An Update of Vehicle Emission Control Policies and Regulations in Japan and Tokyo

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Agenda

1. Vehicle Emission Control Policies and Regulations in Japan
2. TMG’s Diesel Vehicle Emission Control
3. Direction of Recent Emission Control Measures in Japan
4. Defeat Devices with Emission Reduction Function
5. TMG’s Policies toward the Future
1. Vehicle Emission Control Policies and Regulations in Japan
# Current State of Air Quality in Japan and Tokyo

## 1. Nitrogen dioxide (NO₂)

Ratio of monitoring stations that met air quality standards of Japan* for FY 2014

Ambient air pollution monitoring stations: **100% in Japan (for 9 consecutive years); 100% in Tokyo**

Roadside air pollution monitoring stations: **99.5% in Japan; 97% in Tokyo**

*Air quality standards of Japan: The daily average for hourly values shall be within the 0.04-0.06 ppm zone or below that zone

## 2. Suspended particulate matter (SPM)

Ratio of monitoring stations that met air quality standards of Japan* for FY 2014

Ambient air pollution monitoring stations: **99.7% in Japan; 100% in Tokyo**

Roadside air pollution monitoring stations: **100% in Japan; 100% in Tokyo**

*Air quality standards of Japan: The daily average for hourly values shall not exceed 0.10mg/m³, and hourly values shall not exceed 0.20mg/m³

## 3. Fine particulate matter (PM2.5)

<table>
<thead>
<tr>
<th></th>
<th>Japan</th>
<th>Tokyo</th>
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<tbody>
<tr>
<td></td>
<td>Ambient air pollution monitoring stations</td>
<td>Roadside air pollution monitoring stations</td>
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<tr>
<td></td>
<td>Achievement ratio (%)</td>
<td>Yearly average concentration (μg/m³)</td>
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<tr>
<td>2011</td>
<td>32.4</td>
<td>15.1</td>
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<tr>
<td>2012</td>
<td>27.6</td>
<td>15.4</td>
</tr>
<tr>
<td>2013</td>
<td>43.3</td>
<td>14.5</td>
</tr>
<tr>
<td>2014</td>
<td>16.1</td>
<td>15.3</td>
</tr>
<tr>
<td>2015</td>
<td>37.8</td>
<td>14.7</td>
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*Air quality standards of Japan: The yearly average shall not exceed 0.15μg/m³, and daily average shall not exceed 0.35μg/m³
History of Motor Vehicle Emissions Control (NOx)

1. Passenger vehicles

- Japan (gasoline)
- Japan (diesel)
- USA
- EU (gasoline)
- EU (diesel)

2. Diesel heavy-duty vehicles

- Japan
- USA
- EU

<table>
<thead>
<tr>
<th>Year</th>
<th>Category</th>
<th>Emissions</th>
<th>Notes</th>
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<tbody>
<tr>
<td>2000</td>
<td>EURO 3</td>
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<tr>
<td>2005</td>
<td>Non-Tier 2</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>2010</td>
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<tr>
<td>2007</td>
<td>EURO V</td>
<td>2.7</td>
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<td>2004</td>
<td>EURO IV</td>
<td>3.5</td>
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<td>2009</td>
<td>EU2004</td>
<td>3.22</td>
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<tr>
<td>2010</td>
<td>EU2007</td>
<td>2.0</td>
<td>US2007</td>
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<table>
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<th>Year</th>
<th>Category</th>
<th>Emissions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>EURO 6</td>
<td>0.4</td>
<td></td>
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<tr>
<td>2015</td>
<td>PNLT</td>
<td>0.044</td>
<td>Tier 3</td>
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Legend:
- NL: Non-Light-Duty
- LT: Light-Duty
- NST: Non-Specific Type
Certified Low Emission Vehicles (Tax Cuts for Eco-Cars)

1. Certified low emission vehicles

A scheme to certify vehicles that achieve lower emissions than the emission standards.
Certified vehicles are allowed to affix certification labels.
Most gasoline-powered passenger vehicles in Japan are categorized as SULEV (four-star vehicles that achieve 75% reduction)

2. Tax cuts for eco-cars

Among ZEVs and SULEVs, certified low emission vehicles that achieve better fuel efficiency than the standards are eligible for automobile-related tax cuts.
TMG offers further tax reductions for ZEVs.
1. Regulation on vehicle type in the
1. Automobile NOx and PM Reduction Law

In areas specified by law (some parts of Tokyo, Kanagawa, Saitama, Chiba, Aichi, Mie, Osaka and Hyogo), aged vehicles that do not meet NOx and PM emission levels required by law shall not be owned.

