ENERGY EFFICIENT TECHNOLOGIES AND ENABLING POLICIES: EXAMPLES FROM INDIAN INDUSTRY SECTOR

Girish Sethi
Director and Senior Fellow
TERI, New Delhi

Low Carbon Asia Research Network –
1st Annual Meeting: Mobilizing Wisdom for a low carbon Asia
Session: Technology Needs and Enabling Policies for Asia, 16-17 October 2012, Bangkok
Introduction

- Global energy demand will grow by 55% between 2005-30
- 74% of the growth will be on account of increase in demand in developing countries
- Meeting the growing energy demand through conventional means would not be environmentally sustainable
- Effective strategies are needed for promoting Energy Efficient (EE)/Renewable Energy (RE) technologies for sustainable growth
- Broad focus areas for developing countries:
  - Technology Deployment
  - Capacity building
  - Enabling Policy Environment
  - Financing
Sector-wise energy consumption in India

- **Industry**: 129.6 mtoe (48%)
- **Transport**: 41.6 mtoe (15%)
- **Residential and commercial**: 36.8 mtoe (13%)
- **Other energy uses**: 23.2 mtoe (9%)
- **Agriculture**: 22.8 mtoe (8%)
- **Non-energy uses**: 18.4 mtoe (7%)

Unit: mtoe, Source: TEDDY 2010
# Electrical Energy Consumption and Conservation Potential

<table>
<thead>
<tr>
<th>Sector</th>
<th>Consumption (Billion KWh)</th>
<th>Saving Potential (Billion KWh)</th>
<th>% Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture Pumping</td>
<td>92.33</td>
<td>27.79</td>
<td>30.09</td>
</tr>
<tr>
<td>Commercial Buildings/ Establishments with connected load &gt; 500 KW</td>
<td>9.92</td>
<td>1.98</td>
<td>19.95</td>
</tr>
<tr>
<td>Municipalities</td>
<td>12.45</td>
<td>2.88</td>
<td>23.13</td>
</tr>
<tr>
<td>Domestic</td>
<td>120.92</td>
<td>24.16</td>
<td>19.98</td>
</tr>
<tr>
<td>Industry (Including SMEs)</td>
<td>265.38</td>
<td>18.57</td>
<td>6.99</td>
</tr>
<tr>
<td>Total</td>
<td>501.00</td>
<td>75.36</td>
<td>15.04</td>
</tr>
</tbody>
</table>

Source: BEE/ NPC Study 2009
Energy conservation options in industries – Broad categorization

Adoption of energy efficient technologies

- Sector-specific technologies
  - Fuel switch options
  - Recycling and use of secondary materials
  - Cross-cutting technologies

- Large industries
  - Cement
  - Fertilizer
  - Iron & steel
  - Textiles
  - Pulp & Paper
    - Aluminum
    - Others

- Small scale industries
  - Foundry & forging
  - Glass & ceramic
  - Brick making
  - Brassware
  - Food processing
    - Others

- Cross-cutting technologies
  - Boilers
  - Pumps & blowers
  - Compressors
  - HVAC
  - Lighting
  - Use of ICT solutions like plant automation & process control
  - Others
Energy Technology and Policy initiatives in India: a few examples

- Research, Development, Demonstration and Deployment (RDD&D)
  - Adoption of existing technologies to suit the specific requirements of developing countries
    - TERI initiatives in SME sector
    - New energy efficient technologies
      - BEE – Super Energy Efficient Equipment Program
- Dissemination of existing EETs and Best Operating Practices (BOPs)
  - Large variations in the energy consumption levels across industries in the same sub-sector
  - Need for capacity building and focused policy initiatives
    - PAT scheme of Government of India
    - AFD-TERI study in Small industries
Small and Medium Enterprise (SME) sector in India

- 26 million registered units employing 69 million people
- Accounts for 45% of manufacturing output and 40% of India’s total exports
- Many energy intensive sectors like foundry and forgings, glass and ceramics, textiles, food processing and so on
- Uses obsolete energy inefficient technologies
- Good scope to save energy by developing and demonstrating cleaner technological options
Application of low carbon technologies in SME sector - a joint TERI/IGES research project

1) Overall Goal:
   a) Promotion of low carbon technologies in India

2) Cooperation Framework:
   a) Japan - “Science and Technology Research Partnership for Sustainable Development” promoted by JICA and JST;
   b) India - Ministry of Environment and Forests, Govt of India

3) Target sectors:
   a) Small and Medium Enterprises

4) Focus:
   a) Energy efficient technologies

5) Time period:
   a) 4 years (2010-14)

6) Implementation partners:
   a) India: TERI and selected SMEs
   b) Japan: IGES, Kyoto Univ and selected Japanese companies

