Eco-driving
– Introduction of the Japanese activities and a plan of demonstration experiment in China –

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Contents

◆ Introduction of Eco-driving in Japan
  ✓ Positioning in Measures (energy, CO2), Effects, Promotion Activities, Driving Skills and a Case Study

◆ Eco-driving Management System (EMS) with a Digital Tachograph

◆ Plan of an Eco-driving Experiment in China (Wuhan)

◆ Conclusion and Outlook
Average Fuel Economy of Gasoline Cars

Over 30% up (new cars) in the 10-15 driving cycle

15% up / 10 years in the 10-15 driving cycle

70% against the catalog FE in the real world

12% up / 10 years in the real world

*) Source: On the Road to Sustainable Mobility, 2011, JAMA
4 Categories of CO2 Emission Reduction

FE Standards, Reducing Vehicle Weight, Next-generation Vehicles & Promoting Replacement

Greater Fuel Efficiency

Improved Traffic Flow

More Efficient Use of Vehicles

Diversified Automotive Fuel Supply

Eco-driving

(20 - 30% improvement per 10 years, steady effect)

(5-10% improvement, depending on infrastructure)

(5-10% improvement, depending on FE awareness of users)

Bio – fuels, Natural gas, etc.

*) Source: Reducing CO2 Emissions in the Global Road Transport Sector, 2008, JAMA (http://www.jama-english.jp/)

1st. AAI Summit, 26-27 Nov. 2012, Tokyo
3 Categories of Eco-driving Effects

Environmental Protection
- Mitigation of Global Warming (CO2)
- Prevention of Air Pollution (NOx, PM)

Eco-driving

Safety
- Reduction in Traffic Accidents

Economy
- Fuel Cost Savings
- Reduction in Maintenance Cost

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Activities of Eco-driving Promotion

2003 Liaison group for Eco-driving promotion
   Definition of the 10 tips of Eco-driving

2005 Kyoto Protocol Target Achievement Plan

2006 Action Plan for Eco-driving Promotion
   Review of the definition, awareness-raising activities, promotion of supporting devices, establishment of evaluation system, initiatives across local governments with related organizations, etc.

2008 Revised Kyoto Protocol Target Achievement Plan
   Eco-driving is recognized as one measure to promote eco-friendly vehicle use.
Japanese Eco-driving Promotion System

Liaison Committee (Directors of ministries)
- Industry: METI
- Transport: MLIT
- Environment: MoE
- Police: NPA

Action Plan of Eco-driving Promotion as software & hardware
- ECCJ (the Energy Conservation Center, Japan)
  - Development of training tool for drivers, workshops, support for local governments
- JAF (Japan Automobile Federation)
  - Workshops for drivers (personal use)
- Eco-Mo Foundation*1 & ERCA *2
  - Workshops for drivers (business use)
- Automobile & instrument manufacturers
  - Development of idling stop system, eco-driving support system, etc.

Study Group (Managers of ministries)

*1) Eco-Mo Foundation: The Foundation for Promoting Personal Mobility and Ecological Transportation
*2) ERCA: Environmental Restoration and Conservation Agency

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Eco-driving 10 Tips for Passenger Cars

1. Accelerate gently. (e-start, 20 km/h in 5s)

2. Maintain a steady speed.

3. Slow down by releasing the accelerator.

4. Limit the use of your air conditioner.

5. Don’t idle your engine.

6. Don’t warm up your engine before starting off.

7. Know your itinerary.

8. Check your tire pressure regularly.

9. Reduce your load.

10. Respect parking regulations.

*) Source: Eco-driving Textbook of Passenger Cars (http://www.ecomo.or.jp/environment/ecodrive/)
Eco-driving 5 Tips for Trucks and Buses

Driving Skill

1. Gentle starting off & acceleration
2. Early shift up (1000 – 1500 rpm)
3. Steady & economic speed
   40 – 60 km/h (public road), 80 km/h (highway)
4. Prediction & use of the engine brakes
5. Suppression of idling

Maintenance

✓ Check the air filter.
✓ Check the engine oil.
✓ Check the tire pressure.

