

CARL MOYER ADVANCED TECHNOLOGY PROGRAM

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CARL MOYER ADVANCED TECHNOLOGY PROGRAM

- Support commercialization of advanced diesel and alternative fuel technologies
- Carl Moyer Air Quality Standards Attainment Program
 - Incentives for cost-effective NO_x reduction

CARL MOYER PROGRAM AND RELATED FUNDING

CALIFORNIA HEAVY-DUTY VEHICLE FUNDING PROGRAMS to obtain Cost-Effective NOx Reductions for Ozone Attainment

	ARB	AIR DISTRICTS	CEC	DIESEL PORTION
98/99 - \$25 million ARE	\$24,500,000	\$12,250,003		\$17,396,208
99/00 - \$19 million APB (+ \$4 million CEC)	\$18,620,000	\$9,309,996		
00/01 - \$45 million APB (+ \$5 million CEC)	\$44,100,000	\$12,000,001		\$20,000,000
00/01 - Steinberg Bill \$50 million (+ \$20 million CMAQ) for SECAT and \$25 million for SJV		\$70,000,000 \$25,000,000		\$16,281,307
01/02 - \$100 million APB (to generate NOx and PM CARL MOYER ADVANCED TECHNOLOGY - CEC	\$68,000,000			\$45,333,333
99/00 - \$2 million			\$2,000,000	
Ceryx - QuadCAT	\$632,653			\$632,653
Delphi - Non-Thermal Plasma	\$583,090			\$583,090
Englehard - Retrofit Low-Pressure	\$284,257			\$284,257
DDC 0.5 g/bhp-hr NOx S50G (w/	\$500,000			
Westport/Cummins 0.5g/bhp-hr NOx ISX (w/SCAQMD & N		\$830,996		
00/01 - \$2.22 million			\$2,223,000	
ISE Research	\$485,826			
SCAQMD/DDC	\$200,000	\$100,000	\$170,000	
Sorbent	\$440,000	\$250,000		\$690,000
SCAQMD/NREL	\$400,000			\$400,000
Cummins Westport	\$347,174		\$52,826	
Paccar/Cummins Westport	\$100,000		\$278,715	
GM/GM Canada			\$140,000	
Camtec/Caltrans (Class 3)	\$250,000			\$250,000
			TOTAL	\$101,850,848

CMAT 99/00

- Solicited applications late 1999
- Awards mid-2000



1999 Carl Moyer Advanced Technology Program

COMPANY	TECHNOLOGY	CEC FUNDING
Ceryx	QuadCAT Aftertreatment for HDD Engines	\$632,653
Delphi	Non-Thermal Plasma Aftertreatment for HDD Engines	\$583,090
Engelhard	Retrofit Low-Pressure EGR system w/ DPX and ULSD	\$284,257
Detroit Diesel	Series 50G HDNG Engine - 0.5 g/bhp-hr NOx	\$500,000
Cummins/Westport	ISX HPDI HDNG/D Engine - 0.5 g/bhp-hr NOx	
	total	\$2,000,000

Ceryx QuadCAT™

aftertreatment for HDD engines

- Technology: 4-way catalyst with innovative heat management
- Status: Chapter 11 reorganization. Project expected to continue with new financial partners
- Products: ARB verification of 50% NO_x benefits to qualify for Carl Moyer incentives for retrofit application to wide-range of engines

Delphi - Non-Thermal Plasma aftertreatment for HDD engines

- Technology: Non-Thermal Plasma system including plasma reactor, catalyst, power supply/controller, lean NO_x sensor and closed-loop control, and electrical system to avoid electromagnetic interference
- Status: power supply and controller nearly complete, lean NO_x sensor technology identified, and development of other items underway
- Products: Aftertreatment system for incorporation into products by OEMs

Englehard Retrofit Low-Pressure EGR with DPX and ULSD

- Technology: Retrofit kit combining low-pressure EGR from STT and DPX PM filters requiring ultra-low sulfur diesel fuel
- Status: Testing of prototype systems on Cummins M-11 at 305, 330, and 350 hp shows from 45% to 50% NO_x reduction.
- Products: Verification of performance for Cummins M-11 and ISM engines

Detroit Diesel 0.5 g/bhp-hr NO_x Series 50G HDNG engine

- Technology: Refinement of air handling and combustion chamber design, with individual cylinder sensing of onset of lean limit for each cycle and feedback control of auxiliary port fuel injectors to precisely maintain desired A/F ratio along with investigation of aftertreatment as needed for 0.5 g/bhp-hr NO_x certification
- Status: SCAQMD contract with DDC in place
- Products: Commercial introduction for transit buses and trucks

