Role of Energy Efficiency in the Transport Sector NDCs of Sri Lanka

Thusitha Sugathapala
Department of Mechanical Engineering
University of Moratuwa

06th June 2017
INTRODUCTION

- **Transport Sector in Sri Lanka**
  - Dominated by road transport
  - 140 billion passenger-km per year
    - 94.0% road; 6.0% rail
  - Contribute to 40% of the GHG emissions

- **Road Transport:**
  - Active fleet: 5.0 Million
    - 70% is 2W and 3W

% No. of Vehicles

<table>
<thead>
<tr>
<th>% No. of Vehicles</th>
<th>Public: 55.2% Private: 44.8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Cycles</td>
<td>51.1%</td>
</tr>
<tr>
<td>Three Wheelers</td>
<td>19.5%</td>
</tr>
<tr>
<td>Motor Cars</td>
<td>11.3%</td>
</tr>
<tr>
<td>Lorries</td>
<td>4.6%</td>
</tr>
<tr>
<td>Buses</td>
<td>1.0%</td>
</tr>
<tr>
<td>Dual Purpose Vehicles</td>
<td>7.2%</td>
</tr>
<tr>
<td>Land Vehicles</td>
<td>5.31%</td>
</tr>
<tr>
<td>Car + Dual Purpose Vehicles</td>
<td>23.8%</td>
</tr>
<tr>
<td>Rail</td>
<td>5.8%</td>
</tr>
<tr>
<td>Bus</td>
<td>49.4%</td>
</tr>
</tbody>
</table>
INTRODUCTION

- Demand Growth
  - About 2.5% annual growth is expected during next 15 years
  - Contribution from public transport is predicted to decrease continuously from 55% to below 50% by 2030
    - This will have adverse impact on overall energy efficiency and emissions in the transport sector.

Source: Megapolis Transport Masterplan 2016
TRANSPORT SECTOR NDCs OF SRI LANKA

▪ An Overview

- Intended Nationally Determined Contributions (INDCs)
  - As with other member countries of UNFCCC, Sri Lanka has consented to publishing its INDCs as a strategic document to contribute to the mitigate the rise of global temperature.
  - First version was submitted in October 2015, followed by an improved version in April 2015.
  - Subsequently, NDCs of Sri Lanka were prepared covering 14 sectors based on the Readiness Plan 2017-2019 for the Implementation of INDCs, and submitted in September 2016.
  - Transport is one of the key sectors.

- NDCs in the Transport Sector
  - A target of reducing GHG emissions by 10% against business-as-usual (BAU) scenario.
  - There are 11 categories of activities proposed, which are formulated under 8 strategic policy elements.
  - Covers all modes of transport: Road, Water/Sea and Air.
TRANSPORT SECTOR NDCs OF SRI LANKA

- Role of Energy Efficiency
  - **Key Strategies**
    - System-efficiency improvements,
    - Trip-efficiency improvements,
    - Vehicle-efficiency improvements.
  - **Key Interventions**
    - Policy, regulatory, institutional frameworks and information management,
    - Public/mass transport (Bus, Rail and Rapid Transit Systems),
    - Clean and Efficient Vehicle Technologies: Electric/Hybrid vehicles; railway electrification,
    - Vehicle emission standards / Fuel economy standards,
    - Non-motorized transport systems,
    - Inland water transport systems,
    - Transport demand management (use of ICT; avoidance/reduction)
ENERGY EFFICIENCY OF TRANSPORT

- Key Indicators
  - Expressed by fuel economy
    - Average fuel volume or energy per unit distance (l/100 km, MJ/km)
    - Average fuel volume or energy input per unit passenger-distance (l/100 passenger-km, MJ/passenger-km)
    - Could represent a certain class/category of vehicles/fleet or whole fleet/transport sector.
  - GHG Emissions
    - Based on the fuel economy, GHG emissions could also be estimated.
    - GHG intensity is expressed in mass of CO$_2$ per unit distance or per unit passenger-distance (g CO$_2$/km, g CO$_2$/passenger-km)
    - Average fuel volume or energy input per unit passenger-distance (l/100 passenger-km, MJ/passenger-km)
    - Simple relations are available for converting fuel economy to GHG emissions, which depend on the type of fuel (diesel / petrol).
ENERGY EFFICIENCY OF TRANSPORT

- Impacts of Hybrid Vehicles
  - Emergence of hybrid/electric cars in Sri Lanka

![Chart showing number of first registration by type of vehicle]

- Diesel
- Petrol
- Hybrid
- Electric

![Chart showing number of cars in the active fleet]

- 2013: 71.3% Petrol, 10.3% Diesel, 17.6% Hybrid, 0.8% Electric
- 2014: 71.3% Petrol, 10.3% Diesel, 17.6% Hybrid, 0.8% Electric
- 2015: 71.3% Petrol, 10.3% Diesel, 17.6% Hybrid, 0.8% Electric
- 2016: 71.3% Petrol, 10.3% Diesel, 17.6% Hybrid, 0.8% Electric

Source: DMT 2016
ENERGY EFFICIENCY OF TRANSPORT

- Impacts of Hybrid Vehicles
  - Performance trends of new cars registered

**Fuel Economy**

Fuel economy improvement in 2015
- New registrations: 14.4%
- Total active fleet: 6.6%

**GHG Emissions**

GHG emission reduction in 2015
- New registrations: 14.6%
- Total active fleet: 6.8%
ENERGY EFFICIENCY OF TRANSPORT

- Overall Impacts of NDCs (2020 to 2030)
  - Transport demand pattern

![Graph showing transport demand pattern from 2020 to 2030.]

- Public transport share is improved to maintain at 62%
ENERGY EFFICIENCY OF TRANSPORT

- Overall Impacts of NDCs (2020 to 2030)
  - Share of public transport

<table>
<thead>
<tr>
<th>Year</th>
<th>BAU Private</th>
<th>BAU Public</th>
<th>Mitigation Private</th>
<th>Mitigation Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>60%</td>
<td>40%</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>2025</td>
<td>60%</td>
<td>40%</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>2030</td>
<td>60%</td>
<td>40%</td>
<td>60%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Shift of passengers from private to public transport modes
2020: 5.6%; 2025: 7.4%; 2030: 12.4%
### ENERGY EFFICIENCY OF TRANSPORT

- Overall Impacts of NDCs (2020 to 2030)
  - Achievements by 2030

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Transport Demand (Billion Passenger-km)</th>
<th>Annual fuel demand (Million liters)</th>
<th>Fuel Economy</th>
<th>GHG Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>I/Passenger-km</td>
<td>MJ/Passenger-km</td>
</tr>
<tr>
<td>BAU</td>
<td>194.3</td>
<td>4738.4</td>
<td>0.024</td>
<td>0.95</td>
</tr>
<tr>
<td>Mitigation</td>
<td>187.0</td>
<td>3838.1</td>
<td>0.021</td>
<td>0.79</td>
</tr>
<tr>
<td>Improvements /Savings (%)</td>
<td>-</td>
<td>19.0</td>
<td>15.8</td>
<td>16.1</td>
</tr>
</tbody>
</table>
CONCLUSIONS

- The implementation of transport sector NDCs could result in considerable reduction in GHG emissions with respect to BAU scenario, even well above the stipulated target of 10%.

- However, successful implementation of the mitigation actions requires transformational change of the sector governance; particularly related to policy, regulatory, institutional frameworks and information management.

- The anticipated levels of stakeholder engagement and resource mobilization for the NDC Readiness Action Plan 2017-2019 is not visible yet; challenging the effective commencement of the implementation in 2020.

Thank You