2. Low emission vehicle designation system by nine local governments in Kanto districts

A scheme to designate vehicles that meet lower emissions than the emission standards and fuel efficiency standards through collaboration of local governments in the Tokyo Metropolitan Area (Tokyo, Kanagawa, Saitama, Chiba, Yokohama City, Kawasaki City, Chiba City, Saitama City and Sagamihara City).

Designated vehicles are permitted to affix labels shown on the right.
2. TMG’s Diesel Vehicle Emission Control
## Outline of the Regulations

<table>
<thead>
<tr>
<th><strong>Date of implementation</strong></th>
<th>October 1, 2003</th>
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<tbody>
<tr>
<td><strong>Target Substances</strong></td>
<td>Particulate matter (PM) from diesel vehicles</td>
</tr>
<tr>
<td><strong>Target Area</strong></td>
<td>The Tokyo metropolitan area (excluding islands)</td>
</tr>
<tr>
<td><strong>Banned Activity</strong></td>
<td>Diesel vehicles that do not satisfy PM emissions standards cannot be driven in Tokyo</td>
</tr>
<tr>
<td><strong>Targets of the Regulations</strong></td>
<td>Buses, trucks, and special automobiles (e.g. refrigerator and freezer vehicles) *excluding passenger vehicles</td>
</tr>
<tr>
<td><strong>Grace Period</strong></td>
<td>First seven years after vehicle registration</td>
</tr>
</tbody>
</table>
| **Penalties**             | • Banned from driving in Tokyo  
                          • Public disclosure of offender’s identity and a fine of up to 500 thousand yen (US$5,000) for a person who fails to comply with a driving ban order |
Regulation Standard Value

* 2t truck (Total vehicle weight: 4t)

- National emission standard for new vehicles
- Emission standard of TMG (including vehicles in use)

Short-term regulation 0.7

- First-step regulation
  - From October 2003

Long-term regulation 0.25

- Second-step regulation
  - From April 2006

New short-term regulation 0.18

New long-term regulation 0.027

Post new long-term regulation 0.001
Promoting Development of Low Emission Vehicles and Development of Retrofit Devices to Reduce PM Emissions

(1) Promoting development and diffusion of low emission diesel vehicles

In 1999, TMG requested the Japan Automobile Manufacturers Association to develop, produce and sell diesel vehicles that emit less PMs. In response, vehicle manufacturers have advanced development of such vehicles.

(2) Commercialization and diffusion of retrofit devices to reduce PM emissions (DPFs and oxidation catalysts)

- Aged diesel vehicles in use need add-ons to reduce PM emissions to clean up exhaust gas
- Tokyo Metropolitan Research Institute for Environmental Protection and vehicle manufacturers in and outside Japan cooperated in research and development of the equipment and discussed commercialization of retrofit devices (DPFs)

- Furthermore, the introduction of low-sulfur light oil enabled the use of oxidation catalysts cheaper than DPFs, which contributed to the diffusion of retrofit devices
Early Supply of Low Sulfur Diesel Fuels by the Petroleum Association of Japan (PAJ)

- Achieved by the efforts of the Petroleum Association of Japan
- 21 months ahead of schedule
- 2 years ahead of schedule
- Regulatory value of the national government
Diesel vehicles that do not meet the emissions standards set by TMG are not allowed to be driven in Tokyo. Neighboring prefectures comprising the Tokyo metropolitan area also started to impose the same regulations on diesel vehicles under the initiative of TMG.

