UNFCCC – ADP2-4
Technical Expert Meeting on Energy Efficiency

Promoting the application of Japanese low carbon technology in Indian SME
Project Background

- **Goal**: To promote low carbon technologies and practices among Indian SMEs

- **Time period**: 4 years (May 2010 - March 2014)

- **Implementation partners**
  - *Indian*: TERI, SMEs
  - *Japanese*: IGES, Kyoto University, Japanese companies

- **Coordinating government agencies**
  - *Indian*: Ministry of Environment and Forests (MoEF)
  - *Japanese*: Japan International Cooperation Agency (JICA) & Japan Science & Technology (JST)
Pilot project

Technology selection

- Technologies selected for feasibility studies
  - Micro cogeneration
  - Energy efficient ventilation fan
  - Gas heat pump (GHP)
  - Electric heat pump (EHP)
  - Energy efficient air-conditioning system (VRV system)
  - Energy efficient lighting system (light sensor with dimmer control)
  - Amorphous transformer
  - Electric induction melting furnace
  - Compressed air system
  - Wireless energy metering and communication system
Two hard technology systems and two best practices shortlisted for pilot demonstration

<table>
<thead>
<tr>
<th>Technology</th>
<th>Number of investigated sites</th>
<th>Pilot projects</th>
<th>Location of pilot projects</th>
<th>Type of industry</th>
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<tbody>
<tr>
<td><strong>Hard Technologies systems</strong></td>
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<tr>
<td>Gas heat pump</td>
<td>11</td>
<td>2</td>
<td>Rajkot</td>
<td>Investment casting</td>
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<tr>
<td>Electric heat pump</td>
<td>13</td>
<td>2</td>
<td>Anand- Ahmedabad</td>
<td>Dairy</td>
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<td>Chandigarh</td>
<td>Dairy</td>
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<td><strong>Best Practices (Soft technologies)</strong></td>
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<tr>
<td>Compressed air system</td>
<td>13</td>
<td>4</td>
<td>Pune; Noida</td>
<td>Forging industry, Ink manufacturing</td>
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<tr>
<td>Induction furnace</td>
<td>8</td>
<td>2</td>
<td>Kolhapur</td>
<td>Sand casting</td>
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</table>
RESULTS
Results #1: Demonstration of Electric Heat Pump (EHP)

- **Application**
  - Preheating of boiler feed water & precooling of process chilled water
  - Dairy, food processing, pharmaceutical, commercial buildings
  - Pilot plants installed in Chandigarh (Punjab) and Anand (Gujarat)

- **Benefits**
  - Reduction in fuel consumption in boiler and electricity in chiller
  - Primary energy savings 30%-40%
Results #2: Demonstration of Gas Heat Pump (GHP)

- **Application**
  - Room air conditioning
  - Space cooling applications in industry and commercial buildings
  - Two pilots installed in Rajkot (Gujarat)

- **Benefits**
  - Switch from electricity to clean fuel (NG)
  - Primary energy savings around 50%
Results #3: Best practices in compressed air system

Context
- Air compressors account for 20-25% of electricity in many factories

Observations
- Life Cycle Cost (LCC) is significant in compressors e.g. power consumption (84%), maintenance (9%) and equipment (7%)
- Proper selection of all equipment (compressor, receiver, filter, piping, pneumatic actuators, energy saving nozzle, etc.) is crucial
- Significant energy saving could be achieved with zero cost (pressure setting, stop leakage)
- Installing inverter type air compressors, is quite costly, but pay back period is between 2 and 4 years
Results #4: Best practices in electric induction furnace

- **Application**
  - Foundry, metal casting units

- **Observations**
  - Process parameters like product yield and rejection ratio have important influence on energy efficiency
  - Often data recorded is not linked to improvements in operation
  - Awareness on best practices among operators is not high

- **Major recommendations**
  - Establish systems to analyze data and take corrective action
  - Use computer simulations for improving yield and reducing reductions
  - Implement 3S/5S activities
  - Train SME or train trainers (experts) regarding best practices
Results #5: Capacity building and awareness raising (level 1)

- Targeting SME at unit level:
  Onsite capacity building for managers and workers during site visits (in total, more than 50 sites visited)
Capacity building and awareness raising (level 2)

- Targeting SME at cluster/segment level
  Several cluster workshops to introduce technology to business entrepreneurs and business associations
  (in total 10 conducted)

IGES – TERI Joint Workshop
January 2014, Chandigarh (India)

IGES – TERI Joint Workshop
January 2014, Rajkot (India)
Capacity building and awareness raising (Level3)

- Targeting Indian experts:
  Training workshops to Indian experts (In India and in Japan)
  (in Total 4 (2 in India and 2 in Japan))
Capacity building and awareness raising (Level 4)

- Targeting Policy makers:
  Interaction with policy makers through meetings, symposiums, etc.

**Delhi Sustainable Development Summit (DSDS)**  
(February 2014 New Delhi- India)

**India-Japan Energy Forum**  
(September 2013 New Delhi- India)
CASE STUDIES
Case study- Use of EHPs

Site A
Application - Food processing
Size – Heating- 59.6 kW, Cooling – 37.6 kW
Features - Cooling water from 15°C to 12°C (for production process) and simultaneously to heat water from 35°C to 80°C (that will be used to preheat water for boiler).
Refrigerant used – CO2
Energy saving achieved: Around 30-40%

Site B
Application - Dairy industries
Size – Heating- 59.6 kW, Cooling – 37.6 kW
Features - Simultaneously provide pre-heated water (from 35°C to 90°C) to the boiler and pre-cooled return chilled water (from 15°C to 10°C) for chiller.
Refrigerant used – CO2
Energy saving achieved: Around 30-40%
Case study: Use of GHPs

• GHP technology demonstrated at two SME units in Rajkot in February 2013.

