Maximizing Vehicle Fuel Economy Improvement in APEC Region

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• **To present an alternative scenario of energy saving in transport sector by aiming at highly ambitious target of fuel economy improvement for new vehicles in APEC economies.**
APERC – Asia Pacific Energy Research Centre

- Supports the energy activities of APEC with:
  - Research, especially analysis of energy supply and demand in the APEC Region;
  - Cooperative programs to promote energy efficiency, low-carbon energy supply and emergency preparedness for energy security.

- Established in 1996 and funded by the Japanese government, based in Tokyo.

- Currently has 30 staff members, including 16 visiting researchers from APEC economies.
The “APERC Energy Demand and Supply Outlook” is a priority task of APERC under the APEC Energy Action Programme adopted by leaders in 1995.

We try to facilitate APEC cooperation by providing:

- Useful reference work on energy in the APEC region.
- Useful suggestions and case studies to policymakers.

The 5th edition of the “APERC Energy Demand and Supply Outlook” was published in February 2013.

(It is available on APERC website http://aperc.ieej.or.jp/)
APEC’s Significance

Overview

Methods

Results

Conclusions

Population

APEC 60%

Rest of World 40%

GDP

APEC 57%

Rest of World 43%

Energy Consumption

APEC 60%

Rest of World 40%

Source: www.apec.org
The transport sector’s energy demand has increased by 2% per year for last two decades and accounted for more than one-fourth of total energy consumption in APEC region.
## Transport Sector Modelling Techniques

<table>
<thead>
<tr>
<th>Transport sub-sector</th>
<th>Sub-mode/vehicle class</th>
<th>Model</th>
<th>Energy Demand in 2012 (Mtoe)</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domestic Road Transport</strong></td>
<td>- Light and Heavy vehicles</td>
<td><strong>Bottom-up</strong> (Vehicle Fleet Model)</td>
<td>1,098.7</td>
<td>73.9%</td>
</tr>
<tr>
<td></td>
<td>- Motorcycles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Domestic Non-Road Transport</strong></td>
<td>- Rail</td>
<td><strong>Top-down</strong> (Econometric Model)</td>
<td>37.4</td>
<td>2.5%</td>
</tr>
<tr>
<td></td>
<td>- Pipeline</td>
<td></td>
<td>49.6</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td>- Water</td>
<td></td>
<td>41.8</td>
<td>2.8%</td>
</tr>
<tr>
<td></td>
<td>- Air</td>
<td></td>
<td>81.2</td>
<td>5.5%</td>
</tr>
<tr>
<td></td>
<td>- Non-specific</td>
<td></td>
<td>6.6</td>
<td>0.4%</td>
</tr>
<tr>
<td><strong>International Non-Road Transport</strong></td>
<td>- Maritime</td>
<td><strong>Top-down</strong> (Econometric Model)</td>
<td>93.8</td>
<td>6.3%</td>
</tr>
<tr>
<td></td>
<td>- Aviation</td>
<td></td>
<td>78.5</td>
<td>5.3%</td>
</tr>
</tbody>
</table>
APERC’s Vehicle Fleet Model

- **Overview**
- **Methods**
- **Results**
- **Conclusions**

### Macroeconomic data
- GDP & Population
- Crude oil price
- Urbanisation

### Vehicle data
- Vehicle population
- Vehicle age distribution
- Vehicle sales
- Vehicle fuel economy
- Vehicle travel distance

### Energy data
- Retail fuel prices
- Blend ratio of biofuel
- IEA road energy use

- **Vehicle ownership model -> vehicle stock**
  (GDP per capita, vehicle saturation, total vehicle population, income elasticity, urban density)

- **Vehicle stock turnover model -> vehicle sales and vehicle retirement**
  (vehicle population by type and vehicle distribution by age)

- **Vehicle consumer choice model -> share of vehicle technologies**
  (fuel cost, purchase prices, driving range, refueling infrastructure, etc..)

- **Vehicle travel model -> travel distance**
  (fuel cost, income, vehicle ownership, efficiency improvement, urban density)
Vehicle Ownership Curves (1980 – 2011)

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(Source: APERC, 2014)
ASIF – a policy framework to improve energy efficiency and lower carbon emissions in transport

Avoiding or shortening journeys (A) by, for example, densifying urban landscapes, sourcing localized products, utilising ICTs. Smart land-use planning in a compact city could save energy for long-term periods.

Mode shift (S) to lower-carbon transport systems – encouraged by increasing investment in public transport, walking and cycling infrastructure, and so on.

