Technology and policy drivers of the fuel economy of new light-duty vehicles
Comparative analysis across selected automotive markets

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Content

- GFEI and the IEA role in it
- GFEI benchmarking analysis
- Methodology
- What’s new
- Results: policy influence, comparative assessments, technology deployment
- Examples of insights from country profiles
- Conclusions
Global Fuel Economy Initiative

**Target**: improve the fuel economy of cars
- 50% lower fuel use per km by 2030 (new registrations) and 2050 (stock) – benchmark 2005

**Activities**
- Analysis: data gathering, modeling, baseline development
- Evaluation: policy tools and options
- Strategy development: organization of dialogues
- Outreach: Awareness raising, communication

**Core partners**
IEA role in GFEI

- GFEI message fully aligned with IEA message on energy efficiency (first fuel, need to scale up)
- GFEI target developed on the basis of IEA analysis (ETP scenarios)
- IEA performing GFEI benchmarking analyses
GFEI benchmarking analysis

- Aiming at monitoring developments against GFEI target over time
- Unique compilation of OECD and non-OECD data
- Covers more than 80% of the global car market
- 4th edition since 2010
Methodology

- Analysis based on vehicle registration data from IHS Polk
  - New registrations by brand, model, powertrain and other specs
- Data coverage not complete: missing information is completed using other sources
  - Fuel economy and CO₂/km normalized to the WLTP
  - Results evaluated for all light duty vehicles: no arbitrary split between cars, light trucks and LCVs
  - Results shown as sales-weighted averages

- Coverage >80% for segment, weight, footprint, CO₂/km, fuel economy
What’s new

- Increased coverage
  - This was limited to segment, powertrain/fuel type, fuel economy and CO₂/km in earlier editions
  - Now it covers also weight, footprint, power and displacement

- Comparative analysis across markets

- Country reports
  - Market profile (size, income, fuel prices and taxes, fuel economy policy review)
  - Vehicle characteristics (CO₂/km, fuel economy, shares by powertrain & fuel type, power, weight, footprint, displacement)
  - Analysis linking key parameters and relating trends to the policy context
## Results

### Fuel economy - regions

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2008</th>
<th>2011</th>
<th>2013</th>
<th>2030</th>
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<tbody>
<tr>
<td><strong>OECD average</strong></td>
<td></td>
<td></td>
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<tr>
<td>average fuel economy (Lge/100 km)</td>
<td>8.9</td>
<td>8.4</td>
<td>7.8</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>annual improvement rate (% per year)</td>
<td>-2.1%</td>
<td>-2.5%</td>
<td>-1.9%</td>
<td>-2.2%</td>
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<td><strong>Non-OECD average</strong></td>
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<tr>
<td>average fuel economy (Lge/100 km)</td>
<td>8.5</td>
<td>8.5</td>
<td>8.4</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>annual improvement rate (% per year)</td>
<td>-0.1%</td>
<td>-0.4%</td>
<td>-1.2%</td>
<td>-0.5%</td>
<td></td>
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<tr>
<td><strong>Global average</strong></td>
<td></td>
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<tr>
<td>average fuel economy (Lge/100 km)</td>
<td>8.8</td>
<td>8.4</td>
<td>8.0</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>annual improvement rate (% per year)</td>
<td>-1.7%</td>
<td>-1.6%</td>
<td>-1.4%</td>
<td>-1.6%</td>
<td></td>
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<tr>
<td><strong>GFEI target</strong></td>
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<tr>
<td>average fuel economy (Lge/100 km)</td>
<td>8.8</td>
<td></td>
<td></td>
<td></td>
<td>4.4</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>-3.3%</td>
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</tbody>
</table>

- Absolute values are higher than in earlier assessments (LCV inclusion and WLTC), the on-road gap factor is lower (WLTC)
- The OECD still ahead of the non-OECD, but the gap is narrower (WLTC conversion stronger for markets focused on gasoline)
- The global improvement lower than earlier assessments
- Why WLTC? Acknowledgement to its future relevance
Results

Fuel economy – main markets

- Heterogeneous situation across markets
- Values influenced by income, fuel taxes, vehicle taxes, consumer preferences, policy context...
- OECD: both most efficient and least efficient markets
Results

Impacts of policies

Case 1

- stringent fuel economy regulations in place
- monetary incentives (feebate, differentiated vehicle taxation based on CO$_2$/km)