- Regulations by local governments, not by the national government
- Regulations imposed on diesel vehicles, including those already in use

⇒ Both are the first initiatives to be implemented in Japan.
Achievement Ratio of Environmental Standard for SPM (at roadside air pollution monitoring stations)

Regulation starts in Tokyo and 3 nearby prefectures.
Regulatory Actions

Vehicle Pollution Regulators

- On the streets/at distribution centers

Fixed Cameras

- On metropolitan expressways

Mobile Cameras

- Recording vehicles morning, noon and night
- Report ("Stop The Black Diesel Smoke" Hotline)
- Tokyo residents can report illegal diesel vehicles
Control at Sightseeing Spots

AKIHABARA

ASAKUSA

AMUSEMENT PARK

SHINJUKU
Sending Information Outside Japan

(1) Beijing
✓ Sept. 2009: Tokyo and Beijing signed an agreement concerning technical exchange and cooperation
   Items of cooperation included measures to reduce black exhaust from diesel vehicles
✓ Oct. 2013: Tokyo and Beijing held a workshop on air quality
   Six representatives from Beijing attended, including Deputy Senior Director of Beijing Municipal Environmental Protection Bureau
   Inspected the sites monitoring emissions from diesel vehicles in Tokyo

(2) Paris
✓ Feb. 2016: Mayor of Paris visited Tokyo
   Based on the vehicle entry restriction to be introduced to Paris, we explained TMG’s regulation on diesel vehicles and exchanged opinions with the Mayor

We are receiving many inquiries from overseas cities
3. Direction of Recent Emission Control Measures in Japan
Keywords of Motor Vehicle Emissions Control

(1) Balancing emission control with enhancement of fuel efficiency

✓ FY 2015  Fuel efficiency standards (passenger vehicles, light-duty trucks, heavy-duty vehicles)
✓ FY 2020  Fuel efficiency standards (passenger vehicles)
✓ FY 2022  Fuel efficiency standards (light-duty trucks)

With the tightening of fuel efficiency standards, further efforts to balance emission control with fuel efficiency will be needed.

(2) Worldwide Harmonization

✓ Starting with the 2016 regulations (for diesel heavy-duty vehicles), the test method has changed to WHDC
✓ As for passenger vehicles, changing the test method to WLTP is under consideration (Planned for 2018)

(3) RDE: Real Driving Emission

Ensuring lower emissions in the real world, not just on the test bench, will be required.
4. Defeat Devices with Emission Reduction Function
Defeat Device Case in Japan

Defeat device found in a middle-duty diesel truck

- Apr. 2011  Tokyo Metropolitan Research Institute for Environmental Protection, to which TMG outsources surveys on motor vehicle emissions, found a defeat device on a truck
  - It was the latest diesel truck model at the time with a payload of 4 tonnes made by Isuzu Motors
  - NOx emissions were below the regulatory value in the emission test, but the amount increased more than threefold in actual driving conditions

- May 2011
  - TMG reported this fact to the national government

- June 2011
  - TMG disclosed the fact publicly
  - The manufacturer started efforts to restore the function
  - TMG requested the national government to create a law to ban the use of defeat devices
Defeat Device Case in Japan

Defeat device found in a middle-duty diesel truck

✓ Manufacturer’s view
It was a control function to protect the mechanism to reduce emissions. We did not intend to circumvent the regulations.

✓ Requirements of using a protective control (U.S. Environmental Protection Agency: EPA)
① The function shall not be applied under common driving conditions in a normal driving situation;
② The function shall be applied only under driving conditions that require protection, and shall immediately be released when the control becomes unnecessary; and
③ The two points above shall be explained in advance to the regulatory body

✓ Validation by TMG
① NOx emissions increased about threefold under driving on constant speed conditions (40/60 km/h)
   - During testing that involved acceleration which may lead to a high margin of error, it was found that compared to the conditions of normal emission tests,
     NOx emissions increased by about 1.5 times
   - In a test in an actual driving pattern unique to TMG,
     NOx emissions were larger than those of the previous generation model
② The vehicle continued to emit much NOx after an abrupt acceleration that needs a protective control
③ The manufacturer gave an explanation to TMG and the national government one year after the launch of the vehicle (after the revelation of the issue)
Defeat Device Case in Japan

Defeat device found in a middle-duty diesel truck

✓ Emission reduction mechanism of this vehicle

Compared with the trucks of other manufacturers, Isuzu eliminated an SCR that reduces NOx emissions to cut production and running costs.