*) Source: Eco-driving Textbook of Truck & Bus (http://www.ecomo.or.jp/environment/ecodrive/)
EMS (Eco-Driving Management System)

- Planned and continued action with objective evaluation and guidance

(2) Eco-driving Support System

Digital Tachograph

Start eco-driving

Warning Sounds

Acceleration over

(1) Eco-driving Workshop

(3) Evaluation of driving

Guidance

Analysis

Data

*) Source: MLIT website (http://www.mlit.go.jp/jidosha/)

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Eco-driving Support System (YAZAKI ES)

[ Basic System ]

Digital Tachograph DTG4

Card Reader / Writer (USB 2.0)

Analysis System (SD6)

Compact Flash Card (128 MB)

Engine Speed Over

[ Sensors ]

- Basic: Vehicle & Engine Speeds
- Optional: G Sensor, Accelerator pedal position, Sloping road, Temperature, Alcohol checker

Vehicle Speed (km/h)

Engine Speed (rpm)

80 km/h

Vehicle Speed

Engine Speed

2250 rpm

*) Source: http://www.yazaki-group.com/instrumentation/

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## Cost Benefits of Eco-driving (Diesel Trucks)

<table>
<thead>
<tr>
<th>Method</th>
<th>Fuel Economy Improvement Rate</th>
<th>Effect of Reducing Fuel (L/year)</th>
<th>Effect of Reducing Fuel Cost (M yen/year)</th>
<th>EMS Cost (M yen)</th>
<th>Cost Payback of EMS (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eco-driving workshop</td>
<td>4.7%</td>
<td>8,978</td>
<td>1.08</td>
<td>1.20</td>
<td>1.1</td>
</tr>
<tr>
<td>Workshop + Digital Tachograph</td>
<td>15.0%</td>
<td>26,087</td>
<td>3.13</td>
<td>7.32</td>
<td>2.3</td>
</tr>
</tbody>
</table>

*) Source: Kanagawa Prefecture (http://www.pref.kanagawa.jp/cnt/f642/)

Typical Carrier:

- 30 MD trucks, average FE 5 km/L, annual mileage 33,333 km/year, fuel price 120 yen/L

Costs:

- Consultant Costs = 1.2 million yen,
- Digital Tachograph (30 units) = 6.12 million yen excluding maintenance costs
Demonstration Experiment in Thailand

Diesel Trucks (5 x 5 units)  Measurement  Management

<table>
<thead>
<tr>
<th>Shipping Company</th>
<th>FE before EMS (L/100km)</th>
<th>FE after EMS (L/100km)</th>
<th>Improvement Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20.9</td>
<td>17.8</td>
<td>15.1%</td>
</tr>
<tr>
<td>B</td>
<td>22.6</td>
<td>18.8</td>
<td>16.9%</td>
</tr>
<tr>
<td>C</td>
<td>36.1</td>
<td>31.7</td>
<td>12.1%</td>
</tr>
<tr>
<td>D</td>
<td>22.2</td>
<td>18.6</td>
<td>13.6%</td>
</tr>
<tr>
<td>E</td>
<td>21.0</td>
<td>18.1</td>
<td>14.7%</td>
</tr>
</tbody>
</table>

*) Fuel consumption is approximately proportional to the cumulative engine speed.
Demonstration Experiment in Thailand

5 minutes video provided by YAZAKI Energy System
NOx Reduction Project in Wuhan (by MoE)

Technical assistance towards the 12th five-year plan (2011-15) of China

Measures for mobile sources
- Scrap high emitter vehicles
- Eco-driving

Measures for stationary sources
- Denitration equipment for cement plants and boilers

Other measures
- NOx offset technology e.g. Photocatalytic coating

Meeting in Wuhan (Aug., Nov., Feb.)

Knowledge
GtG

Technology
BtG, BtB

Expert advice and case studies of Japanese policies to contribute to the Chinese planning measures to reduce NOx
Advice and coordination for the introduction of measures and Japanese technology on NOx reduction

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Plan of Eco-driving Demonstration in Wuhan

Meeting with a public bus company on 15 August, 2012

A test bus (Euro3 regulation)

Installation

by YAZAKI

(1) Normal driving
(3 Buses, 2 Buses for suburbs)

by JARI

(2) Analysis and guidance

(3) Eco-driving

NOx, PM

(4) Effect evaluation

CO2

More experiments and data storage in 2013
→ Reflection as a new measure towards the 13th five-year plan (2016 - 2020)

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Conclusion and Outlook

Let's eco-drive with JARI

Beijing

1st AAI Summit, 26-27 Nov. 2012, Tokyo

New Delhi

Tokyo

Bangkok

Kuala Lumpur

Jakarta
Thank you for your attention.

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