

Decarbonising India

Transitioning towards efficient practices and cleaner fuels to meet the rising industrial process heat demand

India Energy Transformation Platform

Knowledge partner: Development Environergy Services Ltd.

Secretariat: Center for study of Science, Technology & Policy

Supported by: Shakti Sustainable Energy Foundation and Swiss Agency for Development & Cooperation



About IETP

The India Energy Transformation Platform is an independent, multi-stakeholder group of experts aiming to develop an informed narrative on India's strategies for meeting its Nationally Determined Contributions (NDCs) through non-linear, transformative solutions. This unique initiative, jointly conceptualised by Center for study of Science, Technology & Policy (CSTEP) and Shakti Sustainable Energy Foundation (SSEF), hopes to ensure that India stays ahead of the curve and cements its leadership in the global transition to clean energy – even beyond 2030. Over the past year, the platform has supported research across four themes- decentralised energy systems, renewable energy dominant electricity system, industrial process heat, and urban cooling demand- exploring novel technology options to help develop low-carbon energy pathways up to 2050. The project teams (under each theme) have undertaken rigorous study and have thus put forth their results and recommendations in the form of the following policy brief.



2 Key Recommendations

Energy efficiency of industrial boilers

- » Creation of cluster-level utility facilities and network of industries to make the systems more efficient and scaling up for making biomass fuel cost competitive against coal
- » Conducting competitive tendering in energy efficiency (EE) services/products by designated nodal agencies with probable parameters like lowest cost per greenhouse gas (GHG) saved, reduction in specific steam consumption etc.

- Develop software for energy audit of boiler and mandate boiler manufacturers of > 5 TPH (tons per hour) to provide real time monitoring system
- Fuel shift to biomass in industrial boilers
 - » Financial incentives for a competitive low cost of delivered biomass
 - > Duty free import of biomass logistics & densification machineries
 - Incentives for fuel substitution, until a carbon market is developed
 - » To develop a program for biomass densification covering aspects of indigenous technology development
 - Devise a methodology for development and operation of information system related to harvesting time for agricultural plots
- Futuristic technologies and carbon market mechanism
 - » Institutional mechanism for monitoring of performance of newly developed technologies in the market
 - Increased investments in research and pilot testing of new fuels like hydrogen from renewable energy (RE) sources
 - » Devising means for a voluntary carbon market for the industrial sector through cluster/sectoral cap and trade especially for the Micro, small and medium enterprises (MSMEs)

3 Rationale

The objective of the project is to identify transformative opportunities for decarbonisation of steam generation in industrial sectors along with necessary policy support for promotion of the identified opportunities.

The scope of work includes the following:

- Estimate the baseline carbon intensity in process heat (steam generation process) in selected industrial sectors currently and for 2050
- Identification and prioritisation of transformational decarbonisation technologies
- Identification of policy options for faster implementation of prioritised technologies
- Support India Energy Transformation Platform (IETP) in carrying out stakeholder engagement and outreach efforts

The current policy scenario for the promotion of energy efficiency and renewable energy for industrialprocess steam generation can be categorized as either developmental or regulatory in nature. The developmental policies include the National Mission for Enhanced Energy Efficiency (2010), National Manufacturing Policy (2011), Draft National Energy Policy (2017), and the different state government policies for the industrial/investment promotion/MSMEs. The schemes can be further classified as monetary incentives, fiscal incentives, and mandates. The details of some of the relevant schemes are as follows:



Monetary incentives are available for biomass-based cogeneration in industries, solar thermal for process heat in industries, cost of energy audit/capital for implementation for MSMEs (various state governments), common boiler using cleaner fuel for a minimum of 10 MSMEs (Govt. of Gujarat), partial risk sharing mechanisms for financial institutions while implementing energy efficiency projects, reduced collateral for MSMEs , 'Perform, Achieve and Trade' for large industrial consumers in selected industrial sectors and Research and development (R&D) projects in Public private partnership (PPP) mode





Fiscal incentives are available in terms of accelerated depreciation for high efficiency boilers, instrumentation systems for monitoring energy flow, waste heat recovery equipments, concentrating and pipe-type solar collectors, solar water heaters etc. Presently there is reduced Goods & services tax (GST) for biomass briquettes/pellets, heat pumps, solar water heater and systems at 5% and steam at 12%.

Mandates are available for installation of solar water heaters in industrial buildings (Govt., of Haryana/ Rajasthan), advice for co-firing of 5% to 10% biomass in all coal-fired power plants/utilities

4 Findings

The broad approach, data sources used, and findings from the study are as follows:

