Trend of Next Generation/Zero Emission Vehicle and Policy in Japan

METI, Japan

1. CO2 Emission and Energy Consumption of Transportation Sector in Japan

2. Policy Target and Concept

3. Policy for Improving Entire Fuel Economy

4. Policy Support for Penetration of ZEV

5. Next Step
Reducing CO2 emission from transportation sector is essential for achieving Japan’s INDC

- Transportation sector contributes to entire CO2 emission by 19% in Japan.
- It is planned to be **reduced by 25% in 2030**. Comprehensive measures including ambitious fuel emission economy standard is needed.

CO2 emission (2015)

- **Home section**: 184 million(t) <16.0%>
- **Operation section**: 231 million(t) <20.1%>
- **Industrial section**: 435 million(t) <37.9%>
- **Others**: 82 million(t) <7.1%>

CO2 total discharge 1,150 million(t) 2015 (FY)

Trend of CO2 emission in transportation sector

Source: Joint Meeting (METI’s committee and MOE’S council)(2018)

Source: METI (ANRE)
Joint council’s material by METI and MLIT
Crude oil equivalent (Million kL)

- Half of energy consumption is from commercial vehicle.
- Consumption from passenger car started decreasing after 2001.

Source: METI (ANRE) Joint council’s material by METI and MLIT
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Even in 2DS scenario, 91% of automobiles are with combustion engine in the world in 2030. Balanced policy mix of improving entire fuel economy and policy support for penetration of ZEV is important.

For promoting OEMs’ effort for developing technologies based on each OEMs’ strength, technological neutrality is important. Mandating specific % of EV sales or supply could harm innovation and consumer benefit.

### Policy support for penetration of ZEV
- Infrastructure, early stage financial incentive etc.

### Improving entire fuel economy
- CAFÉ approach

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*Source: IEA 「ETP(Energy Technology Perspectives) 2017」*
“Well to wheel” emission differs among countries with different generation mix.

For reducing “well to wheel” emission, energy policy for promoting zero emission power generation is needed.

In order for consumer to choose based on “well to wheel” emission, how to express fuel economy needs to be discussed.

Source: Global IEA EV Outlook 2017
Japan Set Ambitious Policy Target in 2030

- Japan set ambitious policy target of next generation cars’ penetration in 2030.
  ※These are not regulatory requirement for car makers.
- While HEV has achieved target successfully already, achieving EV/PHV target of 20-30% and FCV target is a big challenge. Strong policy initiative is needed.

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional cars</td>
<td>63.97%</td>
<td>30~50%</td>
</tr>
<tr>
<td><strong>Next generation cars</strong></td>
<td><strong>36.02%</strong></td>
<td><strong>50~70%</strong></td>
</tr>
<tr>
<td>HEV</td>
<td>31.2%</td>
<td>30~40%</td>
</tr>
<tr>
<td>EV PHV</td>
<td>0.41%</td>
<td>20~30%</td>
</tr>
<tr>
<td></td>
<td>0.82%</td>
<td></td>
</tr>
<tr>
<td>Fuel Cell Vehicle</td>
<td>0.02%</td>
<td>~3%</td>
</tr>
<tr>
<td>Clean Diezel Vehicle</td>
<td>3.52%</td>
<td>5~10%</td>
</tr>
</tbody>
</table>

«Reference»

【Sources】
Next Generation Vehicle Strategy 2010
Automotive Industry Strategy 2014

「EV・PHV Roadmap」 (Mar, 23rd, 2016, )
- EV・PHV stocks target
  - 1 Million EV/PHV stocks by 2020

「Hydrogen / Fuel Cell Strategy Roadmap (March 22, 2016)」
- FCV stocks target
  - Spread of about 40 thousand FCVs by 2020, about 200 thousand ones by 2025, about 800 thousand ones by 2030."]
- Dissemination policy of Hydrogen infrastructure
  - About 160 places" by 2020 and "320 places" by 2025 will be installed.
By achieving 2030 target, energy consumption from transportation sector will be cut by 26% in Japan.

- By achieving 2030 target of next generation cars, half of automobiles in Japan will be replaced by next generation cars in 2030.
- Energy consumption from transportation will be reduced by 26% in 2030.

