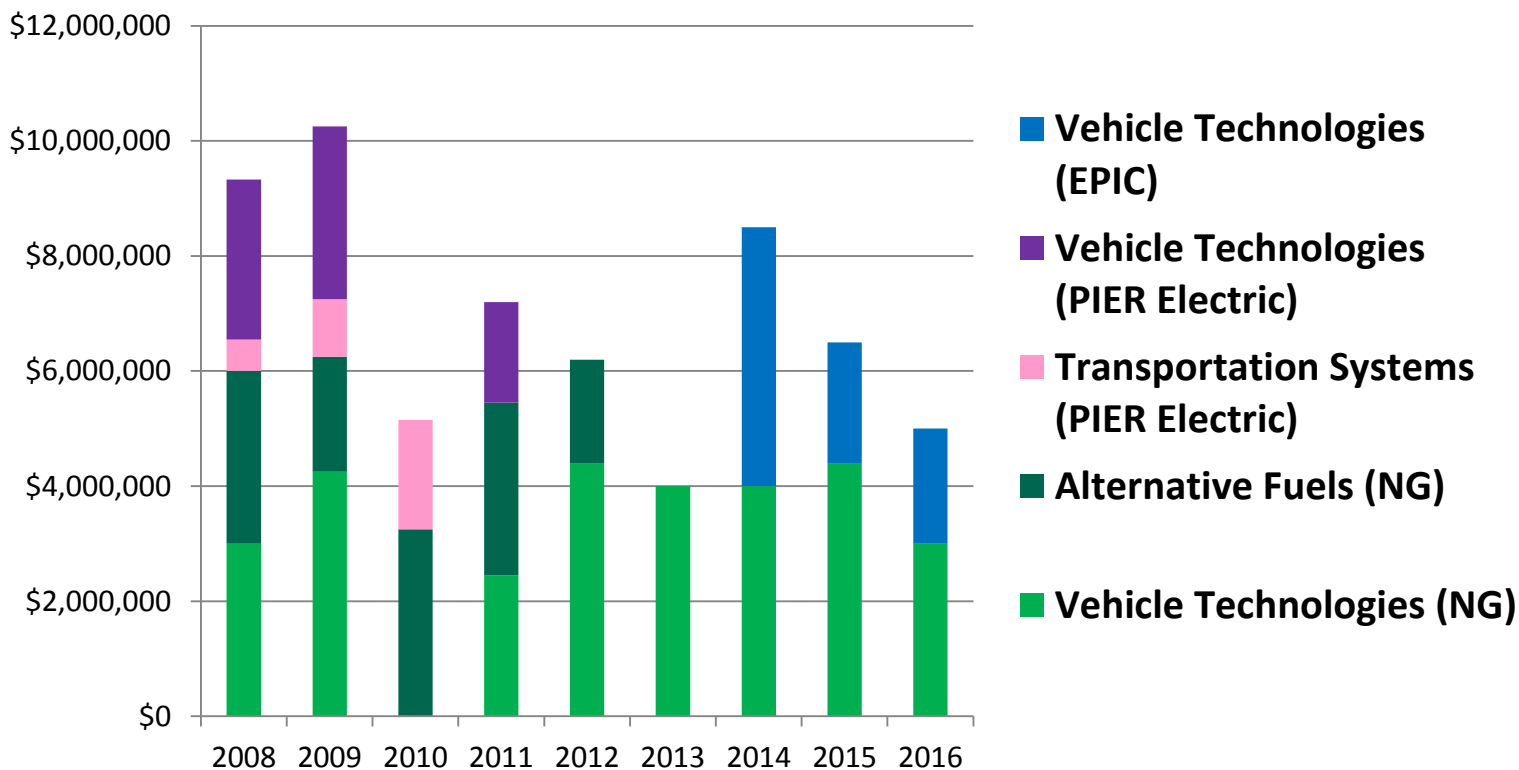
Transportation Research Goals

The goals of transportation-related projects are to:

- *Reduce carbon emissions*
- *Improve infrastructure capacity, reliability, and sustainability*
- *Improve air quality*
- *Increase the use of transportation renewable fuels*