Table 1: Broad approach and data sources and findings from the study

Project segment	Approach & data sources	Findings
Estimate annual GHG emissions from industrial-process steam generation (Baseline and 2050)	Identification of industrial sectors with process steam demand, establish annual/ projected steam consumption and primary fuel share in boiler. The data sources included Development Environergy Services Ltd. (DESL) past energy audit reports and desk research	 Identified sectors: Textile, petrochemical, chemical & fertiliser, and pharmaceuticals are the major sectors (90% contribution) Coal, Naphtha, and Furnace oil are the major primary fuels (90% contribution) Over 60% of the identified sectors are expected to be of MSME Several challenges during study due to disaggregated data
Identification & prioritisation of transformational decarbonisation technologies	Identify transformational decarbonisation technologies, identify market barriers for each of the identified technology, and prioritise the technologies for the decarbonisation pathway for India. The data sources included DESL past energy audit reports, relevant peer reviewed journal papers, global reference documents for decarbonisation pathways and stakeholder consultation	 Aspects of review for technologies: technical/ commercial maturity, cost economics, specific GHG emissions, issues with use of technology etc. The technologies are classified into the following: Mature & viable – Energy efficiency & Fuel shift (Biomass) Mature, but high cost- Solar thermal Developing – Fuel switch (Renewable energy powered electrode boiler) Blue sky technologies – Hydrogen Need for faster mainstreaming of newly developed technologies was considered necessary along with a carbon market mechanism for increasing the viability of costly technologies

• Review of barriers for uptake of identified decarbonisation technologies

Table 2: Review of barriers for the identified technologies

Technology	Review of barriers for uptake of technology				
	High	Medium	Low		
Energy efficiency	Demonstrated and sustained performances; inadequate back up services	Information; cost	Financing		
Biomass combustion	Cost & reliability of supplies	Biomass logistics; Lower plant load factor	Financing		
Electrode boiler	High operational cost				
Solar thermal	Cost, financing, and back-up services	Information & Demonstration	Availability		
Hydrogen	R&D				

- Identification of policy options for faster implementation of prioritised technologies
 - » Approach: Review of global policies for overcoming the identified barriers, review of present Indian policies to identify gaps and propose policy options
 - » Data sources: Desk research on policies and stakeholder consultation
 - » Findings: The global best practices for the technology options targeting the barriers are summarised in the table below:

Table 3: Identification of best practices for specific barriers for the identified technologies

Technology	Major barriers	Identification of best practices
Energy efficiency	Demonstrated & sustained performances	 Global best practice policies Australia: Energy audit standards (2014) ; National Greenhouse and Energy Reporting scheme (2006), Federal Energy Efficiency Opportunities program (2006), Industrial Energy Efficiency Data Analysis Project (2012) Germany: Competitive tendering scheme for energy efficiency in industry (2019), Energy Efficiency Networks Initiative (2019), Compulsory energy efficiency audits in large companies (2015), Intelligent information technology (IT) based pilot systems for energy saving (2016) Stakeholder consultation Industrial boilers in MSME units have 6% to 10% scope in efficiency improvement and large industries have about 2% scope from regular technologies like excess air control, insulation improvement, condensate recovery, waste heat recovery. Programmatic approach of energy efficiency service and product procurement through competitive tendering can help bring down capital cost and encourage innovations Low cost IT solutions for real time monitoring of performance of boilers
Biomass combustion	Cost and reliability of supplies	 Global best practice policies Germany: Industrial incentive program to increase energy efficiency and the use of renewable process heat (2019) Brazil, Denmark, Germany, Japan, Netherlands, United Kingdom (UK) and United States of America: A variety of financial incentives like capital grants, feed-in-tariff, incremental cost converted as surcharge on the electricity bills for co-firing of biomass with coal UK: Accelerated depreciation for biomass boilers and boiler related support equipments Canada: Institutional support for biomass supply chain for industries around forest areas (2017) Lithuania: Establishment of biomass exchange (2012) Stakeholder consultation Availability of biomass at desired quality, quantity, and price is a major hurdle for fuel switch. Industrial boilers of less than 30 TPH capacity have need lesser quantity of biomass than coal-fired utility boilers Common boilers in MSME clusters using biomass as fuel could be an appropriate pilot for demonstration and establishing learnings for upcoming industrial parks. Gujarat state industrial policy has provision for incentivizing common boilers using cleaner fuels. Incentives are desired for biomass suppliers and industries due to the following reasons: Biomass suppliers import capital intensive machinery and high efforts to gather information on harvesting Industries with low motivation to fuel switch for industrial process heat
Blue sky technologies	Mainstreaming of newly developed technologies ; economic viability of a few mature technologies due to low cost fossil fuel	 Global best practice policies UK & Germany: Carbon tax on fossil fuel consumption, as an integral part of their fuel bills. Rebate on carbon tax on committing and achieving GHG reduction through EE/ RE measures (Biomass, Solar, Combined heat and power etc.) China: Unique institutional structure with a funding mechanism to R&D institutions linked to the market diffusion of the newly developed technology Stakeholder consultation Ministry of New & Renewable Energy (MNRE) program for hydrogen with pilot projects are envisaged to be completed for various RE based hydrogen production by 2022 Voluntary carbon market model for MSME industries is being developed under India's Partnership for Market Readiness (PMR) proposal

5 Conclusion

The perceived challenges in the implementation of the identified policy recommendations are as follows:

- Aligning of all the stakeholders through proper communication and confidence on financial benefits
- Quantification of carbon benefits
- Technology risk and bringing changes in the institutional process dealing with science and technology
- Industry consensus for the voluntary climate market

The estimated GHG emission in the industrial sectors with process-steam demand is expected to rise from the present 99 Mn. tCO_2/y to 569 Mn tCO_2/y in 2050. The average size of the process boilers is less than 30 TPH, enabling brighter prospects for decarbonisation opportunities. A few policy recommendations have been identified which can help reduce GHG emissions by 70% to 85% by 2050.





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