**CEO Endorsement (CEO) entry ? Full Sized Project ? GEF - 7**

## Part I: Project Information

**GEF ID**
**10878**

**Project Type**
FSP

**Type of Trust Fund**
GET

**CBIT/NGI**
CBIT **No**
NGI **No**

**Project Title**
Improving thermal energy efficiency in the design, manufacture and operation of industrial boilers for low-carbon micro-, small and medium-sized enterprises in India

**Countries**
India

**Agency(ies)**
UNIDO,

**Other Executing Partner(s)**
Ministry of Micro, Small and Medium Enterprises (MSMEs) - Government; United Nations Industrial Development Organisation (UNIDO) - GEF Agency

**Executing Partner Type**
Others

**GEF Focal Area**
Climate Change

**Sector**
Energy Efficiency

**Taxonomy**
Focal Areas, Influencing models, Stakeholders, Gender Equality, Integrated Programs, Capacity, Knowledge and Research

**Rio Markers**
**Climate Change Mitigation**
Principal Objective 2

**Climate Change Adaptation**
No Contribution 0

**Biodiversity**
No Contribution 0

**Land Degradation**
No Contribution 0

**Submission Date**
2/28/2023

**Expected Implementation Start**
8/1/2024

**Expected Completion Date**
7/31/2028

**Duration**
48In Months

**Agency Fee($)**
253,146.00

**A. FOCAL/NON-FOCAL AREA ELEMENTS**

| Objectives/Programs | Focal Area Outcomes | Trust Fund | GEF Amount($) | Co-Fin Amount($) |
|---|---|---|---|---|
| CCM-1-3 | | GET | 2,664,690.00 | 17,797,500.00 |
| | | **Total Project Cost($)** | **2,664,690.00** | **17,797,500.00** |

**B. Project description summary**

## Project Objective

To scale up and mainstream thermal energy optimization in manufacturing MSMEs through creation of ecosystem for the design, manufacture and operation of efficient industrial boilers

| Project Component | Financing Type | Expected Outcomes | Expected Outputs | Trust Fund | GEF Project Financing($) | Confirmed Co-Financing($) |
|---|---|---|---|---|---|---|

| Project Component | Financing Type | Expected Outcomes | Expected Outputs | Trust Fund | GEF Project Financing($) | Confirmed Co-Financing($) |
|---|---|---|---|---|---|---|
| 1. Demand creation through the development, promotion & implementation of best available techniques & operating practices for thermal energy optimization & industrial boiler efficiency | Technical Assistance | 1.1 Manufacturing MSMEs install, operate & maintain industrial boilers & associated steam systems for enhanced energy efficiency | 1.1.1 Energy savings estimation tools developed for industrial boilers & promoted to manufacturing MSMEs & their technology suppliers & service providers<br>1.1.2 Capacity building and training system established on best available techniques & operating practices for industrial boilers<br>1.1.3 Best boiler operation & maintenance practices assessed & implemented in 50 manufacturing MSMEs<br>1.1.4 Knowledge portal on best available techniques & operating | GET | 902,552.00 | 5,500,000.00 |

| Project Component | Financing Type | Expected Outcomes | Expected Outputs | Trust Fund | GEF Project Financing($) | Confirmed Co-Financing($) |
|---|---|---|---|---|---|---|
| | | | practices for industrial boilers (with guidance documents, case studies, etc.) | | | |
| 2. Market facilitation through the introduction & mainstreaming of energy performance specification in the market for boilers (new & retrofit segments) | Technical Assistance | 2.1 Industrial boilers & boiler retrofits are invested in with due consideration of energy efficiency performance | 2.1.1 Transparent system of efficiency specifications for industrial boilers set up<br>2.1.2 Policy makers & regulators mobilized to add energy efficiency considerations in comprehensive revision of regulatory & institutional frameworks for manufacture & operation of industrial boilers in particular in MSMEs | GET | 205,202.00 | 650,000.00 |

| Project Component | Financing Type | Expected Outcomes | Expected Outputs | Trust Fund | GEF Project Financing($) | Confirmed Co-Financing($) |
|---|---|---|---|---|---|---|
| 3. Supply creation through the promotion of manufacture of & market for energy efficient boilers & boiler retrofits for manufacturing MSMEs | Investment | 3.1 Suppliers manufacture & market energy efficient boilers & components for energy efficient boiler retrofits | 3.1.1 Energy efficient boiler designs provided to industrial boiler manufacturers<br>3.1.2 Energy efficient industrial boilers & steam systems demonstrated in 25 manufacturing MSMEs<br>3.1.3 Energy efficient industrial boilers & steam systems replicated to 150 manufacturing MSMEs | GET | 1,330,046.00 | 10,500,000.00 |

| Project Component | Financing Type | Expected Outcomes | Expected Outputs | Trust Fund | GEF Project Financing($) | Confirmed Co-Financing($) |
|---|---|---|---|---|---|---|
| 4. Monitoring and Evaluation | Technical Assistance | 4.1 Monitoring & evaluation mechanisms & indicators established to facilitate effective project implementation & sound impact assessment | 4.1.1 Project & its activities monitored on a periodic basis in line with GEF, UNIDO & government requirements .<br>4.1.2 External mid-term review and independent terminal evaluation conducted | GET | 100,000.00 | 300,000.00 |
| | | | **Sub Total ($)** | | **2,537,800.00** | **16,950,000.00** |
| **Project Management Cost (PMC)** | | | | | | |
| | | | | GET | 126,890.00 | 847,500.00 |
| | | | **Sub Total($)** | | **126,890.00** | **847,500.00** |
| | | | **Total Project Cost($)** | | **2,664,690.00** | **17,797,500.00** |

**Please provide justification**

**The initial fund will come from the GEF grant and will be allocated to create demand through promotion, implementation of best available techniques, operating practices, and market facilitation through the introduction of energy performance specifications. It will also be used for supply creation through the promotion of manufacturer and market creation for energy ? efficient boilers and boiler retrofits for manufacturing MSMEs. These funds will also be used for monitoring and evaluation. The project envisages two types of interventions, Technical Assistance and Investments. Technical Assistance includes activities such as development of design specification, training modules, conducting training & capacity building, developing documents for policy making, revision of existing policies and guidelines, etc. Investment includes intervention of hardware such as energy**

**efficient retrofits ? waste heat recovery systems, etc. and also the energy efficient boilers. o Government agencies o Non-governmental organizations o The environment The project is a valuable contribution to the efforts to reduce energy consumption and greenhouse gas emissions in India. It is also a good example of how public-private partnerships can be used to achieve sustainable development goals.**

**C. Sources of Co-financing for the Project by name and by type**

| Sources of Co-financing | Name of Co-financier | Type of Co-financing | Investment Mobilized | Amount($) |
|---|---|---|---|---|
| Recipient Country Government | Ministry of Micro, Small and Medium Enterprises (MoMSME) (national execution agency) | In-kind | Recurrent expenditures | 2,797,500.00 |
| Recipient Country Government | National Institute - Micro, Small and Medium Enterprises (NI-MSME) (project execution partner) | In-kind | Recurrent expenditures | 1,800,000.00 |
| Other | Small Industries Development Bank of India | Loans | Investment mobilized | 9,750,000.00 |
| Private Sector | Bidar Industry Association | Equity | Investment mobilized | 1,083,333.00 |
| GEF Agency | UNIDO | Other | Investment mobilized | 75,000.00 |
| GEF Agency | UNIDO | In-kind | Recurrent expenditures | 125,000.00 |
| Private Sector | South Gujarat Textile Processors Association | Equity | Investment mobilized | 1,083,333.00 |
| Private Sector | Panipat Industrial Association | Equity | Investment mobilized | 1,083,334.00 |
| | | | **Total Co-Financing($)** | **17,797,500.00** |

**Describe how any "Investment Mobilized" was identified**

The co-financing of the Ministry of Micro, Small, and Medium Enterprises is mainly in kind and will come from ongoing technical support programs such as the MSME Champion Programme that includes Zero Effect Zero Defect (ZED), lean, design, incubation or IPR). Cash contribution will be through various ongoing Government grant schemes that provide partial grants towards productivity and related investments by MSMEs in the country. It will provide significant support to project component 1 and partially to components 2 and 3. The project would also mobilize US$ 19.5 million from the private sector through equity and loans. Investments in the form of equity are expected in the design and manufacture of innovative energy?efficient boilers (by boiler manufacturers) and for the adoption of energy?efficient boilers and associated steam systems by manufacturing MSMEs (by boiler users). Similarly, local banks

and financial institutes will extend loans to boiler makers and boiler users, especially during replication and scaling up activities. This co ? co-financing amount will be used under component 3 and SIDBI (Small Industries Development Bank of India) has committed to lending. SIDBI co-financing is expected to be invested in hardware costs. UNIDO co?financing amount will be spent in developing tailor-made training and knowledge materials on boiler efficiency and steam optimization for Indian MSMEs. UNIDO will also share its experiences in demonstrating such projects successfully in Asian countries and will share best practices with Indian MSMEs.

**D. Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds**

| Agency | Trust Fund | Country | Focal Area | Programming of Funds | Amount($) | Fee($) | Total($) |
|---|---|---|---|---|---|---|---|
| UNIDO | GET | India | Climate Change | CC STAR Allocation | 2,664,690 | 253,146 | 2,917,836.00 |
| | | | **Total Grant Resources($)** | | **2,664,690.00** | **253,146.00** | **2,917,836.00** |

**E. Non Grant Instrument**

NON-GRANT INSTRUMENT at CEO Endorsement

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Includes Non grant instruments? **No**

Includes reflow to GEF? **No**

**F. Project Preparation Grant (PPG)**

PPG Required **true**

**PPG Amount ($)**

75,000

**PPG Agency Fee ($)**

7,125

| Agency | Trust Fund | Country | Focal Area | Programming of Funds | Amount($) | Fee($) | Total($) |
|---|---|---|---|---|---|---|---|
| UNIDO | GET | India | Climate Change | CC STAR Allocation | 75,000 | 7,125 | **82,125.00** |
| | | | **Total Project Costs($)** | | **75,000.00** | **7,125.00** | **82,125.00** |

## Core Indicators

**Indicator 6 Greenhouse Gas Emissions Mitigated**

| Total Target Benefit | (At PIF) | (At CEO Endorsement) | (Achieved at MTR) | (Achieved at TE) |
|---|---|---|---|---|
| Expected metric tons of CO?e (direct) | 341586 | 483942 | 0 | 0 |
| Expected metric tons of CO?e (indirect) | 1024758 | 1451828 | 0 | 0 |

**Indicator 6.1 Carbon Sequestered or Emissions Avoided in the AFOLU (Agriculture, Forestry and Other Land Use) sector**

| Total Target Benefit | (At PIF) | (At CEO Endorsement) | (Achieved at MTR) | (Achieved at TE) |
|---|---|---|---|---|
| Expected metric tons of CO?e (direct) | | | | |
| Expected metric tons of CO?e (indirect) | | | | |
| Anticipated start year of accounting | | | | |
| Duration of accounting | | | | |

**Indicator 6.2 Emissions Avoided Outside AFOLU (Agriculture, Forestry and Other Land Use) Sector**

| Total Target Benefit | (At PIF) | (At CEO Endorsement) | (Achieved at MTR) | (Achieved at TE) |
|---|---|---|---|---|
| Expected metric tons of CO?e (direct) | 341,586 | 483,942 | | |
| Expected metric tons of CO?e (indirect) | 1,024,758 | 1,451,828 | | |
| Anticipated start year of accounting | 2024 | 2024 | | |
| Duration of accounting | 15 | 15 | | |

**Indicator 6.3 Energy Saved (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)**

| Total Target Benefit | Energy (MJ) (At PIF) | Energy (MJ) (At CEO Endorsement) | Energy (MJ) (Achieved at MTR) | Energy (MJ) (Achieved at TE) |
|---|---|---|---|---|
| Target Energy Saved (MJ) | | | | |

**Indicator 6.4 Increase in Installed Renewable Energy Capacity per Technology (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)**

| Technology | Capacity (MW) (Expected at PIF) | Capacity (MW) (Expected at CEO Endorsement) | Capacity (MW) (Achieved at MTR) | Capacity (MW) (Achieved at TE) |
|---|---|---|---|---|

**Indicator 11 People benefiting from GEF-financed investments**

| | Number (Expected at PIF) | Number (Expected at CEO Endorsement) | Number (Achieved at MTR) | Number (Achieved at TE) |
|---|---|---|---|---|
| **Female** | 2,250 | 2,253 | | |
| **Male** | 6,750 | 6,747 | | |
| **Total** | 9000 | 9000 | 0 | 0 |

Provide additional explanation on targets, other methodologies used, and other focal area specifics (i.e., Aichi targets in BD) including justification where core indicator targets are not provided

? As per the National Sample Survey (NSS) 73rd round conducted during the period 2015 ? 16, the MSME sector provides 111 million jobs (36.04 million in manufacturing, 38.72 million in trade. 36.28 million in other services, and 70,000 in non-captive electricity generation and transmission) nationwide in rural and urban areas. Averaged between manufacturing and non-manufacturing, women represent 24% of the MSME workforce. It is assumed that the proposed project benefits 225 MSMEs across 6 clusters. Assuming an average of 40 employees in each of these enterprises a total of 9000 men and women working in various manufacturing sectors will benefit from this project. Based on the current gender ratio of MSME employment, it is expected to include 4,000 women (44% women). Attempts would be made to identify 65 women led enterprises for the project, comprising a 30% participation ratio of women led enterprises. In terms of training and capacity, it is foreseen to impart knowledge and skills to at least 4,000 professionals. It will be attempted to include 2,000 women (50%). The project will achieve these targets through the following key interventions: ? The target of reducing GHG emissions will be achieved through - (i) improving operating practices for thermal energy optimization and industrial boiler efficiency in 50 manufacturing MSMEs; (ii) boiler retrofits and replacements in 175 manufacturing MSMEs. ? The project plans to work initially in six clusters, namely, Ankaleshwar in Gujarat, Bidar in Karnataka, Panipat in Haryana, Sindhudurg in Maharashtra, Sircilla in Telangana, and Surat in Gujarat. These are the tentative list of clusters where studies were carried out for the implementation. The rationale behind choosing the above-mentioned cluster are- o While making the cluster selection factors like small capacity boiler availability, poor operational practices, lack of awareness, and willingness to upgrade among the entrepreneurs were given consideration. The choice of clusters captures the diversity of MSME clusters, provides opportunities for

cross-learning, slow and rapid acceptance of interventions having mature and nascent ecosystems, etc. As the Project is a first-of-its-kind intervention in the MSME boiler sector, it is considered appropriate to pilot diverse locations/climatic conditions, types/sizes of boilers, boiler applications, and user MSME profiles (size, capacity, technical expertise/capability, etc.). This would provide a fair idea about the range of adoption-related issues/matters and receptivity to various efficiency measures mooted under this project. The implementation experiences gained, and results obtained through this project will be of immense help in designing larger scale-up programs to cater to the needs of a wider MSME audience and generate valuable data on boiler performance, which can be showcased for convincing a wider range of potential adopters. o Sircilla (Telangana) is a comparatively backward area that has a mix of textile, food processing, and other MSMEs. It has a textile park and the government has earmarked land for further addition of industrial parks. There is further scope for agro-based industries such as seed processing, parboiled rice mills, and rice mills. An intervention here will create a road map for more energy-efficient interventions in other backward clusters having micro MSMEs, which is also a focus of the government. o Sindhudurg (Maharastra) is located in the coastal area and is a typical food processing cluster. Building an ecosystem for energy efficiency through performance improvement in this region is expected to infuse high replicability among the MSMEs. Apart from the high potential for replication intervention in this cluster, the project will create an energy efficiency model for multiple agro-based industrial sectors such as mango processing/ canning, modern rice milling, cashew processing, hardboard from husk, and processing of amla. o Surat (Gujarat) textile cluster has a history of acceptance of innovations and the eco-system is almost ready there. Surat is known for textile processing amongst many other enterprises. We expect that this would be the cluster that would be the first pilot for the project because of the proactive interest of the industry associations, which would help create best practices for replication in other similar clusters. o Bidar (Karnataka) is amongst the backward districts in the state, which is a Chemicals and Chemical-based cluster. As this is one of the important sectors from the energy consumption point of view in India, energy efficiency solutions evolved in the sector can go a long way in inculcating energy efficiency best practices in this critical sector. o Ankleswar (Gujarat) is a hub of chemicals MSMEs, and it has a well-established and mature industry association. It has as many as 11 industrial areas. It has a large number of chemicals/ chemical-based units apart from MSME units from other sectors. It has a good growth trend of 20% to 30% every year in MSME. Its proximity to Surat provides a lot of opportunities for cross-learning and quick replication of interventions between clusters. Dahej, one of the industrial areas has been identified as a thrust area for large-scale industrial development by the Government of Gujarat for developing chemicals-based units. o Panipat (Haryana) cluster is famous for textiles and carpets. It has units on cotton, wool, silk, and artificial thread-based textiles, jute and jute-based, ready-made garments, etc. It can contribute thigh numbers when compared to other MSME units in the cluster. Panipat textile cluster has been chosen as a thrust cluster for textiles by the Government of Haryana. o Food processing and textiles have a higher

percentage of women employees and women-led businesses. Gender mainstreaming would have the maximum impact in these two clusters. To ensure alignment with the project's evolving needs and the ever-changing situational dynamics, we maintain the flexibility to expand or introduce new sectors or clusters during the execution phase, subject to approval from the Project Steering Committee. This dynamic approach enables us to respond swiftly and effectively to emerging requirements, ensuring the project's success in an ever-shifting landscape There is significant potential for energy efficiency in the MSME sector and hence a noteworthy decline in fossil fuel-based heat/steam generation and use in the country can be expected in the longer term. The achievable direct GHG emissions r?duction from project activities has been estimated in detail under the Global environmental benefits (in section 6 of 1a. Project Description under Part II). The discussions with stakeholders, and experts and study of various energy efficiency intervention reports during the project preparation study indicated a reduction potential of 13% to 20% from best available techniques and operating practices, 15% to 24% from energy efficient boiler retrofits, and 5% to 30% by replacing an existing boiler with an energy efficient boiler. o Harnessing the energy saving potential of 13% to 20% from the best available techniques and operating practices, would depend on several factors such as training modules and efficacy of imparting training, participation of MSME unit technicians, and their ability and flexibility to adopt them in workplaces; effectiveness of sensitization workshops to MSME unit owners in adopting steam optimization tools, permitting their technicians to participate and adopt the learning; etc. All these have an impact on the ultimate realization of full potential. o Harnessing the energy saving potential of 15% to 24%, identified through energy efficient boiler retrofits would depend on factors such as (a)how many of the retrofit interventions the MSME unit owners implement; (b) financing abilities of MSME unit owners (project provides only a small incentive, a large part comes as investment); (c) the ability of technicians to maintain the retrofits optimally, etc. o Similarly harnessing energy reduction potential of 5% to 30% by replacing old inefficient boilers with new efficient boilers would depend on factors such as the present efficiency levels of the boilers, new boiler design, type, package of new boiler, etc. o After detailed consultations with sectoral experts and subject matter specialists and upon careful consideration given to the technical aspects, conservative estimates on prospective fuel savings from (i) adoption of good operation and maintenance procedures indicated a (3% fuel conservation), (ii) energy efficiency boiler and system retrofit (7% fuel conservation) and of (iii) energy efficient boiler (10% fuel conservation). In the Project Identification Form also, the same fuel-saving quantum was considered. Other indirect GHG benefits and environmental and social-economic co-benefits will be achieved in terms of resource efficiency, pollution reduction, waste minimization, and cost savings which are reflected in the Project Results Matrix.

## Part II. Project Justification

### 1a. Project Description

**DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN WITH THE ORIGINAL PIF**

**DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN WITH THE ORIGINAL PIF**

The project was designed in full accordance with the PIF with some necessary adjustments to the project components, outcomes, outputs, co-financing, and budget. Key changes with the project design with the original PIF is as given below:

| **Components/ Outcome/ Outputs/ others at PIF stage** | **Components/ Outcome/ Outputs/ others at CEO Endorsement stage** |
|---|---|
| **Project Executing Entity(s):**<br><br>Under project stakeholder section of the PIF, the National Institute for Micro, Small, and Medium Enterprises (ni-msme) under the Ministry of Micro, Small and Medium Enterprises (MSMEs) was mentioned as the executing agency. | **Project Executing Entity(ies):**<br><br>Both ni-msme and National Productivity Council (NPC) are included as executing partners in Table 15 of part II Stakeholders. |
| ***Project Focus:***<br><br>The project included boilers using any type of fuels for proposed interventions. The proposal included improving energy efficiency of existing coal-based boilers also. | ***Project Focus:***<br><br>To alleviate the concerns of GEF member countries on fossil fuel boilers, the project focus has been shifted to creating an ecosystem to promote energy efficiency in non-coal-fired boilers or replacing coal boilers is built-in. The key considerations provided under **Section 6, Part II** are that no coal-consuming unit is considered as the project focus on units not using coal for making interventions under Good boiler operation and maintenance practices. 16 coal consuming units add Solar Heat as retrofits, the rest are non-coal consuming units for energy efficient boiler retrofits, and 23 coal-consuming units will be replaced by biomass and electricity boilers under the category of new energy efficient boilers. |

| | |
|---|---|
| ***Projected GHG Reduction Potential:***<br>During PIF, the estimated GHG emission reduction was 37,070 $tCO_2$ equivalent and 341,586 $tCO_2$ over project life cycle of project interventions. Under Table 4, Section 6, Part II of the PIF this was mentioned as Total CO2 emission reduction (tonnes per annum) 37,070, Total direct emission reduction throughout the life cycle of equipment 341,586 tCO2and total reduction of CO2 due to indirect effect 1,024,758 $tCO_2$. | ***Projected GHG Reduction Potential:***<br>Baseline information was gathered from all six clusters. Based on the information, GHG emission reductions were calculated and presented in CEO document in Section 6. Under Section 6, Part II, the annual GHG emission reductions is 43,405 tCO2, GHG emission reduction in project period is 39,629 tCO2, has been reflected. Further, total direct emission reduction throughout life cycle of equipment is 483,943 tCO2, and the total reduction of CO2 due to indirect effect is indicated as 1,451,828 tCO2. |
| ***Cost Effectiveness:***<br>Under Section 5, Part II of the PIF, the project would be cost effective, as it aims to directly reduce about 340,000 tCO2 with a GEF grant of less than 3 million USD, which would mean the cost effectiveness of the project would be 8.78 USD per ton of directly reduced CO2. Cost effectiveness is further evident from the high replication factor of 3 during the project cycle (bringing costs down to USD 2.93 per ton of CO2), owing to the common and widespread use of boilers in manufacturing MSMEs. | ***Cost Effectiveness:***<br>In Section 5 of Part II, the cost effectiveness has been justified as it aims to directly reduce about 483,943 tCO2 with a GEF grant of less than 3 million USD which would mean the cost effectiveness of the project would be 6.02 USD per ton of directly reduced CO2. Cost effectiveness is further proven from the high replication factor of 3 during the project cycle (bringing costs down to USD 2.01 per ton of CO2), owing to the common and widespread use of boilers in manufacturing MSMEs. |
| ***Project budget:***<br>The estimated budget during PIF were<br>? Component 1. 1,000,000 USD,<br>? Component 2. 237,800 USD<br>? Component 3. 1,200,000 USD.<br>? Project Management Cost. 126,890 USD. | ***Project budget:***<br>These estimated budgets have been revised based on more accurate estimates during PPG phase. The revised budgets are inter- component and do not exceed the overall approved budget.<br>? Component 1 budget reduced by 97,448 USD (from 1,000,000 USD to 902,552 USD)<br>? Component 2 budget reduced by 32,598 USD (from 237,800 USD to 205,202 USD)<br>? Component 3 budget increased by 130,046 USD (from 1,200,000 USD to 1,330,046 USD)<br>These revisions are reflected in Part I, A. Focal/Non-Focal Area Elements and detailed out in Annexure E Project Budget Table |

| | |
|---|---|
| ***Type of MSME units for project interventions:***<br>At PIF stage, the project interventions were envisaged to be carried out in boilers of MSME units consuming varieties of fuels including coal. | ***Type of MSME units for project interventions:***<br>GEF council comments included a key comment by Germany as follows, ?No support in improving coal-fired boilers should be conducted by the project, but rather support for renewable alternatives and combinations should be prioritized?.<br><br>Accordingly, the GEF CEO Endorsement document has focused on creating an ecosystem to promote energy efficiency in non-coal fired boilers or replacing coal boilers.<br><br>16 coal consuming units add Solar Heat as retrofits to provide steam partially or fully thereby encouraging them to move away from coal use. 23 coal consuming units will be replaced by biomass and electricity boilers under the category of new energy efficient boilers.<br><br>The descriptions are made under Part II, Section 6. In addition, detailed response is made to the country comments in ?Annex B: Response to Project Reviews. Germain Comments?. The revised detailed GHG calculations are presented in ?Annexure F. GHG Calculations?. The project was aligned with comments received from Council Members and that all feedback and related responses are available in Annex B: Responses to Project Reviews. |

*1a. Project Description.* Elaborate on: 1) the global environmental and/or adaptation problems, root causes and barriers that need to be addressed (systems description); 2) the baseline scenario and any associated baseline projects; 3) the proposed alternative scenario with a brief description of expected outcomes and components of the project; 4) alignment with GEF focal area and/or Impact Program strategies; 5) incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and co-financing; 6) global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF); and 7) innovativeness, sustainability and potential for scaling up.

A brief description of the project is presented below;

1) **The global environmental and/or adaptation problems, root causes and barriers that need to be addressed (systems description);**

**Energy use and GHG emissions**

India accounted for 6.8% global Greenhouse Gas (GHG) emissions in 2018 and is thereby the fourth largest emitter after China, USA and European Union [1]. Energy use accounted for 76% of global GHG emissions and electricity and heat generation is the single largest source of GHG emission, globally responsible for 33% of emissions[2] in 2018. In 2018, 49% of energy was used for heating, 29% for

transport and 22% for electricity[3]. 72.5% of final energy use for heating was derived from fossil fuels, 11.9% by traditional use of biomass, 5.2% by non-renewable electricity and 10.4% by modern renewable energy.

Industry is the fastest growing GHG emitting sector. In India, the industrial sector is responsible for 56% of final energy consumption[4]. Sector-specific technologies, cross-cutting technologies, and measures applicable in both large energy intensive industries andMSMEs can help reduce GHG emissions and enhance productivity in industry, including manufacturing MSMEs.

Industry uses energy for both heat (thermal energy for process heating and cooling) and power (electrical energy). In the manufacturing segment, globally, about 74% of energy is used for heating and cooling[5] (Figure 1), in short, thermal energy use (or industrial heat). 90% of this is provided from fossil fuels - 45% from coal, 30% from natural gas and 15% of oil. Mitigation of GHG emissions from process heating is possible through process changes (reducing heat requirements), energy efficiency, switch to renewable energy sources, and the combinations thereof.

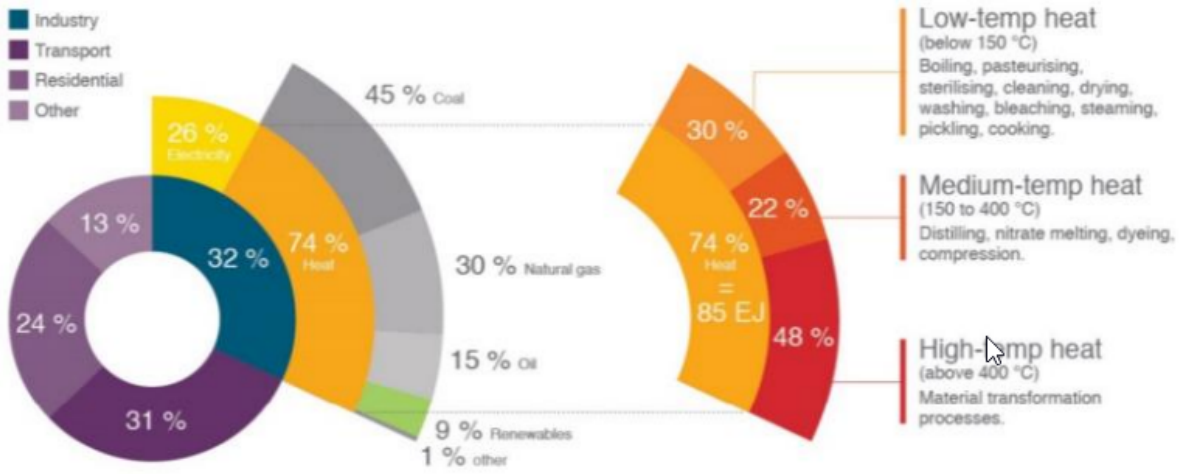


**Figure 1: Total final energy consumption (360 EJ in 2014) ([6])**

As reflected in Figure 1, the heat utilization pattern in industry can be split into low temperature applications (below 150?C) contributing to 30% of energy consumption, medium temperature heat (150 -400 ?C) contributing to 22% of energy consumption, and high temperature heat (above 400?C) contributing to 48% of energy consumption. About half of this industrial heating demand is required in the form of low to medium heat range, not exceeding some 400 ?C, which includes diverse ?light ? manufacturing sectors that exclusively require low and medium heat typically for heating, drying, sanitizing, and alike processes, in sectors as diverse as food processing, textile and garments, leather, pharmaceuticals, chemicals, metal finishing etc. These are sectors that are heavily dominated by MSMEs. Such low to medium heat is most commonly supplied indirectly through a heat transfer medium (e.g., steam, hot water or hot air, thermal fluid) with its associated utility system, comprising heat generation system (e.g., boiler and hot air generator), a process heat exchanger (for the actual supply of heat to the process) and a reticulation system, comprising pipes, pumps, valves, and controls.

Thermal energy losses in boiler and steam systems are highly variable and depend on diverse factors of design, manufacture, installation, and operation and maintenance. Figure 2 provides an illustration of the main heat loss streams in an industrial boiler and steam system.

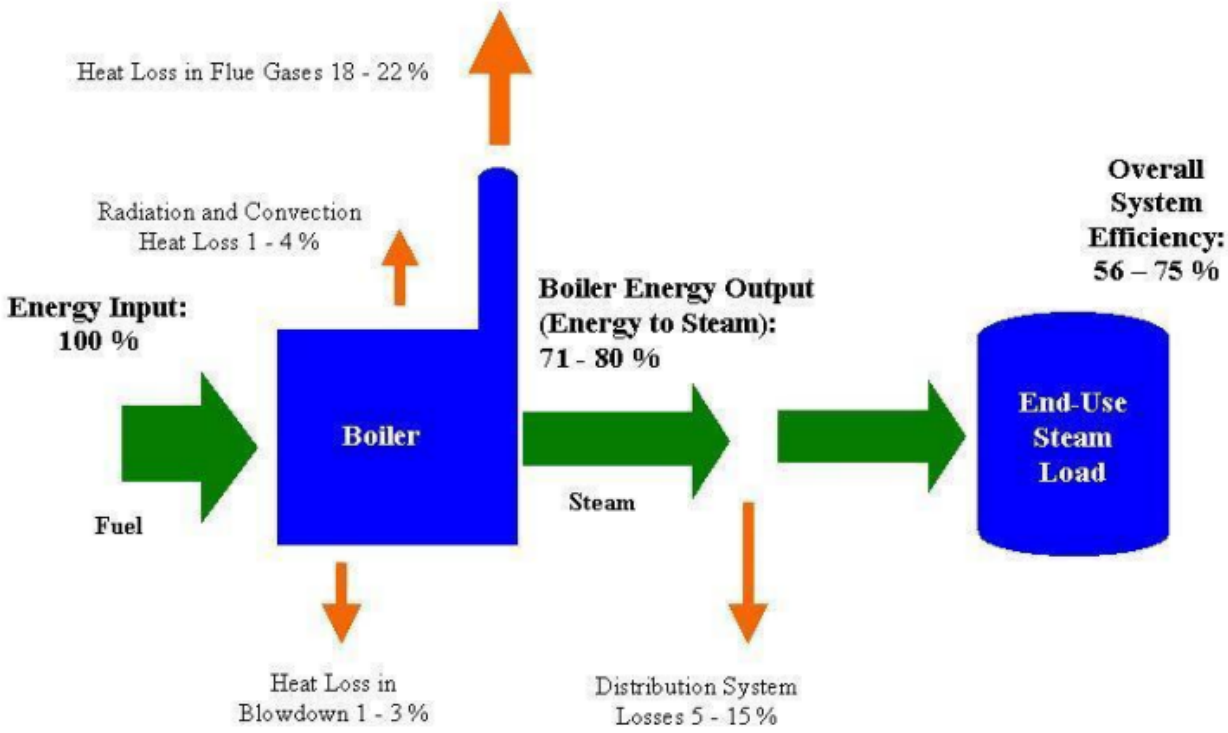


**Figure 2: Illustrative energy balance with key loss areas for industrial boilers**[7]

Thermal energy is costly for industry, including MSMEs, in terms of both operational costs (particularly for fuel, manpower, maintenance and safety of handling and storage of potentially flammable fuels) and investment costs (boilers and other equipment and associated steam reticulation). Inadequate and/or interrupted supply of process heating and cooling typically results in lower process efficiency, product quality and higher wastage, as the over or under heating of the process can result in additional undesired side reactions, slower process rates/additional processing time, insufficient drying, disinfection etc. Improving thermal efficiency, hence, has its benefits: (1) energy savings and reduction of associated GHG emissions; (2) improved process efficiency, productivity, and quality; and (3) financial benefits directly from energy costs savings and indirectly from additional income from enhanced productivity and quality. Moreover, efficient boilers achieve full combustion of the fuel, which minimizes flue gas emissions (of soot, CO, NOx, SOx, etc.) and hence contribute to abatement of air pollution.

**Root causes that need to be addressed**

Energy efficiency projects in India, including UNIDO?s GEF energy efficiency projects[8], have observed widespread inefficiencies in boilers and other indirect thermal energy systems in manufacturing MSMEs. These are caused by a myriad of interrelated technical, managerial, financial and behavioral factors, some of the major ones are listed below.

- ? Short-termism and focus on minimization of investment costs instead of life cycle heat supply costs: In their efforts to minimize investment costs in plant and machinery, MSME owners give preference to lowest cost boilers and auxiliary equipment resulting in lower energy efficiency and hence higher life cycle heat supply costs.
- ? Suboptimal specification, design and controls of the boilers and the thermal energy system at large: Energy efficiency is not included as requirement for design, procurement and installation of boilers and thermal energy systems.
- ? Use of outdated and inherently inefficient heat generation/utility equipment, particularly boilers, thermic fluid heaters, hot air generators: Old and outdated boilers continue to be used due to financial limitations of cash-strapped MSMEs.
- ? Suboptimal operation of utility equipment and other system components (e.g., steam traps, heating jackets, condensers, condensate return, etc.): This happens due to inadequate monitoring, operation and maintenance, and lack of instrumentations. Prevailing attitudes are that leaks and radiation losses are unavoidable and indeed part and parcel of operating an MSME unit, rather than a sign of inefficiency causing energy and financial losses.

These specific barriers for boilers and steam systems are further aggravated by impediments in government policy (lacking specific energy efficiency policy for MSMEs), awareness barriers, institutional barriers, supply-side barriers in manufacturing and service providers (lack of business support ecosystem - readily available, impartial advice and support on energy efficiency to MSMEs), demand side barriers (lack of enterprise capability - with regard to its management, financing, and technological capabilities), and financing (weak financing base of MSMEs), as applicable to all forms of energy efficiency in MSME segment (i.e. also applicable to lighting, motors, compressed air systems, etc.).

**Barriers that need to be addressed**

There are several barriers to the adoption of energy efficient boilers - incorporating better operating practices, retrofitting and replacement of boilers.

**Policy barriers**: There are no/limited policies and regulations for supporting adoption of energy efficient boilers and manufacturing in industry. Indian Boiler Regulation (IBR) is an independent body that provides boiler manufacturing guidelines in India and regulates it. The IBR is a construction code that specifies the design, material, fabrication, inspection, and testing requirements for boiler and boiler connected parts for use in India. India?s energy efficiency policy, the PAT scheme (Perform Achieve Trade), addresses large industries, designated consumers[9] but do not cover boilers and further they do not cover smaller industries/MSMEs. Equipment-wise energy efficiency labelling/ratings are available to appliances such as refrigerators and air conditioners, but they are not available for industrial products like boilers. In the absence of such policies or guidelines, the industries are not in a position to focus on energy efficient boilers and continue to operate at a low efficiency.

**Awareness barriers**: Lack of information on energy savings and proper sources for procuring energy efficient boilers also act as barriers to the end users. Large number of MSME boiler users are not well aware of the benefits in terms of energy reduction, energy bill reduction, local and global emissions

reduction potential. There is also lack of awareness on the current level of efficiency of their boilers, assessment procedures and sources to seek technical support for adopting energy efficiency measures.