• Application - shell drying in wax investment casting

• Size:
  – Unit 1 – 32 TR (2 units)
  – Unit 2 – 93 TR (5 units)

• Replacement of small electric ACs with GHPs in two SMEs

• Overall primary energy savings: around 50 %

• Energy cost savings: Highly elastic - depending upon NG cost
Case Study: Energy savings in Compressed air usage in Forging Unit-1

Introduction of Unit
- 2700 t/yr production capacity
- Electricity consumption: 2,053,000 kWh/yr
- Manufactures flanges for automobile sector

About air compressor infrastructure
- 15-20% energy consumption in air compressors alone
- 5 air compressors (range 37.5 - 150 kW, 200- 900 cfm)
### Forging Unit-1: Impact

<table>
<thead>
<tr>
<th>Energy savings measures</th>
<th>Impact</th>
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<tr>
<td>- Optimization of set air pressure</td>
<td>- 92,385 kWh/yr, primary energy savings</td>
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<tr>
<td>- Replacement of old (diesel) air compressor by new energy efficient compressor</td>
<td>- 86 tCO2/yr, emission reduction</td>
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<tr>
<td>- Removal of air leakages from 30 machines</td>
<td>- Rs. 600,502/- per yr, energy cost savings</td>
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<td>- ~less than 1 yr payback period</td>
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**Before**

![Before Image 1](image1)

![Before Image 2](image2)

**After**

![After Image 1](image3)

![After Image 2](image4)
<table>
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<tr>
<th>Case Study: Energy savings in Compressed air usage in Forging Unit- 2</th>
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</thead>
</table>

**Introduction of Unit**
- Energy consumption: 2,776,560 kWh/yr
- Manufactures flanges, valve bodies and shafts for automobile sector

**About air compressor infrastructure**
- 20-25% energy consumption in air compressors alone
- Three air compressors (range 132-160 KW, approx 1000 cfm each)
## Forging Unit-2: Impact

<table>
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<tr>
<th>Energy savings measures</th>
<th>Impact</th>
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<tr>
<td>- Reset (reduce) pressure setting from 6.5 - 7.0 bar to 5.2 - 5.8 bar</td>
<td>- 139,690 kWh/yr, primary energy savings</td>
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<td>- Removed leakage from air pipes, flow control valves, through installing proper air guns, etc. resulting in 60% reduction in air leakage</td>
<td>- 130 tCO2/yr, emission reduction</td>
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<td>- Rs. 907,985/- per yr, energy cost savings</td>
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<td></td>
<td>- ~less than 1 yr payback period</td>
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</table>

**Before**

![Before Image](image1.png)

**After**

![After Image](image2.png)
OPPORTUNITIES
Opportunities for scaling up ALCT project in Indian SMEs

• Demonstrated technologies/practices
  – EHP in dairy industry and other industries like Pharmaceutical, food processing, textile, other sectors
  – GHP in locations depending upon NG availability
  – Compressed air generation/distribution in forging and other SME sectors
  – Induction furnace BOPs in foundry sector

• New Japanese technologies
  – Demonstration and dissemination
Example: Indian Forging Sector

- ~1200 forging units
- Spread over Pune, Chennai, Delhi, Hyderabad, Ludhiana
- 1.5 million ton per year production capacity
- Energy consumption: Appx. 0.6 mtoe/year
- 30% energy savings as per TERI-IGES study on compressed air systems
- ~300,000 tCO₂ emission reduction potential p.a. - only through compressed air optimization
Example – Indian Foundry sector

- More than 4,500 foundries in India
  - 80% of the foundries are MSME
- Indian foundry industry FY’12
  - More than 9.3 million tonnes production
  - Accounts for 8-9% of total world’s casting production
- Located in different clusters
  - Induction furnace study conducted in Kolhapur cluster
  - Significant energy savings possibilities exist through Kaizen and 3S/5S programs
Example: Indian Dairy Industry

- Annual milk production in India -128 million tonne /year
- India accounts for 15% of world’s total dairy production
- Operates under
  - Milk Producers’ Cooperative Unions
  - Private entrepreneur
- Primary products
  - Different liquid milks (skimmed, toned, standard and high fat etc.)
  - Assorted milk and food products (curd, butter, chocolate, sweets and baby foods etc.)
- Estimated saving potential in just two milk producing states (Punjab and Gujarat) through adoption of EHPs:
  - Potential number of industries for replication of EHP - 50
  - Saving in equivalent primary energy – 1000 toe/year
  - Saving in equivalent CO2 generation at primary level – 3000 t-CO2/year
Example: Adoption of GHP in investment casting industries in India

- Number SMEs - 120
- Production capacity – 50 tonne casting/month
- Connected electrical AC load – 12 TR/tonne of casting/hour
- Equivalent primary energy consumption – 2.6 million toe/year
- Equivalent CO2 generation at primary level - 10 million tonne/year
- Potential saving at primary level on application of GHP – 30% assumed
- Saving in equivalent primary energy – 0.78 million toe/year
- Saving in equivalent CO2 generation at primary level – 3 million t-CO2/year
Conclusions

- Project has demonstrated that significant energy and GHG saving is possible through adoption of EE technologies and practices among SMEs.

- Seeded interest among stakeholders on the demonstrated Japanese technologies.

- Generated awareness on best operating practices.

- Built local capacities through diagnostic studies by Japanese experts and pilot demonstrations.

- Serve as a model to promote cleaner technologies under bilateral/multilateral cooperation.

- Huge opportunities to conduct projects that built upon the findings and lessons learnt from current project.

- TERI already getting enquiries from dairy plants and other industry stakeholders on demonstrated options.
Useful links for further information about project and case studies

Thank you for your attention
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