### Prospect of Supply and Demand of Energy

<table>
<thead>
<tr>
<th>Category</th>
<th>Crude oil equivalent (Million kL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>400</td>
</tr>
<tr>
<td>2030</td>
<td>400</td>
</tr>
<tr>
<td>2020</td>
<td>380</td>
</tr>
<tr>
<td>2025</td>
<td>350</td>
</tr>
<tr>
<td>2030</td>
<td>300</td>
</tr>
<tr>
<td>2035</td>
<td>250</td>
</tr>
<tr>
<td>2040</td>
<td>200</td>
</tr>
<tr>
<td>2045</td>
<td>150</td>
</tr>
<tr>
<td>2050</td>
<td>100</td>
</tr>
<tr>
<td>2055</td>
<td>50</td>
</tr>
<tr>
<td>2060</td>
<td>0</td>
</tr>
</tbody>
</table>

### Prospect of Each car category’s stock ratio in 2030 (FY)

- **HV**: 29%
- **EV**: 16%
- **PHV**: 16%
- **FCV**: 1%
- **CDV**: 4%
- **Gasoline etc**: 50%

Source: Joint council’s material by METI and MLIT
• Sale of next generation vehicle increased steadily after “Next Generation Vehicle Strategy” was formulated in 2010 lead by steady increase of HEV sales.

Sources: METI made based on JAMA's date
Joint council's material by METI and MLIT

Next Generation car’s sale units

(Million Units)

Sources: METI made based on JAMA’s date
Joint council’s material by METI and MLIT
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Fuel Economy regulation in Japan: CAFÉ, Top Runner Approach

- Japan has a fuel economy regulation based on Act on the Rational Use of Energy.
  - Top runner approach, CAFÉ regulation

Setting Target Standard and Target Achievement Evaluation (2020’s regulation)

Target standard is determined for the unified category in expectation.

Target Achievement Evaluation (Calculate each companies’ CAFÉ)

Achieved if CAFÉ (weighted average according to the sales volume) exceeds the Target standard.

Source: Joint council’s material by METI and MLIT
Japan’s fuel economy has improved steadily and it has already achieved 2020 target (20.3km/l which is equivalent to CO2 emission of 122g/km).

Post 2020 fuel economy standard is under discussion in Japan since March 6th 2018.

Trend of each country’s CO2(FE) regulation

**Japan**
- 20年: 122g/km
- 22年: 113g/km
- 25年: 97g/km

**India**
- 22年: 117g/km

**China**
- 20年: 117g/km
- 25年: 97g/km

**USA**
- 25年: 81g/km

**Europe**
- 25年: (81g/km)

Trend of fuel economy(FE) standard and FE performance

- Average FE (Performance:JC08)
- Average FE(Performance:10・15)
- Target standard value (JC08)
- Target standard value (10・15)

Based on NEDC mode.  
*1: Calculated based 15% reduction compared to 2021’s (95g/km)  

Source: The International Council On Clean Transportation 「CO2 emissions from new passenger cars in the EU: Car manufacturers’ performance in 2016」

※Trend is based on only gasoline cars
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Subsidy scheme and trend of EV/PHV and Public chargers

- Subsidy for buying next generation vehicle and for installing infrastructure and Tax incentive (next page) are main policy tools for supporting penetration of ZEV.

Subsidy scheme for car purchase

- **Current FY2017-**
  - EV: $10/km
  - PHEV: $2000 (fixed)
  - i.e., $4,000 for Leaf

  *maximum range on a full charge (km)*

Subsidy scheme for charger installation

<table>
<thead>
<tr>
<th>No.</th>
<th>Installation Site</th>
<th>Public/Private</th>
<th>Eligibility</th>
<th>Subsidy rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Service Areas on Highways, etc</td>
<td>Public</td>
<td>Apparatus</td>
<td>fixed amount</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Construction</td>
<td>fixed amount</td>
</tr>
<tr>
<td>#2</td>
<td>Hotels, Shops, etc.</td>
<td>Public</td>
<td>Apparatus</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Construction</td>
<td>fixed amount</td>
</tr>
<tr>
<td>#3</td>
<td>Apartment complexes, Factories and Firms</td>
<td>Private</td>
<td>Apparatus</td>
<td>2/3 or 1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Construction</td>
<td>fixed amount</td>
</tr>
<tr>
<td>#4</td>
<td>billing devices</td>
<td></td>
<td>Apparatus</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Construction</td>
<td>fixed amount</td>
</tr>
</tbody>
</table>

Subsidy for EV/PHV (units)

- 2012: 27,835
- 2013: 20,000
- 2014: 20,000
- 2015: 30,000
- 2016: 165,516

Public Charger (units)

- 2012: 0
- 2013: 20,000
- 2014: 30,000
- 2015: 30,000
- 2016: 165,516

Subsidy for buying next generation vehicle and for installing infrastructure and Tax incentive (next page) are main policy tools for supporting penetration of ZEV.
# Financial support (Tax reduction)