**Institutional barriers**: There is a void of a proper institutional structure that can facilitate putting up an ecosystem for energy efficient boilers. Ironically, no specific government agencies are responsible for testing, certifying industrial boiler energy efficiency, causing industrial incoherence situation with specific reference to boilers. Quite often it is also observed that the Government agencies dedicated for training and skilling do not exercise a focused approach in raising knowledge and capacity towards energy efficient boilers. As a result, much needed focus for improvement of boiler performance is found misplaced.

**Supply-side barriers (manufacturer)**: The capacity of boiler manufacturers to produce and support energy efficient boilers and components is generally found poor except for a handful of manufacturers. Some of the barriers at the manufacturers end that emerged from the consultations with the boiler manufacturers and suppliers are listed below.

- There is limited availability of technical capacity for research and development (R&D) on the improvement of energy efficiency of locally manufactured boilers.
- Many manufacturers make boilers of their own design which is often poor, focusing designs more on time tested, low cost (as the MSME is price sensitive), and without having advanced or efficient component that might have emerged as part of latest developments.
- Technical teams in manufacturing units are insufficiently skilled for designing and manufacturing high efficiency boilers.
- Advanced technologies are not readily available in the market and even if they are available to certain degree, technical teams may be hesitant to consider them due to barriers of acceptance by end users.
- Many manufacturers have poor capital investment capacities to carry out R&D.
- Post sale of boiler, technical support is limited to AMC (Annual Maintenance Contract), which covers functionality, but no check on energy efficiency or improvement of components on energy efficiency.

In addition to the above barriers faced by boiler manufacturers, they also lack the understanding of marketing strategies for the introduction of energy efficient boilers in the market. Thus, apart from overcoming technical barriers, it is important for suppliers to communicate the benefits of energy efficient boilers/ energy efficient boiler components to the market.

**Supply -side (Service providers):** MSMEs often depend on independent senior industry experts for technical advice. They generally provide their advice to MSME units from their past experiences and may be disconnected with most recent technological developments. Thus, there is a lack of expertise available to evaluate boiler efficiency for conservation measures. MSMEs do not as yet have confidence in EE benefits and ability of EE in reducing energy bills. They do not have confidence that they may get value for money paid to service providers. BEE (Bureau of Energy Efficiency) has developed a number of Certified Energy Auditors and Certified Energy Managers who can provide recommendations. But business with MSME is not generally attractive on account of the low scale of work and low ability to pay; thus, the connect between MSMEs and CEA/CEMs is lacking.

**Demand-side barriers lack of Enterprise capability]**: MSME enterprises lack capability in management, mobilising finances and technical capabilities to embrace energy efficiency improvements in boilers through enhancing operational efficiency, EE boilers and EE boiler components.

- ? Management - Micro and small enterprises are generally one-person shows, with owner or operator covering all aspects of business and hence being unable to dedicate adequate attention to see energy and technology solutions through.
- ? Finances - Micro and small firms operate (partially) on an informal, cash flow basis with very few and outdated assets. Their ability to invest or borrow money through the formal system is very limited.
- ? Technological capabilities - MSMEs have paucity in properly engaging qualified technical staff that can understand thermodynamics and factors driving thermal energy and hence cannot oversee and realize boiler upgrades.

Financial barriers: Government Central/ State do not have any direct incentives for energy efficiency, particularly for boilers. Banks and financial institutions often impose collateral requirements to loan MSMEs as they are considered risky. This causes de-incentivizes MSMEs to seek loans. Further, MSMEs that operate (part) informally, cannot borrow loans through a formal system nor access government incentives.

Since early 2020, MSMEs have been particularly affected by the COVID19 pandemic, its impacts on health, communities, society and economy at large. UNIDO observed that during the national lock down period (March ? May 2020) manufacturing had come to a near standstill. The MSME segment voiced its cash flow and liquidity concerns, yet these were driven by a range of underlying factors, particularly: uncertainty in COVID containment policy and its impacts on society; sudden decline of demands and markets; reverse migration, and labour and skills deficits; stranded equipment and inventories; and disrupted supply chains [10]. In response, UNIDO and its partners, particularly India SME Forum, UN India Business Forum and Empretec India Foundation, developed and promoted ?Building Back Business from Crisis (B3C)? ? an online knowledge and resource portal to support MSMEs to restart, recover and rejuvenate their business (www.b3cmsme.org). B3C provides a roadmap for staged return and rejuvenation of business and puts particular emphasis on improving key aspects of business, including energy and resource efficiency of manufacturing operations.

During the peak of the second COVID19 wave in India (April ? May 2021), UNIDO?s firm level survey found that 61% of firms reported declined sales, 51% reported declined profits and 56% had laid off staff. MSMEs on average had been the worst affected and less able to secure government financial support. Among manufacturing firms, vulnerable sectors such as textile and garments, leather and footwear, and furniture were the worst affected. Resilient sectors included pharma, food processing, and automotive[11]. As a positive sign, UNIDO is observing the benefits of its implementation of its GEF4 and GEF5 energy efficiency projects in the MSME segment in mid-2021. For instance, there is a sustained interest of manufacturing MSMEs across different sectors to invest without specific financial incentives in proven energy efficient technologies to achieve cost savings and facilitate return to profitable business.

## 2) The baseline scenario and associated baseline projects

**Baseline projects and programmes**

India made significant progress in creating an ecosystem for promoting energy efficiency through a number of national programmes and projects, starting with Energy Conservation Act 2001, NMEEE (National Mission on Enhancing Energy Efficiency), Nationally Determined Contributions (NDC) at Paris, updated them recently.

**Energy Conservation (EC) Act 2001**

The Government of India has made EC Act to provide for efficient use of energy and its conservation. Bureau of Energy Efficiency with head office at Delhi is the autonomous body established to promote energy efficiency. BEE promoted- the Standards and Labelling (S&L) program, which is conceived to ensure that only energy efficient equipment and appliances would be made available to the consumers. The main provisions of EC Act on S&L Program are: (i) Evolve minimum energy consumption and performance standards for notified equipment and appliances, (ii) Prohibit manufacture, sale and import of such equipment, which does not conform to the standards, (iii) Introduce a mandatory labelling scheme for notified equipment appliances to enable consumers to make informed choices and (iv) Disseminate information on the benefits to consumers.

The EC Act has provisions for (1) assisting large energy consuming segments of the industry called ?designated consumers?; (2) creating and developing energy managers and energy auditing firms through certification and accreditation programs, respectively; (3) developing and updating Energy Conservation Building Codes for both residential and commercial sectors; and (4) setting up a Central Energy Conservation Fund to develop the delivery mechanism for large-scale adoption of energy efficiency services such as performance contracting and promotion of energy service companies.

In addition to the above, the Act also provides for strengthening institutions at the state and central levels to coordinate, regulate and enforce provisions of the Act and constitute State Energy Conservation Fund for promotion of energy efficiency. The Act has enforcing mechanisms for self-regulation through penalties and adjudication measures.

The industrial energy efficiency programme has a direct bearing on this proposed project. This programme has laid emphasis on mandatory energy efficiency among large, designated consumers, through market-based approach, particularly the Perform, Achieve and Trade (PAT) scheme[12]. PAT Cycle-I concluded in 2015, covered eight industrial sectors, namely: aluminum; cement; chlor-alkali; fertilizer; iron and steel; pulp and paper; thermal power plant; and textile with 478 industries. PAT Cycle-I resulted in energy savings of 8.67 million tonnes of oil equivalent (MTOE), monetary savings of INR 9,500 crore from saved energy consumption, emission reduction of 31 million tonnes of CO2eq, capacity building of over 5,000 engineers and operators and encouraged investments of about 3.5 billion USD in energy efficient technologies. Cumulatively, PAT Cycle-I realized 30% more than the targeted energy savings. PAT Cycle-II (2016-2019) included three more sectors, namely, railways; petroleum refineries; and electricity distribution companies (DISCOMs), covering 621 designated consumers in total. Monitoring and verification of 538 designated consumers under the PAT scheme

has delivered the following results as of June 2020 cumulative energy savings of 13.28 MTOE, annual savings of 4.2 billion USD with investment of 5.8 billion USD and GHG reduction of 61.3-million-ton CO2-eq.

**National Mission on Enhanced Energy Efficiency (NMEEE)**

NMEEE aims to strengthen the market for energy efficiency by creating conducive regulatory and policy regime and envisaged fostering innovative and sustainable business models to the energy efficiency sector. The Mission has been implemented since 2011. It is one of the eight national missions under the National Action Plan on Climate Change (NAPCC). NMEEE consists of four initiatives to enhance energy efficiency in energy intensive industries through PAT (Perform Achieve and Trade) ? improving efficiency in energy intensive sectors, Energy Efficiency Financing Platform (EEFP) - providing enhancement of stakeholders related to EE financing, MTEE (Market Transformation for Energy Efficiency) ? accelerating shift towards energy efficient appliances and FEEED (Framework for Energy Efficient Economic Development) ? development of fiscal instruments to promote energy efficiency. The Bureau of Energy Efficiency and Energy Efficiency Services Limited are the key implementing agencies of NMEEE.

**Updated Nationally Determined Contributions**

India through its Nationally Determined Contributions (NDC) to the Paris Climate Agreement committed to reduce the GHG intensity of its economy by 33%-35% by 2030 relative to 2005 levels[13]. India?s Updated First Nationally Determined Contribution Under Paris Agreement (2021-2030) submitted to UNFCCC in August 2022[14], states the following, namely;

- To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement of LIFE-Lifestyle for Environment ?as a key to combating climate change [Updated]
- To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
- To reduce Emissions Intensity of its GDP by 45% by 2030, from 2005 level [Updated]
- To achieve about 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF) [Updated].
- To create an additional carbon sink of 2.5 to 3 billion tonnes of $CO_2$ equivalent through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
- To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
- To build capacities, create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future technologies.

**Micro Small and Medium Enterprises**

Micro, small and medium-sized enterprises (MSMEs) account for about 90% of businesses and 60%-70% of employment worldwide. India is no exception. In 2015, there were 63.05 million micro-sized enterprises, 330,000 small enterprises and 5,000 medium-sized enterprises, relative to some 1,200 registered large enterprises[15]. Manufacturing sector accounts for 19.67 million MSMEs. MSMEs accounted for 30.3% of Gross Domestic Product (GDP). The Government of India changed the definitions for MSMEs with effect from 1 July 2020, meaning that any Indian business with turnover below INR 250 Cr (approximately 33 million USD) and investment in plant and machinery below INR 50 Cr (approximately 6.7 million USD) currently qualifies as MSME, regardless of its employee strength [16]. The implications of these 2020 definitions on the number and distribution of MSMEs in India are not yet clear.

MSMEs in India operate largely in clusters which are spread across the length and breadth of the country and are involved in producing textiles, food and beverages, including dairy, sugar, etc., pulp and paper, chemicals, pharmaceuticals, automotive components, ceramics etc. In many of the MSME sectors energy is one of the highest operating costs and consequently energy productivity is key to their competitiveness and survival, in particular in weak economic conditions prevailing since the outbreak of the global COVID19 pandemic in early 2020. The energy cost as share of production cost of a MSME varies typically from 10% to 50% depending upon the types of products and sector (as illustrated in Table 1). In the absence of comprehensive data on the energy consumption across the 6,000 estimated MSME clusters in India detailed energy benchmarking is not yet possible. Current energy use data for MSMEs are inadequate for offering robust recommendations on possible interventions for achieving energy efficiency in MSMEs.

**Table 1: Energy cost as share of total manufacturing costs in select MSME sectors ([17])**

| **Sector** | **Energy cost as share of total manufacturing cost (in percentage)** |
|---|---|
| Forging | 50% |
| Foundry | 50% |
| Die casting | 35% |
| Ceramics | 35%-40% |
| Moulding | 12%-50% |
| Sheet metal | 12%-28% |
| Textile dyeing | 10% |

For MSME sector, the government has partnered with GEF, its implementing agencies (UNIDO, World Bank) and other development partners (GIZ, EU, IEA, etc.) on different energy efficiency projects, covering awareness raising, capacity building, energy monitoring and audits and promotion of specific energy efficient appliances, including lighting, motors and pumps[18]. Moreover, energy efficiency is being mainstreamed through sectoral programmes. For example, the Ministry of MSME is running a Zero Defect Zero Effect (ZED) programme on productivity and waste minimization that amongst others

also addresses energy efficiency[19]. The leading specific energy efficiency national initiatives in the MSME sector in India are listed below. These are complemented by state and sector specific initiatives.

**Table 2: List of projects and initiatives aligned with proposed project**

| **Initiative / projects name** | **Brief Summary of the Initiative** |
|---|---|
| GEF-UNIDO-BEE Project on Promotion of Energy Efficiency and Renewable Energy in MSMEs (GEF-4 Cycle Project) (GEF ID 3553) | The objective of this project is to develop and promote a market environment for introducing energy-efficient technologies and enhancing the use of renewable energy technologies in process applications. The programme was initially operational in 12 MSME clusters in India from five sectors. Since 2019 its project activities expanded to 11 more clusters covering the same five sectors. One of the critical components of the projects is to offer a number of Energy Management Centres that help MSMEs doing energy monitoring for facilitating working energy conservation measures. The project is on track to achieve energy efficiency uptake in over 1,100 MSMEs by the end of 2021. By September 2021 the project triggered investments of INR 190 crores (~25 MUSD). |
| Financing EE Projects in the MSME Sector ? KfW | KfW, in cooperation with the Small Industries Development Bank of India (SIDBI) under the framework of the Indo- German Development Cooperation, was offering financial assistance in the form of a line of credit to SMEs for investment in EE projects. |
| GEF funded Facility for Low Carbon Technology Deployment (FLCTD) (GEF ID 4927) | The Facility for Low Carbon Technology Deployment (FLCTD) a GEF-funded UNIDO project was launched in 2016 with the objective to address technology gaps through the use of innovative energy efficiency and clean technologies and support their deployment, validation and scale-up. The project is being implemented in collaboration with the BEE. The FLCTD has already run 12 technology challenges covering six technology verticals, respectively: energy efficient motors; space conditioning; waste heat recovery; electric energy storage; industrial Internet of Things; and industrial resource efficiency, from which 60 innovations were selected for deployment support. |
| ?GEF-UNIDO-MSME-EESL Project on Promoting Market Transformation for Energy Efficiency in MSMEs?, (GEF ID 4893) | This GEF funded project is aimed at addressing in an integrated manner existing market barriers towards energy efficient technologies in manufacturing MSMEs, by, firstly, standardization of energy efficient technologies to sector and cluster requirements; secondly, bulk procurement of these standardized energy efficient technologies; and, thirdly, providing innovative financing solutions for their implementation based on energy service contracts from a revolving fund. The project works with 12 clusters and has so far been identified. The project has promoted 30 energy efficient technologies, based on energy surveys in 700+ MSMEs and detailed energy audits in 70+ MSMEs. The first sets of energy efficient technology have been implemented under the ESCO model in textile, tea, rice and other clusters. |

| | |
|---|---|
| MoMSME Initiatives to promote Energy Efficiency in MSMEs | MSMEs in general pay higher per unit energy costs, leading to higher costs of operations, and are more vulnerable to energy price volatility. MoMSME has the following programmes to assist MSMEs in improving their operational technology and competitiveness in the market, including energy and resource efficiency measures.<br>? Financial Support to MSMEs in Zero Defect Zero Effect (ZED) Certification Scheme to inculcate ZED practices in manufacturing processes<br>? Credit Linked Capital Subsidy for Technology Upgradation (CLCSS) for induction of state-of-the-art or near state-of-the- art technology<br>? Technology and Quality Upgradation Support to MSMEs for adoption of EETs in manufacturing units |

Table 2 is indicative of a considerable policy focus on energy efficiency and growing momentum for its implementation by MSMEs. The remaining policy challenge pertains in the main to focusing on specific energy efficiency opportunities (by sector or energy technology) and achieving scale and speed in implementation of and investments in replicable standard energy efficient technologies. By way of example the Project will zoom in on specific energy savings potential for boilers and associated steam systems and demonstrate these in four sub sectors that are highly dependent on boilers, i.e., textile processing, chemicals manufacturing, pharmaceuticals manufacturing and food processing.

Past and ongoing initiatives have amongst others been able to improve boilers and thermal energy systems in assisted companies in select manufacturing clusters, including for example, in dairy, rice milling, tea and chemical sectors[20]. The resulting body of knowledge on best practices for design, installation, operation and maintenance of boiler and thermal systems and their utility equipment remains ill-documented and needs to be upscaled for widespread application across different sectors and manufacturing clusters to create a specific ecosystem for thermal energy optimization and efficiency.

Under the Indian Boiler Act (1923), India has issued the India Boiler Regulation (IBR). This IBR is focused on boiler safety and does not directly address energy efficiency and GHG and other emissions. The IBR is a well-defined document that is mostly followed in medium to large steam operating industries to operate in a reliable and safe manner. There is scope to work towards updated IBR specifications, including addition of specifications for energy efficiency and GHG and other (e.g. particulate) emissions.

As per one of the estimates drawn from the earlier conducted survey by the National Productivity Council (NPC), there are more than 250,000 industrial boilers operating in India of which at least 40% (100,000+) does not apply IBR and the remaining are reported or considered to be IBR-compliant[21]. By means of example, Figure 3 shows the spread of boilers by their respective size in Surat, the leading textile dyeing and printing cluster in Gujarat that is supported by GEF (5) UNIDO project on market transformation for energy efficiency in MSMEs, as expressed in Ton Per Hour (TPH) steam generation.

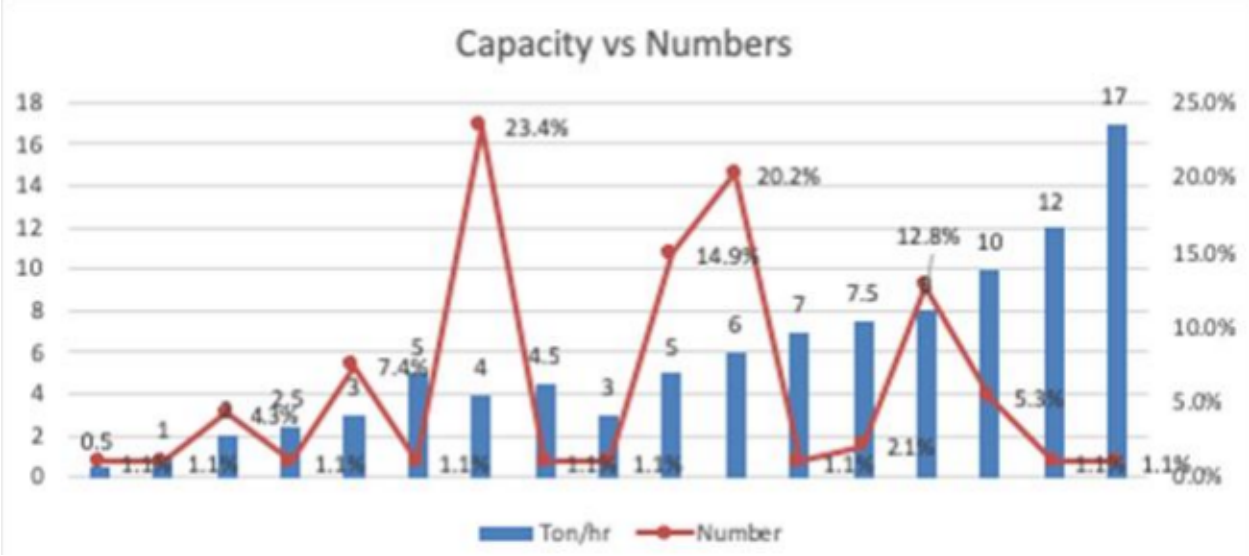


**Figure 3: Size-wise distribution of industrial boilers in Surat textile cluster[22]**

Over 80% of industrial boilers are currently within the range of 1 to 20 Ton (steam) Per Hour (TPH) with less than 20% exceeding 20 TPH. Boilers in size ranges of 4, 6, and 8 TPH appear most common, covering respectively 23.4%, 20.2%, and 14.9% of identified industrial boilers in the Surat textile cluster.

Until the mid-1900s, fixed-grade solid fuel-fired boilers were mostly in use in India with efficiency in the range of 50% to 60%. Then the late 1900s saw the solid fuel chain grade and spreader stoker whose efficiency was better than the fixed grade, typically in the range of 60% to 75%. By the end of the 20th century, the use of fluidized bed boilers came up with higher efficiency, particularly for medium and larger-scale boilers. Similarly, the majority of gas and liquid fuel-fired boilers are either single-pass or double-pass and are mostly non-IBR-complaint with capacities less than 1 TPH (down to 0.5 TPH capacity). The continuing reliance on relatively outdated and inefficient boiler designs, combined with prevailing small-scale and limited specific (thermal) energy knowledge in MSMEs all contribute to observed persistent inefficiencies in the use of industrial boilers by manufacturing MSMEs in India.

Energy efficiency is routinely being adopted by leading large boiler manufacturers (e.g., Thermax, Forbes Marshal). However, local manufacturers and suppliers that are preferred by MSMEs remain ignorant of such energy efficiency considerations and indeed are supplying cheaper boilers and auxiliary equipment that locks MSMEs into higher energy use and costs for years or even decades to come. The inclusion of standard energy efficiency features in the boiler designs will result in improving its efficiency by up to 35% depending on the type of boiler, its auxiliary equipment and integration in steam and thermal systems. UNIDO has estimated the total energy consumption of the MSME manufacturing sector in the range of 90 MTOE (Million Ton of Oil Equivalent). Assuming that some 70% of them used is for thermal utility, then about 60 MTOE (currently) is used by MSMEs. Thus, approximately half of the above energy consumed is in indirect heating systems (e.g. thermic fluid heating) for medium temperature ranges and the other half in direct heating at high temperatures (i.e. both some 30 MTOE each). Energy efficiency in indirect thermal system design and manufacture

may be expected to achieve reduction of some 4-6 MTOE within 5 to 8 years of its policy implementation (based on average of 15%-20% thermal energy savings).

The MSME sector thus still widely operates old technology boilers with lower efficiency. As a result of lack of awareness, the MSME sector does not make use of proven energy efficiency devices, such as flue gas monitoring with optimization of fuel and air ratios, heat recovery, insulation, etc. Another reason for doing so is the mindset of minimizing investment costs, without looking into their potential reduction in energy and thereby payback on investment. Furthermore, inefficient practices remain common in operation and maintenance of steam generation as well as in distribution and use of steam in their processes.

Actual analysis of availability of industrial boilers was attempted from the SAMEEKSHA portal (http://www.sameeeksha.org/) which contains energy mapping for 121 MSME clusters across energy intensive sectors in all parts of India. Out of these, 20 clusters heavily rely on industrial boilers, given the prominent requirement of steam in their respective production processes. With the data an estimate was made for the cumulative CO2 emissions by the installed boilers in these clusters. The following graphs represent the emission in millions of tons of CO2 from each cluster by its steam boilers only (see Figures 4 and 5 below). There are more than 3,500 boilers in these 20 clusters, including solid fuel and gaseous/ liquid fuel fired boilers, which emit more than 12 million tons of CO2 per year. The majority of the boilers are less than 2 TPH capacity which includes both IBR as well as Non-IBR. On categorizing these MSME clusters by sector, there are three major sectors namely rice milling, textile processing and pharmaceuticals manufacturing which contribute the major share in number of boilers (amongst these documented clusters). In terms of emissions generated, textile processing is on the top followed by rice milling and pharmaceuticals (see Figure 4). The rice cluster mostly used biomass as fuel, which makes it carbon neutral if considered the cycle of biomass formation. Thus, making textile and pharma the main CO2 emitters among these 20 MSME clusters. With the improvement of the boiler and its downstream system efficiency, there is a possibility of a reduction of about 2 million tons of CO2 emissions from the above set of clusters.

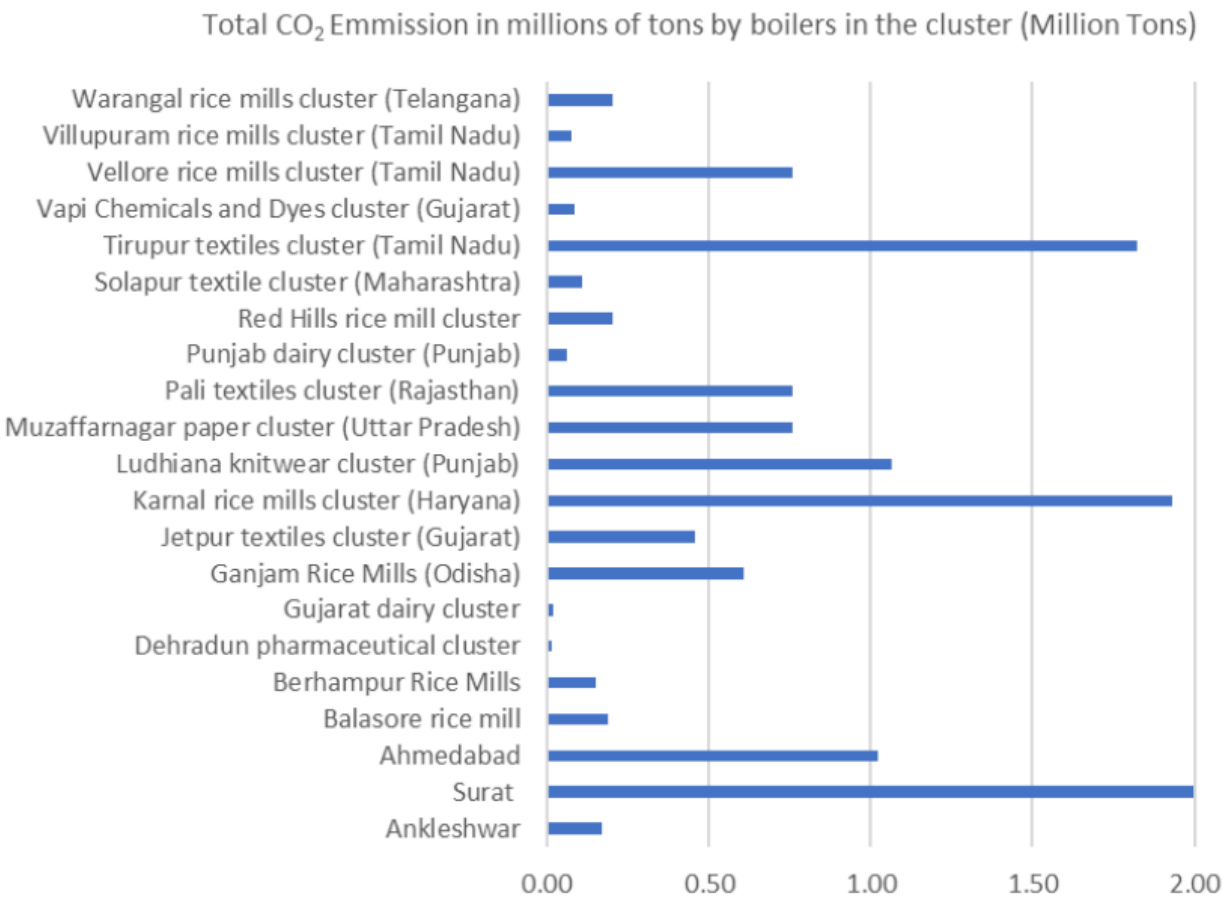


**Figure 4: Estimation of boiler related $CO_2$ emissions from 20 energy intensive clusters (Source: SAMEEKSHA http://www.sameeeksha.org)**

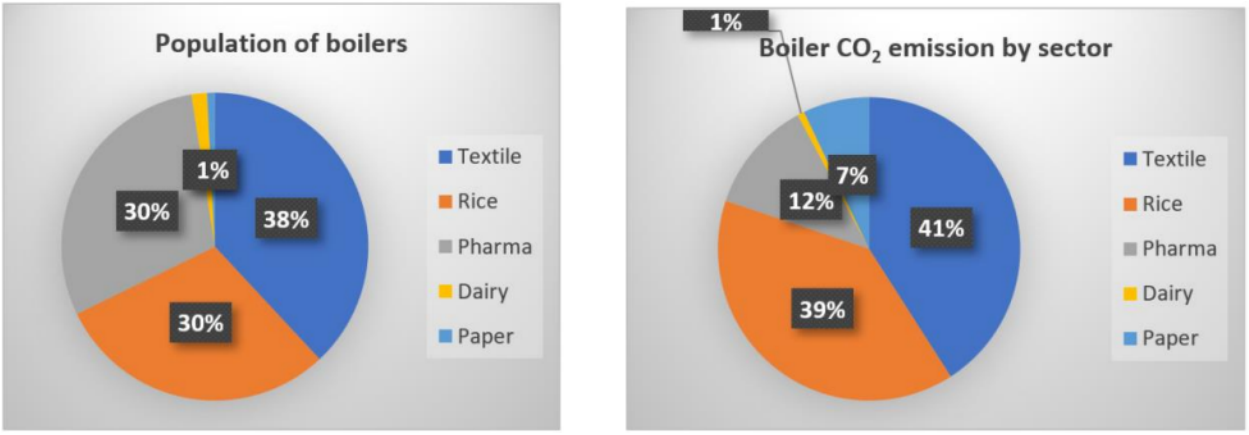


**Figure 5: Distribution of boiler population and boiler related GHG emission by sector from 20 energy intensive clusters (Source: SAMEEKSHA http://www.sameeeksha.org)**

Through its GEF portfolio of industrial energy efficiency projects in India, across Asia and elsewhere, UNIDO has developed and continues to promote steam system optimization[23], including with assessment manual[24], standardized training and qualification packages (training modules), case studies etc. These are further availed and promoted through UNIDO?s industrial energy efficiency accelerator [see: https://www.industrialenergyaccelerator.org/]. Moreover, UNIDO has extensive experience of successful implementation of specific Steam System Optimisation (SSO) Projects in the ASEAN Region.

**Baseline analysis during the Project Preparation phase**

Six clusters, spread in five different states, have been chosen for proposed interventions to enhance energy efficiency in boilers. For capturing the baseline situation in these clusters, questionnaire survey and field visits were conducted to understand the nature and types of boilers used, fuel used, quantity of fuel used, details of technology supply and service situation, environmental and health scenario and gender situation. Subsequently baseline measurement and monitoring were also conducted in some of the representative industries to have a sense on the prevailing energy efficiency of the boilers. Table 3 below provides the name of the cluster, state and the respective industrial sector. Major challenges and issues in adaptation of the energy efficient technologies were also captured through stakeholder consultation meetings.

**Table 3. Name of the cluster, state and sector**

| Sl. No. | Name of cluster | State | Sector |
|---|---|---|---|
| 1 | Ankleshwar | Gujarat | Chemical |
| 2 | Bidar | Karnataka | Pharma |
| 3 | Panipat | Haryana | Dye |
| 4 | Sircilla | Telangana | Mixed |
| 5 | Sindhudurg | Maharashtra | Food processing (Cashew) |
| 6 | Surat | Gujarat | Textile |

The total number of MSME units in the project clusters together are 375,583. 85% of them are micro enterprises, 14% are small and less than 1% are medium. Table 4 provides the total number of MSME units, their distribution to micro, small and medium categories for six selected project clusters/ districts. Subsequent sections summarize boiler related baseline information gathered during the project preparation (PPG) study for each of these project clusters.

**Table 4. Total MSME units, distribution into micro, small and Medium in six selected project cluster/ districts**

| **Name of the clusters** | **Total units** | **Micro** | **Small** | **Medium** |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Ankleshwar (Gujarat) | 14,961 | 10,989 | 3,750 | 222 |
| Bidar (Karnataka) | 4,485 | 3,707 | 746 | 32 |
| Panipat (Haryana) | 21,117 | 17,806 | 3,162 | 149 |
| Sidhudurg (Maharashtra) | 8,565 | 7,626 | 918 | 21 |
| Sircilla (Telengana) | 4,044 | 3,403 | 633 | 8 |
| Surat (Gujarat) | 322,411 | 275,905 | 45,386 | 1,120 |
| **Total** | **375,583** | **319,436** | **54,595** | **1,552** |
| Source: https://dashboard.msme.gov.in/Udyam_Statewise.aspx<br>Reference year: 30 June 2021 | | | | |

**Ankleshwar Chemical Cluster**

Units in the Ankleshwar Chemical Clusters are involved in manufacturing of dyes and pigments, pharma and pharma intermediates, pesticides and chlor-alkalis and utilize boilers in their production process. These boilers have capacity ranging from 0.5 to 5 TPH, which is adequate for their process heating requirements. A total of around 950 boilers are operational in the cluster. About 90% of the boilers in the cluster are of IBR type. Major fuels used in the cluster are biomass and biomass briquettes and these fuels are used in about 89% of the boilers. The boiler operational efficiency in Ankleshwar cluster was found to be in the range of 55% to 62% during the assessment. Total consumption of biomass and biomass briquettes in the cluster is estimated to be about 30,000 tons per month. The consumption of natural gas (NG) in the cluster is estimated to be about 20 lakh SCM (standard cubic meter) per month.

Major issues and challenges in boiler operation at cluster level are - (a) ineffective combustion control, (b) lack of heat recovery system, (c) low-capacity utilization, (d) manual fuel firing, and (e) inadequate insulation. Other issues include difficulty in obtaining clearance for biomass-fired systems due to particulate emissions, insistence on NG use in boilers by the Pollution Control Board (PCB), and high fuel cost (especially NG).

Potential energy efficiency improvement interventions that can be proposed are: combustion control, waste heat recovery, enhanced capacity utilization, and improved thermal insulation. The fuel saving achievable by introduction of above-mentioned measures is estimated to be about 14% to 17% of the total biomass consumption. The resultant biomass saving is expected to be around 5100 tons per month for the said cluster. Similarly, these interventions are expected to result in fuel saving of about 13% of NG. The resultant NG savings is expected to be in the range of 2.70 lakh SCM per month.

**Bidar Pharma Cluster**

The units in Bidar Pharma cluster are involved in manufacturing of various kinds of bulk drugs & intermediates while there are also a few formulation units that use boilers of capacity ranging from 0.5 to 10 TPH for meeting the process heating requirements. A total of about 24 boilers are operational in the cluster. About 96% of the boilers in the clusters are of IBR type. The major fuel used in the cluster is

coal, which accounts for 100% of the fuel consumption. Although biomass fuel is also used, the quantity used is negligible. The boiler operational efficiency in Bidar cluster was found to be in the range of 60% to 65% during the assessment. The total consumption of coal in the cluster is estimated to be about 2500 tons per month. The consumption of biomass briquettes in the cluster is relatively negligible.

The major issues and challenges in boiler operation at the cluster level are: (a) ineffective combustion control, (b) lack of heat recovery system, (c) low-capacity utilization, (d) manual fuel firing, and inadequate insulation. The other issues faced are low qualities of coal and water Potential energy efficiency improvement interventions are: combustion control, waste heat recovery, enhanced capacity utilization, improved thermal insulation, and boiler fuel switch from coal to NG .

**Panipat Dye Cluster (Textile)**

The units in Panipat Dye Cluster (Panipat Dyeing Zone) are involved in manufacturing and dyeing of cotton durries, carpets, furnishings, blankets, and yarns. The units in the cluster use boilers of capacity ranging from 0.5 to 10 TPH for meeting the process heat requirements. A total of 250 boilers are operational in the cluster. Almost 100% of the boilers in the cluster are of IBR type. Biomass and biomass briquettes are used as the major fuels across the cluster along with other fuels like coal and NG about 75% of the boilers in the cluster are being operated with biomass or biomass briquettes as fuel. These boilers were originally designed to operate with Petcoke as fuel. The boiler operational efficiency in the Panipat cluster was found to be in the range of 50% to 56% during the assessment. The total consumption of biomass and biomass briquettes in the cluster is estimated to be about 27,000 tons per month. The consumption of NG in the cluster is estimated to be about 1.0 lakh SCM per month while coal consumption in the cluster is estimated to be about 3000 Tons per month.

The major issues and challenges in boiler operation at cluster level are, ineffective combustion control, lack of heat recovery system, low-capacity utilization, originally boilers designed for Pet Coke but presently biomass is being used, manual fuel firing, and inadequate insulation. Other issues faced by the cluster in general are difficulty in obtaining clearance for biomass- fired systems due to dust pollution, insistence by PCB on NG use in boilers, high fuel cost (especially NG), and quality and availability of fuel. Potential energy efficiency improvement interventions are; combustion control, waste heat recovery, enhanced capacity utilisation, improved thermal insulation, improved fuel quality through briquetting, and replacement of boilers designed for biomass.

**Sircilla textile mills cluster**

The units in Sircilla cluster are involved in manufacturing and dyeing of polyester (dress material)/ cotton fabric (inner wear/ petticoats), etc. About 50 dyeing units are in operation with 250 jiggers (average size of individual units is 2 to 4 Jiggers[25]). The boiler capacity ranges from 1 to 3 TPH. Eleven boilers are in operation, and they are all of IBR category. All the units make use of firewood as fuel. The boiler efficiency measured during the Project Preparation phase was found to be in the range of 45% to 50%. The total estimated consumption of biomass in the form of firewood is 4680 tonnes per year.

