Projections and Scenarios - Transport Sector

Shweta Srinivasan, Research Scientist
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Outline

• About CSTEP
• CSTEP’s Past Work in Low-Carbon (Transport) Pathways
• Ongoing Work – Desired Quality of Life Project
• Scope for Improvement
About CSTEP

Leading policy think tank
• Over 140 employees from sectors such as engineering, policy, economics, IT, and management
• Budget: USD 3.4 million; three offices in India
• Section 25 (Companies Act, 1956) Registration; FCRA
• Recognised as Scientific and Industrial Research Organization (SIRO) by MoST

Chairperson: Dr. V. S. Arunachalam
Executive Director: Dr. Jai Asundi
Past Work in Low-Carbon (Transport) Pathways
Long-Term Strategy for Low-Carbon Growth

Objectives:
• Project emissions up to 2050 by using energy modelling
• Assess ‘Peaking Year’ implications across scenarios
• Scenario analysis for 16 storylines on growth, energy access, clean energy transition, and sustainable urbanisation

Insights:
• Decoupling of energy demand and emissions owing to RE & EE
• Growth in rapid transport sector fastest under current policy scenario
  o Transport energy demand will grow 5X by 2050; can be halved with aggressive EV, PT, FE
• Power sector emissions will peak during 2035-45

Funder: MoEFCC
Decarbonisation Strategies for India’s Land Transport Sector

Objective: To assess land transport’s contribution to India’s Nationally Determined Contribution (NDC) target

• Under Sustainable Growth Working Group (SGWG) – NITI Aayog
• Advisory board comprising representatives from MoEFCC, BEE, MoRTH, and MNRE

Modelling Teams

- CSTEP, CEEW, IRADe, TERI

Knowledge Partner

- Pacific Northwest National Laboratory (PNNL)

Funder:

SSEF

CSTEP’s Model

National Model
TIMES-IMRT

Demands soft linked to CGE model
outputs/GDP-population drivers

Technology and modal share
data from IESS V2 & PPAC data

Modal share and technology share – based on ‘expert’ views; benchmarked constraints (e.g. EVs)

Can explore ‘what if’ scenarios and impact on energy demand and emissions
Decarbonisation Strategies for India’s Land Transport Sector

Change in Transport CO$_2$ Emissions in Ambitious Policy Scenario (2050)

<table>
<thead>
<tr>
<th>Reference emissions 2050 (million tonnes)</th>
<th>CSTEP</th>
<th>PNNL</th>
<th>CEEW</th>
<th>IRADe</th>
<th>TERI</th>
</tr>
</thead>
<tbody>
<tr>
<td>991</td>
<td>692</td>
<td>791</td>
<td>2389</td>
<td>1446</td>
<td></td>
</tr>
<tr>
<td>Electrification</td>
<td>-7%</td>
<td>-24.7%</td>
<td>-12.8%</td>
<td>-21%</td>
<td>-22%</td>
</tr>
<tr>
<td>Increased efficiency</td>
<td>-9%</td>
<td>-22.7%</td>
<td>-12.3%</td>
<td>-72%</td>
<td>-21%</td>
</tr>
<tr>
<td>Modal shift</td>
<td>-21%</td>
<td>-3.5%</td>
<td>-8%</td>
<td>-9%</td>
<td>-16%</td>
</tr>
<tr>
<td>Moderating demand</td>
<td>-10%</td>
<td>-11.4%</td>
<td>-10.6%</td>
<td>-19%</td>
<td>-10%</td>
</tr>
<tr>
<td>Alternative fuels</td>
<td>-6%</td>
<td>-13.2%</td>
<td>-8.8%</td>
<td>-16%</td>
<td>-8%</td>
</tr>
</tbody>
</table>
Sustainable Alternative Futures for India (SAFARI) Model

- **Simulation model** for India’s long-term energy, emissions, and resource implications of achieving development goals
- **System dynamics modelling** captures interlinkages
- **Transport interlinkages** are with buildings (urban form) and agriculture (biofuels) sectors

**Funders:** AfD; Pathways 2050
System Linkages

Passenger Demand
U1, U2, Intercity
Road Transport Demand

Urban 1 passenger-kilometres

Urban 2 passenger-kilometres

Intercity road passenger-kilometres

Road freight tonne-kilometres
Urban Form: Implications of Densification on Transport & Buildings

Densification or compact city development leads to reduced trip lengths and therefore lower transport demand, but what does it mean for the buildings sector energy consumption?

Urban passenger transport GHG emissions*

*includes direct tail-pipe GHG emissions from passenger vehicles in urban areas.

Embodied emissions from buildings**

**includes emissions from producing construction materials like cement, steel, etc., as well as from operational energy (electricity generation)
Energy and Emissions Implications of Road Transport

Final energy demand

- Current policies
- Electrification
- Integrated policies

Direct GHG emissions

- Current policies
- Electrification
- Integrated policies
Trade-offs

- National policy on biofuels 2018 - 20% ethanol blending target by 2030
- Reduced area under sugarcane affects ethanol production and blending % achieved, unless 2G technology picks up
Scope for Transport Model Improvement

• Ongoing under SPIPA project funded by EU (GiZ)
  • Transport Modal Choice
    • MESSAGE ix Vehicle Choice Modal Methodology (TCO; Urban Travel Behaviour)
    • Cost and price sensitivities to inform modal choice under various scenarios

• Net-Zero Implications & Carbon Budgets (WRI)
  • Transport, Industry, Power
  • Using CGE-SAFARI Model
Scope for Transport Model Improvement

• Potential Plug-Ins
  • Economic impacts of EV transition
    • GDP growth, implied costs of travel (affordable mobility), impact on allied economic sectors
  • Techno-economic & modelling assessment for H₂ use in aviation, buses, freight
  • Soft-linking regional and city-level technology and policy plans
Thank You

shweta@cstep.in