

Technology Options for Mitigation of Energy Emissions in Indian Residential and Transport Sectors

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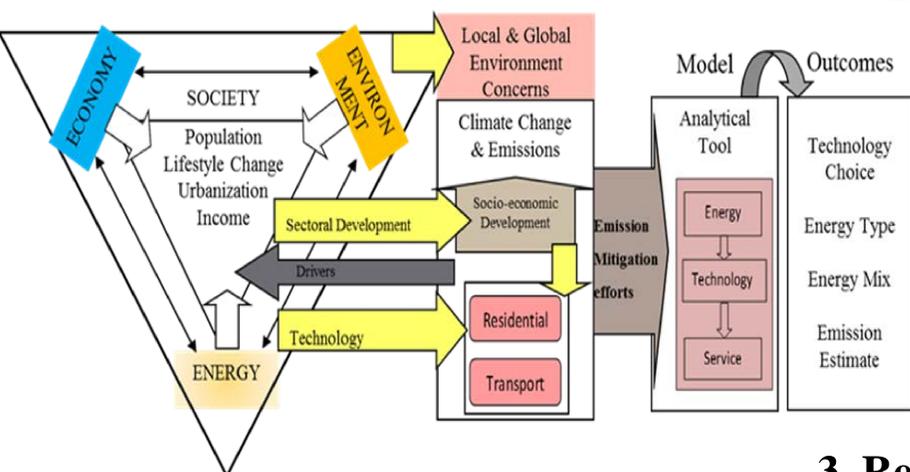
1. Background

Technology options in combination with choice of energy sources are the key factors to analyze energy related emissions from India. In recent years, technology choices, especially in residential and transport sector of India, have attracted the attention of policymakers because of their ability to mitigate emissions. People have also become interested in adopting new technologies because of increasing purchasing power and fast developments in technology. Technology choices, both on the demand and supply sides, have become an important part of India's future energy solutions. This research focuses on mitigation of energy emission via technology options in Indian residential and transport sector.

In this research a bottom-up linear optimization modelling tool 'AIM/Enduse' is used to analyze the technology selection within the system. A detailed database of technologies for Indian residential and transport sector is also prepared for the analysis using AIM/Enduse model. Energy technology perspective, presented in this research, demonstrates that low carbon future and renewable sources are also powerful tools for enhancing energy security and economic development.

In the present work, to reduce the CO₂ emission from both the sectors, four scenarios are described.

2. Methodology



Broad Assumptions/Projections

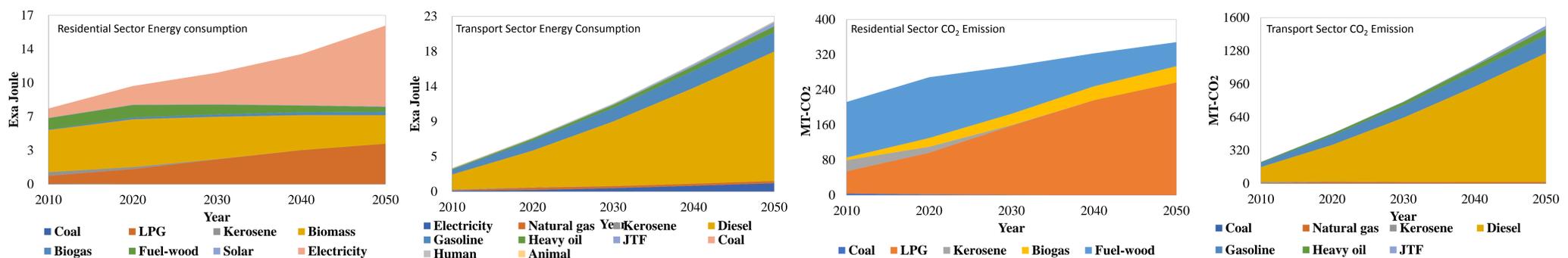
- Service demand**: GDP, household, Population, Urbanization, motorization, disposable income, etc.
- Population**: Year 2000 – 2/3 rural, Year 2050 – 2/3 urban
- Household**: Combined to nucleated shift
- Fuel availability**: Unconstraint (available at any cost upto 2050) except: Solar, Human power
- Price of Fuel**: Increased over the period
- Economy**: Economy will follow the path of developed country