The major factors affecting boiler efficiency are ineffective combustion control, lack of heat recovery system, low-capacity utilisation, manual fuel firing, inadequate/ improper insulation for boilers and steam lines, and condensate recovery.

Further issues faced by the units in the operation of boilers are difficulty in obtaining clearance for new boilers due to particulate emissions, increasing fuel cost, quality and availability of fuel, water quality, lack of technical manpower, instrumentation and skills, and lack of investment capacity.

Potential interventions for boiler efficiency improvements are: proper combustion control, introduction and utilization of waste heat recovery systems, condensate recovery systems, proper boiler sizing for improved capacity utilization, improved thermal insulation, improved water treatment and instrumentation, replacement of inefficient boilers with energy efficient boilers and training to the operators.

**Sircilla rice mills cluster**

Sircilla Rice Milling Cluster is one of the growing food processing clusters in the Telangana state. There are 32 parboiled rice mills and 54 raw rice mills. 35 more units are under construction. Out of 32 parboiled units, 22 have installed capacity of 4 TPH, 10 have capacity of 3 TPH. The cluster comprises micro, small and medium enterprises having capacity of 3-6 TPH. Most of the rice mills are located within a 25 km distance around Sircilla town. The rice milling units provide employment for more than 2000 people. 32 parboiled rice mills in Rajanna Sircilla district are involved in producing parboiled rice. The important by-products from rice mills include husk (18%-20%) and bran (5%-6%). Husk is used as in-house fuel in boilers and bran is sold outside for further processing to solvent extraction units. Almost all boilers in the cluster are of IBR type. Rice husk accounts for almost all fuel consumption in the cluster.

The boiler operational efficiency in Sircilla rice mill was found to be in the range of 50% to 60% during the assessment. The total consumption of rice husk in the cluster is estimated at 90,000 tonnes to 96,000 tonnes per year (if operated fully).

The major issues identified at the operational level are, poor condensate recovery, leakages, improper working of steam traps with leakages, damaged insulation on steam lines and on boiler surfaces, heat losses from firing grates, no attention to water quality, etc.

Causes for energy inefficiencies are - (a) many boilers appear inefficient, (b) old process machinery and technologies in use, (c) general lack of awareness on energy efficiency among workforce and management, (d) lack of awareness on alternative efficient techniques and products, etc.

**Sindhudurg food processing cluster (cashew processing)**

Sindhudurg cashew cluster majorly comprises cashew processing units amongst other food processing units and MSME units. Out of 29 processing units, 12 are small and 17 are micro processing units. Among the existing processing units, 21 are cashew processing units and 8 are food processing units. Both cashew and food processing units use boilers of capacity ranging from 0.2 to 8 TPH for meeting the heating requirements for processing. A total of around 29 boilers are operational in the cluster. Out of the 29 boilers, 9 are IBR type and 20 are non-IBR type. Firewood is the predominant fuel, 86% (25 nos.) of the units using this fuel. The remaining 14% (4 nos.) makes use of cashew shell/ cake as fuel.

The total consumption of firewood is estimated at 777.6 tons per year, cashew shells 581.4 tons per year, and the consumption of NG in the cluster is estimated to be about 14880 SCM per year.

The boiler operational efficiency in the Sindhudurg textile cluster was found to be in the range of 50% to 55% during the assessment. The radiation and convection heat losses account for 1% to 2%, heat loss due to blowdown 3% to 5%, heat loss in flue gases 25% to 30%, distribution losses 5% to 10%.

Major issues in the cluster are: units focus more on production and quality, expansion is the priority if they can leverage investment than improving efficiency. Some of the potential energy efficiency interventions recommended for this cluster are: increase boiler efficiency by lowering stack temperature, installation of economizer, adjustment of burner, installation of variable frequency drive, insulation of valves, cleaning of fireside, preheating combustion air, cleaning of waterside, return condensate to the boiler, recover heat from boiler blowdown, control blowdown rate, reduce excess air, reduce carry-over, inspect steam trap, reduce steam usage.

**Surat textiles cluster**

Surat has a large textile cluster involved in processing textiles for both dyeing and printing. They use boilers of capacity ranging from 2.5 to 20 TPH for meeting process heating requirements. A total of 98 boilers are surveyed and all are operational. Around all boilers in the cluster are of IBR type. The major fuel used in the cluster is coal (imported), which is used in about 73% of the boilers, 27% of them are using Indian Coal, 20% of them using both imported and Indian coal, 14% of them are using both imported and Indian coal and diesel as well, 16% of them are using NG and 2% use other sources.

The boiler operational efficiency in the Surat textile cluster was found to be in the range of 55% to 62% during the assessment. The total consumption of imported coal is estimated at 499,524 tons per year, Indian coal 169,824 tons per year, 22,636,968 litres of diesel per year and the consumption of NG in the cluster is estimated to be about 5.26 crore SCM per year and 33,360 tons of other source of energy per year.

General observations for all the clusters can be summarized as follows;
Issues and challenges in operation of boilers

- ? Ineffective combustion control
- ? Lack of heat recovery system
- ? Low-capacity utilization
- ? Manual fuel firing
- ? Inadequate insulation

The other major issues faced by the units in operation of the boilers are as listed below;

- ? Difficulty in obtaining clearance for biomass-fired systems due to particulate emissions
- ? Insistence by Pollution Control Board (PCB) on NG use in boilers
- ? High fuel cost (especially NG)
- ? Quality of coal
- ? Water quality
- ? Quality and availability of fuel

Potential interventions for boiler efficiency improvement

- ? Proper combustion control
- ? Introduction and utilization of waste heat recovery systems
- ? Proper boiler sizing for improved capacity utilization
- ? Improved thermal insulation
- ? Boiler fuel switch from coal to NG
- ? Maintaining fuel quality through briquetting
- ? Replacement of inefficient boilers with energy efficient boilers

**Baseline GHG Emission Estimates**

During Project Preparation (PPG) phase, information was gathered from about 1,516 MSMEs from the selected six clusters (sectors) namely, Ankleshwar (Chemical), Bidar (Pharmaceutical), Panipat (Textile), Surat (Textile), Sindhudurg (Food processing) and Sircilla (Textile and Rice mills) clusters. Some key summary points are as follows;

- ? Ankleshwar ? Cumulative GHG emissions for 950 MSME units is 679,248 $tCO_2$ annually and average per unit is about 617 $tCO_2$ per year. Emissions for different types of fuel consuming units are given in Table 5.
- ? Bidar ? Cumulative GHG emission for 24 MSME units is 78,000 $tCO_2$ annually and the average per unit is about 3,250 $tCO_2$ per year.
- ? Panipat ? Cumulative GHG emission for 250 units is 663,062 $tCO_2$ annually and the average per unit is about 1919 $tCO_2$ per year
- ? Surat ? Cumulative GHG emission for 159 units is 1,791,584 $tCO_2$ annually and the average per unit is about 8,577 $tCO_2$ per year
- ? Sindhudurg ? Cumulative GHG emission for 36 units is 2409 $tCO_2$ annually and the average per unit is about 64 $tCO_2$ per year
- ? Sircilla (Textile) ? Cumulative GHG emission from 11 units is 8190 $tCO_2$ annually and the average per unit is about 745 $tCO_2$ per year
- ? Sircilla (Rice mill) ? Cumulative GHG emission from 86 units is 168,000 $tCO_2$ annually and the average per unit is about 1,953 $tCO_2$ per year
- ? The cumulative GHG emissions from these units in the six clusters is 3,390,493 $tCO_2$ annually.
- ? The average GHG emission per unit is about 2,236 $tCO_2$ annually.

**Table 5. Key parameters and calculations of GHG emissions based on baseline survey in 6 clusters**

| Sl.no. | Cluster name | Category | Capacity (TPH) | Type of fuel | Quantity per year | No. of units/ boilers (nos.) | Emission factor | GHG emission ($tCO_2$/y) | Avg. GHG emissions/ MSME ($tCO_2$/y) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Ankleshwar | Chemical | 0.5-5.0 | Briquettes (tons) | 360,000 | 850 | 1.75 | 630,000 | 741 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Natural Gas (ton) | 18,240 | 100 | 2.7 | 49,248 | 492 |
| 2 | Bidar | Pharma | 0.5-10.0 | Coal (tons) | 30,000 | 24 | 2.6 | 78,000 | 3,250 |
| 3 | Panipat | Textile | 0.5-10.0 | Briquettes (tons) | 324,000 | 190 | 1.75 | 567,000 | 2,984 |
| | | | | Natural Gas (ton) | 912 | 25 | 2.7 | 2,462 | 98 |
| | | | | Coal (tons) | 36,000 | 35 | 2.6 | 93,600 | 2,674 |
| 4 | Surat | Textile | 2.5-20.0 | Coal (imported) tons | 499,524 | 73 | 2.6 | 1,298,762 | 17,791 |
| | | | | Coal (Indian) tons | 169,824 | 29 | 2.6 | 441,542 | 15,226 |
| | | | | Diesel (litres) | 19,015 | 41 | 2.64 | 50,200 | 1224 |
| | | | | Natural Gas (ton) | 400 | 16 | 2.7 | 1079 | 67 |
| 5 | Sindhudurg | Food | 0.2-8.0 | Firewood (tons) | 778 | 24 | 1.75 | 1361 | 57 |
| | | | | Natural Gas (SCM) | 11 | 4 | 2.7 | 31 | 8 |
| | | | | Cashew shells (tons) | 581 | 8 | 1.75 | 1017 | 127 |
| 6 | Sircilla (textile) | Textile | 1.0-3.0 | Firewood (tons) | 4,680 | 11 | 1.75 | 8,190 | 745 |
| 7 | Sircilla (Rice mill) | Rice mill | 3.0-4.0 | Rice husk (tons) | 96,000 | 86 | 1.75 | 168,000 | 1953 |
| | Total | | | | | 1,516 | | 3,390,493 | |
| | Average | | | | | | | 226,033 | 3163 |

**Energy efficiency**

Sample energy audits were conducted to analyse the energy efficiency levels of these units in different clusters during the Project Preparation (PPG) phase by using appropriate instruments. The results of range of energy efficiency are given in Table 6.

**Table 6. Energy efficiency measured in different clusters during PPG phase**

| Sl.no. | Parameter | Ankleshwar | Bidar | Panipat | Sindhudurg | Sircilla (textile) | Sircilla (Rice mill) | Surat |
|---|---|---|---|---|---|---|---|---|
| 1 | **Boiler efficiency range (%)** | 55-62 | 60-65 | 50-56 | 50-55 | 45-50 | 50-60 | 55-62 |

**Gender baseline**

The methodology adopted for compilation of the gender baseline was a combination of web search, information from secondary sources, discussion with sector experts and officials, stakeholder consultations, field visits to MSME clusters, questionnaire-based surveys and follow up interactions. Issues affecting women entrepreneurs were identified as (i) women entrepreneurs were less visible, (ii) entrepreneurship development programmes were underused by women entrepreneurs (iii) women?s decision-making processes were different and so were their risk perceptions (iv) accessing start up finance was more difficult for women (v) uptake of Government schemes by women entrepreneurs was suboptimal (vi) women had poorer access to business networks and associations. Issues affecting women employees were (i) women workers were engaged mostly in low or unskilled jobs and options for upward mobility for women employees were limited, (ii) women had very limited presence in technical or managerial positions (iii) most jobs in MSMEs were gender stereotyped (iv) recruitment patterns affected women employees more, (v) lack of pay parity between men and women workers especially in low-end jobs (vi) women were concerned about proximity, safety and working conditions in MSMEs and it was not their preferred place of work. Other issues identified as potential barriers for women were (i) absence of a role model of a woman owned MSME, (ii) lack of familiarity with gender mainstreaming processes and reluctance to move away from the business-as-usual practices, (iii) mismatch between skills of women and needs of the MSME (iv) absence of a peer group of women leaders and employees in the MSME, (v) business-as-usual practices and conventional mindsets of men in decision making roles in MSMEs. Men leaders prefer to look for competency and hire men.

Data on women entrepreneurship at national level is scanty. Information about women entrepreneurs in proprietary ownership were therefore included in the Sixth Economic Census[26]. Data from the 73rd Round of NSSO in the MSME Annual Report estimates the number of proprietary MSMEs in the country to be 60,841,245. About 20% of these are women owned. Women?s entrepreneurship is largely skewed towards smaller-sized firms with most of them being micro-enterprises. 83% of women?s enterprises operate without hired labour and 78% of women?s enterprises belong to the service sector. Interestingly, although women entrepreneurs with workers are much fewer than men entrepreneurs with workers, women owned firms have more workers. Collectively, women-owned enterprises contribute 3.09% of industrial output and employ over 8 million people. Approximately, 78% of women enterprises belong to the services sector, which is followed by manufacturing (Sixth Economic Census). Gender disaggregated data on MSME ownership and employment is given in Tables 7-10.

**Table 7. Gendered distribution of proprietary MSME owners [NSS 73rd Round]**

| states | Male | Female | Total |
|---|---|---|---|
| All | 48,450,722 | 12,390,523 | 60,841,245 |

As of the year 2021, 6.52 million enterprises were classified. 95.98% MSMEs were proprietary concerns. 2.11 million enterprises were registered under the manufacturing category and 4.41 million enterprises registered under the service sector.

**Table 8. Percentage distribution of enterprises in rural and urban areas (Male/ Female ownership)**

| Sector | Male | Female | All |
|---|---|---|---|
| Rural | 77.76 | 22.24 | 100 |
| Urban | 81.58 | 18.42 | 100 |
| All | 79.63 | 20.37 | 100 |

**Table 9. Percentage distribution of enterprises owned by Male/ Female entrepreneurs (category wise)**

| Category | Male | Female | All |
|---|---|---|---|
| Micro | 79.56 | 20.44 | 100 |
| Small | 94.74 | 5.26 | 100 |
| Medium | 97.33 | 2.67 | 100 |
| All | 79.63 | 20.37 | 100 |

**Table 10. Distribution of employees in MSMEs (in millions)**

| States | Female | Male | Total |
|---|---|---|---|
| All | 26.49 | 84.46 | 110.98 |

Women?s enterprises have been supported by the Prime Minister?s Employment Generation Program (PMEGP) that provides higher subsidies for women beneficiaries (Annual Report 2021-22, Ministry of MSME). From 2016/17 to 2020/21 (till 31 December 2021), 222,457 women entrepreneurs have benefitted from the PMEGP program. The top five states in terms of percentage share of total number of women owned establishments in the country are: (i) Tamil Nadu (13.51%) (ii) Kerala (11.35%), (iii) Andhra Pradesh (10.56%), (iv) West Bengal (10.33%) and (v) Maharashtra (8.25%).

Majority of women led MSMEs are found in textile, apparel, handicrafts, and food and beverage sectors. The highly diversified textile manufacturing sector dominates the women owned micro enterprise landscape. Over 35% of the women-owned micro- enterprises in the country are involved in manufacturing of textiles. Women constitute about 50% of the workforce in the textile sector. Women led MSMEs involved in manufacturing activities are typically co-located in relevant manufacturing clusters because of availability of specific skill sets, domination of certain trades in those clusters, well developed supply chains and / or targeted government programs.

The gender baseline research also showed that women were either not willing to or unable to scale their enterprises from the micro category to small or medium categories. An IFC document on opportunities and constraints of women owned very small enterprises in India[27] showed that women led /owned MSMEs were particularly hampered by infrastructure gaps, limited access to technology and information, difficulties in accessing talent, and inadequate access to capital.

**Environmental Baseline**

As per an estimate based on a survey conducted by the National Productivity Council (NPC), there are more than 250,000 industrial boilers operating in India. Over 80% of these are sized between 1 and20 tons (steam) per hour (TPH). Boilers sizes of 4, 6 and 8 TPH are the most popular. The NPC survey estimated that about 60% of the boilers in India are compliant with the Indian Boiler Regulation (IBR), while the remaining are not IBR compliant.

Until the mid-1900s, fixed grade solid fuel fired boilers were mostly used in India, with efficiency in the range of 50% to 60%. Subsequently, the late 1900s saw the solid fuel chain grade and spreader stoker whose efficiency was better than the fixed grade, typically in the range of 60% to 75%. By the end of the 20th century fluidized bed boilers had emerged with higher efficiency, particularly for medium and larger size ranges. Further, the majority of gas and liquid fuel fired boilers are mostly non-IBR-compliant. Such boilers are either single pass or double pass, with capacities between 0.5 to 1 TPH. Continued reliance of MSMEs on relatively outdated and inefficient boiler designs, combined with limited expertise on energy efficiency contributed to excessive energy consumption/wastage in the sector.

IBR is the umbrella regulation which governs most of the technical and operational aspects pertaining to boiler installation and operation in India. It also covers important E&S concerns, particularly in respect of technical aspects associated with boiler design and operations. Given below is a compilation of important environmental and social parameters associated with boiler operations, which are covered under different prevailing regulations (Table11).

**Table 11. Environmental and safety aspects, associated governing regulations**

| E&S aspect(s) | Associated governing regulation(s) | Remarks |
|---|---|---|
| Stack Emissions | Air Pollution Regulations (PCB) | Particulate Matter, Ash, Unburnt Carbon, $SO_x$, $NO_x$, CO and $CO_2$ |
| Ash / Waste Disposal | Waste Disposal Regulations (PCB) | Brick making, dumping at approved sites |

| | | |
|---|---|---|
| Safety Features in Boiler Design | IBR | Safety valves, water level and pressure indicators and controllers, fusible plugs etc. mandated by IBR<br>CO sensors, emission indicating devices, remote monitoring system, etc. are not mandated under IBR |
| Work Area Safety | Public Safety Standards of India | No focus on these aspects |
| Certified Workers | IBR | Mandated under IBR. However, compliance is weak and non-IBR boilers are not monitored |
| Worker Facilities and Benefits | Labour Regulations | Weak compliance. Most boiler operations are outsourced |
| Equal Opportunities, Wages | Labour Regulations | No policy is in place as this is unorganized sector |
| Non-discrimination | Labour Regulations | Not present as this is unorganized sector |
| Protection from Harassment | Labour Regulations | No mechanisms are in place as this is unorganized sector |
| Grievance Redressal Mechanism | Labour Regulations | No grievance redressal mechanisms exist as this is unorganized sector |

In general, therefore, it can be said that the baseline environmental and social compliance in the context of boilers deployed in Indian MSMEs is generally feeble, mainly because these boilers are mostly deployed in the unorganized sector and also because regulatory authorities mostly focus on primarily safety and pollution aspects.

3) **The proposed alternative scenario with a brief description of expected outcomes and components of the project**

**Project objective**

The project objective is ?to scale up and mainstream thermal energy optimization in manufacturing MSMEs through creation of an ecosystem for the design, manufacture and operation of efficient industrial boilers. The thermal energy optimization will be achieved through appropriate combinations of good boiler operation and maintenance practices, energy efficient boiler retrofits and installation of energy-efficient new boilers.

The project will focus on five manufacturing sub-sectors and reach out to six clusters. The sectors currently foreseen to be included are textile processing, manufacturing of chemicals, pharmaceuticals and/or food processing. The cluster selection will aim to achieve participation from the four leading manufacturing states in India, particularly Gujarat Haryana Karnataka Maharashtra, and Telangana.

**Project components, outcomes, and outputs**

The project is proposed to be structured in three substantive and one monitoring component and associated outcomes, and outputs. The following provides a brief summary of outputs and key activities foreseen under each component.

**Component 1: Demand creation through the development, promotion, and implementation of the best available techniques and operating practices for thermal energy optimization and industrial boiler efficiency**

This component aims to address demand-side barriers related to awareness, technical capacity, and knowledge of the financial and environmental benefits of adopting EE boilers ? the best available techniques and operating practices for thermal energy optimization and industrial boiler efficiency. Exposure to the latest developments in the boiler technology is essential to bring awareness among MSMEs that triggers the demand creation.

**Outcome 1.1: Manufacturing MSMEs install, operate and maintain industrial boilers and associated steam systems for enhanced energy efficiency**

This requires MSMEs to have better knowledge and capacity for thermal energy optimization and energy efficient installation, operation and maintenance and EHS/OHS requirements in the context of industrial boilers. The following are, therefore, the key outputs foreseen to contribute to this outcome.

Key activities to achieve this outcome shall be:-,

? 900 persons from MSME are trained in the operation and maintenance of industrial boilers and associated steam systems for enhanced energy efficiency,

? 65 MSME units led by women are trained on various activities related to the project,

- ? 50 MSME units are trained, imparted with knowledge to operate and maintain industrial boilers for enhanced energy efficiency
- ? 2,243 $tCO_2$ of GHG emissions reduced in project duration

A list of proposed interventions that are expected to bring energy efficiency are listed below with brief description.

**Fuel Preparation**: Improper fuel leads to fuel line choking, frequent boiler stoppages, erosion of components, poor combustion, etc. Clean fuel to specifications is the key to consistent and continuous boiler operation. Any impurities in the fuel cause choking, improper firing, erosion and lowering of efficiency, component replacement, and increased maintenance cost. Pre-cleaning measures when in place help in smooth boiler operation. Recommendations of the boiler manufacturer and good plant engineering practices are to be followed. For consistent performance:

? Installation of Gas/Oil Filters: Coarse and fine filters are essential components for oil or gas-fired installations. They serve the critical purpose of ensuring that the fuel supplied to the burner is clean and free from impurities. Clean fuel is paramount for the efficient and safe operation of the system.

? Oil Preheaters for Viscosity Reduction: Oil preheaters are indispensable when dealing with heavy oil. Preheating is a necessary step to reduce the viscosity of heavy oil, enhancing fuel atomization and thereby improving combustion efficiency. It's important to note that for light oil installations, the viscosity of the fuel is naturally low, making preheaters unnecessary.

? Solid Fuel Dryers for Moisture Reduction: Many biomass fuels have high moisture content when sourced directly from farms. To optimize their combustion, fuel dryers are employed to reduce moisture levels. This not only improves combustion efficiency but also enhances overall system performance. Additionally, lowering moisture content facilitates easier fuel handling, as dry fuel is far more manageable than wet fuel.

? Screens for Sizing Solid Fuels: Screens designed for sizing solid fuels play a pivotal role in various applications, especially for biomass users. Biomass fuels often contain oversized pieces when received from farms. Without proper sizing, these oversized pieces can lead to blockages in fuel lines and equipment, such as screws, rotary feeders, and chutes. Therefore, employing screens to size and refine solid fuels is a necessity for smooth and efficient operation.

? Expected Energy Savings of 2% to 5%: By implementing these measures, it is possible to achieve significant energy savings ranging from 2% to 5% in boilers that use various types of fuels. These savings result from the improved combustion efficiency and reduced wastage of fuel, making the investment in these technologies highly worthwhile

**Training on efficient operation and maintenance practices**: Fast-changing fuel scenario and boiler designs, improved instrumentation and communication technologies necessitate continuous upgradation of the knowledge and skills of the boiler operators and supervisors. Various training programmes conducted by boiler makers and instrumentation suppliers to be attended. Training of the personnel on plant safety and emergency operation also to be included.

? Maintain operation logbooks
? Boiler operation trend analysis for predictive maintenance and troubleshooting
? Follow manufacturer?s recommendation on maintenance practices
? Critical spares stock
? Knowledge and skill upgradation thru training programmes

Encouraging units to adopt good water treatment practices through appropriate measurements: Water treatment is equally important for healthy and long boiler operation. Focus on the latest water treatment techniques, chemicals and practices is necessary and skill upgradation is recommended. Maintaining water quality as per manufacturer?s recommendations is a must for efficient performance and long boiler life

? Avoid scaling of boiler surfaces, which helps heat transfer and maintenance of consistent efficiency
? Provide water sampling and chemical lab facility for periodical analysis
? Measure and maintain water pH, oxygen content, TDS, and other parameters as per specifications
? Maintain stock of water treatment chemicals and chemical dosing systems
? Expected energy savings are 3% to 5%

**Optimal Capacity Utilisation of Boilers**: Boilers when loaded to 80% capacity have best operating efficiency. Plant load pattern study and boiler capacity selection to match the load can result in good fuel saving up_to 5%. If the capacity mismatch is observed, boiler capacity reduction with lower rated burners / fuel-firing mechanisms, lower fan sizes, etc to be attempted after cost economy analysis. Highest efficiency of the boiler is achieved in the load range of 75% to 90% of the capacity and continuous operation.

? Steam demand to be steady and near this range
? Continuous boiler operation and reduce ON / OFF frequency.
? Avoid / Reduce load fluctuations.
? Steam accumulator for highly fluctuating loads
? Expected energy savings are 1% to 2%

**Systems in place to monitoring combustion parameters**: With improved instrumentation technology and availability at an affordable cost, boiler operation can be monitored more effectively than in the past. Reliable sensors and transmitters and user-friendly display and recording gadgets help in maintaining near ideal boiler operation. Proper combustion with lowest possible excess air leaving minimum unburnt fuel gives high boiler efficiency,

? Measurement and logging fuel consumption
? Frequent measurement of $CO_2$ / $O_2$ and other combustion parameters like furnace temperature, draft, ash quality, and unburnt fuel quality,
? Periodic fuel analysis for calorific value and constituents

**Systems in place for better maintenance practices - descaling**:

**Systems in place for better alarms, safety aspects of boiler operations**:

**Steam optimisation tool (a software)**;

? Energy Saving Estimation Tool/ mobile app for boilers
? Expected energy savings are 2% to 3%

**Use of IOT for monitoring and control**;

? Use of Internet of Things ? owners for monitoring
? Use of IOT for technician/ worker
? Expected energy savings are 3% to 5%

**Overall improvements in energy efficiency**: **13% to 20%**

This component will engage a Component Resource Person ? full time to contribute to and track all activities, a gender expert ? part-time consultant to ensure gender inclusion activities are followed, and a part-time ESMP expert to ensure Environmental and Social Safeguards are included in the project components. They will also contribute to other components of the project wherever required.

***Output 1.1.1: Energy savings estimation tools developed for industrial boilers and promoted to manufacturing MSMEs and their technology suppliers and service providers***

User-friendly Excel based quick estimator tool and/or mobile app will be developed that can analyse the current status of energy loss and possible energy savings potential for various boilers and associated steam and thermal energy systems commonly utilized by manufacturing MSMEs. This will be piloted in representative industries for authenticating the veracity of the data analysed and results thereof (in combination with output 1.1.3). Awareness campaigns will

then be designed and created targeting different involved parties particularly industrial units, consultants, technology suppliers and service providers. The awareness campaign will utilise both digital and physical media for reaching out to the maximum number of industries and business ecosystem participants. Best practices of EHS/OHS can be included. The activities shall include the following;

- Developing an Steam optimisation tool contributing to 2 to 3% energy reduction
- Encouraging manufacturers, service providers (about 40 persons) downloading the tool on their handsets
- Encouraging end user MSME units (1 owner and 3 technical staff in each unit, totalling to 900 persons) to download app on their handset (this includes units doing retrofits and boiler replacements)
- Piloting the Steam Optimisation Ttool in 225 project units (this includes all three types of interventions: O&M, retrofits and boiler replacements)
- Conduct energy audits in 50 project MSME units prior and post project interventions
- Stack assessment for measuring reduction in pollutants such as soot, $CO_2$, $SO_x$, and $NO_x$ carried out in 5 MSME units

***Output 1.1.2: Capacity building and training system established on best available techniques and operating practices for industrial boilers***

A comprehensive capacity building and professional training and learning system will be established and rolled out for MSME owners, their technical and maintenance staff and energy and technology consultants. This will cater to both online and face-to-face delivery mode. The training packages will focus on basic concepts and determinants of thermal energy efficiency in boilers and (steam) systems, including understanding and interpretation of efficiency specifications, comparative performance of alternative boiler designs and system configurations and best practices for installation, operation and maintenance, including relevant key operational performance indicators. This will also include step-by-step guidance for in-house assessment and various potential solutions to address energy losses through appropriate boiler retrofit and upgrading of steam systems. Practical case studies and success stories from the field will also be promoted through the training programmes. The activities shall include the following;

- Developing 4 nos. of training materials on techniques and operating practices for industrial boilers for (i) owners, (ii) technician and maintenance staff, (iii) technology consultants ?levels in applicable languages and (iv) Gender and ESMP
- Training owners of project MSME units (about 225 persons)
- Training of technicians and maintenance staff of 225 project MSME units (about 450persons)
- Training of technology consultants (30 persons)
- Skilling programs for women in data management, safety audits, fuel inventory management etc. (1200 persons)
- Self-financing facilities to meet non-financial needs of women employees (500 persons)
- Promoting women to operate fuel and water testing labs in 6 clusters

***Output 1.1.3: Best boiler operation and maintenance practices assessed and implemented in 50 manufacturing MSMEs***

The quick estimator tool (output 1.1.1) will provide a preliminary estimate for the potential for energy savings within any specific MSME industry or for a specific boiler and steam system design. Under this output, this will be extended with focused thermal energy assessment and development and techno-economic feasibility assessment of energy system optimization solutions for at least 50 manufacturing MSMEs. These solutions will include improved features/sub-systems/procedures for enhanced waste management and worker management practices. Participating MSMEs from different sub-sectors and clusters will also receive advisory support for actual implementation of recommended efficiency solutions with focus on achieving best possible operation and maintenance practices. The MSME specific data from all assessed MSMEs will be analyzed and presented in a technical study report that, firstly, outlines and illustrates the practical thermal system optimization approach, and, secondly, draws conclusions and recommendations in regard to commonly occurring inefficiencies and best installation, operation and maintenance practices. The activities shall include the following

- Assess 50 project MSME units for energy saving potential using Steam Optimisation boiler tool
- Provide advisory support to 50 nos. of MSME units for implementation of efficiency solutions on best possible operation and maintenance practices

***Output 1.1.4: Knowledge portal on best available techniques and operating practices established***

In parallel to above outputs, an online knowledge portal will be established to actively promote the knowledge generated, tools, best practices, case studies, learning modules and other resource materials on thermal energy system productivity and the importance of appropriate selection, installation, operation and maintenance of industrial boilers therein including better EHS/OHS practices as well as better waste and personnel management. The knowledge portal will be clearly structured with different user interfaces to address the specific information and support requirements of different user groups, particularly boiler users (management and technical staff of manufacturing MSMEs), boiler and boiler auxiliary makers (management, design and technology staff of boiler makers), and energy and technology service providers. Moreover, the knowledge portal will present technology, operational and investment information according to each stage of the Project?s three-pronged efficiency improvement approach, respectively for: good boiler operation and maintenance practices; energy efficient boiler (and steam system) retrofit; and new energy efficient boilers (as further elaborated under section 6 below on global environmental benefits).

As UNIDO possesses wide experience of setting up knowledge management platform both at the national and international platform, its vast experience is planned to be utilised in this project. The knowledge portal will have a two-way exchange with the GEF industrial energy efficiency accelerator, implemented by UNIDO. Firstly, the project?s knowledge portal will draw from global knowledge products, technical resources and expertise and de facto provide an Indian access window to the globally available information and resources, specifically for

thermal efficiency of boilers and associated process heating. Secondly, the new knowledge products, including e.g. the energy savings estimator tool (output 1.1.1), training materials (output 1.1.2) and standardized energy efficiency specifications (output 2.1.1) will be promoted for use outside India through the industrial energy efficiency accelerator. In addition to linking of knowledge systems, knowledge exchange virtual events will be hosted to foster South-South and triangular cooperation. The activities will include the following;

- Launch an Energy Efficient Boilers Portal
- 2500 persons visit the portal
- Develop 6 nos. of information and tutorials to improve air quality, better waste management and safety, around boilers for men and women
- Design modules and conduct 6 nos. of Gender sensitization programs for men and women in leadership roles in MSMEs
- Conduct 6 nos. of Gender and ESMP sensitization of employees of financial institutions leading to increased lending for women led MSMEs and ESMP inclusive projects

**Component 2: Market facilitation**

Through the introduction, standardization and mainstreaming of energy performance specifications in the market for boilers (new and retrofit).

This component will engage a component resource person who will ensure activities listed below are carried out and contribute to facilitating scale up and mainstreaming of project results.

**Outcome 2.1: Industrial boilers and boiler retrofits are invested in with due consideration of their energy efficiency performance**

This requires transparency on the actual energy efficiency performance of different boilers and retrofits, which can only be achieved with standardized energy efficient boiler specifications, along with their promotion to market players and their inclusion in existing energy efficiency policy and strengthening of boiler regulations. The following are therefore the key outputs foreseen to contribute to this outcome. Key activity under this outcome is as follows;

? Developing guidelines promoting/ mandating energy efficiency in boilers (3 nos.)

**Output 2.1.1: Transparent system of standardized efficiency specifications for industrial boilers set up**

To bring transparency into the market for smaller-scale industrial boilers, the project will work to set up a system of standardized energy efficiency specifications for industrial boilers. The specifications would include standardized energy efficiency features such as monitoring and control, heat recovery and boiler design with key performance indicators (e.g., with regard to construction materials, fuel-air ratios, residence times, air flows, and insulation). These will allow manufacturers of energy-efficient boilers to differentiate from other boiler manufacturers and assist manufacturing MSMEs to select the industrial boiler that is most appropriate for its thermal energy needs and that achieves lower life cycle steam costs. The efficiency specifications will initially be promoted, demonstrated, and replicated within the project on a voluntary basis, driven by their business case. In addition to standard safety features such as

safety valves, water level and pressure indicators and controllers, fusible plugs etc., modern features like CO sensors, emission-indicating devices, and remote monitoring systems will also be integrated into the design. These though are equally appropriate for inclusion into mandatory requirements (including for example through formal revision of Indian Boiler Regulations IBR addressing all relevant aspects of boiler operations, including safety, registration, inspections etc., as a potential spin-off from output 2.1.2). Definition of efficiency specifications will be pursued for different types of boilers and associated fuels and applications (in terms of thermal heat demands) by critically looking at performance parameters in operational boilers (in connection with output 1.1.3) and through already available secondary source information and data from earlier field studies. These will be peer reviewed by energy experts of the country through a consultative process and once finalised, these will be published in the form of guidance document for utilisation by boiler makers and boiler users. Key activity, therefore, is

- Publish 2 nos. of guidance documents with efficiency specifications for (i) boiler makers and (ii) boiler users

**Output 2.1.2: Policy makers and regulators are mobilized to add energy efficiency considerations in comprehensive revising of regulatory and institutional frameworks for the manufacture and operation of industrial boilers in particularly in manufacturing MSMEs**

Review and assessment of the scope and effectiveness of current regulatory and institutional frameworks that govern the design, manufacture and operation of industrial boilers, including through the IBR. The Indian scenario will be compared with international good practices and assessed with a view to the rapidly changing global energy, climate and environmental scenarios. On the basis thereof, the project will engage with policymakers and regulators to highlight strengths and weaknesses of current practices in India and identify gaps and opportunities for improvement. Depending on findings and interactions, this may be expected to contribute to a spin-off initiative to update and modernize the IBR with extended scope and applicability ([28]). The possibility of influencing non-IBR boiler manufacturers through appropriate quasi-regulatory provisions to incorporate energy efficiency will also be explored. The key activity therefore is,

A document on best practices for energy-efficient boilers and best EHS practices for consideration of policy makers and regulators for review and revision of regulatory and institutional frameworks for the manufacture and operation of industrial boilers in MSMEs and operation of industrial boilers in MSMEs published.

The proposed reports and guidance documents outlined in Output 2.1.1 and 2.1.2 are not merely intended for consideration; they are envisioned to be embraced and effectively put into action. It is noteworthy that both the Ministry of Micro, Small and Medium Enterprises (MSME) and its autonomous entity, the National Institute for Micro, Small and Medium Enterprises (NIMSME), will play integral roles in the formulation of these documents. Consequently, our expectation is not only their consideration but their full-fledged endorsement and practical implementation.

Furthermore, the project is committed to ensuring the accessibility of these resources to a wider audience. With this objective in mind, every effort will be dedicated to making these reports and guidance documents readily available on both the NIMSME and MSME Ministry websites. This proactive approach will enable a broader audience to benefit from the insights and recommendations contained within these valuable resources.

***Component 3: Supply creation through the promotion of the manufacture of and market for energy-efficient industrial boilers and boiler retrofits for manufacturing MSMEs***

**Outcome 3.1: Suppliers manufacture and market energy-efficient boilers and components for energy efficient boiler retrofits**

This requires suppliers to access energy efficiency guidance for the design (including operational, component and material specifications) and manufacture of boilers and components for boiler retrofits and support for market development of these new energy-efficient boilers and retrofits. The following are the key consecutive outputs foreseen to contribute to this outcome. A list of proposed interventions that are expected to bring energy efficiency in boilers through retrofit are listed below with brief description.

**Waste heat recovery from flue gas:** Heat recovery systems recommended when flue gas temperature exiting the boiler are more than 200 0C

? Flue gas exit temperature decided as per Sulphur content in the fuel.
? Typical flue exhaust temperature150 0C after heat recovery unit
? Economizer
? Air preheater
? Solid fuel dryer for moist fuels (moisture above 40%)
? Condensing economizer for gas-fired installations. Flue gas temperature < 1000C possible.
? Expected energy savings are 5% to 10%

**Insulation:**

? Uninsulated boiler surface and pipelines observed during installation visit
? Such surfaces cause heat loss and are also safety hazard
? Follow insulation guidelines available in thermal engineering domain
? Mineral wool insulation from reputed manufacturers as per the recommendations and good engineering practice.
? Expected energy savings are 2% to 3%

**Steam traps:**

? Removes condensate from steam and enhances heat transfer in the user equipment
? Expected energy savings are 2%

**Condensate recovery:**

? Feedwater preheating using process return condensate.
? Condensate cooling below 900 C possible.