## 2017

<table>
<thead>
<tr>
<th>Object/ Requirement</th>
<th>Tax</th>
<th>Special measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EV, FCV, PHV</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNG (Achieved 2018’s regulation or 2009’s regulation (10% NOx)) CD (Achieved 2009’s or 2018’s regulation)</td>
<td>Automobile Acquisition Tax</td>
<td>No Tax</td>
</tr>
<tr>
<td></td>
<td>Automobile Weight Tax (New car inspection, Continued inspection)</td>
<td>Tax Exemption</td>
</tr>
<tr>
<td><strong>Gasoline (include HEV), LPG</strong></td>
<td>FE performance (→) Emission performance (↓)</td>
<td>2015 FE standard</td>
</tr>
<tr>
<td></td>
<td>Achieved</td>
<td>+5%</td>
</tr>
<tr>
<td></td>
<td>20% reduction</td>
<td>20% reduction</td>
</tr>
<tr>
<td></td>
<td>25% reduction</td>
<td>50% reduction</td>
</tr>
<tr>
<td></td>
<td>Continued inspection</td>
<td></td>
</tr>
</tbody>
</table>

Source: Joint council’s material by METI and MLIT

**FE**: fuel economy
Promoting Battery R&D Projects

- For improving battery performance, the government supports R&D projects of next generation battery.

<table>
<thead>
<tr>
<th>RISING2</th>
<th>All Solid State LIB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2016 - 2020</strong></td>
<td><strong>2018 - 2022</strong></td>
</tr>
<tr>
<td>FY 2018 budget: JPY 3.1 billion (US$ 31 million)</td>
<td>FY 2018 budget: JPY 1.6 billion (US$ 16 million)</td>
</tr>
<tr>
<td>Responsible organization: Kyoto University, AIST (※), Automotive companies, Battery Companies, Other Universities etc.</td>
<td>Responsible Organization: LIBTEC(Lithium Ion Battery Technology and Evaluation Center) etc</td>
</tr>
</tbody>
</table>

※National institute of Advanced Industrial Science and Technology

<table>
<thead>
<tr>
<th>EVs Travel range (Energy Density)</th>
<th>400km(200Wh/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td></td>
</tr>
<tr>
<td><strong>Target by 2025</strong></td>
<td>800 km(400Wh/kg)</td>
</tr>
<tr>
<td>(All Solid State LIB)</td>
<td></td>
</tr>
<tr>
<td><strong>Target after 2030</strong></td>
<td>1000 km (500Wh/kg)</td>
</tr>
<tr>
<td>(Innovative battery)</td>
<td></td>
</tr>
</tbody>
</table>
● Formulating reuse and recycle system is important for utilizing battery’s value and conserving raw materials.

● Automobile companies in Japan formulated voluntary collecting system about (NiMH and Li) battery.

Key factors:
1. Efficient collection and transportation scheme
2. Standardized evaluation of remaining battery capacity

Current system:
- Car Owner (End of Life)
- Export oversea (used car)
- Collection Operators
- Dismantling Operators
- Recycling Plants (Recycle, Reuse, and Rebuild)
- Special Forwarding Agents
- Selling to Material operators
V2G

- V2G would increase value of EV batteries.
- NEDO conducted field test of utilizing EV’s battery for providing ancillary service to the grid transmitting electricity from solar in Maui Island, Hawaii.

**Period:** 2011 Oct - 2017 Feb  
**Place:** Maui County, USA  
**Participants:** 320 people  
**Practitioner:** HITACHI, NISSAN etc  
**Budget:** ¥6.4 billion (≒ US $60 million)  
**Charger (DC):** CHAdeMO protocol  
**Max voltage (DC):** 150~450V  
**Result:** This system shifts EV charging peak to the time when more renewables are expected available.
Basic Hydrogen Strategy (key points) (Dec. 26th, 2017)

- **Vision with a view to 2050 + action plan up to 2030**
- **Hydrogen as a New Energy Option Along with Renewable Energy**
  ⇒ Leading the world’s carbon free development with Japan’s advanced hydrogen technology
- **Target: Realizing the same cost as gasoline and LNG**
  (Current: $ 1/Nm³ ⇒ $0.3/kg by 2030 ⇒ $0.2/kg by 2050)

<3 elements for reducing H2 cost>

- **[supply sides]**
  ① **Make it cheap** (=utilize overseas brown coal, surplus renewable energy etc)
  ② **Developing supply chain** for mass production and transportation
  ③ **Mass usage** (Automobile ⇒ Power Generation ⇒ industry)

- **[user side]** ...

### ①Main action as supply side
- **Produce massive amount of hydrogen from cheap material**
  - Utilizing brown coal (less than 1/10th of coal) and oversee renewable energy (about 1/10th of domestic’s)
- **Mass importation by developing an international supply chain**
  - Promote the development of brown coal hydrogen production and mass transport technology of hydrogen by international hydrogen transport project between Japan Australia / Brunei, aiming for commercialization around ‘30.
- **Make maximum use of local renewable energy**
  - Toward the hydrogen base of Fukushima (Namie Town), pioneering the future utilization of surplus renewable energy through demonstration of the world’s largest renewable hydrogen production. Hydrogen from Fukushima is also used in Olympic games in 2020.

