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

	Technology	Number of investigated sites	Pilot projects	Location of pilot projects	Type of industry
Hard Technologies systems	Gas heat pump	11	2	Rajkot	Investment casting
	Electric heat pump	13	2	Anand- Ahmedabad	Dairy
				Chandigarh	Dairy
Best Practices (Soft technologies)	Compressed air system	13	4	Pune; Noida	Forging industry, Ink manufacturing
	Induction furnace	8	2	Kolhapur	Sand casting

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%

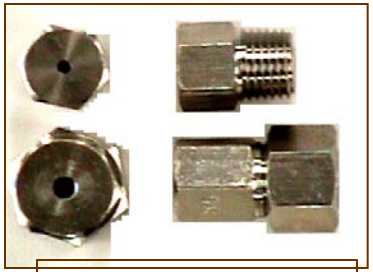
Results #2: Demonstration of Gas Heat Pump (GHP)

- 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



Energy saving nozzle

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 (level1)

- 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 (level2)

- 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 (Level4)

- 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℃ to 12℃ (for production process) and simultaneously to heat water from 35℃ to 80℃ (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℃ to 90℃) to the boiler and pre-cooled return chilled water (from 15℃ to 10℃) 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

Energy savings measures
- Optimization of set air pressure
- Replacement of old (diesel) air compressor by new energy efficient compressor
- Removal of air leakages from 30 machines

Impact
- 92,385 kWh/yr, primary energy savings
- 86 tCO2/yr, emission reduction
- Rs. 600,502/- per yr, energy cost savings
- ~less than 1 yr payback period

Before

After

Case Study: Energy savings in Compressed air usage in Forging Unit- 2

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

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

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 tCO_2 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 CO_2 generation at primary level – 3000 t-CO_2/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

- http://www.iges.or.jp/en/business/jst/activity_alct.html
- http://sameeeksha.org/index.php?option=com_casestudy&task=level&title=&id=16
- http://sameeeksha.org/newsletter/issue_Sep2013.pdf

Thank you for you attention

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