Cummins/Westport 0.5 g/bhp-hr NO_x ISX HPDI HDNG/D engine

- Technology: Adaptation of Westport high-pressure direct-injection technology to Cummins 15 liter ISX engine with cooled EGR plus investigation of aftertreatment as needed to achieve 0.5 g/bhp-hr NO_x
- Status: NREL contract with Cummins in place; analysis and testing proceeding to optimize EGR for performance and low NO_x emissions
- Products: Targeting market opportunities with developing California LNG infrastructure

CMAT 00/01

- Solicited applications late 2000
- Awards mid-2001



2000 Carl Moyer Advanced Technology Program

COMPANY	TECHNOLOGY	CEC FUNDING
ISE Research Corp.	Microturbine Engine Hybrid-Electric Buses	\$485,826
SCAQMD/Detroit Diesel	Very-Low NOx HDNG Engine Reliability Augmentation	\$200,000
Sorbent Technologies Corp.	Retrofit NOx Filter for Stationary and Mobile HDD Engines	\$440,000
SCAQMD/NREL	F-T Diesel with NOx and PM Aftertreatment	\$400,000
Cummins Westport Inc.	B5.9G Plus with Aftertreatment - 0.5 g/bhp-hr NOx	\$447,174
Cummins Westport/PACCAR	CNG Class 3-6 and LNG Class 7-8 Vehicles	
CAVTEC	Emission Testing to Identify NOx Benefits from CalTrans Use of Alternative Diesel Fuels and Aftertreatment Technologies in HDD Engines	\$250,000
		total \$2,223,000

ISE Research - \$485,826 - Development & Demonstration of Turbine- Driven Hybrid Electric Buses

- Technology: Capstone 60 kw microturbine engines being developed for diesel, natural gas, and propane fuel to be integrated with improved hybrid electric control system
- Status: Grant Agreement in process to repower buses operated on propane by Los Angeles DOT
- Products: Commercial availability of high-efficiency and ultra-low emission 30 foot hybrid electric buses and Capstone 60 kw microturbine engines for diesel, propane, and natural gas

SCAQMD/DDC - \$200,000 - Augmentation of 0.5 g/bhp-hr NO_x Series 50G natural gas engine

- Technology: Augmentation of reliability verification of improved technology components to allow 10/2002 market intro.
- Status: SCAQMD contract amendment with DDC in process
- Products: Accelerate reliability development for 10/2002 introduction

Sorbent Technologies Corp. - \$440,000 - Demonstration of retrofit NOx filter for stationary and mobile HDD engines

- Technology: **Selective NOx Recirculation** - adsorb NOx, desorb, and recirculate into engine intake
- Status: Grant Agreement in process
- Products: Aftertreatment system for stationary and mobile HDD engines

SCAQMD/NREL - \$400,000 Develop and Demonstrate F-T Diesel-powered vehicles with retrofit control of NO_x and PM

- Technology: F-T diesel plus EGR & aftertreatment
- Status: CEC Grant Agreement with SCAQMD in process; SCAQMD RFP for technology suppliers including OEM participation anticipated in September
- Products: ARB approved retrofit kits for two engine families

CAVTEC - \$250,000 - Emission testing to identify NOx benefits from Caltrans Use of Alternative Diesel Fuels & Aftertreatment Technologies in HDD engines

- Technology: F-T diesel, ultra-low sulfur diesel, and aqueous diesel fuels with QuadCAT™, CRT, and DPX aftertreatment
- Status: Grant in process
- Products: Verification of NOx benefits to facilitate Caltrans choice of fuel/aftertreatment for their “Greening the Fleet” Program

SCAQMD/NREL - \$447,174
Next Generation Natural Gas
Vehicle Program



Cummins Westport Inc. B5.9G *Plus* with aftertreatment - 0.5 g/bhp-hr NO_x

- Technology: Engine computer commonality with diesel products for improved control and reduced cost, with **Goal Line SCONOX®** or other aftertreatment to achieve **0.5 g/bhp-hr NO_x** certification
- Status: SCAQMD contract with Cummins Westport in process
- Products: Introduction of improved **B5.9G *Plus* engine** by 2004

PACCAR/Cummins Westport vehicle development

- Technology: Packaging advanced Cummins Westport NG engines in a **CNG Class 3-6 vehicle** model and an **LNG Class 7-8 vehicle** model
- Status: SCAQMD contract with Cummins Westport in process
- Products: Commercial vehicle availability in 2004

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