### ③Main action as user side
- **Accelerate dissemination of FCV/FC bus/hydrogen station**
  - ‘Toward self-sustainable business regarding FCV in the latter half of the 2020s,
    ① Low cost technology development (reduce Station cost by half by 2020),
    ② Regulatory reform (realization of station unattended, etc.),
    ③ Advance strategic improvement of the station (a new company established this spring is accelerating development)
  - Horizontal deployment of hydrogen utilization not only for FCV but also for buses, forklift trucks, trucks, ships, etc
- **Commercialization of hydrogen power generation · Mass consumption**
  - Promoting demonstration and technology development towards commercialization around 2030, such as the world’s first hydrogen electric power plant (Kobe) commenced demonstration operation from the beginning of the year.
Budget for Hydrogen and Fuel Cells in FY 2018

**Phase 1**

**Installation Fuel Cell**
Focus on implementation from the present

Disseminate stationary FCs
**Subsidies for Stationary FCs** [8.9 billion yen]
Promote the accelerated introduction and cost reduction of Ene-farm. From FY 2017, support for stationary FC for business and industrial use is added.

Disseminate FCVs
**Subsidies for HRSs** [5.7 billion yen]
Support HRS installations and promote creating new FCV demand.

**Support for FCVs**
[Included in 15 billion yen]

**Phase 2**

**H2 Power Plant/Mass Supply Chain**
Realized in the late 2020s

Build a H2 supply chain
**Demonstrations for global H2 supply chain** 9.4 billion yen]
Demonstrate how hydrogen can be produced from untapped overseas energy resources, transported in the form of liquefied hydrogen or organic hydride, and used to generate power. Implement P2G field tests, etc.

**Phase 3**

**CO2-free Hydrogen**
Realized in around 2040

R&D of H2 production, transport and storage
**R&D for producing, transporting and storing H2 derived from renewable energy** [0.9 billion yen]
Develop technologies of high efficiency water electrolysis units, tanks for storing liquefied hydrogen, etc. with the use of renewable energy sources.

**R&D of FCs** [2.9 billion yen]
Conduct R&D for better performance and lower costs of FCs, and demonstrate stationary FCs for business use

**R&D of HRSs** [2.4 billion yen]
Develop technologies for lower costs and safety of HRSs, and collect data for reviewing regulations.

**Stationary FC for business use**

Develop technologies for producing, transporting and storing H2 derived from renewable energy [0.9 billion yen]

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Automobile Strategic Committee

- Minister Seko (Minister of Economy, Trade and Industry) started “Automobile Strategic Committee” on 18th April to set Japan’s automobile industry’s strategy for solving global issues related to mobility.

- Issues to be discussed:
  - Strategic action toward “CASE”
  - Promoting innovation of battery industry
  - Promoting electrified vehicles
  - Ecosystem of battery
  - Integration of automobile policy and energy policy
  - Transforming automobile supply chain
  - Digitalization and standardization of car development

Committee Members

OEM: CEO of Toyota, Honda, Nissan, Mazda
Supplier: CEO of Akebono brake
Scientist: Zempachi Oguimi Professor Kyoto University, etc
Investor: Hiromichi Mizuno Board Member of PRI, United Nations
          Gen Isayama General Partner & CEO etc.
The Electric Vehicle Symposium & Exhibition (EVS) is the world's largest international exhibition and symposium for all fields related to Electric Vehicle (EV), such as battery electric vehicles, hybrid electric vehicles (HEV) and fuel cell vehicles (FCV).

**Venue**
Kobe Convention Center, Kobe, Japan
Kobe International Conference Center / Kobe International Exhibition Hall

**Date**
September 30 - October 3, 2018 (4 days)
Multilateral policy dialog on September 30th, 3:00PM – 5:00PM

**Hosted by**
Japan Automobile Research Institute (JARI)

**Cooperation with**
Society of Automotive Engineers of Japan (JSAE)
World Electric Vehicle Association (WEVA)
Electric Vehicle Association of Asia Pacific (EVAAP)

**Supported by**
Ministry of Economy Trade and Industry
Ministry of Land, Infrastructure, Transport and Tourism
Ministry of the Environment
Japan Automobile Manufacturers Association (JAMA), etc.

**Contents**
a) Plenary session
Opening & Closing ceremony, Keynote speeches, Panel discussion
b) Technical Session (Oral and Dialogue session) held as EVTeC 2018* in conjunction with JSAE
c) Exhibition & Ride-&-Drive
d) Technical tour
e) Welcome reception, Gala