Scenario Description

- Business as Usual**: BaU scenario for future emission projections assumes continuation with present trend.
- Constraint on Carbon**: 30% CO₂ emission reduction
- Taxes on Carbon**: Energy and emission taxes are applied with assumption to shift towards efficient and cleaner technology
- Renewable Energy Technology**: energy and emission taxes along with subsidy on renewable energy technology.

3. Result & Conclusion

The scenario analysis results show that when taxes on carbon emission and fuels are imposed, the transport sector shoulders higher burden to mitigate CO₂ emission. Whereas on applying taxes along with subsidies and promotion to renewable technologies, the burden of emission reduction shifted to residential sector from transport sector. This is due to penetration of renewables in residential as compared to transport sector. Meanwhile increasing the taxes on transport fuels (mainly gasoline and diesel) and development of public transport infrastructure will reduce the registered number of vehicle and CO₂ emission too.



It is being reported everywhere that coal plays the dominant role in energy whereas in residential and transport sector coal consumption is declining.

Major Findings & Contribution

- Energy**
 - Due to change in lifestyle
 - Commercial fuels : electricity, natural gas, renewables, etc.
 - Conventional fuels: bio-mass, wood, charcoal, cow dung
 - LPG and Electricity: Main source of energy
 - Kerosene & Coal: Decline its share by 2030 & 2020.
 - Solar Energy: increases with subsidy
 - Diesel and gasoline: increases in BAU, decreases slightly in RET. Decrease in both these fuels is due to introduction of bio-diesel and promotion of cycling and walking.

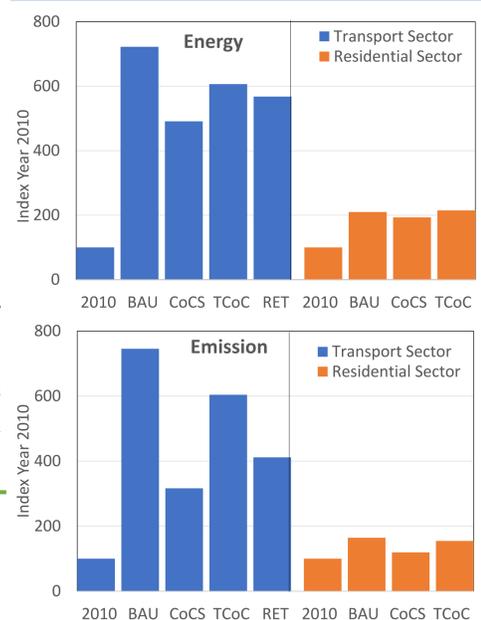
Emission
Residential sector: 2 times
Transport sector: 8 times

Policy contribution

- Blending bio-diesel in diesel will reduce the emission by 10%.
- Subsidies on renewable energy technology alone will promote people to procure these technologies.
- Promoting people for walking and cycling and towards public transport will improve the traffic congestion, reduce the demand of petrol and diesel as well as local emission and health of people from walking and cycling.

Technology

- Residential Sector**: CFL, LED, Solar water heater, 3- 5 star rating appliances
- Transport sector**: Walking, cycling, bio-diesel, public transport



5. Future Target

The extension of the present work will enhance the study of Residential Sector Energy and Emission profile in 18 (rural and urban) provinces in India. In the present study the service demand for the cooking in residential sector has been assumed to rise with increase in number of household and shift towards commercial cooking with lifestyle changes has not been considered. The lifestyle changes with shift in food consumption habits from indoors to outdoor at hotels and restaurants, would lead to reduction in energy consumption and emissions from residential sector for further reduction possibilities in energy consumption and emission can be explored.