? Expected energy savings are 3%

**Air vents, flash steam recovery:**

? Heat recovery from blowdown vessel flash steam
? Condensate collection after heat recovery is additional advantage. To be mixed with process return condensate and save on makeup water
? Apart from heat recovery, also flash steam recovery reduces water treatment cost
? Expected energy savings are 1%

**Instrumentation and control:**

? Install pressure and temperature gauges on steam, water and fuel lines
? Steam pressure-based control loop for fuel firing and combustion control
? Periodic verification of control instruments with dial gauges to ensure efficient operation
? Combustion product measurement and air fuel ratio setting for optimum combustion
? Automatic furnace draft control

**Ash cleaning mechanism:** Applicable for solid fuel fired boilers

? Install soot blowers ? sonic/ steam/ compressed air
? Periodic manual cleaning (scraping) of heating surface
? Water washing of heating surface during shut down

**Energy efficient burner**; Applicable for oil / gas boilers

? Modulation burner in place of on/ burner for continuous firing
? Low NOx and low excess air burner
? Preheated air burner
? Expected energy savings are 2% to 5%

**Fuel switch/fuel blending**;

? Improves fuel combustion
? Better fuel economy with blending cheaper fuel

**Water preheating for boiler / processing from solar heater/ concentrator;** Preheating of water using waste heat / alternate energy source enhances efficiency. Typical methods

? Water preheating using flue gas from boiler
? Using heat from flash steam, blow down cooler, ash cooler, condensate cooler
? Solar energy integration ? flat plate collector, compound parabolic concentrators, Vacuum tubes
? Solar steam generators ? parabolic dish, Scheffler dish, parabolic trough. Linear Fresnel concentrators
? Expected energy savings are 1% to 2%

**Total Expected energy savings are 15% to 24%**

**Change to new energy efficient boilers**

- ? Energy efficient boiler (coal to biomass pellet burner): Expected energy savings are 5 to 6%
- ? Coal to gas: Expected energy savings are 5 to 6%
- ? Coal to electricity: Expected energy savings are 25% to 30%
- ? Oil/Gas to electricity; Expected energy savings are 10% to 12%

Environment Health & Safety (EHS) /Occupational Health Safety (OHS) practices in general include the following;

? Safety measures in the boiler installation itself: Excess pressure alarms, smoke detectors, fire alarms at appropriate places including fuel dump. This will also include appropriate railings, barriers, danger signages, etc.

? Pollution prevention/control equipment: These will mostly feature appropriate stack emission control features, precipitators, etc. depending upon the type of boiler. As this project will feature efficient boilers, the emissions will be inherently controlled by virtue of the efficient design.

? Waste management: This will primarily include proper and sustainable ash disposal but also general cleanliness of the work area around the boiler including waste generated by workers.

? Worker safety: Includes all worker safety equipment: masks, gloves, gum boots, heat shields, tools, etc.

? Emergency arrangements: This includes assembly area in case of accident, first aid arrangements, infirmary, personnel trained in first aid and basic aspects such as mouth to mouth respiration, etc.

? Emergency response arrangements: This will include medical back-up arrangements with nearby hospital, ambulance on call or vehicle stationed at site, etc.

A component resource person will be engaged to ensure and contributes to the activities under the Component 3. Further, a part-time boiler expert shall be engaged to provide technical expertise related to retrofits, replacement of boilers and confirming energy savings.

Key activities under this component are as follows:

? 150 MSME units adopt retrofits to achieve energy efficiency in boilers

? 25 MSME units replace to energy efficient boilers,

**Output 3.1.1: Energy efficient boiler designs supplied to industrial boiler manufacturers**

The project will work with selected boiler manufacturers serving manufacturing MSMEs (both boiler makers and assemblers as well as suppliers of components and accessories, including for retrofits) to incorporate the standardized energy efficiency specifications (output 2.1.1) into their boiler designs and start the manufacturing of improved, more energy efficient boilers. The project?s technical support may include design guidance and technical review and support for piloting, performance monitoring and evaluation of such new boiler designs. The activities are;

- o Prepare guidance document providing better designs (1 no.)
- o Support boiler manufacturers and assemblers involved in producing standardized energy efficient boiler designs (5 nos.)
- o Provide support to piloting designs(interventions) in 25 MSME units

**Output 3.1.2: Energy efficient industrial boilers and steam systems demonstrated in 25 manufacturing MSMEs**

The newly developed and manufactured or assembled energy efficient boilers and/or retrofits can then be promoted through various technology suppliers and service provider channels and also through the MSME associations of target clusters for either an efficiency retrofit (target 20 industries) and/or installation of new energy efficient boiler (target 5 industries). The project targets to complete these 25 pilot demonstrations across up to the 10 industrial clusters prioritized from the project?s four target subsectors and seven target states. The results will be captured and will be recorded as success stories and then be put in the knowledge platform and would be disseminated through various print and electronic media, business meetings and roadshows. The activities are:

- Demonstrate 20 boiler retrofits pilot
- Demonstrate 5 new energy efficient boilers
- Develop knowledge documents, A-Vs prepared for promotion through social/other media (6 in each cluster)
- Publish 18 articles in print media such as newspapers, industry publications, preferably in local languages
- Publish on social media
- Assessments for pollutants such as soot, $CO_2$, SOx and NOx are carried out in 5 MSME units
- Energy audits prior and post implement carried out in 25 MSME units

**Output 3.1.3: Energy efficient industrial boilers and steam systems replicated to 150 manufacturing MSMEs**

India-based manufacturers of boilers and associated systems and components will be contacted and onboarded through workshops and a hand-holding programme to promote the energy efficient boilers and retrofits and facilitate replication of energy efficient boilers and steam systems, through efficiency retrofits (target 80% of MSMEs) and/or installation of new energy efficient boilers (target 20% of MSMEs). Opportunities for innovative financing, e.g., based on energy service contracts and/or vendor finance, will also be explored to support these up-scaling activities, as well as promotion of these energy efficiency investments for potential grant support under existing MSME support schemes. For the manufacturers, business dialogues with prospective buyers would be facilitated by the project through engagement with the respective MSME industrial cluster association.

- Conduct 6 workshops and handholding programmes conducted to promote energy efficiency retrofits and boilers
- Install efficient industrial boiler retrofits in 130 MSME units in 6 clusters (including 16Solar Heating and other RE-retrofit in coal consuming units)
- Install new energy efficient boilers in 20MSME units
- Development of templates for (i) model Energy Service Contract, (ii)Vendor finance
- Facilitation of business dialogue workshops between manufacturers, service providers and end users to promote Energy Efficient Retrofits and EE Boilers (6 nos. in 6 clusters)
- Assessments carried out in 25 MSME units for pollutants such as soot, $CO_2$, $SO_x$ and $NO_x$

- Energy audits prior and post project interventions carried out in 150 MSME units

***Component 4: Monitoring and evaluation***

**Outcome 4.1 Monitoring and evaluation mechanisms and indicators established to facilitate effective project implementation and sound impact assessment**

*This outcome comprises two outputs:*

**Output 4.1.1: Project and its activities monitored on a periodic basis in line with GEF, UNIDO and government regulations**

A set of key performance indicators for all project outputs will be established and regular information gathered to monitor progress. The monitoring information will be reviewed regularly and provided to project partners for adaptive and efficient execution of project activities. Following are the activities to monitor the project

- Identification of KPIs (Key Performance Indicators) for project outputs
- Preparation of periodical monitoring reports (every six months)

**Output 4.1.2: External mid-term review and independent terminal evaluation conducted**

In accordance with the applicable GEF operational guidance UNIDO will at the mid-point of the project undertake an independent mid-term review to identify the achievements to date, make suggestions as needed to revision of the project, and identify lessons learned to be disseminated within UNIDO. Furthermore, UNIDO will facilitate a terminal evaluation by an independent evaluator within 6 months of project closure to verify project achievements, make any final suggestions for the closing period of the project, and identify lessons learned.

- Conduct a Mid-term review conducted, and publish report
- Conduct a Terminal Evaluation conducted, and publish report

**4) Alignment with GEF focal area and/or Impact Program strategies:**

The project is well aligned with the GEF focal area strategy for climate change ([29]).

The project falls under objective 1 of the Focal Area: Climate Change (promote innovation and technology transfer for sustainable energy breakthroughs) with its prime focus on entry point 3 (accelerating energy efficiency adoption) (paragraph 126). The project is an action-oriented intervention that addresses the key challenges of lacking knowledge and tools, inadequate technical and management capacities and non-existent harmonization of energy performance of industrial boilers and steam systems leading to market failure and continued inefficiency in selection, installation, operation and maintenance of small-scale industrial boilers in MSMEs. The project interventions will also improve the environmental performance of the targeted boilers in terms of reduced emissions as well as improved EHS aspects.

Manufacturers of energy efficient boilers and boiler auxiliaries and providers of steam system optimization equipment and services cannot reliably differentiate themselves from competitors offering cheaper, yet less energy efficient, alternatives, and, vice versa, manufacturing MSMEs interested in acquiring and operating superior energy efficient boilers and steam systems cannot

compare energy performances of alternative suppliers. As such the project is designed as a focused thermal energy efficiency accelerator, by building upon knowledge and tools built and piloted under the GEF UNIDO global accelerator for energy management in industry, bringing global best practices for energy efficient design, manufacturing, operation and maintenance of industrial boilers, and assisting local boiler manufacturers and service providers (including technology and management consultants) to adapt and incorporate these into innovative boiler designs and steam system optimization solutions.

? Under objective 1 of the Climate Change Focal Area, the project also contributes to entry point 4 (cleantech innovation and entrepreneurship) (paragraph 127), in particular through the collaboration with manufacturers of boilers and its components and accessories (under outcome 3.1). This collaboration is aimed at boiler innovations and their commercialization resulting from the introduction of energy efficiency features in new boiler and steam system designs and their demonstration, scaling up and commercialization for use by MSME boiler users.

? The project targets transformational change towards thermal energy efficiency through a systemic approach (paragraph 113). Energy audits, in particular in MSMEs, of manufacturing units with steam systems most commonly identify thermal inefficiencies due to deficiencies in boiler design, installation, operation and maintenance. Although such inefficiencies can most often be at least partially mitigated with retrofit investments (adding controls, heat recovery, insulation, etc.) these offer no solution to stop repeating similar inefficiencies in new or replacement boiler systems. The present project seeks to address the root cause of *starting* with inefficient boilers and thermal systems, by providing tools, knowledge and best practices, and increasing the supply of energy efficient industrial boilers and steam systems.

? Inefficient, inadequate and/or unreliable thermal systems are a main cause of product (and/or quality) loss and increased waste generation across different manufacturing sectors, such as food processing, textile dyeing, chemicals and pharmaceuticals manufacturing, etc. By improving boilers and steam systems, co-benefits are achieved from increased resource efficiency, reduced generation of waste, effluents and air emissions and reduced water consumption.

Furthermore, the project capitalizes on earlier GEF investments in energy efficiency in industry in India, across Asia and elsewhere to achieve scale and accelerate the speed of adoption of known energy efficient solutions for small and medium scale industrial boilers. The centrality of industrial boilers for the competitive performance of MSMEs and industries in general, results in this project being relevant to several of the Sustainable Development Goals (SDGs), including not only on energy and climate (SDGs 7 and 13), yet also profoundly towards inclusive and sustainable industrialization and innovation (SDG9), Clean & Affordable Energy (SDG 7) and sustainable consumption and production (SDG12).

**5) The incremental/additional costs reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF and co-financing**

**Table 12. GEF incremental contribution as per component of the project**

| **Baseline scenario (Business As Usual)** | **GEF Incremental Contribution (what the GEF project will contribute)** | **Key Outcomes and GEBs expected with the Alternative Scenario** |
|---|---|---|
| **Component 1. Demand creation through the development, promotion and implementation of best available techniques and operating practices for thermal energy optimization and industrial boiler efficiency** | | |
| In the absence of the GEF grant, the Indian MSMEs will continue to operate with low thermal efficiency boilers and with a lack of steam optimization know-how for most of the poorly managed MSMEs. These MSMEs will have to wait for another such governmental or other developmental agencies for future intervention to stimulate the awareness about the utility of energy efficient design, manufacture, operation and maintenance of industrial boilers and energy saving potential from steam optimization. The lack of awareness and knowledge is likely to keep the majority of MSMEs away from adequate tools and methods for choosing the right kind of boilers and the right approach to improve energy efficiency in their industrial steam systems. | The GEF grant will principally be used to avail and operationalize technical and operational knowledge, methods and tools for technical assistance (TA) to improve the understanding of thermal energy optimization, efficiency and contribution of energy efficient features, design elements and performance criteria therein, among MSME owners and operators, their technical and maintenance workforce, regulators and financial institutions. This will pave the way for application of best thermal energy practices and techniques.<br><br>The GEF project will support manufacturing MSMEs with a steam optimization tool, a portal providing a menu of technology packages, energy assessment, awareness, capacity building and knowledge. | **Demand creation** to ensure that manufacturing MSMEs (or boiler users) understand and practice energy efficiency in the operation and maintenance of their boilers and associated steam systems, and as a result thereof, create a *pool of demand* for energy efficient boilers and steam systems. Demand creation requires the upskilling of and support of MSME boiler users through boiler energy efficiency assessments and advisory support, creating awareness, including quick estimation of energy and economic benefits, and imparting of requisite skills and knowledge, through training and knowledge management. The demand creation pathway has as its outcome that manufacturing MSMEs operate boilers and steam systems energy efficiently.<br><br>The project pathway is, ?Demand Creation through upskilling, & supporting MSME boiler users?. The key outcome is ?Manufacturing MSMEs operate boilers and steam systems efficiently? |
| **2. Market facilitation through the introduction and mainstreaming of energy performance specification in the market for boilers (new and retrofit segments)** | | |

| | | |
|---|---|---|
| The boiler makers, their service providers and the boiler users will miss on the business opportunity arising from the proposed data and knowledge-driven upgradation of their small- and medium-sized industrial boilers that not only conserve energy but also can cut steam generation and supply costs, improve productivity and reduce GHG and other air emissions. | MSMEs will be set in increasingly climate-aware and sensitive markets and communities, which will dent their competitive position and ability to take part in higher valued trade and attract investment and skilled talent.<br><br>*Conducive policy environment for energy efficiency exists:* As elaborated under the baseline scenario, the 2001 Energy Conservation Act provides a solid economy and society-wide foundation for energy efficiency, that has since been reconfirmed and expanded upon through National Mission on Enhanced Energy Efficiency and India?s Nationally Determined Contributions. Over the past two decades, the Bureau of Energy Efficiency has driven the energy efficiency initiatives, including to the MSME segment. Moreover, energy efficiency has progressively been mainstreamed in industry sector initiatives, including for example the Zero Defect Zero Effect scheme of the Ministry of MSME. Furthermore, installation and use of boilers is already addressed through the India Boiler Regulations (IBR). To realize the full potential of existing policy there is a need to develop, demonstrate and replicate technical and operational guidance on specific energy efficiency opportunities, for which the Project zooms in on energy efficient boilers and associated steam systems.<br><br>The GEF project will Develop, promote & standardize energy efficient boiler specifications | **Market facilitation** to ensure that demand and supply of energy efficient boilers (including through retrofits) meet in a transparent and accountable manner. This allows buyers and suppliers of boilers to effectively differentiate between more and less energy efficient boilers and retrofit supplies. This requires development, promotion and standardization of energy efficient boiler specifications, including engagement of policy makers and regulators of boilers to mainstream and include energy efficiency in boiler relevant policy and regulations. The market facilitation pathway has as its outcome that energy efficiency performance is introduced, standardized and mainstreamed in the boiler market for MSMEs.<br><br>The project pathway is ?Market facilitation for energy efficient boilers & boiler retrofits?.<br><br>Key outcome of GEF project will be ?Energy efficiency performance introduced and mainstreamed in boiler market? |
| **3. Supply creation through the promotion of manufacture of & market for energy efficient boilers and boiler retrofits for manufacturing MSMEs** | | |

| | | |
|---|---|---|
| Most local suppliers will also continue to sell their lower-thermal efficient boilers and components in the market and thereby sustain higher fossil fuel consumption and higher emissions of GHGs and particulate matter | The grant-funded project activities will seed and nurture the emergence of a business and technology support ecosystem for industrial boilers and auxiliary equipment and steam systems. Further technical assistance will facilitate assessment and implementation of thermal efficient industrial boilers with enabling policies and regulations. Co-financing for the project will initially mainly come from government funds, for the MSME sector for technology upgradation, innovation and technology and equipment commercialization. The project will trigger investments to manufacture and commercialize the energy efficient boilers and auxiliary equipment for industrial applications.<br><br>The GEF project will ? assist suppliers with manufacturing and marketing of energy efficient boilers and retrofits. | **Supply creation** to ensure that suppliers manufacture and market new more energy efficient boilers (and components and accessories for boiler retrofits), which creates a *supply push*. To achieve this, suppliers need technical and market development assistance, through successive provision of energy efficient design and manufacture guidance, facilitation of demonstrations of energy efficient boilers and steam systems and facilitation of replication of energy efficient boilers and steam systems. The supply creation pathway feeds into the outcome that suppliers manufacture and market energy efficient boilers and retrofits.<br><br>The synergistic execution of these three impact pathways will culminate in the creation and strengthening of the intended ecosystem for design, manufacture and operation of energy efficient boilers and steam systems in MSMEs (as per the project?s objective).<br><br>The project pathway is creation of ?Supply chain for energy efficient boilers and retrofits?.<br><br>Key outcome will be ?Suppliers manufacture and market energy efficient boilers and retrofits |

The project would be cost-effective, as it aims to directly reduce about 483,943 $tCO_2$ with a GEF grant of less than 3 million USD, which would mean the cost-effectiveness of the project would be 6.02 USD per ton of directly reduced $CO_2$. Cost-effectiveness is further evident from the high replication factor of 3 during the project cycle (bringing costs down to USD2.01per ton of $CO_2$), owing to the common and widespread use of boilers in manufacturing MSMEs. Moreover, the project will create a multiplier of 1.37 through resulting from avoided indirect emissions in the fuel supply chain. Furthermore, the project will also mobilize 17.79 million USD from the public and private sector for implementation of and investments in energy efficiency in the MSME sector.

**Theory of Change:**

As a starting point, the Theory of Change is based on following two assumptions:

1. *Conducive policy environment for energy efficiency exists:* As elaborated under the baseline scenario, the 2001 Energy Conservation Act provides a solid economy- and society-wide foundation for energy efficiency, that has since been reconfirmed and expanded upon through National Mission on Enhanced Energy Efficiency and India?s Nationally Determined Contributions. Over the past two decades, Bureau of Energy Efficiency has driven the roll out of energy efficiency initiatives, including to MSME segment. Moreover, energy efficiency has progressively been mainstreamed in industry sector initiatives, including for example the Zero Defect Zero Effect scheme of Ministry of MSME. Furthermore, installation and use of boilers is already addressed through the India Boiler Regulations (IBR). To realize the full potential of existing policy there is a need to develop, demonstrate and replicate technical and operational guidance on specific energy efficiency opportunities, for which the Project zooms in on energy efficient boilers and associated steam systems.

1.

2. *Available MSME financing is increasingly being utilized for energy efficiency investments:* MSMEs are increasingly investing from their own financial resources in profitable energy efficiency measures, provided they have access to unbiased and customized technology and vendor information and investment advice. This is clearly evidenced by the ongoing GEF (4) Energy Efficiency project of UNIDO. The expert support and energy efficiency investment advisory in 23 MSME clusters, mainly from ceramic, foundry, dairy, hand tools and brass sectors, has triggered during January 2020 ? September 2021, energy efficiency investments in 599 MSME firms, with cumulative investment of 19.1 million USD to achieve annual energy savings of 8,750 ton oil equivalent and 7.2 million USD savings on energy costs. Thus, financial support schemes for MSMEs have opened up for energy efficient investments. Based on these assumptions derived from the current energy efficiency practice in India, the Theory of Change has been further elaborated as illustrated in Figure 6.

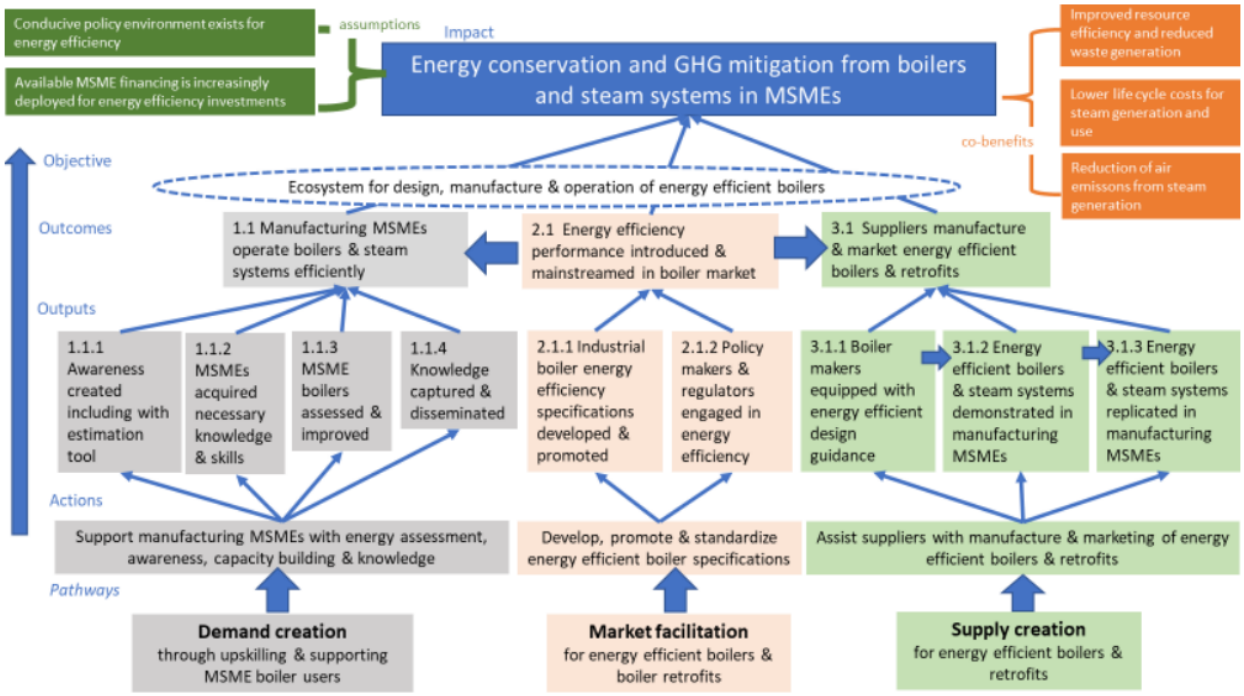


**Figure 6: llustration of the Project?s Theory of Change**

The Project deploys in **parallel** three pathways to impact, respectively:

1. **Demand creation** (in grey) to ensure that manufacturing MSMEs (or boiler users) understand and practice energy efficiency in the operation and maintenance of their boilers and associated steam systems, and as a result thereof, create a *demand pull* for energy efficient boilers and steam systems. Demand creation requires the upskilling of and support of MSME boiler users through boiler energy efficiency assessments and advisory support, creating awareness, including quick estimation of energy and economic benefits, and imparting of requisite skills and knowledge, through training and knowledge management. The demand creation pathway has as its outcome that manufacturing MSMEs operate boilers and steam systems energy efficiently.
2. **Market facilitation** (in pink) to ensure that demand and supply of energy efficient boilers (including through retrofits) meet in a transparent and accountable manner. This allows buyers and suppliers of boilers to effectively differentiate between more and less energy efficient boilers and retrofit supplies. This requires development, promotion and standardization of energy efficient boiler specifications with relevant EHS features, including engagement of policy makers and regulators of boilers to mainstream and include energy efficiency in boiler relevant policy and regulations. The market facilitation pathway has as its outcome that energy efficiency performance is introduced, standardized and mainstreamed in the boiler market for MSMEs.
3. **Supply creation** (in green) to ensure that suppliers manufacture and market new more energy efficient boilers (and components and accessories for boiler retrofits) with relevant EHS features, which creates a *supply push*. To achieve this, suppliers need technical and market development assistance, through successive provision of energy efficient design and manufacture guidance, facilitation of demonstrations of energy efficient boilers and steam systems and facilitation of replication of energy efficient boilers and steam systems. The supply creation pathway feeds into the outcome that suppliers manufacture and market energy efficient boilers and retrofits. The synergistic execution of these three impact pathways will culminate in the creation and strengthening of the intended ecosystem for design, manufacture and operation of energy efficient boilers and steam systems in MSMEs (as per the project?s objective).

### 6) Global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF)

This project objective will feed into the project?s desired impact and its targeted Global Environmental Benefits, namely: energy conservation and GHG mitigation from boilers and steam systems that are operated by (manufacturing) MSMEs in India. Some of the associated co-benefits are:

- ? Lower life cycle costs for steam generation and use in MSMEs, resulting from savings on energy/fuel costs over the life cycle of the boiler and associated steam system;
- ? Improved resource efficiency and reduced waste generation, resulting from improvements in the controlled heating of processes through better steam systems to achieve highest possible process efficiencies with lower waste generation and resource consumption (water, materials, chemicals); and
- ? Reduction of the emissions of combustion related air pollutants (black soot, NOx, SOx) from steam boilers due to full and efficient fuel combustion in the energy efficient boilers.
- ? Improved safety features and operational practices resulting in lower safety risk
- ? Online remote steam health and performance system communication

From the available data base of various activities carried out in the MSME sector, 20 clusters were evaluated where there is a substantial steam consumption in their production process. With

the data collected related to the clusters an estimate was made for the $CO_2$ emission by the boilers operating in each cluster. Over 3500 boilers operate in these 20 clusters, using solid fuel or gaseous/ liquid fuel with estimated total emissions of exceeding 12 million tons of $CO_2$ per year. Three sectors dominate in terms of number of operating boilers, namely rice milling, textile processing and manufacturing of pharmaceuticals. Among these 20 clusters, GHG emissions were highest from textile processing sector, followed by rice milling and pharmaceuticals manufacturing.

Further as part of project preparation study, baseline data was collected from 6 MSME clusters in 5 states from 4 sectors. Information was gathered on boiler usage, different fuel usage to generate steam to support the production process. With the baseline data an estimate was made for the $CO_2$ emission by the boilers operating in each cluster. 1516 boilers operate in these 6 clusters, and the estimated total emissions of 3,390,493 tons of $CO_2$ per year. The sectors prevailing in terms of operating boilers are textile, pharmaceuticals, chemicals and food processing.

From the study it was found that a boiler without a waste heat recovery system loss about 5 to 10% of its efficiency in the exhaust flue gases whereas if it is operating without a proper water treatment system it loses about 3% to 5% of its energy in the blowdown losses and losses due to scale formation. These are just two of the standardized energy efficiency features which needs special consideration in the efficient boiler design.

The project plans to adopt a comprehensive approach to thermal energy optimization and efficiency of boilers and steam systems, through three sets of technical interventions:

? *Good boiler operation and maintenance practices* ? regardless of the type and specifications of the existing boiler and steam system, energy savings are possible through adopting low or even no cost improved operation and maintenance practices, including e.g., proper insulation of boiler and steam system, elimination of steam leaks and fuel losses and maintaining proper operational conditions (steam pressure, temperature, air/fuel ratio). The average energy and GHG savings through good operation and maintenance practices are estimated a 3%.

? *Energy efficiency boiler retrofit* ? addition of energy efficient components to existing boilers and steam systems to improve their thermal efficiency, including e.g., air preheater, economizer, energy efficient burners, feed water preparation, instrumentation and (part) automation. The average energy and GHG savings through an energy efficiency retrofit are estimated at 7%.

? *New energy efficient boilers* ? installation of new boilers that have adopted energy-efficient design guidance and incorporated to maximum level feasible energy efficiency, heat recovery and automated controls. Such new boilers may be considered as replacement of old inefficient boiler or as an alternative for a traditional/cheaper boiler in case of expansion of boiler and steam system. The average energy and GHG savings through new energy efficient boiler is estimated at least 10%.

**Key considerations** while choosing the MSME units, are as follows;

o The project would focus on units that are not using fossil-fuels so that interventions under good boiler operation and maintenance practices could be facilitated,

o 16 coal consuming units add solar heat as retrofits, rest are non-coal consuming units for energy efficient boiler retrofits, and

o 23 coal consuming units will be replaced by biomass and electricity boilers under the category of new energy efficient boilers.

This project aims at reduction of GHG by making three categories of intervention namely, a) Good boiler operation and maintenance, (b) Energy efficiency boiler retrofits and (c) New energy efficient boilers. All three components are divided into two phases i.e., demo period and replication period with span of 4 years as shown in Table 13.

**Table 13. Category of interventions over project period distributed among demonstrations and replications**

| Sl.No | Category of Intervention | Demonstration stage (year) | | Replication stage (year) | | Total No. of Units |
|---|---|---|---|---|---|---|
| | | Year 1 | Year 2 | Year 3 | Year 4 | |
| 1 | Good boiler operation and maintenance practices | 5 | 20 | 15 | 10 | 50 |
| 2 | Energy efficiency boiler retrofit | 5 | 15 | 80 | 50 | 150 |
| 3 | New energy efficient boilers | 2 | 3 | 10 | 10 | 25 |
| | TOTAL | 12 | 38 | 105 | 70 | 225 |

Project interventions in different clusters/sectors/fuel type MSME units are as follows;

? 49 MSME units in Ankleshwar cluster
? 11 MSME units in Bidar cluster
? 65 MSME units in Panipat cluster
? 31 MSME units in Surat cluster
? 35 MSME units in Sindhudurg cluster
? 34 MSME units in Sircilla cluster

Project interventions sector-wise can be listed as follows;

? 109 MSME units in Textile Sector
? 11 MSME units in Pharma Sector
? 49 MSME units in Chemical Sector
? 56 MSME units in Food sector (cashew processing, and rice mill are listed here)

Project interventions fuel type wise can be listed as follows:

? 149 MSME units using biomass fuel (firewood, briquettes, rice husk)
? 39 MSME units using coal

? 18 MSME units using natural gas
? 9 MSME units using diesel

Further details of selected units for project interventions are given in Table 1, Annexure F.

GHG emissions reduction for the project per year, project duration, total direct throughout life cycle of equipment, total reduction due to indirect effect

The emission reduction depends on the type of interventions and percentage reduction potential of the interventions. For instance, (good boiler operation and maintenance practices reduce 3%, energy efficiency boiler retrofit reduce 7%, and new energy efficient boilers reduce 10%), (i) Date of intervention (Year-wise interventions are given in Table 13). They are calculated for annual, project period, direct over life cycle of equipment, and indirect over the life cycle of equipment. Summary of GHG emission reductions are as follows;

? Annual emission GHG emission reduction is 45,405 $tCO_2$,
? GHG reduction in project period is 39,629 $tCO_2$,
? GHG emission reduction throughout life cycle of equipment is 483,943 $tCO_2$ (the life time of intervention of good boiler operation and maintenance practices is taken as 7 years, energy efficient boiler retrofit is taken as 7 years, and energy efficient boiler is taken as 15 years)
? GHG emission reduction due to indirect effect over life cycle of equipment is 1,451,828 $tCO_2$ (replication factor is taken at 3)

The details as per stages of implementation for three categories of interventions are given in Table 2, Annexure F. The emission reduction based on type of interventions are given below.

a) Good boiler operation and maintenance practices **(O&M):** Interventions are planned in 25 MSME units during the demonstration stage. It is expected that the demonstration stage may require 2 years. The lifetime assumed for the intervention is 7 years.
? Demonstration stage: 25 units are taken up during project demonstration stage for O&M interventions. It is estimated that these interventions will result into801 $tCO_2$/y and for project duration is 1762 $tCO_2$. Total lifetime direct emission reduction is 5606 $tCO_2$. Assuming a replication factor of 3 for indirect emissions, the emissions reduction potential is 16,818 $tCO_2$.
? Replication stage: 25 MSME units will make interventions during the replication stage. It is estimated that these interventions result into 801 $tCO_2$/y and for project duration is 481 $tCO_2$ (note that the units making interventions in $4^{th}$ year is not accounted). Total direct emission reduction during lifetime of equipment is 5,606 $tCO_2$. Assuming a replication factor of 3, the indirect emissions reduction over life cycle of equipment is 16,818 $tCO_2$.
? Demonstration stage and Replication stage: In all, 50MSME units will make interventions related to O&M improvements. It is estimated that these interventions will lead to, 1,602 $tCO_2$/y and for project duration is 2,243 $tCO_2$. The direct emission reduction during lifetime of 7 years is 11,212 $tCO_2$. Assuming a replication factor of 3, indirect emissions reduction potential over 7-year lifetime is 33,636 $tCO_2$.

b) **Replacement:** The project aims to make interventions in 25 MSME units with boiler replacements from in-efficient ones to energy efficient boilers. 20 nos. of coal boilers are expected to switch to biomass boilers, 3 coal boilers will switch to electricity and 2 diesel boilers will switch to electricity.
? Demonstration stage: 5MSME units will replace their boilers. This will result into GHG reductions of 4,273 $tCO_2$/y and for project duration is 10,255 $tCO_2$. The direct emission reduction throughout life

cycle of equipment (15 years) is 64,097 $tCO_2$. Assuming a replication factor of 3, the indirect emissions reduction over lifetime of equipment is 192,290 $tCO_2$.

? Replication stage: 20MSME units will replace the boilers. They will result into GHG reductions of 16,490 $tCO_2$/y and 8245 $tCO_2$ in project duration. The direct emission reduction potential over lifetime of equipment (15 years) is 247,355 $tCO_2$. Assuming a replication factor of 3, the indirect emissions reduction over lifetime of equipment is 742,065 $tCO_2$.

? Demonstration and Replication stage: In all 25 nos. of MSME units will change the boilers to more energy efficient boilers. It is estimated that the 25 nos. of boiler replacements will lead to following GHG reductions, 20,764 $tCO_2$/y and for project duration is 18,500 $tCO_2$. The direct lifetime emission reduction potential is 311,452 $tCO_2$. Assuming a replication factor of 3 for indirect emissions, the indirect emissions reduction potential is 934,355 $tCO_2$.

c) **Retrofit:** The project aims to make interventions in 150 MSME units with energy efficient retrofits. 20 MSME units in demonstration stage and 130 MSME units in replication stage will implement energy efficient boiler retrofits.

? Demonstration stage: 20MSME units will make EE retrofit interventions. This will result into GHG emission reductions of, 2881 $tCO_2$/y and 6480 $tCO_2$ in project duration. The direct emission reduction throughout life cycle duration of 7 years is 20,164 $tCO_2$. Assuming a replication factor of 3, the indirect emissions reduction throughout life cycle is 60,493 $tCO_2$ .

? Replication stage: 130MSME units will make EE retrofits. This will result into GHG reductions of 20,159 $tCO_2$/y and 12,406 $tCO_2$ in project duration. The direct emission reduction potential throughout life cycle duration of 7 years is 141,114 $tCO_2$. Assuming a replication factor of 3, the indirect emissions throughout life cycle is 423,343 $tCO_2$ .

? Demonstration and Replication stage: In all 150MSME units will make EE retrofits. This will lead to GHG reductions of 23,040 $tCO_2$/y and 18,886 $tCO_2$ in project duration. The direct lifetime emission reduction throughout life cycle is 161,278 $tCO_2$. Assuming a replication factor of 3, the indirect emissions reduction throughout life cycle of equipment is 483,836 $tCO_2$.

### 7) Innovativeness, sustainability and potential for scaling up

**Innovativeness:** The Project design is innovative in stimulating both demand for energy-efficient boilers and steam systems (from MSME units) and supply of energy efficient boilers and auxiliary equipment (by boiler makers and equipment manufacturers). It captures the opportunity created by the observed recent improvements in policy environment and greater willingness of MSMEs to invest, as captured in the baseline scenario. This proposed approach is critical to addressing the technical market failures that currently prevent widespread adoption of energy efficient boilers and steam systems, and, thereby, scalability and sustainability of project interventions. The development and promotion of quick estimation tools, (online) learning packages, knowledge systems, and energy efficiency design guidance can drive project impacts to scale, once the approach has been demonstrated and benefits documented over the course of the project activities in the targeted clusters covering two to three sectors and up to the seven key manufacturing States. Moreover, by developing and promoting energy efficiency features and boiler design guidance, the Project will support and facilitate innovation and commercialization of energy-efficient smaller-scale industrial boilers and auxiliary equipment and controls. This will further contribute to the optimization of boiler designs to typical MSME use applications, making new smaller scale boilers that are more energy efficient, and appropriate and affordable to MSMEs. This project will not only strive to evolve benchmark through the application of efficient design and operation of the boiler and steam optimisation

but will also guide/give a platform to the smaller MSMEs who lack such technical know-how to select the right kind of boiler both in terms of reliability as well as efficiency.

