Electric Vehicle Scenarios for India

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Key Interventions

National Level

- Case Study of mega infrastructure / dedicated Rail Freight Corridor
- Fuel Efficiency Policy Study
- Macro Indicators of Low Carbon Transport
- Adaptation Framework for Climate Proofing
- Integrated Assessment of the Transport Sector up to 2050

City Level

- Case Studies of Urban Transport Technologies - Metro, BRT, NMT
- Sustainability Indicators for Urban Transport Planning
- Methodology for Development of Low Carbon Comprehensive Mobility Plans
- Toolkit on Low Carbon Comprehensive Mobility Plans

Transport Action Plan

- Development of Project Proposals - technology and financial packages for implementation of action plans

Networking and Information Sharing (Workshops, website, publications, case studies)

Completed activity  
ongoing activity  
Target activity for 2012/13
Decomposing CO2 Reductions

Emission Identity

\[ \text{CO}_2 \text{ from Transport} = \text{No of Trips (No)} \times \text{Modal Share (\%)} \times \text{Average Distance (km)} \times \text{Energy Intensity (Energy/km)} \times \text{Emission Intensity} \]

- **Demand Side**
  - ICT, CP
  - BRT/Metro
  - Land Use
  - Car Size
  - Renewable

- **Supply Side**
  - Conventional Strategies
    - Hybrids/EV
    - Coal+CCS

**2°C Stabilization with Sustainability**

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Scenario Framework

**Base (BAU) Scenario**
- GDP – 8% CAGR
- CO₂ – 3.6 deg C

**Sustainable Scenario**
- GDP - Pegged to 8% CAGR
- CO₂ – 2 deg C

**Sustainable Urban Mobility**
- i. Public Transport
- ii. NMT
- iii. Urban Planning and design
- iv. ICT Navigation

**Sustainable Inter City Mobility**
- i. Upgrading existing Rail
- ii. Electrification of rail
- iii. High Speed Corridor

**Sustainable Fuels & Vehicles**
- i. Fuel Efficiency
- ii. Bio-fuels
- iii. Electric Vehicles

**Sustainable Logistics**
- i. Dedicated Freight
- ii. Coal by wire
- iii. Pipelines

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Trends in Personal Vehicle Ownership

Source: Census of India, 2011
PM10 levels in Indian cities (2001 and 2011)
Integrated Modeling Framework

DATABASES
Socio-Economic, Technologies, Energy Resources, Environment

AIM CGE/GCAM

ANSWER-MARKAL Model

Modal Choice Model

End Use Demand Model

AIM (SDB) (Strategic Database)
Drivers: Population, Urbanization and GDP growth

Figure 9. Rural urban population transitions

Figure 7. GDP Growth Rate Future
Figure 10. Projected Vehicle Ownership for two wheelers and cars
National Policies and Programs

• India’s Climate Change Plan (INDCs)
  – focuses on vehicle efficiency and clean fuel use

• The ‘Faster Adoption and Manufacturing of Hybrid & Electric Vehicles’ in India (FAME India), a scheme formulated as part of the ‘National Electric Mobility Mission Plan 2020 (NEMMP)’,
  – to promote faster adoption and manufacturing of hybrid and electric vehicles in the country by providing incentives.

• ‘Vehicle Fuel Efficiency Program’
  – with effect beginning in April 2016, sets the efficiency targets for new cars.
National Electric Mobility Mission Plan

• **Demand side incentives** - focused to create demand through incentivizing consumers.

• **Supply side Incentives** - focus to create supply of affordable vehicles into the market.

• **R & D** – focus to create technology capability to achieve localization and domestic manufacturers.

• **Charging Infrastructure** - focus to create conducive environment for mass adoption of Electric Vehicles.

• **Pilot projects** - focus towards creating awareness, kick start adoption, test market condition, developing conducive business models and product feedback from customers.

• Estimated fuel savings of 2.2 – 2.5 million tonnes, Substantial lowering of vehicular emissions and decrease in carbon dioxide emissions by 1.3%-1.5% in 2020 compared to the status quo scenario.
Range of Battery Types, Energy and Price

Bruce et al., 2012; Shukla et al., 2014
Challenges for EVs in India

- Testing and certification
- Vehicle Servicing
- High capital cost and Financing
- Electricity quality
- Market for electricity storage
- Consumer perceptions
- Raw Materials for batteries

- Taxation of vehicles and components
- Subsidies on fossil fuels
- Electricity tariff policies

- Efficiencies of batteries
- Driving range of EVs
- Charging time
- Safety
- Environmental Impacts

- Charging infrastructure
  - Smart Grids
  - Battery recycling
  - Dedicated lanes for EVs

- Market
- Technical
- Policy
- Infrastructure

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Scenario Architecture

EV Scenarios

- **BAU**
  Follow existing trends in socio-economic transitions

- **EV Scenario**
  Strong policy support for EVs which improves the competitiveness of EVs

- **EV plus 2 degree C Scenario**
  Considers both a policy push for EVs and a carbon price
Modal Shares of EV in 2 wheelers and cars

- Share of Electric and Hybrid 2 wheelers
- Share of Electric, Hybrid and Fuel Cell 4 wheelers

BAU, EV Scenario, EV + 2 deg C
Energy Demand and Fuel Mix for Electricity

Energy Demand (Mtoe)

- 2010: BAU 100, EV Scenario 110, EV + 2 deg C 120
- 2020: BAU 150, EV Scenario 160, EV + 2 deg C 170
- 2030: BAU 200, EV Scenario 210, EV + 2 deg C 220
- 2040: BAU 250, EV Scenario 260, EV + 2 deg C 270
- 2050: BAU 300, EV Scenario 310, EV + 2 deg C 320

Electricity Output 2035 (Twh)

- BAU: Coal 3500, Gas 2500, Renewables 1000, Nuclear 500, Other 0
- EV Scenario: Coal 3300, Gas 2400, Renewables 1100, Nuclear 600, Other 0
- EV + 2 deg C: Coal 3100, Gas 2300, Renewables 1200, Nuclear 700, Other 0

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CO\textsubscript{2} Emissions in different EV scenarios

- BAU
- EV Scenario
- EV + 2 deg C

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PM2.5 Emissions in different EV scenarios

- BAU
- EV Scenario
- EV+2 deg C
Key Findings

• Given India’s large growing 2-wh market, there exists a significant potential for scaling up electric two-wheelers.
• Opportunity to develop domestic industry and emerge as a major player in the global market.
• Financial support, incentives and infrastructure can increase the share of EVs.
• EV policies supported by carbon price increase competitiveness of EVs compared with conventional vehicles and can result in rapid diffusion.
• Significant air pollution reduction in near and medium term.
• Shift away from oil and contribute to energy security.
• If electricity is decarbonized, EVs can also be a significant option for CO₂ mitigation.
Thank you
• Resources

  • Project Website
    www.unep.org/transport/lowcarbon

Reports Referred


  • Dhar, S., Pathak, M., & Shukla, P. R. 2015. Transport Scenarios for India: Harmonising Development and Climate Benefits: UNEP DTU Partnership, Technical University of Denmark