Lowering energy intensity (I) by enhancing vehicle and engine performance by regulating energy performance standards, deploying new technologies by financial incentive and car labelling program, and promoting eco-driving for in-use vehicles.

Fuel choice (F) by shifting to efficient and low-carbon content fuels, such as biofuels and “green electricity”.

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Fuel economy – one of the key parameters of energy efficiency improvement

Table ES1 • Fuel economy evolution compared to GFEI target

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2008</th>
<th>2011</th>
<th>2013</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD average</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>average fuel economy (Lge/100km)</td>
<td>8.6</td>
<td>7.9</td>
<td>7.3</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td>annual improvement rate (% per year)</td>
<td>-2.7%</td>
<td>-2.6%</td>
<td>-2.6%</td>
<td>-2.6%</td>
<td></td>
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<tr>
<td>Non-OECD average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>average fuel economy (Lge/100km)</td>
<td>7.3</td>
<td>7.4</td>
<td>7.3</td>
<td>7.2</td>
<td></td>
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<tr>
<td>annual improvement rate (% per year)</td>
<td>0.5%</td>
<td>-0.4%</td>
<td>-0.9%</td>
<td>-0.2%</td>
<td></td>
</tr>
<tr>
<td>Global average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>average fuel economy (Lge/100km)</td>
<td>8.3</td>
<td>7.7</td>
<td>7.3</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>annual improvement rate (% per year)</td>
<td>-2.3%</td>
<td>-1.9%</td>
<td>-1.8%</td>
<td>-2.0%</td>
<td></td>
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<tr>
<td>GFEI target</td>
<td></td>
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<tr>
<td>average fuel economy (Lge/100km)</td>
<td>8.3</td>
<td></td>
<td></td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>required annual improvement rate (% per year)</td>
<td>2005 base year</td>
<td>-2.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014 base year</td>
<td>-3.1%</td>
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</tbody>
</table>
Assumption of fuel economy improvements for new light vehicles in APEC economies

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<table>
<thead>
<tr>
<th>Scenario</th>
<th>Group of economies</th>
<th>Fuel economy improvement (percent per year)</th>
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<tbody>
<tr>
<td></td>
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<td>2012-2030</td>
</tr>
<tr>
<td>BAU</td>
<td>A</td>
<td>1.0%</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>2.0%</td>
</tr>
<tr>
<td>MAX</td>
<td>A</td>
<td>2.7%</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Group A is economy where vehicle fuel economy labelling and standard policy has not been currently implemented, which include Brunei Darussalam, Indonesia, Malaysia, Mexico, PNG, Peru, Philippines, Russia, Thailand.

Group B is economy where vehicle fuel economy labelling and standard policy has been currently implemented, which include Australia, Canada, Chile, China, Hong Kong, Japan, Korea, New Zealand, Singapore, US, Viet Nam, Chinese Taipei.
Vehicle stock in APEC region will be nearly double by 2040. About 600 million new vehicles on roads, most of them (>70%) will be in China and Southeast Asia.
Energy demand for road transport in APEC region will increase from 1,120 to 1,450 Mtoe in 2040, equal to 0.95% AAGR. China and SEA are responsible for the increased demand.
Road Transport Energy Demand: BAU vs MAX

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- 0.95% AAGR
- 0.27% AAGR
- 17%
Vehicle Stock by Technology: BAU vs MAX

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<table>
<thead>
<tr>
<th>Year</th>
<th>Battery Electric Vehicle</th>
<th>Plug-in Hybrid</th>
<th>Hybrid</th>
<th>CNG</th>
<th>LPG</th>
<th>Diesel</th>
<th>Gasoline</th>
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</thead>
<tbody>
<tr>
<td>2013</td>
<td>2%</td>
<td>7%</td>
<td>13%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BAU 2040</td>
<td>5%</td>
<td>8%</td>
<td>24%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAX 2040</td>
<td>8%</td>
<td>2%</td>
<td>13%</td>
<td></td>
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</tbody>
</table>

EVs 22%

Evs 38%
• Fuel economy improvement is a key success of energy efficiency in transport sector. It can deliver a crucial reduction and curve energy demand in transport sector.

• To realise energy efficiency target, a policy package of fuel economy improvement is needed to be implemented: vehicle fuel economy standards & labelling; rebate for high efficiency vehicles; feebate for low efficiency vehicles, vehicle scrappage scheme, etc.

• Fuel economy standards should be reviewed and raised every few years to ensure higher energy saving.
Thank you

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