✓ TMG’s view

- This does not meet the requirements to install a protective control system (normal control for other manufacturers)
- Without an SCR, the subject vehicle emitted a large amount of NOx
- The company intended to reduce production and running costs by eliminating the SCR

TMG judged that it was highly likely that it was a defeat device.
Defeat Device Case in Japan

Defeat device found in a middle-duty diesel truck

✓ Actions of the manufacturer
  • Stopped shipment of new vehicles
  • Rewrote the control map of the subject vehicles with the defeat device and replaced engines

✓ Actions of the Japan Automobile Manufacturers Association (JAMA)
  Formulated design guidelines banning the installation of defeat devices on diesel heavy-duty vehicles in September 2011 as a voluntary measure of the automobile industry

✓ Actions of the Ministry of the Environment and the Ministry of Land, Infrastructure, Transport and Tourism of Japan
  • Set up an expert meeting to discuss emission reduction measures in the off-cycle in August 2011 to discuss clarification of the definition of defeat devices and measures to prevent their use
  • Revised the law to clarify the definition of defeat devices of diesel heavy-duty vehicles (definition of a protective control) and the ban on the use of defeat devices (Oct. 2013)
Impact of Volkswagen’s Emissions Scandal using Defeat Device

It was found out in Europe and the U.S. that Volkswagen had intentionally programmed diesel engines to activate emissions controls only during emissions testing, not in the actual driving. (Sept. 2015)

Impact in Japan

- Because it was only recently that diesel vehicles become popular in Japan, Volkswagen models with defeat devices were not imported through official channels.

- However, considering a prospect that the number of diesel passenger vehicles will rise and the absence of a clear ban on the use of defeat devices on diesel passenger vehicles, etc., the Ministry of Land, Infrastructure, Transport and Tourism of Japan started discussions on the survey and measures on diesel passenger vehicles sold in Japan
Impact of Volkswagen’s Emissions Scandal using Defeat Device

Actions of the Ministry of the Environment and the Ministry of Land, Infrastructure, Transport and Tourism of Japan

✓ Set up an expert meeting to review the inspection method of diesel passenger vehicles in response to the emissions scandal in October 2015

✓ Conducted bench tests and on-road tests on emissions from diesel vehicles sold in Japan to check for test-rigging software

① Bench tests: JC08 (emission test cycle in Japan), WLTC, constant speed driving test, etc.

② On-road tests: Measure emissions in urban traffic, inter-city transportation and on highways with PEMS equipped

⇒ Result: No test-rigging software was found, but in some vehicles NOx emissions varied between bench tests and on-road tests, from double to tenfold

✓ The meeting is planning to form a conclusion in 2017 with the aim of introducing on-road tests as certification tests and establishing guidelines on the scope of activation of a protective control (interim report in April 2016)
5. TMG’s Policies toward the Future
Promote measures against motor vehicle emissions as part of air pollution control measures (to reduce PM2.5 and Ox emissions)

Policy goals (concerning air pollution)
- Reduce the number of days when photochemical smog alerts are issued to zero by FY 2020
- Improve the achievement ratio of emission standards for PM2.5 to 100% by FY 2024
- Reduce the photochemical oxidant concentration at all monitoring stations to 0.07 ppm or lower by FY 2030 (3-year average of the maximum 8-hour concentration value of the day with fourth highest value of the year)

Relation of the change of photochemical oxidant concentration and target value

Achieve the target in FY 2030 ahead of the attenuation trend
Promote measures against motor vehicle emissions as part of air pollution control measures (to reduce PM2.5 and Ox emissions)

- Steady promotion of diesel vehicle regulations
- Comprehensive monitoring of motor vehicle emissions within Tokyo (utilizing PEMS)
- Measures against evaporated gasoline emission reduction

Promote the measures as part of countermeasures against climate change and energy measures

Policy goals (concerning ZEVs)
- Raise the diffusion ratio of FCVs, BEVs, PHEVs and HEVs to 80% or more for passenger vehicles and 10% or more for trucks by 2030
- Increase the number of FCVs to 6,000 (including 100 or more buses) by 2020, 100,000 by 2025 and 200,000 by 2030.
Thank You