Example in the figure: France
Results

Impacts of policies

Case 2

- NO fuel economy regulations
- NO monetary incentives

- Example in the figure: Chile (prior to the reform of 2015)
Results

Impacts of policies

Case 3

- NO fuel economy regulations
- Monetary incentives as of 2010

- Example in the figure: South Africa
Results

Impacts of policies

- Ambitious policy frameworks can effectively improve fuel economy and limit carbon emissions of cars
- Fuel economy policies had little effect on the weight or size of vehicles
- Differentiated vehicle taxation demonstrated a good capacity to improve fuel economies, even in the absence of regulatory measures
- In the absence of policies, the tendency for most vehicle attributes (including fuel use/km is to stagnate)
Comparative results
Market segment

- Japan has the largest share of cars in the small segment, the United States is at the opposite end
- Small vehicles consistent with low fuel use (France, Italy...)
- Germany & India (same fuel use/km, very different segments) show that this is not the whole story
- Small segments tend to be coupled with lower weight
- Weight matters for fuel economy: fuel use is affected by inertial forces, but there is an influence of dieselization (comparatively heavier cars)
- Technology also matters: German cars much heavier than in India, but have similar fuel use
• Larger segments and higher weight tends to go hand in hand with larger power ratings to keep performances up
• North America & Australia: higher power rating than rest of the World
• Germany-India: similar FE, very different power: lower income tends to be coupled with lower performances
Comparative results

Footprint

- Exceptions exist for footprint: Germany & North America have similar footprints, not weight
- No surprises on Germany & India comparison
Comparative results

Insights on country clusters 1/2

OECD markets: two main clusters also in drivers

- Europe, Japan (on the low end for size, power, weight, footprint) – consistent with comparatively higher fuel and vehicle taxation, plus presence of feebate/differentiated vehicle taxes

- North America & Australia on the high end for the same characteristics – low fuel and vehicle taxes

- Germany and Korea main exceptions
  - Germany influenced by strong car industry with hi-tech profile and prices regional above average
  - Korea needs further investigation
Comparative results

Insights on country clusters

Emerging economies mostly between OECD clusters

- Thailand, Philippines, Mexico tend to be on the high-end for fuel use/km, weight, power and footprint
- Russia, China in a central cluster, between EU-Japan & North America
- Brazil and Indonesia closer to Europe for power, weight and footprint
- India has small and light vehicles (also the lowest income), leading to better fuel economy, but not on par with OECD vehicles having similar features – technology gap
Comparative results

Vehicle powertrain & fuel type

- Diesel matters (see the gap?): Europe, India, Korea and Thailand (pick ups) have the largest shares
- Hybrids most relevant in Japan, flex fuel mainly in Brazil
- Germany & India: about the same diesel shares (!), but...
Comparative results
Engine technologies

... engine and drivetrain technology shares higher in OECD:
- much higher shares of turbochargers in diesel-intensive countries
- higher penetration of 6 gears or more, earlier use of 4 valves
- larger share of hybrids and EVs (there is still a long way to go...)
Comparative results
Performances vs. fuel economy

- Cars in the non-OECD tend to have lower power, but also technology that is less up-to-date than in OECD markets (higher fuel consumption per kW)
- Brazil, India and Indonesia have the highest fuel use/kW
Country reports

Trends over time

- Fuel economy and CO₂/km
- Powertrain, weight, power, displacement, footprint

Example: Germany
Country reports

Trends over time

- Fuel economy by vehicle segment and powertrain

Example:
- Average fuel economy strongly influenced by small segments
- Narrowing fuel economy gap between hybrids and national average as hybrid share grows
Country reports

Fuel economy versus weight and footprint

- Values by model at different points in time, showing evolution of the diversity of the offer and changes over time

Example: market diversification in India

- Diversification resulted in improved fuel economy, but also led to weight and footprint growth
Country reports

Evolution of fuel economy, weight and footprint for major market segments

- Tendencies towards improved fuel economy, vs. stagnation, size shift, weight increases...

Example: weight increase in China

- Easier to shift up a class than to save fuel?
- CAFE standard in place since 2015 (Phase III)
Conclusions

- Confirmation of key trends (OECD improve faster than non-OECD), even with methodological revisions
- Market shifts (non-OECD growth in market share) are less beneficial for global average than assessed before
- Policies matter: both fuel economy regulations and differentiated taxation worked. Combined use was very effective (e.g. in France)
- Fuel prices have an impact on absolute values (OECD clusters, plus the case of Turkey)
- Monitoring matters (e.g. to understand policy formulation issues and revise strategies)
- The report provides a new format for future updates
- 2014-15 data analysis now ongoing: the next report will keep country insights ad will include an analysis of prices
Thank you!

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