7) Identified technologies:
   a) Small sized Gas and Electric Heat Pumps for process heating and cooling applications
Unique RDD&D initiative among Indian SMEs: TERI-SDC Partnership

- Initiated in 1994 by Swiss Agency for Development and Cooperation (SDC) in collaboration with Indian research institute (TERI)
- Identified energy inefficient operations in four SME sub-sectors: foundry sector (cupola melting furnace), glass sector (pot furnace), brick sector (vertical shaft brick kilns) and biomass applications (gasifier)
- TERI in collaboration with international experts worked towards development and demonstration energy efficient technologies in each of the four sector
- Diffusion of the demonstrated technology was possible due to accumulation of technological capacity within TERI and Indian partners
- TERI and Indian partners provide training and hand-holding support of local service providers as well as SME operators during technology replications
Supporting partners in technology development

Sorane Sa, Switzerland
Energy & Environment Technology

British experts
Foundry & Glass Technology

Implementing agency

Local consultants

Local fabricators

Sponsor

Embassy of Switzerland in India
Glass – Pot furnace

Conventional coal fired Pot Furnace

Recuperative natural gas fired Pot furnace

Energy savings: 25-50%
Technology diffusion curve for demonstrated pot furnace in glass industry
Impact of the RDD&D initiative

- 95 energy efficient cupola furnaces and 76 pot furnaces replicated in foundry and glass sectors. Energy saved in the two sectors about 102,000 tonnes of oil equivalent (365,000 tonnes of CO2)

- Diffusion of the technologies was made possible by constant modifications to the demonstrated technologies e.g. lowering of cost and adapting to local requirements

- Many more self-replicated versions of these furnaces by local service providers whose energy savings have not been quantified
BEE- SEEP : Example - Ceiling fans

- 40 million ceiling fans produced per year in India
  - Standard fans consume 75 W, air delivery 220 m3/min (1200 mm sweep)
  - Energy efficient (EE) fans consume 50 W but are having lower air delivery
  - Super energy efficient (SEE) fans would consume 35 W with air delivery of standard fans

- Need programs to focus on RDD&D to develop such equipment /technologies
  - BEE planning to launch Super Energy efficient program (SEEP) initially for ceiling fans
  - Other examples : Room ACs, pump sets, industry specific process technologies etc.
Key features: PAT

- Focuses on 478 large consumers of commercial energy (7 industry sub-sectors and thermal power plants)
- Large variation in SEC observed within each sub-sector
- Key goal of the PAT scheme is to mandate specific energy efficiency improvements.
- These units consume about 165 million tons of oil equivalent (mtoe) energy
- Unit specific energy reduction targets mandated based on their baseline energy consumption
- By the end of the first PAT cycle (2012-15), the energy savings of 6.686 mtoe is envisaged.
Perform Achieve and Trade (PAT) Mechanism: Overall structure

**Market Based Mechanism**

- **Reward over-achiever**
- **Penalize under-performer**

- **Administrator**
  - Set target and compliance period

- **Designated Consumers**
  - 8 sectors (~478 units) Power, Steel, Cement, Fertilizer, Pulp & Paper, Textile, Aluminium, Chlor-alkali

- **Auditing Agencies**
  - Independent
  - Monitor, verify and certify

- **Market Place**
  - Transaction of energy efficiency instrument

**Set Targets**
- Setting targets on the basis of current specific energy consumption
- Set compliance period
- May take into account Location, Vintage, Technology, raw materials, product mix etc.

**Monitoring & verification of targets by Designated Energy Auditors**
- Check if designated consumer has achieved targets
- Underachievement: Obligations to buy ESCerts or pay penalty
- Overachievement: Issuance of ESCerts for banking for later use or trade

**Trading of ESCerts**
- Participation by Designated consumers on platform provided by Power Exchanges
- Symmetrical flow of information
National Energy Saving Targets under PAT (%) (2012-15)

- Chlor-Alkali: 12%
- Textile: 7%
- Paper and pulp: 7%
- Aluminium: 7%
- Fertilizer: 2%
- Iron and steel: 22%
- Power plant: 48%
AFD-BEE-ADEME-TERI study

- Energy data of 36 SME clusters was analyzed
- Large variation in specific energy consumption (SEC) was observed
- Average and median SECs show significant scope to save energy through targeted dissemination programs.

Brass industry cluster in Eastern India
Conclusions

• Opportunities for energy efficiency exist in all industry sectors

• Need to develop sector specific technology implementation models with close involvement of various stakeholders

• Other related challenges to be addressed include finance, capacity building and an enabling institutional mechanism

• Large opportunities for international collaborative Research Partnerships (North-South and South–South)
THANK YOU FOR YOUR ATTENTION

Email girishs@teri.res.in