This project proposal is unique also from the perspective that the whole steam generation system including its auxiliaries and controls are covered as a system and it will not only address the boiler efficiency but also improve the system efficiency by considering the steam system as a whole up to the point of actual steam use by the manufacturing processes itself. This way the technology users' concerns will also be taken care of as it covers the operational aspects too, as for the users of boiler and steam systems are not an end in itself yet the system should be able to supply heat requirements of the processes in an efficient, effective and timely manner to achieve highest productivity and quality. It is also expected that technology suppliers will appreciate the system?s perspective to be promoted by the Project.

**Sustainability:** The robust project design and unique project components provide a strong basis for the sustainability of the project and replication and scaling up of its technical interventions. UNIDO's previous experience both at national and international level would be helpful in terms of understanding the risks of the project and as such the mitigation plans that have been derived also gives enough strength to the sustainability of this project proposition. UNIDO will play a catalytic role in terms of bringing the relevant players to the table for discussing and evolving solutions pertaining to the energy-efficient boiler and steam optimization requirements for the MSMEs. The technical know-how generated by the various previous and ongoing projects in India as well as the global industry energy efficiency accelerator will also be helpful in evolving the efficient solution on the subject area.

The Ministry of MSME ? the national executing agency ? has a mandate to develop and strengthen the MSME segment in the country in terms of its economic output, contributions to trade, create income and job. The Ministry has already recognized that improved energy efficiency and reduced GHG and other emissions are essential to this mission and indeed the survival and growth of the sectors. As the project sets out to unveil and demonstrate replicable boiler related energy efficiency solutions with real-time productivity gains and cost savings, the Ministry of MSME can immediately mainstream and scale these up as part of its already established core mandate and through its existing productivity linked investment incentives (including partial grants). This will pave way for progressively increasing energy and GHG benefits post project completion and indeed high sustainability of project interventions. During the project period, similar actions are expected by other Ministries namely, Ministry of Textiles, Ministry of Food Processing and Ministry of Chemicals and Fertilizers as the sectors covered include textiles, food processing, chemicals and pharmaceuticals.

The institutional and business model for this sustained service delivery will be considered and finalized by the Project Steering Committee (PSC), based amongst others, on findings and recommendations from the independent Mid Term Review. One potential option can be the formation of a Special Purpose Vehicle (SPV) with representation from MoMSME, ni-msme and industrial associations or private sector. The modalities for such Public Private Partnership would be worked out once replication takes off. ni-msme may coordinate the SPV and its service

delivery to MSME sector. These frameworks and modalities are expected to evolve proactively from project initiation stage in close consultation with project stakeholders.

Further, inclusion of NPC as Technical Partner will strengthen project sustainability. NPC core mandate is to work towards improving productivity and energy usage. They support the policies of the Bureau of Energy efficiency in India by implementing them, apart from conducting various energy conservation studies in the industrial sectors.

**Potential for scaling up**: The project by way of focusing on four industrial sectors will reach out to six clusters in five states that have significant manufacturing MSME units in India. Outreaching to India-based manufacturers of boilers and associated systems and components in those specified sectors/clusters will be made through workshops and hand-holding programs with an aim to promote the energy-efficient boilers and retrofits and facilitate replication of energy-efficient boilers and steam systems, though efficiency retrofit (target 80%) and/or installation of new energy-efficient boilers (target 20%). Manufacturers' dialogue with prospective buyers would also be facilitated by the project through engagement with the respective MSME industrial cluster association.

Facilitation to the manufacturing MSMEs (or boiler users) to understand and adopt energy efficiency in the O&M of their boilers and associated steam systems will not only create a market demand for energy-efficient boilers and steam systems but also will be supplemented by upskilling of MSME boiler users through boiler energy efficiency assessments and advisory support. The market facilitation will steer the appreciation of energy efficiency performance paving the way for mainstreaming the same in the boiler market of Indian MSMEs not only in the specified clusters but also in other clusters and sectors. Market facilitation will, on the other hand raise the industry's interest so that the demand and supply of energy-efficient boilers (including retrofits) will be expanded that would be met in a transparent and accountable manner. Effectively, the buyers and suppliers of boilers will be brought together by the project and enabled to make informed data and technology driven choices for lower or higher efficiency boilers.

The project will undertake advocacy to businesses, through their local, state, national and sectoral associations, energy professionals and government to directly adopt good boiler operation and maintenance practices, boiler and steam system efficiency retrofits and/or boiler replacements. Moreover, the project will sensitize the IBR system partners and regulators to incorporate the project?s standardized energy efficiency features into a further comprehensive update of the IBR. The project?s support to boiler and component manufacturers, in particular those operating near and servicing MSME clusters, will increase the supply of energy efficient boilers and retrofits and will thus create a supply push through the regular marketing, business meets and roadshows of these manufacturers. To achieve this, suppliers need technical and market development assistance, through the successful provision of energy-efficient design and manufacture guidance, facilitation of demonstrations of energy-efficient boilers and steam systems, and facilitation of replication of energy-efficient boilers and steam systems.

This supply creation pathway feeds into the outcome that suppliers manufacture and market energy-efficient boilers and retrofits. The synergistic approach of the project therefore will ultimately result in the creation and strengthening of the intended ecosystem for the design, manufacture, and operation of energy-efficient boilers and steam systems in MSMEs (as per the project?s objective). Through this project, the knowledge generated for energy efficient steam and heat supply to manufacturing processes will be catalogued, customized and enhanced and replicated to both boiler users as well as boiler makers.

Under this project, integrated communication, capacity building and knowledge management (respectively outputs 1.1.1, 1.1.2 and 1.1.4) will drive the widespread promotion of best practices in the design, manufacture and operation of efficient boilers as well as steam optimization. This will align with existing energy efficiency portals, including the Bureau of Energy Efficiency as well as through SAMEEKSHA and UNIDO and project-specific platforms. As boilers are a common utility for many other diverse sectors and functionality does not vary on its use within different sectors, the learnings from the project can be expected to be helpful for other sectors too and the boiler suppliers can act as a change agent as this is a commercial win-win strategy for them.

Effective promotional materials with a mix of digital, printed media and virtual and face-to-face industry meets and workshops would be used to outreach specifically within the target clusters, sectors and states with an expected spin off (particularly through digital and virtual formats) to other sectors and clusters and in the last year of the project. Such an aggressive industry outreach campaign supported by policy and stakeholders advocacy is expected to reach at least 12 additional clusters and targets up to 3000 boilers adopting energy efficiency, beyond those directly supported by the Project. In these up-scaling efforts, matchmaking with suitable technology suppliers through organisation of workshops and electronic media would be undertaken. This would further increase if the recommended expansion of IBR with energy efficiency features materializes as a spin-off from the project, in which case up to all (estimated 250,000) boilers may be reached on the medium to longer term (depending on timelines and requirements of such IBR revision). Independently, the steam optimization tools and best operation and maintenance practices would be helpful for all MSMEs having boilers and as such the steam optimization measures may realistically be adopted in some 30,000 MSMEs within 5 years of project completion.

The present project is strongly focused on developing and applying technology, design, operational and maintenance knowledge, tools, guidelines, expertise and partnerships for thermal energy efficiency, with focused application and demonstrations in a few key MSME sectors and clusters. As such the project is explicitly foreseen to provide a strong foundation for follow-up projects and initiatives that scale up and mainstream thermal energy efficiency. The project?s national executing agency, Ministry of MSME, has already expressed strong commitment for a nationwide energy and resource efficiency and security campaign for the MSME sector, provisionally as the Programme on Resource Efficiency and Sustainable Production (PRESP). Moreover, the Government has already made profound commitments to mainstream energy, carbon and resource efficiency and circularity in the Indian economy and

society. This has been reflected in the Prime Minister?s address to the Nation on the occasion of 75th Independence Day (15 August 2021) and India?s participation in the Global Alliance for Circular Economy and Resource Efficiency (GACERE, a joint EU-UNEP-UNIDO initiative launched in 2021). The project thereby also connects to the foreseen directions and ambitions under the upcoming 8th GEF cycle, in particular by providing a steppingstone for an industry focused net zero accelerator in India that could possibly also be replicated elsewhere.

The proposed project can provide a building block for a Net-Zero Accelerator Integrated Program and support a Green Recovery through the Integrated Programs[30] supporting two major strategic themes as identified under GEF-8 programming directions. This project will generate practical examples, knowledge tools and market facilitation for thermal energy efficiency that can be scaled up to a principal contributor to the decarbonization of the lighter manufacturing sector, including the MSME segment. The project?s interventions will connect the target energy-intensive MSME sectors with energy-efficient and low-carbon technology and equipment providers. The project?s approach, objectives and criteria are in line with the zero-carbon energy systems transformation agenda identified for consideration under GEF-8.

Within the framework of GEF-8, there is a concerted effort to introduce integrated programs aimed at fostering a green recovery from the economic challenges precipitated by the COVID-19 pandemic. This project, in particular, is tailored to focus on the specialized domain of enhancing boiler efficiency and optimizing steam systems. These targeted interventions are positioned to play a pivotal role in advancing the green recovery agenda.

By enhancing boiler efficiency and optimizing steam systems, this project aligns with broader economic recovery initiatives while simultaneously propelling the transition towards decarbonized economies. In this vein, the project aligns with the objectives set forth in the Paris Agreement. In essence, it signifies a harmonious convergence of economic recovery measures that also serve as stepping stones towards a more sustainable and environmentally responsible future.

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[1] See: https://www.climatewatchdata.org/ghg-emissions?breakBy=sector&chartType=percentage&end_year=2018&source=CAIT&start_year=1990 (accessed 21 July 2021)

[2] See: https://www.climatewatchdata.org/ghg-emissions?breakBy=sector&chartType=percentage&end_year=2018&source=CAIT&start_year=1990 (accessed 21 July 2021

[3] As per international convention, the category heat inclused electricity used for heating and category electricity includes electricity used for cooling. See: IRENA, IEA and REN21, *Renewable energy policies in time of transition: heating and cooling*, https://irena.org/-/media/Files/IRENA/Agency/Publication/2020/Nov/IRENA_IEA_REN21_Policies_Heating_Cooling_2020.pdf

[4] MOSPI (2021, *Energy Statistics 2021,* Ministry of Statistics and Programme Implementation, Government of India, see:

http://www.mospi.nic.in/sites/default/files/reports_and_publication/ES/Energy%20Statistics%20India%202021.pdf.
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[7]Source: http://cleanboiler.org/workshop/steamimprove/
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[15]*Annual Report 2020-2021*, Ministry of MSME, Government of India, New Delhi, https://msme.gov.in/sites/default/files/MSME-ANNUAL-REPORT-ENGLISH%202020-21.pdf
[16] See: https://msme.gov.in/know-about-msme (accessed 21 July 2021)
**[17]** Council for Energy, Environment and Water (2018), *Factors influencing the uptake of energy efficiency initiatives by Indian MSMEs,*https://www.ceew.in/sites/default/files/CEEW_Factors_influencing_uptake_of_EE_initiatives_by_Indian_MSMEs_08Feb19.pdf
[18] See e.g. AEEE (2021), *India?s energy efficiency landscape*, https://aeee.in/our_publications/indias-energy-efficiency-landscape/
[19]http://dcmsme.gov.in/CLCS_TUS_Scheme/ZED_Scheme/Scheme_Guidelines.aspx.
[20] See e.g.: Energy Conservation Guidelines for MSMEs, Bureau of Energy Efficiency, EC Guidelines-Final.pdf (beeindia.gov.in).
[21]*Industrial Boiler Survey Report*: National Productivity Council (not dated)
**[22]**UNIDO (2019), *Boiler survey in Surat textile cluster,* conducted within framework of GEF UNIDO MSME Project on Market transformation for energy efficient technologies in SME clusters in India. (not published, internal project data)
[23]https://www.industrialenergyaccelerator.org/general/efficiency-solutions-for-industrial-heat/ (accessed 21 July 2021)
[24]https://www.industrialenergyaccelerator.org/general/manual-for-industrial-steam-systems-assessment-and-optimization/ (accessed 21 July 2021)

[25]Jigg or jigger dyeing machine is one of the oldest dyeing machines used for cloth dyeing operations. Jigger machine is suitable for dyeing of woven fabrics, up to boiling temperature without any creasing.

[26] All India Report of Sixth Economic Census 2016 https://msme.gov.in/sites/default/files/All%20India%20Report%20of%20Sixth%20Economic%20Census.pdf

[27] Opportunities and constraints of WVSEs in India https://www.ifc.org/wps/wcm/connect/publications_ext_content/ifc_external_publication_site/publications_listing_page/opportunities-and-constraints-of-wvses-in-india

[28] The Project targets expansion and revision of IBR as its spin off. A comprehensive review and update of all aspects of the IBR is beyond the scope of this Project and the mandate of the GEF climate change focal area. A limited update of IBR with exclusive focus of including energy efficiency may not be feasible and may not realize the full potential of IBR in all aspects of boiler design, operation and maintenance.

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Noted. revised

**1b. Project Map and Coordinates**

**Please provide geo-referenced information and map where the project interventions will take place.**

**1b. *Project Map and Coordinates.* Please provide geo-referenced information and map where the project interventions will take place**.

The project will be implemented in six clusters in five states namely, Gujarat; Haryana; Karnataka; Maharashtra, and Telangana [33]. The cluster and state selection were finalized during the project preparation study and the exact geo locations with co-ordinates are given below.


**Figure 7: Map of India highlighting states for potential project sites**

**Table 14: Name of cluster, state, longitude and latitude**

| SN | Name of Cluster | State | Longitude | Latitude |
|---|---|---|---|---|
| 1 | Ankleshwar | Gujarat | E 73.152 | N 21.6264 |
| 2 | Bidar | Karnataka | E 77.5199 | N 17.9104 |
| 3 | Panipat | Haryana | E 76.9635 | N 29.3909 |
| 4 | Sindhudurg | Maharashtra | E73.5594 | N16.3492 |
| 5 | Sircilla | Telangana | E 78.8015 | N 18.3892 |
| 6 | Surat | Gujarat | E 72.8311 | N 21.1702 |

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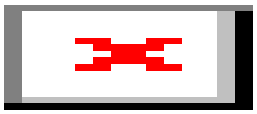
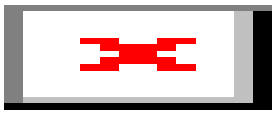
|  |  |
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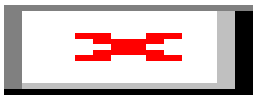
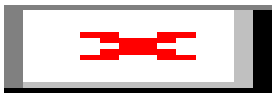
|  |  |
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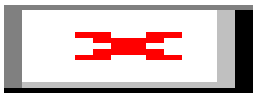
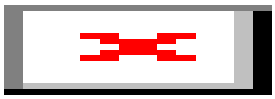
|  |  |
| Sircilla, Telangana | Surat, Gujarat |

**Figure 8. Geo-coordinates of project clusters**

**1c. Child Project?**

**If this is a child project under a program, describe how the components contribute to the overall program impact.**

N/A

**2. Stakeholders**

**Select the stakeholders that have participated in consultations during the project identification phase:**

**Civil Society Organizations** Yes

**Indigenous Peoples and Local Communities**

**Private Sector Entities** Yes

**If none of the above, please explain why:**

The COVID-19 pandemic has severely affected the entire MSMEs sector, forcing many to close down or cut their operation activities and future expansion plan[1]1. The Government of India has announced many revival plans through several stimulus packages. In line with such efforts, the GEF OFP in India

requested UNIDO to develop a proposal that can support the MSME in their business recovery through optimization of production cost. Subsequently, two rounds of consultation meetings were held with the MoMSME in the month of August 2021. In one such consultation meeting on 19th August 2021 the proposed project?s overall framework, as well as output/ activities/deliverables were discussed. During the meeting potential industry sectors (food processing, pharma, chemicals and textiles) and preliminary identification of target states (Maharashtra, Gujarat, Tamil Nadu, Karnataka, Uttar Pradesh and West Bengal) were agreed. With this initiation, UNIDO consulted stakeholders, and developed the PIF. During the PPG phase, discussions were held with ni-msme and other stakeholders, and converged to 5 states namely, Gujarat, Haryana, Karnataka, Maharashtra, and Telangana.

[1] See also UNIDO?s own assessment of impact of COVID19 on Indian firms, https://www.unido.org/sites/default/files/files/2021-10/UNIDO%20COVID19%20impact%20survey%20-%20India_AMR.pdf.

**Please provide the Stakeholder Engagement Plan or equivalent assessment.**

The COVID-19 pandemic has severely affected the entire MSMEs sector, forcing many to close down or cut their operation activities and future expansion plan[1]. The Government of India has announced many revival plans through several stimulus packages. In line with such efforts, the GEF OFP in India requested UNIDO to develop a proposal that can support the MSME in their business recovery through optimization of production cost. Subsequently, two rounds of consultation meetings were held with the MoMSME in the month of August 2021. In one such consultation meeting on 19th August 2021 the proposed project?s overall framework, as well as output/ activities/deliverables were discussed. During the meeting potential industry sectors (food processing, pharma, chemicals and textiles) and preliminary identification of target states (Maharashtra, Gujarat, Tamil Nadu, Karnataka, Uttar Pradesh and West Bengal) were agreed. With this initiation, UNIDO consulted stakeholders, and developed the PIF. During the PPG phase, discussions were held with ni-msme and other stakeholders, and converged to 5 states namely, Gujarat, Haryana, Karnataka, Maharashtra, and Telangana.

Further, during the Project Preparation phase, visits were conducted to selected clusters & carried out cluster-level stakeholder consultation, consulted many agencies, and carried out a national stakeholder?s consultation. Based on all these, the following stakeholder?s engagement plan has been developed.

**Table 15. Stakeholder groups, name, role, and engagement**

| Stakeholders/ main groups | Stakeholder?s name/ agency | Content engagement, contribution to the project and potential role |
|---|---|---|
| Implementing Agency | UNIDO | GEF Implementing agency. UNIDO is a specialized agency of the United Nations that promotes inclusive and sustainable industrial development. UNIDO will contribute as knowledge partner, introduce best practices and learning from similar initiatives elsewhere in the world, and act as overall guide on project management. UNIDO will also be a PSC member. |

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|---|---|---|
| National Executing Agency (NEA) | Ministry of Micro, Small & Medium Enterprises (MoMSME) | The Ministry of MSME is the National Executing Agency (NEA) of the project. Senior official from the ministry will be Chairperson of PSC to lead and monitor project activities in the country. MoMSME will also nominate a National Project Director to the project who will guide PMU and support Project Implementation. In addition, the National Project Director will chair the PEC. |
| Project Management Unit (PMU) | UNIDO and MoMSME | The project will be implemented through a PMU. PMU will consist of a National Project Manager. PMU will liaise with two Project Execution Partners ? ni-msme & NPC, manage monitoring & evaluation and provide overall guidance to project implementation. PMU will report to UNIDO and guided by National Executing Agency through National Project Director and the Project Steering Committee. |
| Project Execution Partner (PEP) | National Institute-Ministry of Micro, Small & Medium Enterprises (NI- MoMSME) | Project Management Unit (PMU) at ni-msme will be responsible for the day-to-day planning and execution of project activities as in the agreed project work plan. They will be members of PEC and PSC. ni-msme will be responsible for implementing Component 1 (Outputs 1.1.2, and 1.1.4) and Component 2. |
| Project Execution Partner | National Productivity Council (NPC) | NPC provides technical support to Project implementation, specifically they will implement the project Component 1 (Part activities of Output 1.1.1 and Output 1.1.3) and Component 3. They are members of PSC and PEC. |
| Government and National Agencies | Bureau of Energy Efficiency (BEE) | BEE provides guidance to mainstream energy efficiency measures in their overall Energy Efficiency policy promotion and regulatory framework in the country. They are member of PSC |
| | Ministry of Environment, Forest & Climate Change (MoEFCC) | The GEF Operational Focal Point of India will be a member of the PSC. |
| | Ministry of Textiles (MoT) | One of the sectors identified for intervention is Textiles. The Ministry of Textiles will be kept in loop, and informed on project progress and results. MoT may be able to consider the project results integrated into their schemes to reap the benefits of Energy Efficiency interventions. They will be invitees to the PSC. |
| | Ministry of Food Processing (MoFP) | One of the sectors identified for intervention is Food Processing. The Ministry of Food Processing will be kept in loop and informed on project progress and results. MoFP may be able to consider the project results integrated into their schemes to reap the benefits of Energy Efficiency interventions. They will be invitees to the PSC. |

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| | Ministry of Chemicals and Fertilizers (MoCF) | Chemicals & Fertilizers and Pharmaceuticals are identified for project interventions. They fall under the Ministry of Chemicals and Fertilizers. MoCF will be kept in loop and informed on project progress and results. MoCF may be able to consider the project results integrated into their schemes to reap the benefits of Energy Efficiency interventions. They will be invitees to the PSC. |
| Sector Skill Councils | Skill Council for Green Job (SCGJ),<br>Power Sector Skill Council (PSSC) | The Ministry of Skilling has established Sector Councils to develop course curriculum (in the form of Qualification Packs), impart skilling, certify the candidates, accredit agencies imparting skilling. The QPs go through rigorous scrutiny and approval processes.<br>Skilling modules developed under the project can be included into the scheme of actions of sector skill councils to roll out at national level. Skill Council for Green Jobs/ Power Sector Skill Councils may leverage project interventions to develop skilling qualification packs around Energy Efficient Boilers, Green interventions such as CST and roll out the skilling during or/ and beyond the project. SCGJ and PSSC will be invitees to the PSC. |
| Beneficiaries / Local private sectors | MSME units | MSME units will be the main beneficiaries of the project. The participating units will share data, cooperate with PMU, Project Executing Entity and Technical Partner for proposed interventions, implement the recommended changes and comply with the monitoring protocols.<br><br>The owners/ managers of MSME units will participate in awareness/ sensitization programmes of the project.<br>They will nominate their staff for training/ skilling in enhancing the energy efficiency of boilers. They will also participate by downloading online apps developed by the project and piloting them. They will pilot and adopt tools such as steam optimisation, developed by the project.<br><br>They will also make equity contributions and leverage loans to retrofit and establish energy efficient boilers in their respective units. |

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|---|---|---|
| | MSME cluster Associations (CSO) | Industry Associations (Civil Society Organisations) will be involved in mobilizing MSME unit as project participating units. They will motivate owners to participating in project interventions (i) in participating in sensitization programmes, (ii) in releasing their staff for training, (iii) investing in technology packages and (iv) participating using the software/ apps developed under the project.<br><br>Major associations from the six clusters will be involved during the project. Their role will be to facilitate workshops, create outreach and sensitize not only participating MSME units but also others to participate. They will encourage units to demonstrate and replicate retrofits and energy efficient boilers.<br><br>They will also be involved in the dissemination efforts of the project. They will be invitees on PSC. CSO- industry associations shall promote scale up of the project intervention in non-project MSME units. |
| | NGOs | The project has envisaged a number of gender activities. CSO- NGOs who have specifically worked in gender inclusion, will be engaged in carrying out activities pertaining to gender in the project. |
| | Academia and technical research institutions | Academia and Research Institutions are involved in research and innovation including energy efficiency. Project will make consultations on efficient designs and engineering aspects to enhance energy efficiency of boilers. They will be invited to the consultation meetings, sharing knowledge as and when felt necessary by the Project Management Unit. |
| Financial Sector | Financial institutions [ Small Industrial Development Bank of India (SIDBI) and Yes Bank] | Financial institutions are expected to provide loans to MSME units to purchase and install retrofits and energy efficient boilers. They will participate in financing components, guide in formulating financing packages. SIDBI will be a member of the PSC. Other bankers may be invited to PEC or PSC as per requirement identified by PMU. |
| | Lead banks | Lead banks in respective clusters will be informed on the project interventions and its goals. They will be sensitized to consider lending for energy efficient retrofits and energy efficient boilers to the interested MSME units. |
| Other stakeholders | Gender experts | Gender experts will be invited to PEC/ PSC to seek advice on reviewing and inclusion of Gender Action Plan in the project. |

[1] See also UNIDO?s own assessment of impact of COVID19 on Indian firms, https://www.unido.org/sites/default/files/files/2021-10/UNIDO%20COVID19%20impact%20survey%20-%20India_AMR.pdf.

In addition, provide a summary on how stakeholders will be consulted in project execution, the means and timing of engagement, how information will be disseminated, and an explanation of any resource requirements throughout the project/program cycle to ensure proper and meaningful stakeholder engagement

***1. Stakeholders? engagement plan***

The project engages with a number of stakeholders. Their engagement plan is as follows;

**(i) Participating MSME units**

MSME units will be the main beneficiaries of the project. The participating units will share data, cooperate with PMU, Project Executing Entity and Technical Partner for proposed interventions, implement the recommended changes and comply with the monitoring protocols.

The owners/ managers of MSME units will participate in awareness/ sensitization programmes of the project.

They will nominate their staff for training/ skilling in enhancing the energy efficiency of boilers. They will also participate by downloading online apps developed by the project and piloting them. They will pilot and adopt tools such as steam optimisation, developed by the project.

**(ii) Industry associations of six clusters**

Major associations from the six clusters will be involved during the project. Their role will be to facilitate workshops, create outreach and sensitize not only participating MSME units but also others to participate. They will encourage units to demonstrate and replicate retrofits and energy efficient boilers.

They will also be involved in the dissemination efforts of the project. They will be invitees on PSC.

**(iii) Sector Skill Councils**

The Ministry of Skilling has established Sector Councils to develop course curriculum (in the form of Qualification Packs), impart skilling, certify the candidates, accredit agencies imparting skilling. The QPs go through rigorous scrutiny and approval processes.

Skilling modules developed under the project can be included into the scheme of actions of sector skill councils to roll out at national level. Skill Council for Green Jobs/ Power Sector Skill Councils may leverage project interventions to develop skilling qualification packs around Energy Efficient Boilers, Green interventions such as CST and roll out the skilling during or/ and beyond the project. SCGJ and PSSC will be invitees to the PSC.

**(iv) Financial sector**

Financial institutions are expected to provide loans to MSME units to purchase and install retrofits and energy efficient boilers. They will participate in financing components, guide in formulating financing packages. SIDBI will be a member of the PSC. Other bankers may be invited to PSC as per requirement identified by PMU.

Lead banks in respective clusters will be informed on the project interventions and its goals. They will be sensitized to consider lending for energy efficient retrofits and energy efficient boilers to the interested MSME units.

**(v) Other stakeholders ? Gender, Environment and Social Management and Boiler Experts**
These experts will be engaged as consultants to provide inputs in implementing relevant project activities. They may also be invited to PEC/ PSC to provide advice, review and inclusion of Gender Action Plan, ESMP plan, Technical aspects of boilers respectively in the project.

**(vi) Government and National Agencies**
Bureau of Energy Efficiency (BEE), Ministry of Environment, Forest & Climate Change (MoEFCC), Ministry of Textiles (MoT), Ministry of Food Processing, (MoFP), Ministry of Chemicals and Fertilizers (MoCF). They participate in Project Steering Committee meetings and provide suggestions, comments & support during project implementation. They will also incorporate findings in their schemes wherever relevant.

**(vii) National Institute- Ministry of Micro, Small & Medium Enterprises (NI- MoMSME)**
Implements Component 1 & 2 of the project. Also contributes to the co-financing in kind.

NI-MSME will be responsible for the execution of project activities as in the agreed project work plan. They will be members of PSC. NI-msme will be responsible for implementing Component 1 and Component 2.

**(viii) National Productivity Council (NPC)**
NPC provides technical support to Project implementation, specifically, they will implement the project component 3 and part of component 1. They are members of PSC.

**(ix) Ministry of Micro, Small & Medium Enterprises (MoMSME)**
The Ministry of MSME is the project's National Executing Agency (NEA). Senior officials at the level of Additional Secretary from the ministry will be Chairperson of PSC to lead and monitor project activities in the country. MoMSME will also nominate a National Project Director to the project who will guide PMU and support Project Implementation. In addition, the National Project Director will chair the PSC.

**(x) UNIDO**
GEF Implementing agency. UNIDO is a specialized agency of the United Nations that promotes inclusive and sustainable industrial development. UNIDO will contribute as a knowledge partner, introduce best practices and learning from similar initiatives elsewhere in the world, and act as an overall guide on project management. UNIDO will also be a PSC member. GEF implementing agency, responsible for ensuring the project is implemented as per the approved GEF CEO Endorsement Document. They will also be responsible for getting the project Mid Term Review and Terminal Evaluation. UNIDO will also undertake a partial execution as outlined in Section 6 on Institutional Arrangement and Coordination.

**Select what role civil society will play in the project:**

**Consulted only;** Yes

**Member of Advisory Body; Contractor;**

**Co-financier;** No

**Member of project steering committee or equivalent decision-making body;**

**Executor or co-executor;**

**Other (Please explain)**

Civil society representative was part of the regional stakeholder consultation at three different clusters. Members expressed positive feedback since the project components are positively going to imact in terms of energy conservation and cleaning the work environment as well as the ambinet environment.

The project has several trendsetting features for the MSME clusters. In addition to the committed CO2 emission reduction there are several other environmental benefits. The air quality in the MSME units and greater cleanliness, especially the boiler unit would have positive impacts on the people and the environment. Reduced pollution, reduced heat (due to project interventions that would focus on energy efficiency) would create a feeling of safety and well being for the labour. MSME owners and workers would thus get sensitized to acceptance of eco friendly interventions and better waste management practices. This would in turn have spin off effects in management employee relations. The management would benefit from lower operational cost and so lower cost of utilities. The interventions would also free up shop floor space. This would translate into higher profits. Gender sensitization programmes would make MSME leaders more gender sensitive and considerate of women?s issues. Other gender mainstreaming processes would result in higher participation of women as a skilled work force. The greatest impact could perhaps be through behaviour change where employees and management accept sustainable interventions and realize the benefits of the same. This would also create an appetite for more sustainable interventions. Acceptance of change and innovations would also be mainstreamed into MSME processes. Replication of the success stories of this project across more MSME cluster would result in acceptance of sustainability in geographically dispersed and varied MSME clusters. The project would thus contribute to early ecosystem building for sustainability in MSME clusters.

**3. Gender Equality and Women's Empowerment**

**Provide the gender analysis or equivalent socio-economic assesment.**

Empowerment of women transforms lives of women and enables them to gain power and control over their own lives. It has strong co-benefits and is a strong and non-negotiable deliverable of UNIDO projects. The project would be guided by UNIDO recommended processes such as awareness-raising, building self-confidence, expanding choices, increasing access to and control over resources and eliminate actions that reinforce and perpetuate gender discriminations and inequality.

UNIDO recognizes that gender equality and the empowerment of women have a significant positive impact on sustained economic growth and inclusive and sustainable industrial development, which are key drivers of poverty alleviation and social progress. Commitment of UNIDO towards gender equality and women?s empowerment is demonstrated in its different publications which include (i) the UNIDO Strategy for Gender Equality and the Empowerment of Women, 2020-2023, (ii) UNIDO Policy on Gender Equality and the Empowerment of Women (2019), (iii) UNIDO Guide to Gender Analysis and Gender Mainstreaming the Project Cycle. UNIDO has also developed an operational energy-gender guide to support gender mainstreaming of its sustainable energy initiatives. These publications have been used to develop the gender

action plan. The Gender Plan has activities that can be implemented in a gender-responsive manner leading to positive gender equality results.

Women are structurally highly underrepresented in the workforce due to various reasons. The female labour force participation stands in India at 20% versus male labour force participation of 76%, or in other words, males in the age bracket of 15-60 years are about 4 times more likely to be employed. This skewed gender balance is also reflected in the workforce of MSME. As per the latest MSME survey data (for 2015-2016 Fiscal year), the MSME sector employed 111.1 million, 24% women and 76% men. While data is available for the workforce in manufacturing MSMEs (3.6 million jobs), it is not sex-disaggregated data. While sex-disaggregated data is available for women-owned MSMEs (20% of MSMEs,) specific data on women-owned manufacturing MSMEs is not available.

The gender analysis of the sector has been carried out as a part of the gender action plan (annexed). The baseline gender situation in MSME has been captured qualitatively and quantitatively from desk research / secondary data collection, by discussions with sector experts, participation in stakeholder consultations, field visits to MSME clusters, interaction with boiler operators, questionnaire-based surveys, and follow-up interactions. The entry points for gender-aware outcomes are:

- ? Gender sensitization programs and modules designed for men and women in leadership roles in MSMEs,
- ? Information and tutorials to improve air quality around boilers for men and women, and
- ? Actions to meet non-financial needs of women.

Gender-sensitive activities are included in component 1 ?Demand creation through the development, promotion & implementation of best available techniques & operating practices for thermal energy optimization & industrial boiler efficiency? and specifically under outcome 1.1 ?Capacity building and training system established on best available techniques & operating practices for industrial boilers.? These are:

- ? Gender sensitization of employees of financial institutions leading to increased lending for women-led MSMEs,
- ? Skilling programs in data management, safety audits, fuel inventory management which are the emerging needs for project interventions and not yet gender stereotypes, and
- ? Training programs and enterprise support for setting up cluster-level fuel and water testing labs.

A guiding principle of the proposed project will be to ensure that both women and men are provided equal opportunities to access, participate in and benefit from the project activities, including training, knowledge products, and advisory support, whilst ensuring the highest possible technical quality of the project results. In practical terms, gender-sensitive identification and selection will be practised at all levels where possible, especially in the selection of industry staff, project staff, and stakeholders, and inclusion of women-owned or women-led enterprises for

assessment, demonstration and scaling up activities. In cases where the project does not have direct influence, gender-sensitive recruitment will be encouraged. Furthermore, whenever possible, existing enterprise staff will be trained, and their awareness raised regarding gender issues.

Outreach to women will be facilitated under the project in different ways: The project is implemented in 225 MSMEs. Based on an average employee strength of 40 persons per MSME unit, 9,000 employees from 225 MSMEs will benefit from the project. As per data, women's participation/ employment in MSME is 24%. Thus, the project is considering to include 4,000 women as beneficiaries.

- ? As owners or operators of these 225 MSMEs that the project directly supports ? specific efforts will be made to achieve above pro-rata (i.e., 20% female MSME ownership) participation of up to 30% of women-led MSMEs, i.e., 65 in total.
- ? As recipients of training, capacity building, and knowledge: the project targets 4,000 beneficiaries for technical capacity building and specific efforts will be made to achieve above pro-rate (i.e., 20% female labour force participation) of 50% women beneficiaries, i.e., 2,000 as project total.

Moreover, due to diverging industrial needs and rights regarding energy consumption and production, women and men are expected to be affected differently by the project (in terms of their rights, needs, roles, opportunities, etc.). Therefore, regardless of the project?s gender classification, the project aims to demonstrate good practices in mainstreaming gender aspects into an approach, knowledge products, and guidance for thermal energy efficiency wherever possible and avoid negative impacts on women or men due to their gender, ethnicity, social status, or age.

A guiding principle of the proposed project will be to ensure that both women and men are provided equal opportunities to access, participate in, and benefit from the project activities, including training, knowledge products, and advisory support, whilst ensuring the highest possible technical quality of the project results. In practical terms, gender-sensitive identification and selection will be practiced at all levels where possible, especially in the selection of industry staff, project staff, and stakeholders, and inclusion of women-owned or women-led enterprises for assessment, demonstration, and scaling up activities. Gender-responsive TORs will be used to mainstream gender in the activities of consultants and experts. In cases where the project does not have direct influence, gender-sensitive recruitment will be encouraged. Furthermore, whenever possible, existing enterprise staff will be trained and their awareness raised regarding gender issues.

**Does the project expect to include any gender-responsive measures to address gender gaps or promote gender equality and women empowerment?**

Yes

**Closing gender gaps in access to and control over natural resources;**

**Improving women's participation and decision making**

**Generating socio-economic benefits or services or women** Yes

**Does the project?s results framework or logical framework include gender-sensitive indicators?**

Yes

**4. Private sector engagement**

**Elaborate on the private sector's engagement in the project, if any.**

The project is designed with private sector engagement in the forefront. MSMEs are the primary target group, and these are private entities. During the PPG phase, visits were made to end user MSME units, associations, and boiler manufacturers. Some associations recalled other UNIDO project interventions that helped them advance in technology interventions leading to improved productivity and energy efficiency and hence, they welcomed the interventions to enhance boiler energy efficiency. The engagement will be in the lines listed below

**With users of industrial boilers and steam systems (manufacturing MSMEs):** The project will provide these MSMEs with knowledge products, steam estimation and optimisation tools and on-line and face-to-face learning opportunities on boiler and steam system energy efficiency and technical advisory services. The project will also provide specific thermal energy audits and implementation of boiler and steam system upgradation and/or replacement. Based on response to the project?s outreach and knowledge products, the project will directly support 225 MSME units through its assessment, demonstration and scale up activities.

