REGIONAL DISPARITIES IN ENERGY USE AND ACCESS ACROSS HOUSEHOLDS IN INDIA

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Presented at the 26th USAEE/IAEE Annual North American Conference, Ann Arbor, Michigan

25 September 2006
Outline of the Presentation

• Background
• Introduction
• Data
• Methodology
• Results
• Conclusion
Background and Motivation

- There are large regional variations in geography, climate, socio-economic development levels and living standards across States in India.
- Recent high rates of economic growth and development have not affected different sections of the population or different regions uniformly.
- Differences in income and poverty levels across States have been analyzed extensively but relatively little has been done on studying differences in access and consumption to energy and other infrastructure across States.
- Understanding the causes of such variations has also received relatively little attention in the literature.
## Economic Growth Rates and Urbanization Across States

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>9445</td>
<td>3.8</td>
<td>26.8</td>
<td>27.1</td>
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<tr>
<td>Bihar</td>
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<td>0.8</td>
<td>13.1</td>
<td>10.5</td>
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<td>Gujarat</td>
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<td>4.6</td>
<td>34.5</td>
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<td>24.6</td>
<td>29.0</td>
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<td>30.9</td>
<td>34.0</td>
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<td>4.7</td>
<td>26.4</td>
<td>26.0</td>
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<td>23.2</td>
<td>26.7</td>
</tr>
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<td>Maharashtra</td>
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<td>4.6</td>
<td>38.7</td>
<td>42.4</td>
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<td>Orissa</td>
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<td>1.0</td>
<td>13.4</td>
<td>15.0</td>
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<td>Punjab</td>
<td>14809</td>
<td>2.5</td>
<td>29.6</td>
<td>34.0</td>
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<td>Rajasthan</td>
<td>8555</td>
<td>3.4</td>
<td>22.9</td>
<td>23.4</td>
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<td>Tamil Nadu</td>
<td>12167</td>
<td>5.4</td>
<td>34.2</td>
<td>43.9</td>
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<td>Uttar Pradesh</td>
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<td>2.1</td>
<td>19.8</td>
<td>20.8</td>
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<tr>
<td>West Bengal</td>
<td>9320</td>
<td>5.0</td>
<td>27.5</td>
<td>28.0</td>
</tr>
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</table>

Source: Census of India and CSO
Percentage of Households with Electric Lighting

Source: Census of India 2001
Percentage of Households Using Liquid or Gaseous Commercial Cooking Fuels

Source: Census of India 2001
Variations in Access and Consumption of Energy Across Rural and Urban Sectors

Per Capita Useful Energy Consumption in 1999-00

Percentage Users in 1983 and 1999-00
Introduction – Measuring Energy Poverty

• Measurement at the disaggregate household level

• Dynamic assessment – data from large household surveys, conducted every 5 years for last decade and a half analysed

• Two dimensions captured:
  – Access to energy sources
  – Actual energy use or consumption of energy
Data Sources

• Housing tables from the Census of India, 2001.
• Unit level data from the National Sample Survey Organisation’s (NSSO) Household Consumer Expenditure Survey for the following Rounds –
  – Round 38 for the year 1983
  – Round 43 for the year 1987-88
  – Round 50 for the year 1993-94
  – Round 55 for the year 1999-00
• Data on other socio-economic indicators at the State level from the Central Statistical Organisation (CSO)
• Estimates of State level consumption of Dung for cooking energy from Ravindranath and Hall (1995)
## Methodology – Energy Access-Use Matrix

<table>
<thead>
<tr>
<th>Access</th>
<th>Use (useful energy)</th>
<th>Less than 0.5 GJ/capita</th>
<th>0.5-1.0 GJ/capita</th>
<th>1.0-2.0 GJ/capita</th>
<th>More than 2.0 GJ/capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass and Kerosene</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity, Biomass and/or Kerosene</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPG, Electricity and possibly others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Pachauri et al., 2004
Results
Changes in Share of Biomass Users

