Development of Fuel Economy Standards for Light Duty Vehicles in Sri Lanka

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10th June 2016
AN OVERVIEW

Transport Sector in Sri Lanka

- Dominated by road transport
- 110 billion passenger-km/yr
  - 95.0% road; 5.0% rail
- 7 million ton-km per year
  - 97.5% road; 2.0% rail; 0.5% water

Road Transport:

- Active fleet: 4.5 Million

- Annual fuel consumption: 2.7 million tons
- Average fuel economy: 0.025 litre/passenger-km
FUEL ECONOMY OF ROAD TRANSPORT

- Local Initiatives
  - Main interventions so far are primarily related to mitigation of air emission
    - Vehicle Emission Testing Programme
    - Fuel Quality Improvements
    - Fiscal measures.
  - Energy Efficiency / Fuel Economy
    - Awareness & education / Eco-driving
    - Baseline data collection (in progress)
    - Development of driving cycle (in progress)
    - Fuel economy labeling (proposed).
  - Technology shift in LDVs
    - Hybrid/Electric vehicles
    - Integrated EV to Solar PV (net metering)
    - Conversion of ICE to electric/hybrid (pilot testing).

Key Interventions proposed within urban development programs:
- Mass transit: BRT / Monorail
- Railway electrification
- NMT

Yet, the private vehicles would have dominant influence on the performance of the transport sector for the years to come.
FUEL ECONOMY OF ROAD TRANSPORT

- Local Initiatives
  - Emergence of Hybrid/Electric Vehicles
FUEL ECONOMY OF LDVs

Scope:

- Objective is to establish a baseline for the fuel economy of new passenger cars in the country
  - develop strategies and implement vehicle fuel economy policies,
  - supporting the regional and global tracking of the fuel economy performance towards 50by50 target set by GFEI.

Methodology: Main Steps – GFEI

Step 1: Establish the baseline year.

Step 2: Establish the data points that are required to collect for the estimation of a robust baseline.

Step 3: Find and evaluate available new car registration data sources.

Step 4: Calculate the average fuel economy and other characteristics for newly registered vehicles in the baseline year.

Step 5: Repeat the same exercise using uniform methodology at regular intervals (to derive annual average variations).
FUEL ECONOMY OF LDVs

- Methodology: Estimation of FE / GHG Emissions

  - Reported in international databases/ Manufacturers data:
    - Based on various test driving cycles (and different units)
    - Need to converted to a single test driving cycle (and same unit), for which conversion factors have been developed.

  - Units:
    - Fuel economy: l/100-km; mpg; MJ/km; km/l
    - GHG Emissions: gCO$_2$/km; gCO$_2$/mile

  - Driving cycles:
    - New European drive cycle (NEDC): EU, India, China, Australia
    - US Corporate Average Fuel Economy (US CAFE): US, Canada, South Korea, Mexico
    - JC08: Japan
    - World-wide Harmonized Light-duty Test Cycle (WLTC) is been developed.
FUEL ECONOMY OF LDVs

Methodology: Estimation of FE / GHG Emissions

Conversion formula:

[Adjusted fuel economy value] = [Original fuel economy value] × [Unit conversion] × [Test cycle multiplier].

Test cycle conversion factors:

<table>
<thead>
<tr>
<th>Conversion Factor</th>
<th>Test Cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NEDC-JC08</td>
</tr>
<tr>
<td>Test cycle multiplier (simple average)</td>
<td>1.15</td>
</tr>
</tbody>
</table>

Source: ICCT, 2007

Unit conversions in fuel economy and GHG emissions:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Standard A</th>
<th>Standard B</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel economy</td>
<td>km/l</td>
<td>mpg</td>
<td>B = A × 2.35</td>
</tr>
<tr>
<td></td>
<td>l/100 km</td>
<td>mpg</td>
<td>B = 235.2/A</td>
</tr>
<tr>
<td></td>
<td>CO₂ g/km</td>
<td>mpg</td>
<td>B = 5469/A(1)</td>
</tr>
<tr>
<td>GHG emissions</td>
<td>km/l</td>
<td>CO₂ g/km</td>
<td>B = 2325/A</td>
</tr>
<tr>
<td></td>
<td>l/100 km</td>
<td>CO₂ g/km</td>
<td>B = A × 23.2</td>
</tr>
<tr>
<td></td>
<td>mpg</td>
<td>CO₂ g/km</td>
<td>B = 5469/A(1)</td>
</tr>
</tbody>
</table>

Notes: (1) For diesel vehicles, B = 6424/A to reflect the higher carbon content of diesel fuel.
Source: ICCT, 2007
FUEL ECONOMY OF LDVs

- Data Requirement
  - **Main Information:**
    - Vehicle make and model, and if possible configuration,
    - Model production year & Year of first registration,
    - Fuel type and Engine size,
    - Domestically produced or imported,
    - New or second hand import,
    - Rated fuel economy per model and test cycle basis,
    - Number of sales by model.
  - **Main Sources:**
    - Local – DMT, Vehicle Importers; VET Project Office
    - Global – Vehicle manufacturers; Fuel economy data bases.
  - **Sample (Random selection - VET database during a year)**
    - Sample size = 16,825 (73% Gasoline; 27% Diesel)
    - 45 makes.
FUEL ECONOMY OF LDVs

- Characteristics of the Vehicles
  - Engine Capacities - Yearly average:

```
Year | Average Engine Capacity (cc)
---- | ----------------------------
2012 | 1400
2013 | 1800
2014 | 1700
2015 | 1900
```
FUEL ECONOMY OF LDVs

- Characteristics of the Vehicles
  - Annual average fuel economy of cars:

  ![Graph showing annual average fuel economy of cars from 2011 to 2015.]

  - Without Hybrid: Average FE = 6.5 l/100-km (Global Average = 7.1 l/100-km)
  - With Hybrid: Average FE = 5.6 l/100-km (15% Reduction)
FUEL ECONOMY OF LDVs

- Characteristics of the Vehicles
  - Annual average GHG emissions of cars:

> Without Hybrid: Average GHG Emissions = 160 g CO₂/km
FUEL ECONOMY LABELING

- Main Steps
  - Establish a representative driving cycle
  - Determine cycle conversion factor
  - Design format of the fuel economy label
  - Set fuel economy benchmarks for the energy labeling.

**Colombo Driving Cycle**

**Average Speed (km/h)**

- Time Proportion for Idling: 20.5%
- Time Proportion for cruising: 12.8%
- Time Proportion for acceleration: 36.1%
- Time Proportion for Deceleration: 30.7%

Expected to accomplish by mid 2017
CONCLUSIONS

- Use of cars in the country is on the rise, so does the average engine capacity.
- Still the ICE technology dominates, though use of hybrid/electric vehicles are emerging (16% of active fleet, surpassing diesel).
- Annual average fuel economy and GHG emissions of ICE cars in Sri Lanka are about 6.5 l/100 km and 160 g/km of CO₂.
- Use of hybrid vehicles has improved the fuel economy by 15%, indicating considerable potential for further improvements.
- Fuel economy labelling is expected to improve the energy efficiency in the transport sector.
- Improving fuel economy of vehicles would play a major role within broader interventions in sustainable city programmes.

Acknowledgements
- United Nations Environment Programme (UNEP)
- Global Fuel Economy Initiative (GFEI)
- Clean Air Sri Lanka
- Asian Development Bank (ADB)