Energy Commission Transportation R&D Funding





Current Portfolio Highlights & Major R&D Initiatives

Initiative	Description	Status
Ultra Low Emissions, High Performance, Spark Ignited Natural Gas Engine	Developing and demonstrate a low NOx, spark-ignited, natural gas 6.7L engine for applications such as shuttle buses, delivery trucks, and yard spotters.	<ul style="list-style-type: none">▪ Alpha Engine Completed 2015▪ Beta Engine Demo In Progress, Started 2016
Near-Zero Emission Technology Research for Heavy-Duty Natural Gas Vehicles	Reduce NOx levels by 90% through advanced engine technologies while meeting other emission standards without incurring a fuel penalty.	<ul style="list-style-type: none">▪ CWI 8.9L NZ Engine In Production▪ CWI 12L NZ Engine Development In Progress



Current Portfolio Highlights & Major R&D Initiatives

Initiative	Description	Status
Natural Gas Vehicle On-Board Storage	Develop and demonstrate a safe, low-pressure, high-density, conformable adsorbed natural gas storage system that enables cost-effective home refilling of NGVs.	<ul style="list-style-type: none">▪ In Progress▪ Expected Completion 2017
Natural Gas Fueling Infrastructure Improvements	Develop technology that improves the fueling method in natural gas vehicles to achieve a better “full fill” of compressed natural gas.	<ul style="list-style-type: none">▪ In Progress▪ Expected Completion 2017



Current Portfolio Highlights & Major R&D Initiatives

Initiative	Description	Status
Natural Gas Vehicle Hybridization	Develop and demonstrate hybridization designs that use battery power to minimize emissions, idle, and low-load engine operation.	<ul style="list-style-type: none">▪ In Progress▪ Three projects awarded:<ol style="list-style-type: none">1. Efficient Drivetrains, Inc.2. TransPower3. Gas Technology Institute▪ Expected Completion 2017
Advanced Ignition Engine Research	Develop advanced ignition methods to improve engine efficiency while reducing emissions.	<ul style="list-style-type: none">▪ In Progress▪ Three projects awarded:<ol style="list-style-type: none">1. Gas Technology Institute2. North American Repower3. Olson Ecologic▪ Expected completion 2017/18



Project Success

Purpose: Development, integration, and demonstration of an advanced low NOx 8.9L stoichiometric spark-ignited natural gas engine for vocational applications.

Contractor: South Coast Air Quality Management District

Partners: Cummins Westport, Inc., SoCalGas

PIER Funds: \$2M with \$2M in match share

Results: CWI's 8.9L engine (ISL G NZ) was certified at CARB's lowest optional NOx emissions standard of **0.02 g/bhp-hr NOx** on October 2015.

Rate Payer Benefits: Near zero NOx and PM emissions improve urban community air quality. Additional GHG reduction benefits can be realized when combined with renewable natural gas.





Current Natural Gas Solicitation

Title: Off-Road Heavy-Duty Natural Gas Engine Research and Development (GFO-16-XXX)

Research: Incorporate advanced natural gas vehicle technologies in off-road applications to reduce petroleum dependency and improve air quality.

Group	Minimum Award per Project	Maximum Award per Project
South Coast Air Basin	\$750,000	\$1,500,000
San Joaquin Valley Air Basin		
CA Ports/Military Bases		

Proposed Timeline:

- Solicitation Release: October 17, 2016
- **Deadline to Submit Applications: November 18, 2016, 5:00 pm**
- NOPA: December 2016
- Business Meeting: March 2017



Upcoming Natural Gas Solicitation

Title: Natural Gas Engine Improved Efficiency Research and Development

Research: Advanced natural gas engine technologies that assist in reducing the efficiency gap between spark-ignited stoichiometric natural gas engines and diesel engines.

Funding Amount: \$2,700,000 (\$900,000 max/project)

Proposed Timeline:

- Solicitation Release: December 2017
- Deadline to Submit Applications: February 2017
- Business Meeting: July 2017



2015 Natural Gas Vehicle Research Roadmap (NGVRR)

November 2015: NGVRR Draft published.

March 2016: Public workshop held.

May 2016: Updated graphics and made edits responding to public comments.

October 2016: Publication process for final report to begin after 2016 NGVTF.

CONSULTANT REPORT

2015 Natural Gas Vehicle Research Roadmap

Prepared for: California Energy Commission
Prepared by: National Renewable Energy Laboratory

May 2015
CEC-XXX-XX-XXXX