Outline of Next-Generation Environmentally Friendly Vehicle (EFV) Development Promotion Project

Transmitted by Japan

1. Background and Objectives

   In order 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 have to be promoted. To pave the way for the popularization of such vehicles, therefore, next-generation EFVs will be developed and manufactured on a trial basis, and standards regarding safety and conservation of the environment will be formulated.

2. Project Implementation Period

   2002 - 2004 (3-Year Plan) (See Figure 1)

3. Project Scale

   2002: Approximately 10 million euros

   [Total 3-year expenditure: Approximately 30 million euros are scheduled]

4. Organization Formed to Promote Project (See Figure 2)

   Commissioned by the Road Transport Bureau and the Road Bureau of the Ministry of Land, Infrastructure and Transport, this project will be executed with the National Traffic Safety and Environment Laboratory, an independent administrative institution, acting as the principal research agency with the cooperation of automobile manufacturers, people of experience or academic standing, and others. Consequently, the Ministry of Land, Infrastructure and Transport established the “Next-generation Environmentally Friendly Vehicle Development Promotion Committee,” comprised of members such as people of experience or academic standing, automobile manufacturers, and transportation company representatives. In addition, working groups made up of people with expertise in different types of EFVs were set up within the National Traffic Safety and Environment Laboratory.

5. How the Project Will Be Implemented

   In order to set a target of 2010 for the practical application of alternative EFVs with the below-mentioned environment performance, we invited public participation regarding the development and trial manufacture of vehicles or power systems that would live up to the name “next-generation EFVs.” The developed vehicle or power system prototypes will be exhibited at the 2004 Tokyo Motor Show.

* Final Development Targets (See Figure 3)
(1) Exhaust gas
   Nitrogen oxide: Further reduction to one-tenth of the level set by new regulation (to be started in 2005)
   Particulate matter: Zero or infinitely close to zero

(2) Fuel efficiency
   Preserve the excellent fuel consumption of diesel vehicles and aim to improve it further.

6. Development Models

The following development models were selected from the results of our public solicitation. (See Table 1)
DME (dimethyl ether) truck (18-ton class)  (See Figure 4)
Natural gas truck (25-ton class)  (See Figure 5)
Series-hybrid diesel bus (78-passenger seating capacity) (See Figure 6)
Parallel-hybrid diesel truck (13-ton class)  (See Figure 7)
Super-clean diesel engine (for 25-ton class trucks)  (See Figure 8)

7. Reflecting Development Models in Resultant Standards Formulated

Development models will be divided into the following groups and data will be obtained to formulate Japanese standards according to the distinctive features of each group.

i) Alternative fuels (DME, CNG)
   Exhaust gas test method and fuel consumption measurement method for heavy-duty alternative-fuel engines
   (Reference fuel properties, correction formulae needed for exhaust gas measurement, evaluation of carbon balance method, exhaust condition of unregulated substances, etc.)

ii) Hybrids
   Exhaust gas test method and fuel consumption measurement method for heavy-duty hybrid vehicles
   (Evaluation of battery control technologies, energy regeneration performance evaluation, study of engine bench test methods that replace a chassis dynamometer test, etc.)

iii) Conventional engines
   Ultra-low concentration exhaust gas test method
   (Evaluation of exhaust gas reducing technologies that use after-treatment system and electronic control, evaluation of effects of fuel properties on exhaust gas tests, etc.)
### Table 1. List of Developing Environmentally Friendly Vehicles

<table>
<thead>
<tr>
<th>Vehicles to be developed</th>
<th>DME truck</th>
<th>Natural gas truck</th>
<th>Series hybrid bus</th>
<th>Parallel hybrid truck</th>
<th>Super clean diesel engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current targeted values</td>
<td>NOx</td>
<td>PM</td>
<td>NOx</td>
<td>NOx</td>
<td>NOx</td>
</tr>
<tr>
<td></td>
<td>&lt; 0.5g/kWh</td>
<td>&lt; 0.5g/kWh</td>
<td>&lt; 0.5g/kWh</td>
<td>&lt; 0.4g/kWh</td>
<td>&lt; 0.2g/kWh</td>
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<tr>
<td>Fuel efficiency</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
<td>PM</td>
</tr>
<tr>
<td></td>
<td>0.0g/kWh</td>
<td>0.0g/kWh</td>
<td>0.007g/kWh</td>
<td>0.003g/kWh</td>
<td>&lt;0.013g/kWh</td>
</tr>
<tr>
<td>Description</td>
<td>GVW</td>
<td>GVW</td>
<td>GVW</td>
<td>GVW</td>
<td>GVW</td>
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<tr>
<td>Major new R&amp;D items</td>
<td>GVW</td>
<td>GVW</td>
<td>GVW</td>
<td>GVW</td>
<td>GVW</td>
</tr>
<tr>
<td>*DME fuel injection system</td>
<td>*3-way catalyst, EGR for natural gas engines</td>
<td>*New combustion method based on HCCI (Homogeneous Charge Compression Ignition)</td>
<td>*High efficiency permanent magnet synchronous motor</td>
<td>*Electric controlled turbo charging and advanced EGR system</td>
<td></td>
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<tr>
<td>*High pressure DME fuel supply system</td>
<td>*Optimized engine control for pure methane fuel</td>
<td>*Electronics controlled transmission</td>
<td>*Engine construction for high Pmax</td>
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</tr>
<tr>
<td>*Special EGR system</td>
<td>*Turbo-intercooler system for natural gas engines</td>
<td>*High performance Li+ battery and Electric brake system (EBS)</td>
<td>*Inductive power transmitter (IPT) system</td>
<td>*Engine construction for high Pmax</td>
<td></td>
</tr>
<tr>
<td>*NOx absorber type De-NOx catalyst</td>
<td>*Electric driven axially power system</td>
<td>*Electric driven axially power system</td>
<td>*Electric driven axially power system</td>
<td>*Engine construction for high Pmax</td>
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</tr>
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3
Appendix

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drafting of technical standard</td>
<td>Engine/Vehicle evaluation</td>
<td>Review of base technologies</td>
<td>Fundamental studies</td>
</tr>
<tr>
<td>Survey, Feasibility study</td>
<td>Components test</td>
<td>Survey, feasibility study</td>
<td>Performance test procedure</td>
</tr>
<tr>
<td>Engine/vehicle trial</td>
<td>Product bench test</td>
<td>Engine/vehicle trial</td>
<td></td>
</tr>
<tr>
<td>Product</td>
<td>Prototypes can be seen in 38th TOKYO MOTOR SHOW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle &amp; product test</td>
<td>Prototypes can be seen in 38th TOKYO MOTOR SHOW</td>
<td></td>
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</tr>
</tbody>
</table>

Figure 1. Schedule of the Project

Participants
Automotive company, Parts maker, University, Fuel maker, etc.

Government sponsorship
MLIT

Execution organization
NTSEL

Schedule
2002-2004: Prototype vehicles and ready for field test
(2005-2010: Field test and preparation for market penetration)

Prototype vehicles for this project were selected from the proposals offered by industries etc.

Figure 2. Scheme of the Development Project of Next-Generation Environmentally Friendly Heavy Duty Vehicles in Japan

Figure 3. Ideal Emission Target of Next-Generation EFVs (Heavy-duty vehicle)
Figure 4 Configuration of DME Engine System

Figure 5 Heavy-Duty CNG Engine System

Figure 6. Outline of Series Hybrid Bus
Figure 7. Outline of Parallel Hybrid Truck

Figure 8. Outline of Super Clean Diesel Engine