RURAL

URBAN
Changes in Share of Kerosene Users

RURAL

URBAN
Changes in Share of Electricity Users

RURAL

URBAN
Changes in Share of LPG Users

RURAL

URBAN
Access to Modern Energy Across States in 1999-00

Percentage with access in 1999-00

- **Bihar**
- **Orissa**
- **West Bengal**
- **Uttar Pradesh**
- **Rajasthan**
- **Madhya Pradesh**
- **Kerala**
- **Andhra Pradesh**
- **Tamil Nadu**
- **Karnataka**
- **Maharashtra**
- **Gujarat**
- **Haryana**
- **Punjab**

**Electricity**

**LPG**
Shifts in Patterns of Consumption

[Graph showing shifts in patterns of consumption with energy consumption in MJ per capita from 1983 to 2000 for rural and urban areas.]
Shifts Across Consumption Segments
Changes in Energy Poverty Levels Across States

[Bar chart showing energy poverty levels across different states from 1983 to 1999-00.]
Changing Divergence in Access Levels Across States

Regional divergence in change of access to electricity for rural areas – States in order of level of electrification

Regional divergence in change of access to LPG for urban areas – States ordered by degree of LPG access
## Increasing Inequality in Consumption Across States

State Growth Rate in Total Useful Energy Relative to India Growth Rate 1983-1999

<table>
<thead>
<tr>
<th>State</th>
<th>RURAL</th>
<th>URBAN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Poor States</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BHR</td>
<td>-0.41</td>
<td>-0.27</td>
</tr>
<tr>
<td>ORS</td>
<td>-0.24</td>
<td>-0.03</td>
</tr>
<tr>
<td>MP</td>
<td>-0.29</td>
<td>-0.02</td>
</tr>
<tr>
<td>RAJ</td>
<td>0.41</td>
<td>-0.02</td>
</tr>
<tr>
<td>UP</td>
<td>-0.20</td>
<td>-0.02</td>
</tr>
<tr>
<td><strong>Middle States</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AP</td>
<td>0.07</td>
<td>0.10</td>
</tr>
<tr>
<td>KRT</td>
<td>-0.05</td>
<td>-0.01</td>
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<tr>
<td>KER</td>
<td>0.04</td>
<td>0.11</td>
</tr>
<tr>
<td>WB</td>
<td>-0.07</td>
<td>-0.07</td>
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<tr>
<td><strong>Rich States</strong></td>
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<td></td>
</tr>
<tr>
<td>GUJ</td>
<td>-0.04</td>
<td>0.03</td>
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<tr>
<td>HAR</td>
<td>0.28</td>
<td>0.11</td>
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<tr>
<td>MHR</td>
<td>-0.01</td>
<td>0.02</td>
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<tr>
<td>PUN</td>
<td>0.32</td>
<td>-0.07</td>
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<tr>
<td>TN</td>
<td>0.18</td>
<td>0.28</td>
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</table>
Energy-Expenditure Relationship Across States

RURAL for 1999-2000

URBAN for 1999-2000

The diagrams show the relationship between real expenditure in Rupees per capita and useful energy in M.J per capita for rural and urban areas across different states for the year 1999-2000.
Relationship Between Electric Lighting and the HDI

Census of India 2001 and UNDP 2003
Conclusions

• Significant regional variations in access and consumption of energy across states
• Differences in expenditure levels explain some of the regional variations but other factors seem to contribute to the variation as well
• States with higher proportions of their populations lacking in modern energy also on average have a lower score on other developmental indicators like the HDI
• While states with lower levels of access to modern energy have performed better on average in increasing access over the period 1983-99, their initial levels of access were so low that they still have not caught up with other better performing states
• The gap in useful energy consumption appears to be widening across states and this mirrors the increasing disparities in state domestic products and incomes
EXTRA SLIDES
Shifting Percentages of Users

[Graph showing the percentage of users for different energy sources in rural and urban areas, with states labeled such as AP, MH, etc.]

- Wood 1983
- Wood 1999
- Kerosene 1983
- Kerosene 1999
- Electricity 1983
- Electricity 1999
- LPG 1983
- LPG 1999

Major States: AP, MH, TN, UP, WB, etc.

RURAL

URBAN