Macro Considerations for Low Carbon Mobility Plan

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Presentation Agenda

1. Low Carbon Mobility: Framing
2. Mapping Low Carbon Mobility Options
3. Macro Indicators for Sustainable LCMP
4. LC Methodology: Stepwise Approach
Low Carbon Mobility: Framing
Low Carbon Mobility: Framing

- **Avoid Lock-ins**
  - Transport
  - Energy
- **Co-benefits**
  - Energy Security
  - Air Quality
  - Water Security
  - Social Value of Carbon

### Demand Side

- No of Trips (No)
- Modal Share (%)
- Average Distance (Km)
- Energy Intensity (Energy/Km)
- Emission Intensity (CO2/Energy)

### Supply Side

- 450-C: Conventional (Developed World)
- EV
- Coal + CCS

**CO2 from Transport**

- 2°C Stabilization with Sustainability

- ICT
- BRT/Metro
- Land Use
- Modal Shift
- Renewable
What do we mean by Low Carbon?
Global Climate Stabilization Target

UNFCCC Negotiations
2°C Temperature Stabilization Target

IPCC Representative Concentration Pathways (RCPs)

Emission Paths for RCPs

Available online (August 2011)
in ‘Climatic Change’, Springer

Ref. Krieger et. al. 2010
Ref. Edmonds, 2010
GDP, Energy, Emissions: Indian Scenarios

**GDP (GDP in 2005 = 1)**

- **Low Growth**
- **Medium Growth**
- **High Growth**

**Primary Energy**

- **High Growth**
- **Medium Growth**
- **Low Growth**

**GDP/capita (US $2005)**

- **Low Growth**
- **Medium Growth**
- **High Growth**

**Carbon Emissions**

- **High**
- **Medium**
- **Low**

**Typical LCS Trajectory**
Mapping Transitions

• Demographic Transitions
  – Age, Gender, Urban/Rural, Education/Skills

• Income
  – Growth, Distribution

• Infrastructures
  – Modes, Investment, Ownership

• Technologies
  – Efficiencies, IPRs, Domestic vs. Foreign

• Governance/Institutions
  – Market Orientation, Global Interfaces, Effectiveness
Influencing Transitions

**Socio-Economic**

- Income Distribution (Equity, Welfare)
- Cooperation vs. Competition
- Co-benefits; Discount Rate

**Behavioral**

- Consumption (Awareness, Policies)
- Conservation (e.g. 3R)

**Instruments**

- Market / Non-Market
- Direct / Indirect
Coordination

Policies (e.g. Technology)
- Infrastructures
- Vehicles
- R&D
- Domestic Industry

Gaining co-benefits
- CO2 and Air Quality
- Energy Security and Low Carbon Energy

Global Carbon Price vs. Social Value of Carbon
- Aligning Global Carbon Markets and National/Local Objectives
- Project Investment: What Carbon Price & Discount Rate?
Mapping Low Carbon Mobility Options
Sustainable Low Carbon Transport: National Level Assessment Methodology

Soft-Linked Integrated Model Systems (SLIMS)

DATABASES
Socio-Economic, Technologies, Energy Resources, Environment

GCAM-IIM/AIM CGE

ANSWER-MARKAL Model

AIM ExSS

Scenario Database

Sustainable Transport Indicators Database

Transport Model

Transport Demand Model

Transport Database
Infrastructure Alternatives: Coal by Wire

Composition of Railway Freight Traffic (%): 2010

- Coal: 44%
- Iron Ore, Steel & Pig Iron: 3%
- Cement: 5%
- Foodgrains: 5%
- Fertilizers: 4%
- Petroleum Oil Lubricants: 8%
- Container Service: 21%
- Others: 10%
Japan will provide technology and financial support for Delhi-Mumbai Industrial Corridor (DMIC) to be developed similar to Tokyo-Osaka corridor for Rail transport.

DMIC will result in substantial and sustained reduction in GHG since rail will replace road transport along this corridor.

Legend
- Major Cities
- Proposed DMIC
- Konkan Railways
- Broad Gauge Railway Line

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Transport Transitions: Historical Lock-ins

Figure 15.11: Relationship between GDP per capita and motorised modal share

Source: UITP, 2006 (Courtesy of SYSTRA)
City Planning: Co-benefits

Ahmedabad City: Pop. In 2010 - 5.5 Million

Per Capita CO2 Emissions (Ton)

Co-benefits: Transport Transitions

Co-benefits: Water per capita (ML/million)
Macro Indicators for Low Carbon Mobility
Sustainable & Low Carbon Transport

1. Inclusiveness

2. Co-benefits (by aligning ‘development and climate’ goals)

3. Long-term (Intergenerational) Perspective
   • Avoid Lock-ins (or irreversibility)
   • Social Discounting
# Macro Indicators of Low Carbon Transport

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<td>Operational Efficiency of Transport Infrastructure</td>
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**Technical**
- Vehicle (fleet) Energy & Emissions Efficiency
- Carbon Content of Electricity
- Transport demand substitution
- Operational Efficiency of Transport Infrastructure

**Meta/Strategic**
- Sustainable Urban Form and Structure
- National Logistics Grid
- Investment in Transport Sector Innovations
Air Quality Co-benefits of LCS

![Graph showing co-benefits of SO2 emissions with different scenarios: Base Case, Conventional Path + High Carbon Price, Sustainable Development + Low Carbon Tax. The graph plots SO2 emissions in Million tSO2 from 2000 to 2050.](image-url)
Energy Security Co-Benefits of LCS

Energy Mix in 2050

Total Energy Demand (Mtoe)
- Base: 2825
- LCS_CT: 2945
- LCS_SS: 2207
LCS with Lower Social Value of Carbon

Analysis with ANSWER-MARKAL Model
LC Methodology: Steps
Low Carbon Mobility Roadmap: Method

1. **Time Frame** (Year 2030/ 2050/ 2100)
2. **Decide Carbon Target** (Carbon Price Profile)
   i. City Level
   ii. Sector level
3. **Macro Data Inputs** (Drivers)
   i. Demographic (Population, Labour Force)
   ii. Economic (Income, Sector Output)
4. **Indicators**
5. **Outputs**
   i. Mobility Demand
   ii. Modes (Infrastructure)
   iii. Land-use
6. **Finance**
   i. Aggregate
   ii. Project Level
7. **Institutional / Implementation**
Low Carbon Mobility Plan

Ahmedabad 2035
Total travel demand (billion passenger km) : 53.3
- Modal Share
  - Public Transport: 21%
  - Non-motorized: 36%
  - Other modes: 43%

Mobility Module

Inputs
- Economic output from Household, Industry and Commercial sector
- City Development Plans
- National Development Plans
- Labour input for different sectors

Outputs
- Demand for mobility
- Modal shares
- Infrastructure needs
- Traffic speed

Model Framework
- Land use transportation model
Low Carbon Mobility Plans for Cities

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