**With manufacturers of industrial boilers, its components and auxiliary equipment:** The project will support boiler manufacturing sector with design and operational guidance, including efficiency features, performance indicators, etc., to support and enable them to start design, manufacture and sales of new energy efficient design and manufactured boilers and boiler retrofit components. Boiler manufacturers will be onboarded for the project?s technical support on the basis of their expression of interest and commitment to dedicate human, technological and financial resources into development and marketing of more energy efficient boilers.

**With providers of design, installation and maintenance services for industrial boilers and steam systems:** The project will avail these service providers, which are often operating at local scale, knowledge and tools for enhancing the thermal efficiency of their products and services.

**With industry associations:** Taking guidance from past and ongoing energy efficiency initiatives in the MSME sector, the project will work extensively with industry associations, including cluster level associations (to reach out to MSMEs operating in the target clusters), industry sector associations (particularly boiler sector, and priority manufacturing sectors targeted in the project) and industry bodies.

**Local banks and other financial institutions: Local banks and other financial institutions from** both public and private sectors will be engaged in the replication and scaling up of the energy-efficient boiler projects by considering lending to the investors in retrofits and changing to

new boilers. As already indicated under output 3.1.3 alternative financing options, including vendor finance, energy service contracting (ESCO), and/or potentially in other forms will be actively pursued by the Project.

**5. Risks to Achieving Project Objectives**

**Elaborate on indicated risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, the proposed measures that address these risks at the time of project implementation.(table format acceptable):**

The key risks for successful project implementation as identified during this Project Preparation phase are summarized below with appropriate mitigation measures:

**Table 16: Risks assessment and mitigation measures**

| Risks | Risk level | Mitigation Measure |
|---|---|---|
| **Financial risk**: Lack of availability of financing at MSMEs and/or leveraging finance from financing institutions, will impact the uptake demonstration/ replication of EE retrofits/ EE boilers and further scale up beyond the project duration. | Probability: Low<br>Impact: medium | The project directly provides partial funding support to demonstration and replication projects apart from Technical Assistance. Project has also leveraged committed support from SIDBI for lending the proposed interventions in project MSME units. The local lead banks will also be sensitized on the interventions, their financial viability, and benefits |
| **Operational risk 1:** Inability of MSME unit owners to let their technicians participate in capacity building and training programmes | Probability: Medium<br>Impact: Medium | Exhaustive stakeholder consultations with MSME units and associations were carried out during the PPG phase. Further before taking up MSME units as project units, acceptance of owners to participate in the project will be considered as key criteria. Further MSME local cluster level associations are also key stakeholders and invited members of PSC are expected to motivate MSME units to participate that will help reaping benefits. |
| **Operational risk 2**: Delay in endorsement and enforcement of new regulations, guidelines, and standards on promotion of energy-efficient operation for industries | Probability: Medium<br>Impact: Low | The proposed measures include: (1) cooperation with the concerned government agencies and; (2) establishment of the Project Steering Committee with a high-level representation from all concerned authorities. This will help resolve problems if any arises.<br><br>The strong involvement and ownership of the counterpart Ministry of MSME will ensure the mitigation of operational risks associated with the proposed project. Moreover, implementation of energy efficient measures will not be exclusively dependent on new regulations or standards. They may be able to stand alone based on their financial viability and benefits they provide. |

| | | |
|---|---|---|
| **Climate Change Risks**: Climate change may impact operations of MSMEs, depending on their location and emergency preparedness | Probability: Medium<br>Impact: Low | This is an external risk and the project itself which is aimed to mitigate this risk by scaling up the adoption of energy efficiency and climate friendly technologies. Moreover, from an adaptation perspective, the project will address any potential risks to project areas by including criteria related to such risks in the cluster surveys, and if a risk is identified, develop an adaptation mitigation strategy before implementation begins. |
| **Policy and institutional risk:** In absence of policies the ecosystem may not be conducive for mainstreaming and sustainability of project interventions | Probability: Low<br>Impact: Low | Private sector agencies and several government agencies (i.e. MoEFCC, MoMSME, BEE) will be closely involved and contribute to project activities to ensure that activities continue beyond the project period. These mitigation measures will contribute to creating ecosystems for sustainability of the proposed project. Moreover, there is strong evidence from ongoing GEF4 energy efficiency project that MSMEs continue to invest from their own financial resources in profitable energy efficiency investments, even during stressed COVID pandemic period. |
| **Social and Gender Risk:** Risk of resistance against, or lack of interest in, the project activities from stakeholders, especially with regard to the active promotion of gender equality. Low participation rates of suitable female candidates and/or women led or women-owned enterprises due to lack of interest, inadequate project activity, or missing qualified female population with engineering discipline and/or within manufacturing sector | Probability: Low Impact: Low | This project will pursue gender responsive communication and ensure stakeholder involvement at all levels. It will pay special attention to involving women and men, as well as CSOs and NGOs promoting gender mainstreaming and equal participation of women, and a gender expert. This shall mitigate social and gender related risks, promote gender equality, create a culture of mutual acceptance, and maximize the potential contribution of the project to improving gender equality in the energy field. |
| **Technological Risks**: Failure of technological interventions due to either faulty equipment or inappropriate installation/utilization | Probability: Low<br>Impact: medium | Technical risks associated with efficient boilers are very low. Considerable energy savings have been achieved in many countries through the capture of systems level efficiency opportunities.<br>The boiler manufacturers will be engaged in the project, who will do the testing at manufacturers end and user end before rolling out.<br><br>To deliver the required capacity building, UNIDO and its execution partners will employ the services of highly skilled experts with systems specific expertise and proven training skills. |

| | | |
|---|---|---|
| **Environmental and Social Risks**: These risks will mostly originate from non-inclusion of relevant EHS/OHS features in efficient boiler designs, poor O&M practices, weak safety regime and poor labour management | Probability: Medium<br>Impact: Medium | Given the weak compliance to Environmental and Social regulatory requirements and weak enforcement and monitoring on these aspects, the risk on these counts will be higher. The project has an Environmental and Social Management Plan, which will ensure that all EHS/OHS aspects are adequately addressed and policies/standards are suitably updated to ensure compliance in future as well. Further it is proposed to have an Environment and Social Specialist in the Project implementation phase to (a) sensitize MSME units about Environmental and Social requirements, (b) recommend unit-specific measures for improving upon the Environmental and Social Aspects and (c) monitor and backstop upon the adoption of Environmental and Social measures by the units supported by the project. |
| **Risk of Stranded Assets:** There are risks of what will happen to the existing equipment, when they are replaced with energy efficient retrofits. There are risks of what will be done with existing boilers when they are replaced with Energy Efficient boilers | Probability: Medium<br>Impact: Low | It is expected that some inefficient components are replaced with energy efficient retrofits. The present components will be disposed of. Most often they go to the recycling market in India. Further, when a new energy efficient boiler is purchased, old boilers are used as standby or it acts as capacity enhancement plan of the MSME unit |
| **Market risk:** Most often, industrial units, particularly MSME units shift fuel from one to another depending on price change. This may create many issues including the stranded assets. | Probability: Medium<br>Impact: Medium | Solid fuel boilers are available in multifuel options. Whereas other boilers such as gas, diesel, appear specific to the fuel. The project will keep multifuel options wherever practically possible and technically/ economically feasible |

Industries, including MSMEs, are increasingly realizing and already experiencing their climate vulnerability in terms of impacts of extreme weather events (such as storms, Flooding, and/or extreme temperatures) on their physical facilities, equipment, installations, and premises and on their supply chains, delivery channels and workforces. The project will promote MSME awareness of climate risks and their management, in particular by promoting climate smart engineering and installation practices, such as location of boiler and steam systems and standards for their construction, installation and emergency controls, including their supportive civil structures.

The arrival of COVID-19 pandemic is forcing enterprises, including MSMEs, to rethink, regroup and reorganize their workplaces, workflows, and people movements to minimize physical contact in workplaces. This COVID-19 necessity is already observed to improve ?industrial discipline? and greater emphasis for and adherence to standard operating protocols that have the potential for higher e1ciency in use of energy, materials, and water and less wastage. This provides a good starting point for anchoring better boiler and steam system operation and maintenance practices and protocols, as targeted by the project.

**COVID-19 Risk and Opportunity Analysis**

Countries including India continue to grapple with the COVID-19 crisis and its severe health, humanitarian and socio-economic impacts, prospects of recurring pandemic waves and associated partial lockdowns, and the need to support those who have lost their jobs and livelihoods. The COVID-19 crisis and containment measures did not have the same impact on everyone in the same way. In the business sector, MSMEs, suffered the most, particularly in service sectors and in vulnerable manufacturing sectors (such as textiles and garments, leather and footwear, furniture and homewares). Businesses that were more agile, people-centred and energy and resource-conscious appear to have been impacted less and recovered more easily, aided by their rapid transition to e-commerce and teleworking, showing the value of sustainability, resilience and inclusiveness also for MSMEs. The ongoing pandemic also imposes new risks and at the same time provides new opportunities to the project. The COVID 19 associated risks and opportunities are tabulated below:

**Table 6a: COVID-19 risks analysis**

| Risk | Risk level | Risk mitigation measure |
|---|---|---|
| a) Delay: Project development in PPG phase cannot be executed as expeditiously as planned due to continuous disruptions by and recovery from pandemic conditions | Low/ medium | It is assumed that India will progressively succeed to contain and minimize the spread of the pandemic, aided by its large-scale vaccination programme, particularly at commencement of project implementation phase in 2023 onward. Simultaneously, industries, governments and other organisations are expected to have recovered from personnel and humanitarian impacts and have been restaffed and reskilled. From its side, UNIDO and its partners will design and undertake Project Implementation activities in COVID-19 appropriate manner using virtual communication and consultations, and leveraging existing expert and delivery networks across the country (that were built up over past cooperation). |
| ***b)*** Access to critical international technical expertise | Low / medium | Project activities will be planned with maximum use of national expertise. Where international technical expertise is critically required, it will preferentially be sourced and accessed remotely. |

| | | |
|---|---|---|
| ***c)*** Financing (National debt crisis , availability of co-financing, price increase in procurement) | Low | The project was designed in close cooperation with the Ministry of MSME and is aligned with the Government of India?s MSME recovery plan. It will get priority in co-financing through various ongoing and pipeline recovery initiatives. |
| ***d)*** Infection prevention and control | Medium | Project activities will be planned for minimum physical contacts, gathering, and travels, utilizing to maximum extent digital and other communication and consultation tools. Moreover, risks of COVID-19 infections will be duly considered in the imple mentation and execution of the project and all the necessary prevention and mitigation measures, as appropriate at the time, will be taken to minimize risks including using personal protective equipment, physical distancing, hygiene, cleaning and disinfection, ventilation and other administrative and engineering controls while following local and international guidelines. |

**6. Institutional Arrangement and Coordination**

**Describe the institutional arrangement for project implementation. Elaborate on the planned coordination with other relevant GEF-financed projects and other initiatives.**

**Project Implementation:** UNIDO, as the GEF implementing agency, is responsible for the overall project development, oversight, and implementation. UNIDO will also ensure close coordination and perform a liaison role of all project Execution Partners, MoMSME, Stakeholders, and the GEF Secretariat.

**Project Execution:** The execution of the project will be led by the Ministry of Micro Small and Medium Enterprises (MoMSME) as the National Executing Agency (NEA). The National Institute for Micro Small and Medium Enterprises (ni-msme) of MoMSME and the National Productivity Council (NPC) will be the executing partners. As per request of the Operational Focal Point, UNIDO will provide partial execution support.

A small Project Management Unit (PMU) will be hosted by MoMSME in the office space provided by the Ministry. The PMU will carry out the key role of liaising with all the concerned Project Implementation and Execution agencies, and that of coordinating the project activities with support from the Project Steering

Committee (PSC). The PMU will recruit a National Project Manager, conduct day-to-day monitoring, regularly report to UNIDO, and work under the overall guidance of the National Project Director at MoMSME and the Project Steering Committee (PSC).

As mentioned above, the ni-msme of MoMSME and the NPC will be engaged as Project Execution Partners. The ni-msme, being a premier knowledge institute, is envisioned to take the lead in execution pending positive Harmonized Approach to Cash Transfers (HACT) Framework assessment. The agency will take care of the capacity building, knowledge management, and policy components.

The NPC, which comes with its extensive experience of working in energy efficiency implementation at the national level, is foreseen to support the execution pending positive HACT assessment. It will lead the technical aspects of the project in terms of providing the right set of technical interventions.

The executing agencies will either directly execute the activities and/or outsource activities, where external expertise is required. For outsourcing the agencies will follow approved procurement processes and procedures of the respective agencies. Exact execution activities and related responsibilities (direct execution or through outsourcing) will be outlined in the project's annual work plan.

UNIDO and the MoMSME will sign a Project Execution Agreement (the ?Agreement?). Additionally, PMU-MoMSME/UNIDO will sign agreements with ni-msme and NPC providing details of responsibilities.

As mentioned above, UNIDO will also provide partial targeted technical and administrative execution support services. Particularly the execution support by UNIDO will include technical review and development of steam optimization tools through the engagement of an international consultant/s, as well as project management support through related planning, monitoring and reporting.

On the technical side, UNIDO will deliver partial execution by performing Activity 1.1.1.1, under Output 1.1.1: Energy savings estimation tools developed for industrial boilers &promoted to manufacturing MSMEs & their technology suppliers & service providers. Executing Activity 1.1.1.1 involves developing a steam optimization tool by sourcing specific technical expertise from international expert/s. Consequently, UNIDO has been requested to source the right type of international expertise for this activity. Additionally, UNIDO will undertake the responsibility for carrying out monitoring and evaluation activities planned under Component 4: Monitoring and Evaluation. The activities foreseen under Component 4 include, amongst others, project monitoring activities and preparation of related monitoring reports, as well as project mid-term review and terminal evaluation.

On the administrative side, UNIDO will facilitate the recruitment of the National Project Manager (NPM) under the PMU. The NPM will enable communication across all of the entities engaged in project execution. The NPM will report directly to UNIDO and will operate under the consultation and guidance of the National Project Director (NPD).

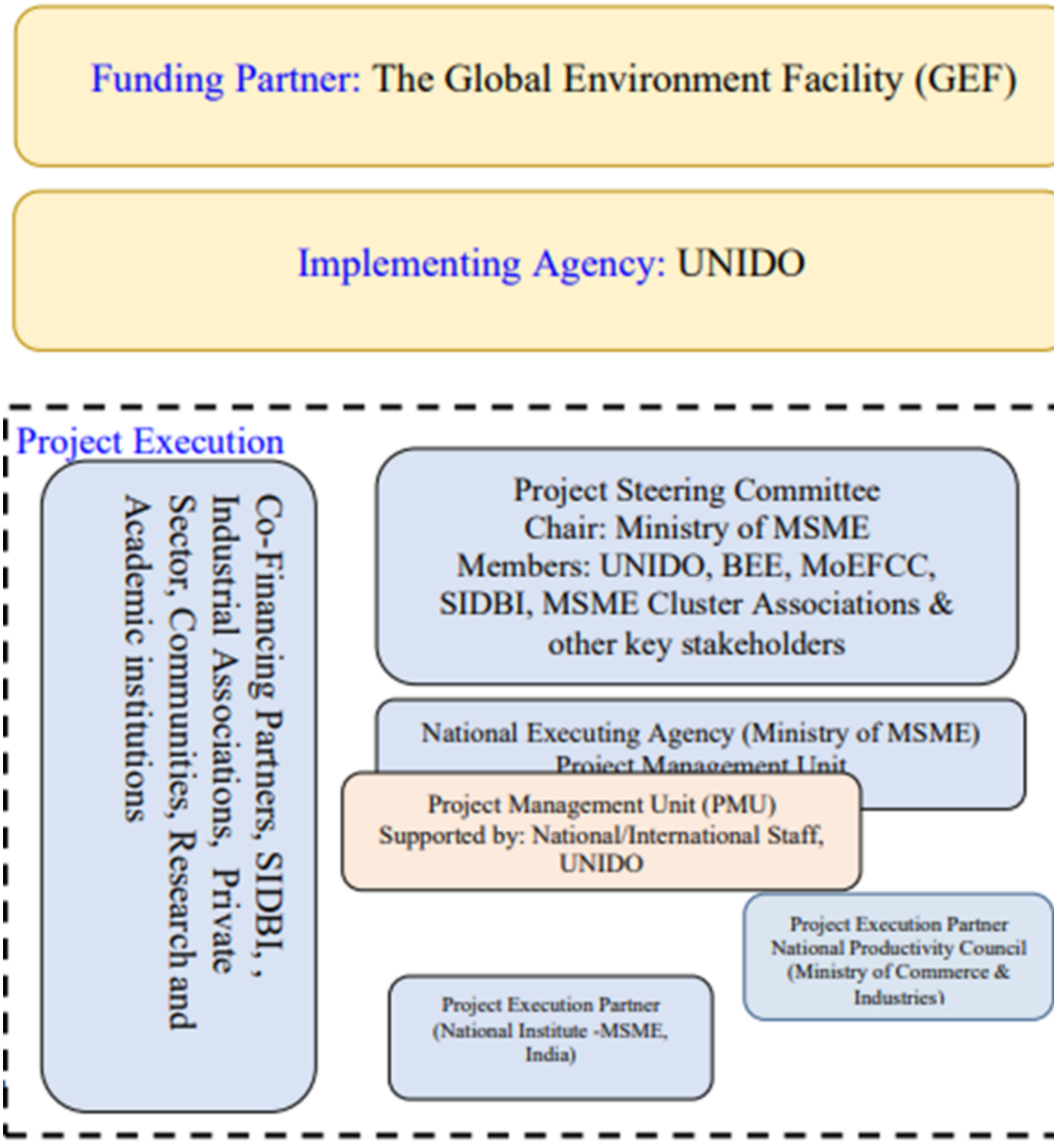
In accordance with the **UNIDO Policy on Implementation and Execution of GEF Projects** (DGB/2019/04), whenever UNIDO provides execution support services in respect of a GEF-financed project for which it is the responsible GEF Implementing Agency, UNIDO is mandated to maintain an appropriate segregation between the Organization?s implementing and executing functions. As such, for this project

UNIDO will ensure that separate organizational units, each having distinct lines of responsibility, reporting and accountability, are assigned to provide project-specific implementing functions, on the one hand, and executing services, on the other.

Here is a summary of the execution distribution across the various entities by project components:

? Component 1 (Outputs 1.1.2 & 1.1.4), Component 2, and Component 3 (a minor part pertaining to knowledge products development) will be executed by ni-msme.
? Component 1 (Output 1.1.1 ? 2 of 3 activities & 1.1.3) and a major part of Component 3 will be executed by the NPC.
? Component 1 (Steam optimization tool part of Output 1.1.1 ? 1 activity) will be executed by UNIDO.
? Component 4 will be executed by UNIDO.

**Figure 8. Organizational structure for implementing and executing the UNIDO-GEF-MoMSME India Boiler Project**




Based on Figure 8, below is the detailed description of the roles and responsibilities which will be performed by the various stakeholders represented in the figure.

**Project Implementing Agency**

UNIDO has vast experience working in the field of industrial energy efficiency in India in the last two decades and has earned high credibility among the MSME industries through successful demonstrations in the area of industrial energy efficiency. UNIDO, having developed a close relationship and understanding with the Ministry of MSME, Govt. of India, has all the reasons and justification to work in the area of Boiler energy efficiency which is planned to be hosted at the office facility of MoMSME. UNIDO is the GEF?s Implementing Agency for the project. UNIDO will implement the project through its India office and HQ. It will be responsible for overall project supervision. UNIDO will bring the experience of implementing projects being supported by GEF and other agencies in India and other countries.

**Project Steering Committee (PSC)**

PSC is the project?s superior governing body responsible for guiding the project as per the approved GEF CEO Endorsement document. It can also take corrective action as needed to ensure the project achieves the desired results. The PSC will be chaired by the Senior Official of MoMSME. The PSC will consist of high-level representatives from the Ministry of MSME, Bureau of Energy Efficiency (BEE), GEF Focal Point at the Ministry of Environment Forests and Climate Change, and UNIDO. PSC may invite senior officials from the National Institute of Ministry of Micro Small and Medium Enterprises, the National Productivity Council (NPC), Cluster Associations (Civil Society organizations), and other key stakeholders. PSC may invite other relevant agencies and experts as and when required.

PSC will provide (i) overall guidance to the execution of the project, and (ii) to ensure good coordination among participating agencies and other stakeholders. The PSC will meet twice in a year to monitor progress and confirm work plans for the subsequent year. If there is a need, the PSC will meet more often. Senior official (Additional Secretary/ Development Commissioner) from the Ministry of MSME will chair the PSC meetings and ensure the project progress and accountability. Specific responsibilities of the PSC include the ones listed below:

? Provide overall guidance and direction to the project
? Address project issues as raised by the PMU
? Provide guidance on new project risks, and agree on possible mitigation and management actions to address them
? Advise on major and minor amendments to the project within the parameters set by UNIDO-GEF
? Ensure coordination between various donor and government-funded projects and programmes
? Review the project progress, assess performance, and appraise the Annual Work Plan for the following year
? Ensure commitment of human resources to support project implementation, arbitrating any issues within the project
? Review combined delivery reports prior to certification by the Executing Agency
? Provide direction and recommendations to ensure that the agreed deliverables are produced satisfactorily according to plan
? Approve Project Inception Report, Mid-Term Review and Terminal Evaluation reports and corresponding management responses
? Review the final project report package during an end-of-project review meeting to discuss lessons learned and opportunities for scaling up.

**National Executing Agency (NEA)**

NEA for this project is the Ministry of Micro, Small and Medium Enterprises, Government of India. NEA assumes full responsibility and accountability for the effective use of GEF resources and the delivery of outputs, as set forth in this document. The NEA is responsible for executing this project. A senior official of the MoMSME will be appointed as National Project Director (NPD). It would execute the project through a Project Management Unit. Their responsibilities are as follows:

? Approving and signing the multi-year/ annual work plan,
? Approving and signing the combined delivery report at the end of the year,
? Guiding PMU in executing project activities and,

? Signing the financial report or the fund authorization and certificate of expenditure.

**Project Management Unit (PMU)**

The PMU will have members for overall project implementation and coordination, as well as for monitoring and evaluation, who will be placed in an office space provided by MoMSME under the overall supervision of UNIDO and guided by the NPD. The specific tasks of PMU are as follows:

? Submission of Annual Work Plan/Quarterly Work Plans/Budgets aligned to approved GEF CEO Endorsement document,
? Provide inputs to UNIDO in preparing and finalizing Annual Progress Reports (APR)/ Project Information Reports (PIR),
? Submission of Quarterly Progress Reports (semi-years or periodically as required),
? Submission of reports, providing progress information, reports as required by NEA, UNIDO,
? Coordinating with Project Executing Entity and Technical Partner for implementing, tracking project and following up on timely submissions,
? Risk management as outlined in this Project Document,
? Procurement of goods and services, including human resources,
? Financial management, including overseeing financial expenditures against project budgets
? Track and monitor co-financing for this project
? Undertaking sensitization programs and monitoring progress on Environmental and Social Safeguards and Gender Plan
? Facilitating conduction of Mid-Term Review and Terminal Evaluation of the project.

**Project Execution Partner ? ni-msme - Component 1 (Outputs 1.1.2, and 1.1.4), Component 2, and Component 3 (a minor part pertaining to knowledge products development)**

The NEA has designated ni-msme as one of the Project Execution Partners. The ni-msme is an Organisation of the Ministry of MSME, Govt. of India. It is a pioneer institute in the field of MSME and Entrepreneurship Development. The Institute provides a host of services with a focus on Capacity Building, Research, Consultancy, Skilling, Education, and Extension. The institute commemorated the Diamond Jubilee, 60 years of commendable services to the MSME sector and the country. By virtue of its strength in the area of sustainable development especially in the energy management space, it is well placed to execute the role of capacity building, knowledge management, and policy advocacy role. It will coordinate/execute project activities under Component 1 - Outputs 1.1.2, and 1.1.4, and Component 2. The ni-msme will engage a Component Resource Person. The budget is provided for the project. The NEA will coordinate closely with PMU/ NPM and ni-msme in implementing these two components. The specific tasks will be as follows:

? Prepare annual work plans for two components, clearly identifying activities to be conducted by ni-msme and activities to be outsourced with budgets,
? Prepare RFPs/tenders, publish, evaluate, and award contracts as per approved guidelines,
? Identify and implement activities,
? Provide monitoring and oversight to outsourced activities,
? Prepare and submit quarterly progress reports, inputs to annual reports,s and other reports as sought by PMU/ MoMSME-UNIDO,
? Prepare quarterly payment plans and facilitate payments,
? Participate in progress meetings, PSC meetings (as an invitee), and
? Any other tasks identified by PMU/MoMSME-UNIDO that are relevant to the project within the framework of the approved GEF CEO document.

The ni-msme will also engage a Gender Expert and ESMP (Environmental and Social Management Plan) Expert to provide oversight on various gender and ESMP-related activities.

**Project Execution Partner ? National Productivity Council (NPC) - Component 1 (Output 1.1.1 ? 2 of 3 activities and Output 1.1.3) and Component 3**

NPC is another Project Execution Partner specialized in working with industries on technical matters. The National Productivity Council of India (NPC), established in the year 1958, is an autonomous organization under the Department for Promotion of Industry & Internal Trade, Ministry of Commerce and Industry, Government of India. Besides undertaking research in the area of productivity, NPC has been providing consultancy and training services in areas of Industrial Engineering, Agri-Business, Economic Services, Quality Management, Human Resources Management, Information Technology, Technology Management, Energy Management, Environmental Management etc., to the Government and Public & Private sector organizations. NPC is a constituent of the Tokyo-based Asian Productivity Organisation (APO), an Inter-Governmental Body of which the Government of India is a founding member.

NPC will be responsible for implementing Output 1.1.1 ? 2 of 3 activities and Output 1.1.3 of Component 1 and Component 3. They will prepare the work plan for these activities/ outputs, which shall be included in the overall Annual Work Plan (AWP) signed between MoMSME and UNIDO.

There will be a tripartite agreement between UNIDO, MoMSME, and NPC for this partnership, signed before the inception workshop. NPC will engage two full-time Component Resource Persons to carry out activities under Component 1 and Component 3. They will also engage a boiler expert as a consultant. For all these resource persons, the budget is drawn from the project component 3. NPC will also engage a full-time Finance and Administration Assistant (F&A Assistant), in consultation with UNIDO. The F&A Assistant will be placed in the PMU stationing at the space provided by MoMSME. The specific tasks of NPC shall be the following:

? Prepare annual work plans for Component 1 and Component 3, clearly identifying activities to be conducted by NPC and activities to be outsourced with budgets,
? Prepare RFPs/tenders, publish, evaluate, and award contracts as per approved guidelines,
? Identify and implement activities,
? Provide monitoring and oversight to outsourced activities,
? Prepare and submit quarterly progress reports, inputs to annual report,s and other reports as sought by PMU/ UNIDO,
? Prepare quarterly payment plans and facilitate payments,
? Participate in progress meetings, PSC meetings (invitee), and
? Any other tasks identified by PMU/MoMSME-UNIDO that is relevant to the project within the framework of the approved GEF CEO document.

**Co-financing Partner ? Small Industries Development Bank of India (SIDBI)**

SIDBI is mandated to serve as the Principal Financial Institution for executing the triple agenda of promotion, financing, and development of the MSME sector and coordination of the functions of the various Institutions engaged in similar activities. The objectives of SIDBI are giving financial aid to MSMEs, refinancing banks and financial institutions, regulating the micro, small, and medium enterprise financial companies, and facilitating technology modernization & upgradation. They also have a window to provide a micro-lending development department through which they provide financial assistance to monetarily weak people and women.

SIDBI is a member of the Project Steering Committee. They will provide loans to Project interventions pertaining to energy-efficient boiler retrofits and the replacement of new boilers on need basis as per SIDBI?s rules and regulations.

**National Project Manager (NPM)**

NPM will lead the PMU and will be responsible for liaising with all entities involved in project implementation. The NPM?s primary responsibility is to ensure that the project produces the results specified in the project document, to the required quality and within the time and the cost. The NPM will be the custodian of the Project Document and as such will be responsible for overseeing compliance with the agreed

work plan and budget. The NPM will ensure that subsequent revisions to the Project Document are verified and approved by the PSC and in accordance with the requirements of the Government and GEF. The NPM will report to UNIDO and work under the consultation and guidance of the National Project Director. The NPM maintains the project management plan and coordinates the scheduling of activities. The NPM prepares and collates all project management and financial reports, and; ensures effective communication and coordination of the project team and partners; establishes the result monitoring systems and facilitates all project evaluations and reviews; and keeps track of project risks and issues in the project's risk and issues log.

The NPM will inform the PSC through NPD of any delays or difficulties as they arise during implementation so that appropriate support and corrective measures can be adopted. The specific tasks of NPM are as follows;

? Overall coordination to implement the project,
? Guiding Component Resource Persons at Project Execution Partners, and the consultants,
? Liaising with NEA/NPD, UNIDO-India/HQ, ni-msme, and NPC,
? NPM will coordinate, and develop the Annual Work Plan and budgets in consultation with the above, place it for approvals and secure approvals,
? NPM will coordinate submission of quarterly progress reports, FACE (Fund Authorisation and Certificate of Expenditure) and provide a plan for next quarter and fund requests in a timely manner,
? NPM will be responsible for implementing activities identified under Components 1, 3, and Component 4 (fully) of the project, and all other project generic activities ?
o risk identification, reporting, and taking mitigation measures,
o tracking if gender/Environmental related activities are undertaken by component managers,
? Coordinate conducting inception workshop, Mid Term Review, and Terminal Evaluation of the project, prepare management responses and submit them in consultation with the concerned,
? Coordinate timely conduction of PSC meetings and document them, and
? Coordinate operational closure and transfer of assets of the project.
? Will oversee the process of engagement of international experts for the steam optimization tool

She/he is responsible for preparing/collating reports as per the Project Document and reporting to UNIDO through NPD for all Components/Outcomes to PSC, UNIDO, and GEF.

**Consultant ? Gender Expert (Part-time)**

This person will (a) sensitize MSME units about Gender, (b) provide expert inputs to gender-related activities, (c) review training modules, (d) provide gender-related sections in the project closure report. Gender experts shall be engaged by ni-msme.

**Consultant - Environmental and Social Expert - Component 3 (Part-time)**

This person will (a) sensitize MSME units about Environmental and Social requirements, (b) recommend unit-specific measures for improving upon the Environmental and Social Aspects and (c) monitor and backstop upon the adoption of Environmental and Social measures by the units supported by the project. This person will also contribute Environmental and Social inputs to the PMU?s periodic reports to the Implementing Agency (UNIDO). Environmental and Social Expert shall be engaged by ni-msme.

**Component Resource Person? Component 1 (Outputs 1.1.3 and Component 2)**

Component Resource Person ? is responsible for implementing as following,

? Output 1.1.2 Capacity building and training system established on best available techniques & operating practices for industrial boilers
? Output 1.1.4 Knowledge portal on best available techniques & operating practices for industrial boilers (with guidance documents, case studies, etc.)

Both under Component 1 ?Demand creation through the development, promotion and implementation of best available techniques & operating practices for thermal energy optimization & industrial boiler efficiency?, and

? Component 2, ?Market facilitation through the introduction & mainstreaming of energy performance specification in the market for boilers (new & retrofit segments)?.

She/he will be full-time, has experience in project implementation, curriculum development, skills, and market facilitation through policy and other means. She/he will have an understanding of, energy efficiency & preferably exposure to boiler audits, She/he will have the responsibility to lead and provide inputs to other activities of the Project as and when required. The person will be engaged by the NPC

**Component Resource Persons (2 nos.) ? Component 1 (Output 1.1.1 and 1.1.3) and Component 3**

Component Resource Person ? Component 3, is responsible for implementing the following,

? Output 1.1.1 Energy savings estimation tools developed for industrial boilers & promoted to manufacturing MSMEs & their technology suppliers & service providers (Conduct energy audit prior and after interventions and Stack assessment for measuring reduction in pollutants such as soot, CO2, SOx and NOx)

? Output 1.1.3 Best boiler operation & maintenance practices assessed & implemented in 50 manufacturing MSMEs under Component 1

? Component 3 ?Supply creation through the promotion of the manufacture of & market for energy efficient boilers & boiler retrofits for manufacturing MSMEs? (all outputs, activities except 3 activities identified for implementation by PMU)

She/he will be full-time, with experience in project implementation pertaining to energy efficiency & particularly boilers. Experience in energy audits including boilers, preparing analytical reports, and developing recommendations, as exposure to implementing energy efficiency recommendations is essential. The person is preferably a Certified Energy Auditor or Certified Energy Manager. The positions will be located at NPC, New Delhi or PMU or the key clusters or their offices nearer to the clusters as determined by NPC in consultation with UNIDO.

**Consultant ? Boiler Expert ? Component 3**

Consultant - Component 3 is responsible for providing technical expertise to the project and particularly implementing ?Supply creation through the promotion of the manufacture of & market for energy efficient boilers & boiler retrofits for manufacturing MSMEs?.

She/he will review the final reports pertaining to the curriculum on boiler energy efficiency, policy & regulatory recommendations, and recommendations on retrofits & new energy-efficient boilers under Components 1 & 2.

She/he will be an expert in Energy Efficiency and in boilers. The position can be part-time, located in PMU or NPC. The position would be engaged by NPC.

**Transfer of assets**

Full or partial ownership of equipment/assets purchased under the project may be transferred to national counterparts and/or project beneficiaries during the project implementation as deemed appropriate by the government counterpart in consultation with the UNIDO Project Manager.

**Legal clause**

?The Government of The Republic of India agrees to apply to the present project, mutatis mutandis, the provisions of the Revised Standard Technical Assistance Agreement concluded between the United Nations and the Specialized Agencies and the Government on 31 August 1956 and as amended on 3 October 1963

**7. Consistency with National Priorities**

Describe the consistency of the project with national strategies and plans or reports and assesments under relevant conventions from below:

NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, INDCs, etc.

The proposed project is in line with the major national commitments to climate change, energy efficiency policies in India. It is relevant to the implementation of the Energy Conservation Act, National Mission on Enhanced Energy Efficiency, India?s National Communication, and Ministry of MSME schemes in which the project is anchored.

Through its Nationally Determined Contributions (NDC) under the Paris Agreement on Climate Change, India has set two major goals, namely (1) to reduce the greenhouse gas intensity of its GDP by 45 percent by 2030 from 2005 level [Updated]; and (2) to achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, [Updated], ([1]). Progress towards the NDCs is driven by the Government?s National Action Plan for Climate Change, which set out eight transformative missions, respectively:  National Solar Mission; National Mission on Enhanced Energy Efficiency; National Mission on Sustainable Habitat; National Water Mission; National Mission for Sustaining the Himalayan Ecosystem; National Mission for Green India; National Mission for Sustainable Agriculture; National Mission on Strategic Knowledge for Climate Change ([2]2). A further National Mission on Hydrogen has been announced in India?s 2021-2022 budget. The present project is directly relevant to the National Mission on Enhanced Energy Efficiency.

In 2001 India passed the Energy Conservation (EC) Act, which amongst others created the Bureau of Energy Efficiency (BEE) as the statutory agency for energy conservation and efficiency in the country. Under the EC Act, and the strengthening of the Act through the Amendments in 2010, the Perform, Achieve, and Trade (PAT) scheme has gained momentum. The large energy consuming industries ? Designated Consumers (DCs) ? are required to undertake energy audits to identify potential areas for energy savings and work towards achieving the targets set under PAT.

The trading of Energy Savings Certificates rewards companies that exceed their energy saving targets and allows under-performing companies to compensate for failing to meet their targets. The appliance labelling programme is expected to play a major role in limiting an increase in national energy demand, keeping the demand relatively low despite growth in the stock of equipment and demand for appliances such as lights, fans, air-conditioners, and other appliances used in the residential and commercial sectors. India?s energy efficiency initiatives resulted in total energy savings of 28.06 Mtoe during 2019-2020, along with monetary savings of INR 115,702 crores (~USD15.5 billion) and annual GHG reduction of 177.6 Mton CO2. During the earlier years, 2011-12 to 2018-19, India?s energy intensity decreased from 65.5 toe per INR crore to 55.5 toe per INR crore, a 15 percent reduction. Hence, India has updated their target of 33- 35% reduction of GHG intensity as per India?s NDCs to 45% .

To advance its commitment to accelerate the pace of energy efficiency implementation in the country, India joined the Three Percent Club launched at the occasion of the 2019 UN Secretary General Climate Action Summit. This ?Three Percent Club ?brings together 15 governments (Argentina, Colombia, Denmark, Estonia, Ethiopia, Ghana, Honduras, Hungary, India, Ireland, Italy, Kenya, Portugal, Senegal and the UK) and 13 businesses and international organizations that commit to put in place ambitious policies to help drive a 3% annual increase in energy efficiency.

