Policies for transformative change: Insights from the Global Energy Assessment

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Starting points

- Challenges
  - Need to meet multiple objectives and to do so simultaneously and not sequentially – transformative change required
  - Incumbency, legacy infrastructure and legacy policies
- Large-scale transitions are complex and messy and involve multiple actors and changes at many levels
- Innovation in the broadest sense – not only technologies, but policies and business models
Multi-level perspective on technology change

Technology-based regime

Technology System

Technology Product / Process

New business, developing institutions, governing organizations, involvement of banks, defined market, complementing applications

Increase in infrastructure, complementing technologies, defined application area

Changes in end-use, in one application area, environmental benefits
Switch to CNG in Mumbai and Delhi

Transition to low-carbon intensity in transport sector

Policy stage

Use stage

Outcome
(Environmental benefits, market, technology)

Decision making

Ancillary infrastructure

Requires and involves technology, systems and regime

Public perception

Regulators

Individual decision

Decision making

Ancillary infrastructure

Requires and involves technology, systems and regime

Individual decision

Outcomes
(Environmental benefits, market, technology)
Determinants of change

Technology and technology System
- Fuel availability
- Engine retrofit technologies

Policy and standardization
- Fuel use policy
- Inspection and maintenance
- Retrofit standardization
- Interventions by courts

Developing institutions, markets
- Infrastructure companies
  - User benefits
  - Development of small businesses
  - Increasing investments

Technological regime around transport fuel

Societal benefits
- Lower vehicular pollution
  - Health benefits
Actors and policies interact in a complex manner

**Pre-Policy**
- Citizens’ PIL
- GAIL’s first set up in 1992
- MoEF - NAQS

**Stage 1: Policy**
- MoPNG/GAIL
- GoD-NCR
- MoEF
- MoST
- Courts
- BIS/IPP
- MoF

**Stage 2: Use (Ancillary infra)**
- Inception of IGL
- Importers of CNG kits
- Cylinder mnfgs (PSU)
- Taximen’s Association (HM)
- 3-wheeler operators’ assotn
- ARAI/IPP (CNG use, dispensing and storage standards)
- OPCs (COCO stations)
- RTO PUC checks
- DTC, TELCO, AL
Multi-actor networks in a socio-technical regime
Waste-to-energy socio-technical regime in the dairy sector
Biomass-based grid-connected RE

![Diagram showing the interconnectedness of various entities in the context of biomass-based grid-connected renewable energy systems.](image)
The interaction of energy and non-energy policies: Differential growth in wind energy in India
Implications for policy design

• “Safe spaces” for experimentation
  • Often, heterogeneity is good, and blind adherence to “best practices”, “scalability” and “replicability” may be counter-productive
• Integration and linkage within the energy sector and between energy and non-energy policies is important
• Co-benefits allow for the engagement of different (and multiple) actors and different (and multiple) entry points for change
• Finding options that avoid conflicts while leveraging synergies
  • The density conundrum – a denser urban form that reduces vehicle miles traveled may be good for mitigation, but climate resilience might require open spaces for management of storm-water
• Overcoming barriers for transformation
  • Legacy infrastructure in the developed world and under-investment in public infrastructure and uneven, unplanned growth in the developing world
## Supporting policy formulation: Identifying and assessing multiple benefits

<table>
<thead>
<tr>
<th>Energy option</th>
<th>Access</th>
<th>Energy Security</th>
<th>Health</th>
<th>Environment</th>
<th>Climate change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Efficiency</strong></td>
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<tr>
<td>Buildings (residential public and services)</td>
<td>Access to higher energy service levels from same budget and production capacity through efficiency</td>
<td>Reduced needs for imports due to saved energy; more resilient energy systems from building-integrated distributed generation</td>
<td>clean/efficient cooking; lower respiratory infectious morbidity in well-ventilated buildings; reduced noise exposure</td>
<td>Reduced energy-related emissions from saved energy; both local and regional</td>
<td>Reduced GHG emissions: CO2 from saved energy, non-CO2 from less cooling; more climate and heat resilience: adaptation gains</td>
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<td><strong>Systems and grids</strong></td>
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<td>Advanced Electricity and Gas systems (possibly Hydrogen in future)</td>
<td>Inexpensive and more linked systems provide easier access. Distributed generation provides access where needed</td>
<td>Smart systems provide redundancy through rapid deployment of energy, and enhanced use of alternatives. Microgrids offer autonomy, stability, flexibility</td>
<td>Smart systems are more efficient reducing air pollution from sources</td>
<td>Smart systems reduce overall need for energy with less environmental impact. Can assimilate large amounts of variable RES</td>
<td>More efficient, use less energy and produce fewer GHGs</td>
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<td><strong>Supply</strong></td>
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<td>Coal (with and without CCS and biomass)</td>
<td>Can provide the initial energy for access in many countries as most ubiquitous fossil</td>
<td>Coal and biomass are geographically rather equally available; can be imported easily</td>
<td>Health impacts through mining and burning-related emissions</td>
<td>Large particulate and other emissions, including radioactive; damages through mining</td>
<td>Highest specific emissions without CCS; CCS enables CO2-free power; with biomass can have negative emissions</td>
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<td>Natural gas</td>
<td>provides access to more energy services if available locally</td>
<td>Might reduce reliance on other imported energy if available locally; more equally distributed than oil</td>
<td>Little or no impact due to relatively perfect combustion</td>
<td>Lower emissions than other fossil fuels</td>
<td>Lower emissions than other fossil fuels; lower CO2 emissions with CCS; CH4 emissions can be controlled</td>
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<tr>
<td>Renewables</td>
<td>PV: Provides interim power source until full access to grid is provided. Thermal: provides some hot water. Can be self-made</td>
<td>Security gains through reduced energy and fuel import needs</td>
<td>Improved health due to lower emissions and pollution</td>
<td>Reduced emissions from fossil fuels and resources depletion; lifecycle environmental impact for PV</td>
<td>Limited life-cycle GHG emissions except in production of PV</td>
</tr>
</tbody>
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Source: Technical summary
Multiple objectives & entry points: Solutions targeting more than one objective

- Access $\rightarrow$ electrification
- Renewable energy $\rightarrow$ support for RE

- Energy security $\rightarrow$ reduce oil dependency
- Reduce local pollution $\rightarrow$ Cleaner fuels

- Infant and maternal mortality $\rightarrow$ clean cooking
- Renewable energy $\rightarrow$ Biomass

- Energy efficiency $\rightarrow$ monetization of savings
- New ventures, job creation
Concluding thoughts

• Heterogeneity in circumstances, contexts and priorities will require variety in policy “packages”. Recognition of multiple benefits allows different entry points for change

• Technology is important, but equally important to address critical issues related to implementation: institutions, consumer preferences & market behavior, skills & capacities

• Early action is essential to avoid negative lock-in, create positive lock in and accelerate the technology cycle

• Energy policies need to be coordinated with policies in sectors such as industry, buildings, urbanization, transport, health environment etc. to have real impact