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Outline of Next-Generation Environmentally Friendly Vehicle (EFV) Development Project (2nd report)

Transmitted by Japan

1. Background and Objectives

   To find a fundamental solution to air pollution problems caused by motor vehicles and to protect the global environment, the development and commercialization of the next-generation EFVs that will replace heavy-duty diesel vehicles will need to be promoted. To pave the way for the widespread use of such vehicles, next-generation EFVs will be developed and manufactured on a trial basis, and safety and environmental standards for EFVs will be formulated.

2. Project Implementation Period and Scale

   2002 - 2004 (3-Year Plan)
   Total 3-year expenditure: Approximately 30 million euros

3. Development Models

   The following development models were selected from the results of our public hearings:
   DME (dimethyl ether) truck (18-ton class)
   Natural gas truck (25-ton class)
   Series-hybrid diesel bus (78-passenger seating capacity)
   Parallel-hybrid diesel truck (13-ton class)
   Super-clean diesel engine (for 25-ton class trucks)

4. Current Status of Development

   i) DME truck

   A common rail type fuel injection system, EGR system and NOx catalyst system were developed, and then a heavy duty DME engine incorporating these component systems was manufactured on a trial basis. The power performance of this DME engine proved practically equivalent with that of the base diesel engine. NOx emission was reduced to one-half by injection timing optimization and EGR, to one-fourth by combining the catalyst, and to 85% of the base engine's emissions as a total result(0.7 g/kWh). Subsequently a heavy duty truck to host this DME engine was designed.

   ii) Natural gas truck

   Using a test engine, control variables were adjusted primarily to increase the accuracy of transient air excess ratio control. The NOx emission was decreased to 1.0 g/kWh. Based on these results, an engine for installation on a vehicle was manufactured. A vehicle suited for the installation of this engine and a CNG fuel feed system were designed, and major design specifications were determined for the prototype vehicle. It was predicted that this vehicle, with its five CNG containers for a total storage capacity of 873 liters, would achieve the targeted driving range of 600 km or more.

iii) Series-hybrid diesel bus

A diesel engine with a new combustion system was developed on a trial basis, while improvements were achieved in the fuel injection system, intake/exhaust systems and compression ratio. Accordingly, engine specifications were determined. With the PM trap rate of the after-treatment device confirmed to be 96%, the performance target was reached. The measured fuel economy also reached the target set for engines. An optimal control of systems involved was examined in detail to develop a high-efficiency system, a compact electric auxiliary drive unit was designed. Installation planning, designing and trial- manufacture were performed for drive system devices, efficient electric auxiliary drive system, control system devices, and high- performance Li-ion battery packages.

iv) Parallel-hybrid diesel truck

Hybrid systems were examined by means of computer simulation, resulting in the setting of targets to achieve a two-fold rise in fuel economy over conventional diesel trucks and 0.2 g/kWh of NOx, 0.003 g/kWh of PM. Subsequently, combustion tuning was done for the engine, a motor and an inverter were developed, and their operation with the engine was tested. A one-way clutch, battery package and electronic transmission were developed, and their operation in combination with the powertrain system was tested. An IPT unit was installed on the prototype vehicle to conduct the vehicle compliance assessment.

v) Super-clean diesel engine

Regarding HCCI (homogeneous charge compression ignition) to be applied under partial load conditions, emission characteristics and methods of expanding HCCI-applicable combustion regions were studied. The basic characteristics of the NOx absorption catalyst for diesel exhaust gas were investigated. Emission reduction by EGR under high pressure supercharging conditions was examined, and an EGR rate of 40% was obtained at 1,200 rpm and at a high boost pressure of 300 kPa. Under the same condition, the reduction of NOx and PM emissions was also verified. The fuel consumption was measured to be 180 g/kWh in terms of a multicylinder engine value.

5. Subjects under Discussion for the Formulation of Standards

i) Exhaust emission test method for heavy-duty hybrid vehicles

* An engine bench test method that will replace the chassis dynamometer test under transient test cycle conditions
* Evaluation of battery control technologies, energy regeneration performance, etc.

6. Exhibition Plan at the 38th Tokyo Motor Show

Date: November 2 (Tue) to 7 (Sun), 2004
Venue: Nippon Convention Center in Chiba, Japan
Planned exhibition lot: 1,100 m^2

Aim of Exhibition

To inform the visitors, mass media and people in the automobile industry of the importance and benefits of the project, together with the environmental activities and policies of the Ministry of Land, Infrastructure and Transport which promotes the project.

Exhibition Outline

* All Prototype vehicles and engines developed under the project
* Video and panel displays

* Distribution of Project pamphlets
* Other exhibits and activities

Next-Generation EFV Exhibition Booth Image at Tokyo Motor Show

Logo mark

EFV 21
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