The Ministry of MSME works towards inclusive and sustainable growth and diversification of the MSME sector, which also contributes to the realization of the Government?s climate policy and its NDCs. As an example, the Ministry of MSME is operating the Zero Effect Zero Defect (ZED) programme that supports MSMEs to improve productivity and quality, with a view to reduce waste and effluent generation and conserve energy, water and materials. Moreover, the Ministry of MSME is the executing agency for the current GEF UNIDO project on Market transformation for energy efficient technologies for MSMEs in India and of the completed GEF UNIDO Global Cleantech Innovation Programme in India. Based on the successes and early positive responses from the participating industries on Market Promotion project and other experiences and lessons learned, the Ministry of MSME is currently preparing the development of a flagship initiative ?Programme for Resource Efficiency and Sustainable Production? (PRESP) which is foreseen to have a major focus on Energy and Resource Efficiency. In terms of energy thematic area, this new government initiative would expand the horizon and outreach to newer members of MSMEs. The proposed UNIDO project here along with the (GEF5) market transformation project would provide a foundation stone for the further operationalization and rollout of this initiative. Acknowledging the importance of initiative, the MoMSME has expressed its readiness to act as National Executing Agency for this proposed project.

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[1] India?s intended nationally determined contribution (2018),
see: ttps://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf .
[2] National Action Plan on Climate Change, Prime Minister Council on Climate Change,
see: http://moef.gov.in/wp-content/uploads/2018/04/Pg0152.pdf

**8. Knowledge Management**

**Elaborate the "Knowledge Management Approach" for the project, including a budget, key deliverables and a timeline, and explain how it will contribute to the project's overall impact.**

Knowledge management is an integral element of the project and thus is mainstreamed throughout the project structure. ni-msme will manage this component. Since ni-msme has vast experience of handling knowledge products and its promotion, it is expected to do justice to the mandate required under this component. ni-msme will ensure that lessons learned and best practices from the proposed boiler projects in India are incorporated into the project design and implementation, including the ongoing GEF funded UNIDO-MoMSME energy efficiency projects in India and the clean/low-carbon technology programme. UNIDO has experience in the implementation of climate change mitigation projects globally and in India, and this knowledge and network will be leveraged by the project and PMU will guide ni-msme in reflecting the knowledge product in an effective manner.

To systematize and share its lessons and knowledge, the project will use different communication channel including the following:

? An online portal that has technical resource materials (including energy efficiency guidelines, operation and maintenance techniques and practices), e-learning portal (including instructor-led and self-paced e-learning). The online portal will be effectively hyperlinked to other relevant portals including those of MoMSME, ni-msme, UNIDO, SAMEEKSHA, BEE, etc. It will also be regularly popularized through social media, including through Twitter, LinkedIn and as appropriate through the regular advocacy and business and government liaison of UNIDO on inclusive, sustainable, and low carbon industrial development and innovation, as part of ni-msme core mandate.

? Development of business case studies/success stories and industry connects (local service providers, boiler manufacturers, etc.),

? Promotion of knowledge and learning products through awareness workshops, training, business meets, and/or roadshows in collaboration with industry associations, first in selected project MSME clusters and as the project evolves, also sector, state, and national associations.

? It is foreseen that the project?s knowledge and results will be presented in different knowledge products. Particularly:

? Baseline/status report for improvement of operation and maintenance of MSME boilers (output 1.1.3) ? a technical assessment report that will be utilized to argue the opportunity associated with energy efficiency in boilers,

? Boiler energy efficiency specifications (output 2.1.1) ? technical guidance/reference document

? How to application guides ? for design, installation, operation, and maintenance of boilers, customized to different user profiles, including MSME owners, boiler technical and maintenance staff, boiler makers, and

? Case studies/success stories (resulting from outputs 3.1.2 and 3.1.3) ? each documenting energy efficiency implementation boilers in selected clusters or enterprises in terms of technology, investment, cost and energy savings, and GHG benefits.

Widespread dissemination of these knowledge products accompanied by online and face-to-face training and awareness activities, in collaboration with MSME associations and other stakeholders, will make the project?s technical knowledge, methods, and tools readily available to MSMEs across the country and enable the implementation of energy efficiency in boilers beyond the clusters and sectors specifically supported by the project. This is critical to achieving sustainability of the project?s achievements and indeed widespread replication of project findings post-project closure.

In the following table knowledge management products, communication strategy, timeline, and budget are indicated.

| SN | Description | Communication strategy | Timeline (Start ? close time to prepare Knowledge product) | Budget (USD) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 1 | Activity 1.1.1.1 Develop Steam optimization tool | Mobile-based app for individual factories [to assess energy loss and possible energy savings potential in boilers] | Y1Q2 to Y2Q1 | 50,000 |
| 2 | Activity 1.1.2.1 Developing training materials on techniques and operating practices for industrial boilers developed at (i) owners, (ii) technician & maintenance staff, (iii) technology consultants? levels in applicable languages, and (iv) Gender and ESMP | 4 nos. of training modules developed [they are used to conduct training during the project period and then made available to relevant stakeholders for further dissemination] | Y1Q2 to Y2Q1 | 11,200 |
| 3 | Activity 1.1.4.1 Launch Energy Efficient Boilers Portal | One number of portals launched on energy efficient boilers ? a platform for industries for information, and knowledge on energy-efficient methods of boilers | Y1Q2 to Y2Q3 | 9,183 |
| 4 | Activity 1.1.4.2 Develop information and tutorials to improve air quality around boilers for men and women | Develop training modules and conduct Training and workshops in 6 different clusters | Y1Q2 to Y2Q1 | 12,000 |

| | | | | |
|---|---|---|---|---|
| 5 | Activity 1.1.4.3 Design modules and conduct Gender sensitization programs and modules designed for men and women in leadership roles in MSMEs | Develop training modules and conduct Training and workshops in 6 different clusters | Y1Q2 to Y2Q4 | 12,000 |
| 6 | Activity 2.1.1.1 Publish guidance document with efficiency specifications for (i) boiler makers and (ii) boiler users | MoMSME expected to publish for voluntary/ mandatory adoption | Y3Q3 to Y4Q4 | 34,100 |
| 7 | Activity 2.1.2.1 Doc ument best practices for energy efficient boilers and best EHS practices for consideration of policymakers and regulators for review & revision of regulatory & institutional frameworks for the manufacture and operation of industrial boilers in MSMEs | Document for consideration of concerned governmental agencies, Industry associations, and relevant state agencies | Y3Q3 to Y4Q4 | 20,541 |

| | | | | |
|---|---|---|---|---|
| 8 | Activity 3.1.1.1 Prepare guidance document providing better designs | Guidance document for designers, manufacturers, assemblers, and technical service providers of boilers. To be disseminated through the portal, relevant stakeholders such as industry associations, state agencies | Y1Q2 to Y2Q4 | 8,248 |
| 9 | Activity 3.1.2.3 Develop knowledge documents, A-Vs prepared for promotion through social/other media | Disseminated through relevant stakeholders, portal, social/ other media | Y3Q1 to Y4Q3 | 30,000 |
| 10 | Activity 3.1.2.4 Number of articles in print media [newspaper, industry publications, preferably in local languages] | Disseminated through newspaper, and industry publications, preferably in local languages | Y3Q1 to Y4Q3 | 11,745 |
| 11 | Activity 4.1.2.4 Preparing Promotional Material | Disseminated through relevant stakeholders, portal, social/ other media | Y1Q1<br>Y2Q1<br>Y3Q1<br>Y4Q1 | 5,000 |
| | Sub-total | | | 204,017 |

The Ministry of MSME will be anchoring the project execution activities at the National Institute for MSMEs, located in Hyderabad. The ni-msme is the premium national training and capacity-building institute for the MSME sector in India. The project will strengthen ni-msme capacity in the energy domain and the project?s knowledge will be integrated and mainstreamed in the training and capacity-building programs of ni-msme.

The National Productivity Council is a national-level, government-autonomous agency in India involved in various energy efficiency activities in the country. They are identified to act as Technical partners to the project during the PPG phase. They will be leading Component 3 which aims at making interventions to bring energy efficiency improvements in boilers both by retrofits and energy-efficient boilers. One of their main areas of work is providing energy audits to industry, providing recommendations to enhance energy

efficiency, including boilers. The project will strengthen NPC to further integrate and mainstream recommendations in industries to enhance energy efficiency in boilers.

Both NIMSME and NPC will also make use of knowledge products from the project to replicate in industries they take up for training, audit, and supporting implementation of recommendations related to boilers.

**9. Monitoring and Evaluation**

**Describe the budgeted M and E plan**

Monitoring and Evaluation (M&E) will include reports of progress in both individual demonstration and replication projects that receive funding. It will also include external review and evaluation. These reports will be available for official use for the project'sindicative M&E plan.

According to the M&E policy of the GEF and UNIDO, follow-up studies such as Country Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All project partners and contractors are obliged to (i) make available studies, reports and other documentation related to the project; and (ii) facilitate interviews with staff involved in the project activities.

A M&E framework will be used to assess the project?s impact on GHG emissions reduction in the industrial sector in India. To facilitate reporting of progress and impacts to the GEF Secretariat and UNIDO, there will be three main processes:

i) Internal tracking: the PMU will collect data from participating units, vendors identified by the project, and other stakeholders, and agencies at regular intervals throughout the project?s implementation period. This includes the monitoring of performance indicators in the Project Results Framework and the use of a GHG accounting methodology. Internal tracking will inform both the Midterm Review and the Final Evaluation. The PMU will be responsible for preparation of regular progress reports with full support of, and in agreement with, the participating companies, municipalities, and other beneficiaries. The PMU is also responsible to develop promotional materials.

ii) **Midterm Review (MTR) and Terminal Evaluation (TE)** - The GEF Monitoring and Evaluation Policy has two overarching objectives:

a. Promote accountability for the achievement of GEF objectives through the assessment of results, effectiveness, processes, and performance of the partners involved in GEF activities. GEF results will be monitored and evaluated for their contribution to global environmental benefits; and
b. Promote learning, feedback, and knowledge sharing on results and lessons learned between the GEF and its partners, as a basis for decision making on policies, strategies, program management, projects, and programs; and to improve performance.

iii) The Midterm Review and Terminal Evaluation will examine the Project?s performance with respect to the planning and adaptive management requirements of both UNIDO and the GEF. UNIDO uses a Results Based Management approach, captured in the Project Results Framework (Annex A), which

includes performance indicators, targets and timelines. In addition to the reporting on the internal tracking of performance indicators, review and evaluation will focus on the following principal dimensions which are in line with the general guidelines of the GEF Monitoring and Evaluation Policy:

a. **Relevance** ? the extent to which the activity is suited to local and national environmental priorities and policies and to global environmental benefits to which the GEF is dedicated; this analysis includes an assessment of changes in relevance over time,
b. **Effectiveness** ? the extent to which an objective has been achieved or how likely it is to be achieved,
c. **Efficiency** ? the extent to which results have been delivered with the least costly resources possible,
d. **Results** ? in GEF terms, results include direct project outputs, short to medium term outcomes, and progress toward longer term impact including global environmental benefits, replication effects, and other local effects.
e. **Sustainability** ? the likely ability of an intervention to continue to deliver benefits for an extended period of time after completion; projects need to be environmentally as well as financially and socially sustainable.

MTRs are important and valuable instruments for generating real-time learning as project activities unfold and may therefore lead to mid-term improvements and evidence-based corrective actions ensuring that activities are on track to achieve planned outcomes. A review of progress at midpoint is part of the transparent and accountable management practices of UNIDO and the GEF. The MTR will have the following aims:

? To enhance project and sector-level learning;
? To enable informed decision-making about next steps;
? To strengthen the adaptive management of the Program; and
? To ensure accountability for the achievement of the Project?s objective.

The monitoring and evaluation will be financed with US$ 100,000 budgeted including $60,000 for contracting external evaluation contractors - who must adhere to the internationally recognized professional standards that are applied to GEF project reviews and evaluations, as set out in the GEF Evaluation Principles and Criteria and Minimum Requirements. Other costs associated with data collection will be included in the staff costs for team members in the day-to-day execution of their tasks and not tracked separately.

A PMU will be established at the office space of Ministry of MSME for the project under the overall supervision of UNIDO and will hold responsibility for continuous monitoring of project activities execution, performance and track progress towards milestones. UNIDO will be responsible for overall implementation and tracking overall project milestones and progress towards the achievement of the set project outputs. The PEP/ PMU will be responsible for providing the draft reporting which will be finalised by UNIDO before submitting to the GEF. The following table presents the budgeted monitoring and evaluation plan of this project.

**Table 17. Allocation of GEF grants for different M&E activities**

| Type of M&E activity | Engaged Parties | GEF Grant (US$) | Time frame |
|---|---|---|---|
| Project inception workshop | PMU, UNIDO, consultants | 10,000 | Within first two months of Project start up, with reports immediately following Inception Workshop |
| Measurement of Means of Verification for Project Progress And Performance | UNIDO, M&E expert | 5,000 | Start verification of projects annually and at the project end |
| Semi -Annual project progress report | PMU | 10,000 | Every six months. |
| Project Implementation Review (PIR) reports | PMU, UNIDO | 5,000 | Once a year |
| Promotional material | PMU | 5,000 | As required |
| Mid Term Review | UNIDO, External consultants | 30,000 | Mid-term of the project (expenditure or at the end of two years) whichever is earlier |
| Project Terminal Report | UNIDO, PMU | 5,000 | At end of project implementation. |
| Project Terminal Evaluation | Independent evaluators, PMU, UNIDO PM, and UNIDO Evaluation Group | 30,000 | Within 6 months of completion of project implementation |
| **TOTAL indicative cost** | | **100,000** | |

**10. Benefits**

**Describe the socioeconomic benefits to be delivered by the project at the national and local levels, as appropriate. How do these benefits translate in supporting the achievement of global environment benefits (GEF Trust Fund) or adaptation benefits (LDCF/SCCF)?**

The project is expected to provide several socio economic, national and local level and Global environmental benefits. The technical interventions, good practices as part of Environment and Social Management Plan and Gender Action plan are expected to provide a number of benefits.

The project has several trendsetting features for the MSME clusters. In addition to the committed $CO_2$ emission reduction there are several other environmental benefits. The air quality in the MSME units

and greater cleanliness, especially the boiler unit would have positive impacts on the people and the environment. Reduced pollution, reduced heat (due to project interventions that would focus on energy efficiency) would create a feeling of safety and well being for the labour. MSME owners and workers would thus get sensitized to acceptance of eco friendly interventions and better waste management practices. This would in turn have spin off effects in management employee relations. The management would benefit from lower operational cost and so lower cost of utilities. The interventions would also free up shop floor space. This would translate into higher profits. Gender sensitization programmes would make MSME leaders more gender sensitive and considerate of women?s issues. Other gender mainstreaming processes would result in higher participation of women as a skilled work force. The greatest impact could perhaps be through behaviour change where employees and management accept sustainable interventions and realize the benefits of the same. This would also create an appetite for more sustainable interventions. Acceptance of change and innovations would also be mainstreamed into MSME processes. Replication of the success stories of this project across more MSME cluster would result in acceptance of sustainability in geographically dispersed and varied MSME clusters. The project would thus contribute to early ecosystem building for sustainability in MSME clusters. The social, economic, local, national, and global benefits can be listed as below;

Social benefits

? Reduced pollution
? Better work environment
? Better worker safety due to enhanced safety regime
? Better worker facilities
? Better labour relations because of improved air quality and general feeling of well being
? Mindset change of msme enterprises and greater acceptability of sustainable interventions
? Gender mainstreaming would result in acceptance of women as skilled work force.

Economic benefits

? Lesser operational costs due to higher efficiency
? Savings on fuel bills through fuel
? Savings due to water savings

Local level

? Reduced air pollution (sulphur dioxide, suspended particulate matter, etc.)
? Reduced land and water body pollution due to better waste management
? Further acceptance of innovations would be easier

National level

? Potential for replication to other clusters and industry segments and creating a new eco system for sustainable intervention
? Better productivity
? Contributing to National Action Plan on Enhanced Energy Efficiency
? Contributing to Global commitments through Nationally Determined Contributions

Global Environmental benefits

? Contributing to reduction in Greenhouse Gas emissions
? GHG emissions reductions, continue for life cycle of equipment life

## 11. Environmental and Social Safeguard (ESS) Risks

Provide information on the identified environmental and social risks and potential impacts associated with the project/program based on your organization's ESS systems and procedures

**Overall Project/Program Risk Classification***

| PIF | CEO Endorsement/Approval | MTR | TE |
|---|---|---|---|
| Medium/Moderate | Medium/Moderate | | |

**Measures to address identified risks and impacts**

Elaborate on the types and risk classifications/ratings of any identified environmental and social risks and impacts (considering the GEF ESS Minimum Standards) and any measures undertaken as well as planned management measures to address these risks during implementation.

The key risks for successful project implementation as identified during this Project Preparation phase are summarized below with appropriate mitigation measures:

**Table 16: Risks assessment and mitigation measures**

| Risks | Risk level | Mitigation Measure |
|---|---|---|
| **Financial risk**: Lack of availability of financing at MSMEs and/or leveraging finance from financing institutions, will impact the uptake demonstration/ replication of EE retrofits/ EE boilers and further scale up beyond the project duration. | Probability: Low Impact: medium | The project directly provides partial funding support to demonstration and replication projects apart from Technical Assistance. Project has also leveraged committed support from SIDBI for lending the proposed interventions in project MSME units. The local lead banks will also be sensitized on the interventions, their financial viability, and benefits |

| | | |
|---|---|---|
| **Operational risk 1:** Inability of MSME unit owners to let their technicians participate in capacity building and training programmes | Probability: Medium<br>Impact: Medium | Exhaustive stakeholder consultations with MSME units and associations were carried out during the PPG phase. Further before taking up MSME units as project units, acceptance of owners to participate in the project will be considered as key criteria. Further MSME local cluster level associations are also key stakeholders and invited members of PSC are expected to motivate MSME units to participate that will help reaping benefits. |
| **Operational risk 2**: Delay in endorsement and enforcement of new regulations, guidelines, and standards on promotion of energy-efficient operation for industries | Probability: Medium<br>Impact: Low | The proposed measures include: (1) cooperation with the concerned government agencies and; (2) establishment of the Project Steering Committee with a high-level representation from all concerned authorities. This will help resolve problems if any arises.<br><br>The strong involvement and ownership of the counterpart Ministry of MSME will ensure the mitigation of operational risks associated with the proposed project. Moreover, implementation of energy efficient measures will not be exclusively dependent on new regulations or standards. They may be able to stand alone based on their financial viability and benefits they provide. |
| **Climate Change Risks**: Climate change may impact operations of MSMEs, depending on their location and emergency preparedness | Probability: Medium<br>Impact: Low | This is an external risk and the project itself which is aimed to mitigate this risk by scaling up the adoption of energy efficiency and climate friendly technologies. Moreover, from an adaptation perspective, the project will address any potential risks to project areas by including criteria related to such risks in the cluster surveys, and if a risk is identified, develop an adaptation mitigation strategy before implementation begins. |
| **Policy and institutional risk:** In absence of policies the ecosystem may not be conducive for mainstreaming and sustainability of project interventions | Probability: Low<br>Impact: Low | Private sector agencies and several government agencies (i.e. MoEFCC, MoMSME, BEE) will be closely involved and contribute to project activities to ensure that activities continue beyond the project period. These mitigation measures will contribute to creating ecosystems for sustainability of the proposed project. Moreover, there is strong evidence from ongoing GEF4 energy efficiency project that MSMEs continue to invest from their own financial resources in profitable energy efficiency investments, even during stressed COVID pandemic period |

| | | |
|---|---|---|
| **Social and Gender Risk:** Risk of resistance against, or lack of interest in, the project activities from stakeholders, especially with regard to the active promotion of gender equality. Low participation rates of suitable female candidates and/or women led or women-owned enterprises due to lack of interest, inadequate project activity, or missing qualified female population with engineering discipline and/or within manufacturing sector | Probability: Low<br>Impact: Low | This project will pursue gender responsive communication and ensure stakeholder involvement at all levels. It will pay special attention to involving women and men, as well as CSOs and NGOs promoting gender mainstreaming and equal participation of women, and a gender expert. This shall mitigate social and gender related risks, promote gender equality, create a culture of mutual acceptance, and maximize the potential contribution of the project to improving gender equality in the energy field. |
| **Technological Risks**: Failure of technological interventions due to either faulty equipment or inappropriate installation/utilization | Probability: Low<br>Impact: medium | Technical risks associated with Efficient Boilers are very low. Considerable energy savings have been achieved in many countries through the capture of systems level efficiency opportunities.<br>The boiler manufacturers will be engaged in the project, who will do the testing at manufacturers end and user end before rolling out.<br><br>To deliver the required capacity building, UNIDO and its execution partners will employ the services of highly skilled experts with systems specific expertise and proven training skills |
| **Environmental and Social Risks**: These risks will mostly originate from non-inclusion of relevant EHS/OHS features in efficient boiler designs, poor O&M practices, weak safety regime and poor labor management | Probability: Medium<br>Impact: Medium | Given the weak compliance to Environmental and Social regulatory requirements and weak enforcement and monitoring on these aspects, the risk on these counts will be higher. The project has an Environmental and Social Management Plan, which will ensure that all EHS/OHS aspects are adequately addressed and policies/standards are suitably updated to ensure compliance in future as well. Further it is proposed to have an Environment and Social Specialist in the Project implementation phase to (a) sensitize MSME units about Environmental and Social requirements, (b) recommend unit-specific measures for improving upon the Environmental and Social Aspects and ? monitor and backstop upon the adoption of Environmental and Social measures by the units supported by the project. |

| | | |
|---|---|---|
| **Risk of Stranded Assets:** There are risks of what will happen to the existing equipment, when they are replaced with energy efficient retrofits. There are risks of what will be done with existing boilers when they are replaced with Energy Efficient boilers | Probability: Medium<br>Impact: Low | It is expected that some inefficient components are replaced with Energy efficient retrofits. The present components will be disposed of. Most often they go to the recycling market in India. Further, when a new energy efficient boiler is purchased, old boilers are used as standby or it acts as capacity enhancement plan of the MSME unit |
| **Market risk:** Most often, industrial units, particularly MSME units shift fuel from one to another depending on price change. This may create many issues including the stranded assets. | Probability: Medium<br>Impact: Medium | Solid fuel boilers are available in multi fuel options. Whereas other boilers such as gas, diesel, appear specific to the fuel. The project will keep multifuel options wherever practically possible and technically/ economically feasible |

**Supporting Documents**

Upload available ESS supporting documents.

| Title | Module | Submitted |
|---|---|---|
| **ESMP_220223 UNIDO Boiler Project** | **CEO Endorsement ESS** | |
| **210191_ES_Screening_Template_DD - 15** | **Project PIF ESS** | |

## ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

**Annex A: Project Results Framework** (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| **Project objective:** To scale up and mainstream thermal energy optimization in manufacturing MSMEs through creation of ecosystem for the design, manufacture and operation of efficient industrial boilers | Quantity of GHG reductions | | Direct GHG reductions during project period: 39,629 tonnes of $CO_2$eq in the project period. 45,405 $tCO_2$/y Direct GHG emissions reduction. 483,943 $tCO_2$ direct GHG emissions over the project life cycle. 1,451,828 $tCO_2$ indirect GHG emission reduction over project life with a replication factor of 3. | ? Project final report<br>? Terminal Evaluation Report<br>? Survey reports of energy consumption and reductions for each project implemented | ? Willingness of industrial units to accept the Operational training, boiler replacement and boiler retrofits<br>? Manufacturers adopting efficient design and supply EE boilers and EE retrofits accordingly<br>? Support from government agencies |
| **Component 1: Demand creation through the development, promotion & implementation of best available techniques & operating practices for thermal energy optimization & industrial boiler efficiency** | | | | | |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| **Outcome 1.1:**Manufacturing MSMEs install operate & maintain industrial boilers & associated steam systems for enhanced energy efficiency | ? Number of MSME personnel trained<br>? Number of MSME personnel from women-led enterprises trained<br>? Number of MSME units that install, operate & maintain industrial boilers for enhanced energy efficiency | 0<br>0<br><br>0 | **90**<br>**0**<br>**65**<br>**50**<br>**.** | ? Project progress reports<br>? Quarterly progress report<br>? Post-implementation monitoring report<br>? Project closure report<br>? Energy audit reports | ? Willingness of participants to spare time and participate in training<br>? Willingness of owners of MSME units to allow their staff to participate in the training apart from themselves participating<br>? Willingness to adopt energy-efficient technology by MSME entrepreneurs in the identified clusters |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| ***Output 1.1.1:*** Energy savings estimation tools developed for industrial boilers &promoted to manufacturing MSMEs & their technology suppliers & service providers | ? Number of Steam Optimisation Tool developed<br>? Number of manufacturers, service providers downloading the app on their handsets<br>? Number of men end users downloading app on their handset<br>? Number of women end users downloading app on their handset<br>? Number of MSME units where the Steam Optimisation tool is piloted<br>? Number of units estimated for energy consumption at baseline and post project interventions<br>? Stack assessment for measuring reduction in pollutants such as soot, CO2, SOx and NOx | 0<br>0<br>0<br>0<br>0 | 1<br>40<br>810<br>90<br>225<br>50<br>5 | ? Launched mobile app<br>? Progress reports<br>? Project closure report<br>? Project progress/ closure report<br>? Energy audit reports[1]<br>? Stack analysis reports | ? App developed is user-friendly for the MSME unit owners/ staff<br>? MSME unit owners are willing to pilot in their respective units<br>? App is supported continuously and MSME Unit owners continue to use it. |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| ***Output***:1.1.2 Capacity building and training system established on best available techniques & operating practices for industrial boilers | ? Number of training materials prepared on techniques and operating practices for industrial boilers developed at (i) owners, (ii) technician & maintenance staff, (iii) technology consultants? levels in applicable languages<br>? Number of owners trained<br>? Number of technicians & maintenance staff trained<br>? Number of technology consultants trained<br>? Number of women skilled in data management, safety audits, fuel inventory management etc.<br>? Number of men skilled in data management, safety audits, fuel inventory management, etc.<br>? Number of women employees provided with self-financing facilities to meet non- | 0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | 4<br>225<br>450<br>30<br>2000<br>2,000<br>500 | ? Training modules or Qualification packs<br>? Progress reports<br>? Project closure reports<br>? Attendance sheet of participants<br>? survey among women beneficiaries<br>●Review of test reports prepared by labs with women employees/owners | ? MSME Unit owner's spare time to participate in owners' training<br>? MSME unit owner allow their staff to participate in training<br>? MSME owners encourage women employees to participate in skilling programs.<br>? MSMEs hire or offer consulting assignments to skilled women<br>●Non-financial interventions meet women?s needs and women avail of these facilities |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| | financial needs of women employees<br>●Promote setting up Fuel and water testing labs operated by women in dense clusters | | | | |
| ***Output*** :1.1.3 Best boiler operation & maintenance practices assessed & implemented in 50 manufacturing MSMEs | ? Number of MSME units assessed for energy-saving potential using ESET boiler tool<br>? Number of MSME units received advisory support for implementation of efficiency solutions on best possible operation and maintenance practices | 0<br>0 | 50<br>50 | ? Progress report consisting of ESET results<br>? Report consisting of recommendations<br>? | ? MSME unit owners continue to show interest in Energy Efficiency<br>? MSMEs in the identified clusters regularly use the facility offered by the cluster-level fuel and water testing labs |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| ***Output*** :1.1.4 Knowledge portal on best available techniques & operating practices for industrial boilers (with guidance documents, case studies, etc.) | ? Number of portals Launched<br>on Energy Efficient Boilers<br>? Number of men visiting the portal(gender-disaggregated)<br>? Number of women visiting the portal<br>? Number of information and tutorials to improve air quality around boilers for men and women<br>? Number of Gender sensitization programs and modules designed for men and women in leadership roles in MSMEs<br>? Number of Gender and ESMP sensitization programs for employees of financial institutions leading to increased lending for women-led MSMEs | 0<br>0<br>0<br>0<br>0<br>0 | 1<br>2000<br>500<br>6<br>6<br>6 | ? Active Portal, reported in MTR and TE<br>? Website visitors declare gender in the footprint report | ? Stakeholders have access to the portal<br>? Stakeholders continue to access and utilize in portal and its information |
| **Component 2:** Market facilitation through the introduction & mainstreaming of energy performance specification in the market for boilers (new & retrofit segments) | | | | | |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| **Outcome 2.1:** Industrial boilers & boiler retrofits are invested in with due consideration of energy efficiency performance | ? Number of guidelines developed promoting/ mandating Energy Efficiency in Boilers | 0 | 3 | ? Publication of guidelines promoting/ mandating EE in boilers | Concerned Governmental agencies take note to promote/ mandate guidelines on EE in boilers |
| ***Output:*** 2.1.1 Transparent system of efficiency specifications for industrial boilers set up | ? Number of guidance document with efficiency specifications for (i) boiler makers and (ii) boiler users published | 0 | 2 | ? Energy efficient boiler design, operation and maintenance Guidance documents | |
| ***Output***:2.1.2 Policy makers & regulators mobilized to add energy efficiency considerations in the comprehensive revision of regulatory & institutional frameworks for the manufacture & operation of industrial boilers in particularly in MSMEs | ? Number of documents on best practices for energy efficient boilers and best EHS practices for consideration of policymakers and regulators for review & revision of regulatory & institutional frameworks for the manufacture and operation of industrial boilers in MSMEs | 0 | 1 | ? Revised regulatory and institutional framework document | Policy makers and regulators accept the guidance document for further action to include them in regulatory and institutional framework |
| **Component 3:** Supply creation Through the promotion of the manufacture of and market for energy-efficient industrial boilers and boiler retrofits for manufacturing MSMEs | | | | | |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| **Outcome 3.1:** Suppliers manufacture & market energy efficient boilers & components for energy efficient boiler retrofits | ? Total number of MSME units adopting retrofits to achieve Energy Efficiency in boilers<br>? Total number of MSME units replacing boilers | 0<br><br><br>0 | 150<br><br><br>25. | ? Project closure report<br>? Terminal Evaluation Report | ? MSME units invest in EE retrofits for their existing boilers based on project inputs and scale them up based on pilot demonstrations<br>? MSME units invest in new Energy efficient boilers based on project inputs and scale them up based on pilot demonstrations<br>? The dynamic situation is favorable to fuel switch as projections in project document |
| ***Output 3.1.1:*** Energy efficient boiler designs provided to industrial boiler manufacturers | ? Number of Guidance documents prepared providing better designs<br>? Number of boiler manufacturers and assemblers involved in producing standardized energy efficient boiler designs<br>? Number of men led MSME supported to piloting designs<br>? Number of women led supported to piloting designs | 0<br><br>0<br><br>0<br><br>0 | 1<br><br>5<br><br>20<br><br>5 | ? Document of improved designs for EE boiler retrofits and boilers<br>Progress reports<br><br>? Progress reports | ? Manufacturers and assembler show interest in better designs and implement the project initiatives<br><br>? Women led MSMEs in textile and food processing realize the impact of energy efficiency on their enterprise and show interest in piloting designs |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| ***Output 3.1.2:*** Energy efficient industrial boilers & steam systems demonstrated in 25 manufacturing MSMEs | ? Number of boiler retrofits installed in demonstration stage<br>? Number of new energy-efficient boilers installed in the demonstration stage<br>? Number of knowledge documents and A-Vs prepared for promotion<br>? Number of articles published In print media newspapers, industry publications<br>? Number of units assessed for pollutants such as soot, CO2, Sox and NOx<br>? Number of energy audits conducted prior and post project interventions | 0<br>0<br>0<br>0<br>0<br>0 | 20<br>5<br>6<br>18<br>5<br>25 | ? Progress reports<br>? A-Vs and print articles<br>? Successful commissioning report[2] | ? MSME unit owners invest in EE retrofits in boilers and EE boilers |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| ***Output 3.1.3:*** Energy-efficient industrial boilers & steam systems replicated to 150 manufacturing MSMEs | ? Number of workshops & handholding programs conducted to promote energy efficiency retrofits and boilers<br>? Number of efficient industrial boiler retrofits installed in the replication stage<br>? Number of new energy efficient boilers installed in replication stage<br>? Development of templates (i) model Energy Service Contract, (ii)Vendor finance<br>? Number of business dialogue workshops facilitated between manufacturers, service providers and end users<br>? Number of assessments to measure pollutants such as soot, CO2, Sox and NOx<br>? Number of post implementation audit report prepared | 0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | 6<br>130<br>20<br>2<br>6<br>25<br>150 | ? Progress reports<br>? Project closure reports<br>? Template for model ESCO and Vendor Finance<br>? Workshop proceedings<br>? Stack analysis reports<br>? Energy Audit reports[3] | ? MSME units continue to be interested and invest in EE retrofits in boilers and EE boilers<br>? The interventions result in estimated improvements |
| **Component 4:** Monitoring and Evaluation | | | | | |

| Strategy | Objectively Verifiable Indicators | | | Source of Verification | Critical Assumptions and Risk |
|---|---|---|---|---|---|
| | Indicator | Baseline | Target | | |
| **Outcome:** 4.1 Monitoring & evaluation mechanisms & indicators established to facilitate effective project implementation & sound impact assessment Monitoring and Evaluation mechanisms and indicators established for the gender mainstreaming strategy and action plan | ? Number of external evaluations conducted | 0 | 2 | ? Evaluation reports | |
| ***Output :***4.1.1 Project & its activities monitored on a periodic basis in line with GEF, UNIDO & government requirements | ? Identification of KPIs (Key Performance Indicators) for project outputs<br>? Preparation of periodical monitoring reports (every six months) | 0<br><br>0 | 1<br><br>6 | ? KPI document for project outputs<br>? Periodical monitoring reports | |
| ***Output :***4.1.2 External mid-term review and independent terminal evaluation conducted | Number of Mid-term review conducted, and report published<br>Number of Terminal Evaluation conducted, and report published | 0<br><br>0 | 1<br><br>1 | ? Mid Term Review Report<br>? Terminal Evaluation Report | |

[1]Energy audit reports will also provide RE potential particularly for boiler energy needs such as CST
[2]Energy audit reports will also provide RE potential particularly for boiler energy needs such as CST

[3]Energy audit reports will also provide RE potential particularly for boiler energy needs such as CST

## ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

**Austria Comments**

| Comment & Response | Reference |
|---|---|
| Comment 1:<br>For the project in India (Improving thermal energy efficiency in the design, manufacturing and operation of industrial boilers for low carbon MSMEs in India), what falls under thermal energy and what kind of energy source will be used (for example fossil fuels or nuclear energy)?<br><br>Response:<br><br>The project considers boilers that uses heat value in the form thermal energy using both fossil and non-fossil types of fuel. The thermal energy efficiency will be achieved by (i) promoting & implementing best available techniques & operating practices for thermal energy optimisation & industrial boiler efficiency, (ii) replacing with energy efficient industrial boilers and (iii) energy efficient retrofits. Utilisation of non-fossil fuels include biomass - in the form firewood, biomass residue, briquettes made from biomass residue. Fossil fuels that are primarily used in these MSME boilers includes coal, natural gas, diesel. The project plans to focus on prospective interventions which would attempt to promote adoption of technologies that facilitates switching from coal consuming boilers to much cleaner biomass based fuel or electricity consuming units. Similarly, MSME units that uses diesel as fuel will be converted to Electricity consuming units. Operating practices will be improvised in MSME units that uses non-fossil fuel, and natural gas, diesel as well as fossil fuel consuming units. The project does not consider nuclear energy consuming units, and there are no MSME units consuming nuclear energy as such in India. | Part II, Section 1a) Project Description 6) Global environmental benefits (GEFTF) and/or adaptation benefits (LCDF/SCCF) |

**United States Comments**

Comment by Jennifer Novotney, U.S. Department of State Comment by Jennifer Novotney, U.S. Department of State (DOS), Bureau of Oceans and International Environmental (DOS), Bureau of Oceans and International Environmental and Affairs (OES), Office of Environmental Quality and Affairs (OES), Office of Environmental Quality (ENV), Council, (ENV), Council, made on 1/14/2022

| Comment & Response | Reference |
|---|---|
| Comment 1:<br>We would appreciate additional risk assessments to address the potential of stranded assets from this project and impacts of local and regional policies on the scalability of this work.<br><br>Response:<br>The project has three main interventions, firstly providing training and support to enhance operational efficiency of existing boilers. Secondly, advising & supporting MSME units on EE retrofits to enhance boiler efficiency. Thirdly, replacing inefficient boilers with EE boilers.<br><br>In the first two cases, there are no potential of generation of stranded assets, as no assets are created by replacement. In the third case, the existing assets are replaced with new EE boilers. However, number of discussions with the MSME units and technology suppliers at the cluster level has revealed that most of the MSME unit owners replaces their boilers only when the useful life of existing assets is completed. Further, purchase of pre-owned assets is quite prevalent in India, because of which most often these assets would continue to be used beyond recommended lifetime. Thus, there is little or no risk of stranded assets being generated from the project activities. | Output 3.1.3 of Outcome 3 |
| Comment 2:<br>We would also encourage the project developers to consider opportunities to increase the gender ratio.<br><br>Response:<br>During the Project Preparation phase, field visits and stakeholder consultations were undertaken to explore the opportunities to increase the gender ratio in the participation of the project activities. Opportunities to increase women?s participation in manufacturing MSMEs were explored. Most of the stakeholders during these consultation meeting suggested that the prevalent labour laws prohibit employment of women in night shifts at the shop-floors, which basically pose challenges in increasing participation of women in the operation and maintenance of boilers. However, the stakeholders suggested that the energy efficiency interventions would create new opportunities for skilled women. They recommended skilling of women so that they could be employed / self-employed and also add value to the MSMEs. There was large consensus about women?s participation in greater numbers for new opportunities like fuel testing laboratories, data management, safety audits etc. Meeting non-financial needs of women to ensure their participation also emerged as a need for increasing the gender ratio.<br><br>Number of 9000 direct beneficiaries disaggregated by gender as a co-benefit of GEF investment in this boiler energy efficiency initiative would include, 2253 women benefit from project processes. This would include participation of 65 women led enterprises and skilling of 1222 women. A detailed action plan is attached in the CEO Endorsement document. | Gender action plan. Annexure A of the Project Results Framework Outcome 1.1 and Output1.1.2 |

**United Kingdom Comments**

Commonwealth Climate and Environment Division Foreign, Commonwealth& Development Office of the United Kingdom, Council, & Development Office of the United Kingdom, Council, made on 1/16/2022

| Comment & Response | Reference |
|---|---|
| Comment 1:<br>It is important to ask UNIDO whether the boilers use coal/biomass/gas? Energy efficiency is the immediate solution before the country?s power system makes a full shift to RE or alternative technologies.<br><br>Response:<br>Majority of the targeted boilers on the baseline situation are using solid fuels like coal or biomass either in the form of woody biomass or prepared biomass fuel like briquettes and pellets using biomass residue,. Some of the boilers also are using natural gas, diesel. No MSME unit reported usage of electricity during the Project Preparation phase. During the PPG phase, information has been gathered from 1516 MSME units, out of which around 11% of units are using Coal, 77% of units are using Biomass, 10% used Natural Gas and 3% consumed Diesel.<br><br>The project plans to focus on enhancing the Energy Efficiency of MSME unit boilers by improving operational effectiveness through training, capacity development, Energy Efficiency retrofits and changing existing inefficient boilers to Energy Efficient boilers.<br><br>In order to alienate concerns of some of the GEF member countries on fossil fuel boilers, project focus has been revised to creating an ecosystem to promote energy efficiency in non-coal fired boilers or replacing coal boilers which has now built-in in the project framework. The key considerations provided under Section 6, Part II of this CEO endorsement document are that shift to new boilers do not consider coal-based boilers, as the project focuses on units not using coal for making interventions under good boiler operation and maintenance practices. 16 coal consuming units are added for Solar Heat as retrofits, rest are non-coal consuming units for energy efficient boiler retrofits, and 23 coal consuming units will be replaced by biomass and electricity boilers under the category of new energy efficient boilers.<br><br>Project encourages fuel shift to non-fossil based fuels such as coal to biomass and few to electricity. Thus, while the project focus is on Energy Efficiency as an immediate and low-cost solution, it would also encourage fuel shift in existing multi fuel boilers and new boilers. The project would also promote usage of Renewable Energy through Concentrating Solar Technologies, etc and will explore possibility of adoption of electric boilers in appropriate MSME units . | Part II, Section 1a)Project Description 6) Global environmental benefits (GEFTF) and/or adaptation benefits (LCDF/SCCF )<br><br>Annexure A: Project Results Matrix |
| Comment 2:<br>We understand the project is more to improve the efficiencies of the existing boilers and if the plan is to use biomass pellets instead of coal/NG then this cannot be deemed fossil fuel based. These specs need to be checked with UNIDO.<br><br>Response:<br>The main focus of the project is more to improve the efficiencies of existing boilers by bringing operational efficiencies through training, capacity development? and also Energy Efficiency retrofits. The project encourages fuel shift from coal to non-fossil fuels like biomass residue briquettes. In addition, the project promotes shifting from inefficient boilers to new energy efficient boilers. Shift to new boilers do not consider coal-based boilers. The project would help developing specifications for the energy efficient boiler retrofits and energy efficient boilers. It also encourages use of Renewable Energy such as Concentrating Solar Heat. | |

**Norway and Denmark Comments**

Ministry of for Green Diplomacy and Climate (GDK), Ministry ofForeign Affairs of Denmark, Council, Foreign Affairs of Denmark, Council, made on 1/21/2022 made on 1/21/2022

| Comment & Response | Reference |
|---|---|
| Comment 1:<br>The proposed project is in line with the mandate and priorities of the implementing agency UNIDO. However, the results of the last MOPAN assessment of UNIDO should be taken into consideration when following up the progress of the project.<br><br>Response:<br>MOPAN key findings are, commitment to results-based management, commitment to its technical cooperation/ project implementation and knowledge function, level of HQ centralisation, lack of risk management processes, addressing cross-cutting priorities such as governance and human rights.<br>UNIDO?s 2018-21 organisational theory of change provides clear vision and direction for the organisation. Further this project with funding from GEF has inherent tools like Results Based Management which is amply presented in Project Result Matrix (Annexure A). It provides a clear path for Results and targets. The project has identified likely risks and risk mitigation measures which are presented in detail in the CEO endorsement document. The project will leverage knowledge gained from the previously UNIDO implemented Vietnam Boiler project. The project has detailed out Gender inclusive measures summarised in section 3 of 1b) in GEF CEO ED and a separate Gender Action Plan developed even in this hard to be gender inclusive sector (Baseline indicated no women works in shop floor, particularly in the Boiler area). It also has made baseline assessment for Environmental and Social inclusion into the project and prepared a separate Environment and Social Impact Assessment Report. We believe that the above mentioned measures amply clarifies that the results of the last MOPAN assessment of UNIDO are fully taken into consideration in the planning process of the project. | Annexure A -Project Results Matrix, 1b) 5. Risks of the GEF CEO Endorsement Document Gender Action Plan Environment and Social Impact Assessment and management Plan |

| Comment & Response | Reference |
|---|---|
| Comment 2:<br>The primary responsibility of promotion and development of MSMEs is of the State Governments. However, the Government of India, supplements efforts of the State Governments through various initiatives. UNIDO will be working with the ministry. The Ministry of MSME and its organizations assists the states in their efforts to encourage entrepreneurship and enhance the competitiveness of MSMEs in the changed economic scenario. The project appears relevant for these issues facing the MSME sector. Bilateral, multilateral agencies and Indian Financial institutions also assist MSMEs to Finance both implementation and operation of emission reduction related technologies. There may be coordination issues with so many actors.<br><br>Response:<br>UNIDO will be working closely with the Ministry of Micro Small and Medium Enterprises (MoMSME) at the central level. MoMSME will be the National Executing Agency of the project. While executing this kind of Pan-India level projects in all previous GEF projects specially in the GEF 4th and 5th cycle, close co-ordination is built-in with the financial institute and state level industry department who are not only invited in the regional and national level consultation meeting but also participation of all these relevant stakeholders both from the state, central government and other financial institutes are ensured by adoption of proper strategy by the execution partners (who in this case is ni-msme and NPC). UNIDO PMU would also facilitate the co-ordination process between various regional and central stakeholders in consultation with the MoMSME, ni-msme and NPC.<br><br>National Institute of Micro Small and Medium Enterprises (ni-msme) (under Ministry of MoMSME, Govt. of India) is the Project Execution partner. The ni-msme core activity is training the trainers, and its other activities include consultancy, research, extension, and information services. The other execution partner proposed for execution of the project is National Productivity Council (Under Ministry of Commerce & Industry, Government of India), who will complement the technical part of interventions. NPC provides consultancy and training in various fields including Energy Management and undertakes research in the areas of productivity.<br><br>Both these agencies are a national level reputed agency who has strong standing in the professional area and have offices across the country and has their established network in the state and regional level too. They have worked with bilateral, multilateral agencies and Indian financial institutions, MSMEs, state agencies. ni-msme has connections with MSME related agencies at State and Central level along with a strong training portfolio. They have a full-fledged campus with residential training facilities for more than 200 people at a time. NPC is the key nodal agency in providing consultancy and implementation support on energy management in the country. Above measures would minimise the chances of any mis-coordination between relevant agencies. | |

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| Comment 3:<br>As STAP mentions in their review, the project identifies an important area for climate mitigation in a range of large industries in India. The instalment of efficient boilers will achieve full combustion of fuel which minimizes emissions on soot, CO, NOx, SOx etc. This contributes to reduced air pollution and important health co-benefits. It would therefore be useful if the results framework can capture the reduced emissions of these pollutants from new boilers, in addition to $CO_2$-emissions.<br><br>Response:<br>Stack analysis is included as an activity with budget. It is listed as an indicator and presented with targets and means of verification in Project Results Framework. The results will be part of Project progress reports and Project Closure reports. | Output 3.1.2 and 3.1.3 |
| Comment4:<br>There are several risk assessments related to project financing. The project's budget seems to rely on significant funds being raised by the private sector, which would be a very important outcome. It should however be ensured that strong risk mitigation measures are in place in case the project fails to mobilize this finance. Can the project still be successful if it has to rely on project funding from GEF and national ministries only?<br><br>Response:<br>UNIDO and other agencies have carried out similar projects where significant funds were raised by private sector, primarily as equity, particularly in MSME sector. However, many industries have taken loans from banks in the past. It is a practice and requirement to leverage co-financing to GEF funds. Large quantum comes as equity/ loan in most GEF projects, particularly in climate mitigation projects. MSME owners willingness to invest on techniques and technologies with value for money during the stakeholder consultations conducted . Further, co-financing commitment letters from MSME unit owners association and banks have been mobilized and are attached as part of this document. As such prior-commitment from the private sector stakeholders has already been ensured by the project in the preparation stage. | |

**Germany Comments**

Ministry Head of Climate FinanceDivision, German Federal Ministryfor Economic Cooperation and Development, Council, for Economic Cooperation and Development, Council, made on 1/7/2022

| Comment & Response | Reference |
| --- | --- |
| Comment 1:<br>Germany requests for the following project that the Secretariat sends draft final project documents for Council review four weeks prior to CEO endorsement: Germany requests that the following requirements are taken into account during the design of the final project proposal: The project proposal focuses on the scale up and mainstreaming of thermal energy optimization through improved design, manufacture and operation of industrial boilers based on coal, oil and natural gas.[1]<br><br>Response:<br>The project focuses on the scale-up by building on the learnings from the demonstration of energy efficient technologies as far as retrofits and replacement of old inefficient boilers to efficient boilers are concerned. In the projectthe target boilers will be replaced or complimented by using renewable fuel or renewable technologies.<br><br>It aims on promoting and implementing the best available techniques and operational practices for thermal energy optimisation & industrial boiler efficiency. It also plans to develop an Energy Saving Estimation tool/ mobile app for boilers. The project would facilitate launching Energy Efficient Boilers Portal which helps mainstream the results from the project in enhancing energy efficiency in industrial boilers. | Various indicators in Annex A: Project Result Matrix |

| Comment & Response | Reference |
|---|---|
| Comment 2:<br>The use of energy efficiency in fossil fuels application is not in line with the objectives of the Paris Agreement to limit global temperature increase to 1.5?C and to reach climate neutrality at the latest in 2050. In this regard, Germany has committed to end direct public support for coal [2] and the international unabated fossil fuel energy sector more generally.[3]<br><br>Response:<br>The project plans to focus on enhancing the Energy Efficiency of MSME unit boilers by improving operational effectiveness through training, capacity development, Energy Efficiency retrofits and changing existing inefficient boilers to Energy Efficient boilers.<br><br>At the PIF stage the proposal included energy efficiency of existing coal-based boilers also. However, considering the above comment, the proposal has been revised to focus on creating an ecosystem to promote energy efficiency in non-coal-based boilers and fuel shift from coal to biomass or coal to electricity. Use of biomass as an alternative to coal by modifying the boiler designs/ retrofitting is also proposed. Availability of a gas grid across the country would also help in reducing dependence on coal as fuel for MSMEs. Renewable fuel and technological options would be explored rigorously so that the project activities could be aligned with the net-zero or decarbonization strategy.<br><br>Project focus has also been modified to creating an ecosystem that promotes energy efficiency in non-coal fired boilers or replacing coal boilers which has now built-in in the project framework. The key considerations provided under Section 6, Part II of this CEO endorsement document are that shift to new boilers do not consider coal-based boilers, as the project focuses on units not using coal for making interventions under good boiler operation and maintenance practices. 16 coal consuming units are added for Solar Heat as retrofits, rest are non-coal consuming units for energy efficient boiler retrofits, and 23 coal consuming units will be replaced by biomass and electricity boilers under the category of new energy efficient boilers.<br><br>Project encourages fuel shift to non-fossil based fuels such as coal to biomass and few to electricity. Thus, while the project focus is on Energy Efficiency as an immediate and low-cost solution, it would also encourage fuel shift in existing multi fuel boilers and new boilers. The project would also promote usage of Renewable Energy through Concentrating Solar Technologies, etc and will explore possibility of adoption of electric boilers in appropriate MSME units . | Table 2, Annexure F. |

| Comment & Response | Reference |
|---|---|
| Comment 3:<br>The project proposal includes in Output 3 ?Supply creation? retrofitting and financing energy-efficient new boilers. The technical/ operational lifetime of the new efficient boilers is assumed to be 15 years. This bears significant risk of a carbon lock-in and of the boilers becoming a stranded asset if a more ambitious climate policy is pursued. Consequently, these risks shall be tackled with corresponding risk mitigation measures.<br><br>Response:<br>The proposed interventions of ?Supply creation? retrofitting and financing energy efficient new boilers aims to generate energy savings, reduce energy bills and reduce GHG emissions. The benefits presented in the project document is on the basis of the assumption that boilers will have almost around 15 years life. The proposition to shift to cleaner or renewable fuel and not promoting the coal-based boilers, as well as adaptation of renewable technologies will positively help to reach the interim decarbonization goals of India with specific reference to the MSMEs. Since all the sub-set of project intervention are going to be based on cleaner fuel or technologies, carbon lock-in risk would not arise and chances of becoming a stranded asset is also not foreseen. | |
| Comment 4:<br>No support in improving coal-fired boilers should be conducted by the project, but rather support for renewable alternatives and combinations should be prioritized.<br><br>Response:<br>At the PIF stage the proposal included improving energy efficiency of existing coal-based boilers also. However, in light of the above comment, the proposal has been revised to focus on creating an ecosystem to promote energy efficiency in non-coal fired boilers. In addition, project revised its focus on promoting replacement of coal fired boilers to biomass fired boilers and electric boilers. These revised target, action plan and GHG emissions are outlined in Annexure A. Project Results Matrix and section6), Part II Global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF)<br>- | Annexure A. Project Results Matrix and section 1a) 6) Global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF) |

| Comment & Response | Reference |
|---|---|
| Comment 5:<br>The project?s promotion of the manufacturing and marketing of fossil fuel-based boilers has potential negative consequences for the price competitiveness of renewable alternatives such as Solar Heat for Industrial Processes (SHIP). The project proposal has to display a clear decarbonizing pathway and include a plausible assessment regarding the technological project orientation and its clean energy alternatives such as solar heat, biomass and electrification based on renewable. The mono-dimensional focus on energy efficiency is further on not in line with holistic decarbonization approaches, e.g., the project should address the option of a combination of renewable heat / electrification and fossil fuel co-firing. Particularly when co-firing is load-following fluctuating renewable heat/ electricity production, the process can be less energy efficient but lead to overall higher decarbonisation rates.<br><br>In particular, an evaluation on the possibility of introducing, combining and upscaling renewable energies has to be conducted. This is especially relevant in regard to India?s announcements made at COP26 to significantly increase its renewable energy generation.[4]<br><br>Response:<br>There are no/limited number of Industrial boilers in India running on electricity. As for Promotion of Solar Heat for Industrial Process is being implemented by UNIDO in another GEF-supported project. As highlighted in the comment above, to follow the decarbonization pathway, the proposal is revised to include Solar Heat for Industrial Processes (SHIP) and boilers running on electricity. Awareness creation and information package on Renewable Energy interventions will be part of the project. | Outcome 3.1, Component 3, Section 3) of Part II |
| Comment 6:<br>National targets / NDC are mentioned, but the project should elaborate further on the possibilities to reach these targets with renewable energies and ending fossil fuel combustion. Additionally, Germany recommends developing in output 1 an economic tool including a comprehensible business model for both boiler manufacturers and the target group consisting of micro, small & medium enterprises (MSMEs) using new industrial boiler technologies based on renewable energies.<br><br>Response:<br>As for promotion of Renewable Energy in Industries, Solar Heat for Industrial Process in Industries is being implemented by UNIDO in another GEF supported project. In the current project MSME units shall be provided with information on the solar thermal technology adoption and encouraged to leverage support to install SHIP to provide boiler feed water, steam.<br><br>?Development of an economic tool for both boiler manufacturers and the target group of MSMEs using new industrial boiler technologies based on renewable energies is included in the project activity. | Output 1.1.1 in Project Results Matrix |

**Response to STAP Feedback**

| PIF | What STAP looks for | Feedback | UNIDO responses |
|---|---|---|---|

| **Part I: Project Information B. Indicative Project Description Summary** | | | |
|---|---|---|---|
| Project Objective | Is the objective clearly defined, and consistently related to the problem diagnosis? | Yes ? though it could be linked to energy sources for boilers in related projects | |
| Project components | A brief description of the planned activities. Do these support the project?s objectives? | Yes | Noted |
| Outcomes | A description of the expected short-term and medium-term effects of an intervention.<br>Do the planned outcomes encompass important global environmental benefits?<br>Are the global environmental benefits likely to be generated? | Yes ? very clear metrics of GEB calculations are provided though it would be helpful to have some footnoting and backup of how they were calculated. | Noted |
| Outputs | A description of the products and services which are expected to result from the project. Is the sum of the outputs likely to contribute to the outcomes? | Yes, there are a series of outputs listed along with each outcome, but these could be made more specific. | The series of outputs and outcomes are made specific and described in Part II, 3) Project components, outcomes, and outputs. |
| Part II: Project justification | A simple narrative explaining the project?s logic, i.e. a theory of change. | | |

| | | | |
|---|---|---|---|
| **1. Project description. Brieflydescribe:**<br>1) the global environmental and/or adaptation problems, root causes andbarriers that need to be addressed (systems description) | Is the problem statement well-defined? Are the barriers and threats well described, and substantiated by data andreferences?<br>For multiple focal area projects: does the problem statement and analysis identify the drivers of environmental degradation which need to be addressed through multiple focal areas; and is the objective well-defined, and can it only be supported by integrating two, or more focal areas objectives or programs? | The multiple focal areas and the linkages and synergies are also presented. | Noted |

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| 2) the baseline scenario or any associated baseline projects | Is the baseline identified clearly? Does it provide a feasible basis for quantifying the project?s benefits? Is the baseline sufficiently robust tosupport the incremental (additional cost) reasoning for the project?<br>For multiple focal area projects: are the multiple baseline analyses presented (supported by data and references), and the multiple benefitsspecified, including the proposed indicators; are the lessons learned from similar or related past GEF and non-GEF interventions described; and how did these lessons inform the designof this project? | Yes, and the outcomes are benchmarked with the baselinevery well. | Noted |

| | | | |
|---|---|---|---|
| 3) the proposed alternative scenariowith a brief description of expected outcomes and components of the project | What is the theory of change?<br>What is the sequence of events (required or expected) that will lead tothe desired outcomes?<br>? What is the set of linked activities,outputs, and outcomes to address the project?s objectives?<br>? Are the mechanisms of change plausible, and is there a well-informed identification of the underlying assumptions?<br>? Is there a recognition of what adaptations may be required during project implementation to respond to changing conditions in pursuit of the targeted outcomes? | Theory of change document is provided in congruence with suggested STAP guidelines. | Noted |
| 5) incremental/ additional cost reasoning and expected contributions from the baseline, the GEF trust fund, LDCF, SCCF, and co-financing | GEF trust fund: will the proposed incremental activities lead to the delivery of global environmental benefits?<br>LDCF/SCCF: will the proposed incremental activities lead to adaptation which reduces vulnerability, builds adaptive capacity, and increases resilience to climate change? | Noted | Noted |

| | | | |
|---|---|---|---|
| 6) global environmental benefits (GEF trust fund) and/or adaptationbenefits (LDCF/SCCF) | Are the benefits truly global environmental benefits, and are theymeasurable?<br>Is the scale of projected benefits both plausible and compelling in relation tothe proposed investment?<br>Are the global environmental benefitsexplicitly defined?<br>Are indicators, or methodologies, provided to demonstrate how the globalenvironmental benefits will be measured and monitored<br>during project implementation?<br>What activities will be implemented to increase the project?s resilience to<br>climate change? | Yes | Noted |

| | | | |
|---|---|---|---|
| 7) innovative, sustainability and potential for scaling-up | Is the project innovative, for example, in its design, method of financing, technology, business model, policy, monitoring and evaluation, or learning? Is there a clearly-articulated vision of how the innovation will be scaled-up, for example, over time, across geographies, among institutional actors? Will incremental adaptation be required, or more fundamental transformational change to achieve long term sustainability? | There are some localized innovations, but further linkages to energy source usage and integrated systems change innovations that link this project to others in emissions reduction of fuels sources should be considered. | The project envisages to pool best available techniques and operating practices for thermal energy optimization and industrial boiler efficiency. It includes developing energy saving estimation tools and popularizing them among technology suppliers and service providers. This is described in Part II, 3) Component 1.<br><br>With energy efficiency and environmental compliances the sector would need new capacity. The project?s capacity building plan is innovative with sector specific online and offline trainings and awareness creation. This is described in Part II, 3) Component 1.<br><br>The project envisages introduction, standardization and mainstreaming of energy performance specifications in the market for boilers. This is described in Part II, 3) Component 2.<br><br>The project encourages integrated systems change by improving designs with boiler manufacturer and testing them with 50 MSME units. This is described in Part II, 3) Component 3, Output 3.1.2. |
| **1b.** Project Map and Coordinates.Please provide geo-referenced information and map where the project interventions will take place. | | Provided | Noted |

| | | | |
|---|---|---|---|
| **2. Stakeholders**.<br>Select the stakeholders that have participated in consultations during the project identification phase: Indigenous people and local communities; Civil society organizations; Private sector entities.If none of the above, please explain why.<br>In addition, provide indicative information on how stakeholders, including civil society and indigenous peoples, will be engaged in the project preparation, and their respective roles and means of engagement. | Have all the key relevant stakeholders been identified to cover the complexityof the problem, and project implementation barriers?<br>What are the stakeholders? roles, andhow will their combined roles contribute to robust project design, to achieving global environmental outcomes, and to lessons learned and knowledge? | Yes ? stakeholder mapping is included in project design and stakeholder satisfaction also in outcome goals. | Noted |
| **3. Gender Equality and Women?s Empowerment.**<br>Please briefly include below any gender dimensions relevant to the project, and any plans to address gender in project design (e.g. gender analysis). Does the project expect to include any gender-responsive measures to address gender gaps or promote gender equality and women empowerment? Yes/no/ tbd. If possible, indicate in which results area(s) the project is expected to contribute to gender equality: access to and control over resources; participation and decision-making; and/or economic benefits or services. Will the project?s results framework or logical framework include gender sensitive indicators? yes/no /tbd | Have gender differentiated risks and opportunities been identified, and were preliminary response measures described that would address these differences?<br><br>Do gender considerations hinder full participation of an important stakeholder group (or groups)? If so, how will these obstacles be addressed? | Gender equity plan with clear set of question to be addressed and linkages with policies are provided | Gender risks have been identified as low and impact as low. Gender opportunities have been identified and the skilling plan has been conceived for creating opportunities and empowerment.<br><br>The project has chosen interventions in MSMEs like textile and food processing where a large number of women are employed. Gender biases and mind sets have hindered full participation of women in pharma and chemicals. These obstacles have been addressed by preferentially skilling women in new competencies like safety audits required by the sector.<br><br>The provisions made for preferential skilling of women are described in Part II, 3) Component 1, Output 1.1.1. |

| | | | |
|---|---|---|---|
| **5. Risks**. Indicate risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, propose measures that address these risks to be further developed during the project design | Are the identified risks valid and comprehensive? Are the risks specifically for things outside the project?s control? Are there social and environmental risks which could affect the project? For climate risk, and climate resilience measures: How will the project?s objectives or outputs be affected by climate risks over the period 2020 to 2050, and have the impact of these risks been addressed adequately? ? Has the sensitivity to climate change, and its impacts, been assessed? ? Have resilience practices and measures to address projected climate risks and impacts been considered? How will these be dealt with? ? What technical and institutional capacity, and information, will be needed to address climate risks and resilience enhancement measures? | Risk management table is also included Climate risk screening with adequate citations provided. | Risk assessment and mitigation measures are provided in Part II, 1b), 5. Table 16. It covers risks due to financial, operational, climate change, policy and institutional, social and gender, technological, environmental and social, stranded assets, and market. It also assigns probability of their occurrence and impact. In the table, mitigation measures are also provided.<br><br>The most recent aspect of phase down of coal, Germany provided comment that ?Germany has committed to end direct public support for coal?. During PIF stage the proposal included energy efficiency of existing coal-based boilers also. However, considering above comment, at PPG phase, the proposal has been revised to focus on creating an ecosystem to promote energy efficiency in non-coal based boilers only. In addition, fuel shift from coal to biomass or coal or to electricity is included. This is presented in Part II, Section 6. |

| | | | |
|---|---|---|---|
| **6. Coordination**. Outline the coordination with other relevant GEF-financed and other related initiatives | Are the project proponents tapping intorelevant knowledge and learning generated by other projects, including GEF projects?<br>Is there adequate recognition of previous projects and the learning derived from them?<br>Have specific lessons learned fromprevious projects been cited?<br>How have these lessons informed theproject?s formulation?<br>Is there an adequate mechanism to feed the lessons learned from earlier projects into this project, and to share lessonslearned from it into future projects? | Yes ? there is listing of coordination prospects providedwith public and private sector and donors. | Noted |
| **8. Knowledge management.** Outlinethe ?Knowledge Management Approach? for the project, and how itwill contribute to the project?s overallimpact, including plans to learn from relevant projects, initiatives and evaluations. | What overall approach will be taken,and what knowledge management indicators and metrics will be used? What plans are proposed for sharing, disseminating and scaling-up results, lessons and experience? | Yes adequately provided | Noted |

## ANNEX C: Status of Utilization of Project Preparation Grant (PPG). (Provide detailed funding amount of the PPG activities financing status in the table below:

| PPG Grant Approved at PIF: | | | |
|---|---|---|---|
| ***Project Preparation Activities Implemented*** | ***GETF/LDCF/SCCF Amount ($)*** | | |
| | ***Budgeted Amount*** | ***Amount Spent To-date*** | ***Amount Unspent*** |
| FOR THE PROVISION OF SERVICES RELATED TO THE PREPARATION OF CEO ENDORSEMENT DOCUMENT INLINE WITH THE GEF DOCUMENTATION GUIDELINE | 75,000 | 72,261 | 2,739 |
| 1. Stakeholder engagements | 10,000 | 9,078 | 922 |
| 2. Baseline Data collection, analysis and reporting | 21,000 | 21,740 | -740 |
| 3. Climate/Environmental/Social/Gender Assessment | 11,000 | 10,640 | 360 |
| 4. Travel of local experts and cost of local workshop | 14,700 | 12,455 | 2,245 |
| 5. Assessing the capacity of executing partners | 18,300 | 18,348 | -48 |
| Total | 75,000 | 72,261 | 2,739 |

In accordance with GEF/C.59/Inf.03, it is proposed that the remaining unspent amount of the PPG be used for eligible expenditure items under the PPG within one year after the project will be CEO Endorsed. More specifically, the remaining resources will be used to finalize the preparation of sectoral plans and programs on boiler energy efficiency that have a direct bearing on project design; national policy analysis, and inventories and data analysis in support of the proposed project.

## ANNEX D: Project Map(s) and Coordinates

## Please attach the geographical location of the project area, if possible.

The project will be implemented in six clusters in five states namely, Gujarat; Haryana; Karnataka; Maharashtra; and Telangana ([1]). The cluster and state selection were finalized during the project preparation study and the exact geo location with co-ordinates are given below.


**Figure 7: Map of India highlighting states for potential project sites**

**Table 14: Name of cluster, state, longitude and latitude**

| SN | Name of Cluster | State | Longitude | Latitude |
|---|---|---|---|---|
| 1 | Ankleshwar | Gujarat | E 73.152 | N 21.6264 |
| 2 | Bidar | Karnataka | E 77.5199 | N 17.9104 |
| 3 | Panipat | Haryana | E 76.9635 | N 29.3909 |
| 4 | Sindhudurg | Maharashtra | E73.5594 | N16.3492 |
| 5 | Sircilla | Telangana | E 78.8015 | N 18.3892 |
| 6 | Surat | Gujarat | E 72.8311 | N 21.1702 |

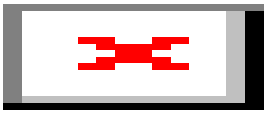
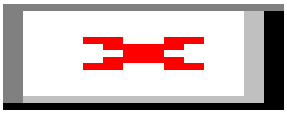
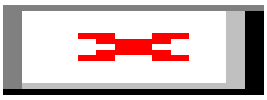
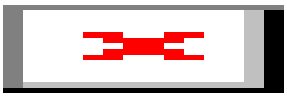
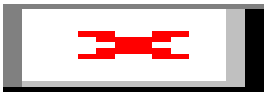
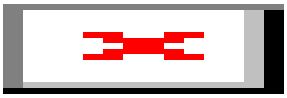
| | |
|---|---|
|  |  |
| Ankleshwar, Gujarat | Bidar, Karnataka |
|  |  |
| Sindhudurg, Maharashtra | Panipat, Haryana |
|  |  |
| Sircilla, Telangana | Surat, Gujarat |

**Figure 8. Geo-coordinates of project clusters**

[1] RBI (2021), Net state added value by economic activity ? manufacturing (constant prices), Reserve Bank of India, https://m.rbi.org.in/Scripts/PublicationsView.aspx?id=20017, last viewed 20 August 2021.

[1] https://www.industrialenergyaccelerator.org/general/efficiency-solutions-for-industrial-heat/ (accessed 21 July 2021)
[2] https://www.industrialenergyaccelerator.org/general/manual-for-industrial-steam-systems-assessment-and-optimization/ (accessed 21 July 2021)

**GEO LOCATION INFORMATION**

**The Location Name, Latitude and Longitude are required fields insofar as an Agency chooses to enter a project location under the set format. The Geo Name ID is required in instances where the location is not exact, such as in the case of a city, as opposed to the exact site of a physical infrastructure. These IDs are available on the GeoNames? geographical database containing millions of placenames and allowing to freely record new ones. The Location & Activity Description fields are optional. Project longitude and latitude must follow the Decimal Degrees WGS84 format and Agencies are encouraged to use at least four decimal points for greater accuracy. Users may add as many locations as appropriate. Web mapping applications such as OpenStreetMap or GeoNames use this format. Consider using a conversion tool as needed, such as:https://coordinates-converter.com Please see the Geocoding User Guide by clicking here.**

| Location Name | Latitude | Longitude | Geo Name ID | Location & Activity Description |
|---|---|---|---|---|
| Ankleshwar | 21.63236 | 72.99001 | 1,278,553 | |
| Bidar | 17.90802 | 77.51524 | 1,275,738 | |
| Panipat | 29.38747 | 76.96825 | 1,260,476 | |
| Sindhudurg | 16.1012 | 73.4200 | 7,626,539 | |
| Sirsilla | 18.38865 | 78.81048 | 1,256,039 | |
| Surat | 21.19594 | 72.83023 | 1,255,364 | |

## ANNEX E: Project Budget Table

### Please attach a project budget table.

Please see below a summary of the indicative budget, which serves as a condensed summary, offering an overview of budgets categorized by Component and Outcome levels. A more detailed table is uploaded as an attachment to the submission. The attached table provides a more detailed breakdown, extending to the Output and Activities levels, along with budget category specifications. We affirm that the totals for Outcome/Component in the summary table below align with the sub-totals/totals in the attached detailed table (activity/outputs/outcome/component). The detailed table proves highly beneficial during project implementation.

| Expenditure Category | | Component (USDeq.) | | | | | | Total (USDeq.) | Responsible Entity |
|---|---|---|---|---|---|---|---|---|---|
| | *Detailed description* | *Component 1* | *Component 2* | *Component 3* | *Sub-Total* | *M&E* | *PMC* | | (Executing Entity receiving funds from the GEF Agency)[1] |
| | | *Outcome 1.1* | *Outcome 2.1* | *Outcome 3.1* | | | | | |
| Grants/ Sub-grants | Financial incentives to participating MSMEs; | | | 472,750 | 472,750 | | | 472,750 | NPC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Contractual Services ? Individual | Gender expert and Environmental and Social Management Plan expert. M&V, semi-annual project progress reports; Project Implementation Review (PIR) reports; and Project Terminal Report | 17,900 | | | 17,900 | 25,000 | | 42,900 | NPC and ni-msme |
| Contractual Services ? Company | Inception workshop; Promotional material, Assessment of MSMEs, advisory support to MSME units, EE boiler portal, design modules, guidance document | 173,233 | 54,641 | 351,043 | 578,917 | 15,000 | | 593,917 | NPC, ni-msme, UNIDO |
| International Consultants | Development of steam optimisation tool | 50,000 | | | 50,000 | 60,000 | | 110,000 | UNIDO |
| Local Consultants | Project coordinator (consultant) to provide administrative, accounting, and meeting support to PMU | | | | | | 63,445 | 63,445 | UNIDO |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Salary and benefits / Staff costs | Component Resource Person and Boiler expert of NI-MSME. Component Resource Person & Boiler expert; Component Resource Person NPC. | | 124,000 | 296,000 | 420,000 | | | 420,000 | NPC and ni-msme |
| | The National Project Manager contributes to planning, project execution support services, program management support for technical planning, peer review, reporting, and monitoring support. NPM will support in implementing the Components - 1, 2 & 3 from the component budget only. | 112,519 | 26,561 | 133,303 | 272,383 | | - | 272,383 | UNIDO |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Training, Workshops, Meetings | Training materials and Training contents, imparting training, Conducting workshops & handholding programs to promote energy efficiency retrofits and boilers; Facilitating business dialogue workshops between manufacturers, service providers, and end users in components 1 and 3. A budget is also provided for PMU to conduct meetings with the service provider, technology suppliers, participating industries, and other stakeholders. | 548,900 | | 76,950 | 625,850 | | 12,689 | 638,539 | NPC, ni-msme, UNIDO |
| Travel | Travel of project staff | | | | | | 25,378 | 25,378 | UNIDO |
| Office Supplies | Office supplies for Project staff, coordinator, and others | | | | | | 12,689 | 12,689 | UNIDO |
| Other Operating Costs | PMU operating costs | | | | | | 12,689 | 12,689 | UNIDO |
| Grand Total | | 902,552 | 205,202 | 1,330,046 | 2,437,800 | 100,000 | 126,890 | 2,664,690 | |

[1] In exceptional cases where GEF Agency receives funds for execution, Terms of Reference for specific activities are reviewed by GEF Secretariat

| Agency | USD |
|---|---|
| NPC | 1,322,993 |
| NI-MSME | 792,424 |
| UNIDO | 549,273 |
| | 2,664,690 |

**ANNEX F: (For NGI only) Termsheet**

Instructions. Please submit an finalized termsheet in this section. The NGI Program Call for Proposals provided a template in Annex A of the Call for Proposals that can be used by the Agency. Agencies can use their own termsheets but must add sections on Currency Risk, Co-financing Ratio and Financial Additionality as defined in the template provided in Annex A of the Call for proposals. Termsheets submitted at CEO endorsement stage should include final terms and conditions of the financing.

n/a

**ANNEX G: (For NGI only) Reflows**

Instructions. Please submit a reflows table as provided in Annex B of the NGI Program Call for Proposals and the Trustee excel sheet for reflows (as provided by the Secretariat or the Trustee) in the Document Section of the CEO endorsement. The Agencys is required to quantify any expected financial return/gains/interests earned on non-grant instruments that will be transferred to the GEF Trust Fund as noted in the Guidelines on the Project and Program Cycle Policy. Partner Agencies will be required to comply with the reflows procedures established in their respective

Financial Procedures Agreement with the GEF Trustee. Agencies are welcomed to provide assumptions that explain expected financial reflow schedules.

n/a

**ANNEX H: (For NGI only) Agency Capacity to generate reflows**

Instructions. The GEF Agency submitting the CEO endorsement request is required to respond to any questions raised as part of the PIF review process that required clarifications on the Agency Capacity to manage reflows. This Annex seeks to demonstrate Agencies? capacity and eligibility to administer NGI resources as established in the Guidelines on the Project and Program Cycle Policy, GEF/C.52/Inf.06/Rev.01, June 9, 2017 (Annex 5).

n/a