

Country	Thailand
Request ID#	2015000087
Title	Benchmarking energy consumption and GHG emissions of iron & steel industries of Thailand
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Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)

National Designated Entity to the UNFCCC Technology Mechanism for which the Climate Technology Centre and Network is the operative arm

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Date: September 14, 2016

Signature:



Request Proponent for the Response Plan

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Date: November 14, 2016

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UNFCCC Climate Technology Centre and Network (CTCN)

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Date: 21/11/16

Signature:



Summary of the CTCN Technical Assistance

The iron & steel industry in Thailand is an important industry sub-sector. It is an energy intensive sub-sector and energy generally forms a major cost component in the overall cost of production. The domestic industry is facing competition from imports and is therefore interested in reducing its energy consumption to remain competitive. The iron & steel industry structure in Thailand can be clearly divided into units involved in (i) steel making (ii) finishing & coating and (iii) forming. In each of these industry segments, there are a large number of units that are in operation. The technologies and processes used in units in each of these segments are different hence requiring separate/independent in-depth studies. Organisations like ISIT (Iron & Steel Institute of Thailand) have undertaken preliminary studies in a few segments within iron & steel sector in the past and have identified large potential for energy efficiency improvements in iron & steel industry in Thailand. The Energy Conservation Promotion (ENCON) Act, 1992 of Thailand mandates large industries to implement energy conservation measures and reporting. The Board of Investments (BOI) and Thailand Energy Efficiency Revolving Fund (TEERF) have been created to support large investments on energy efficiency projects.

In order to have a systematic detailed study of iron & steel industries, a 'benchmarking' of key sub-sectors/ segments is proposed. The study would undertake comprehensive analysis of individual segments (e.g. scrap recycling of long & flat products, hot rolling of long & flat products) in terms of 'Specific Energy Consumption' (SEC) levels and GHG emissions. A detailed field survey of units through proper sampling is proposed for collection of data for benchmarking of iron & steel industries in Thailand. The project will develop suitable benchmarking tool for evaluating SEC and GHG emissions.

The proposed CTCN assistance will also conduct detailed performance assessment of representative units within selected iron & steel segments to identify potential technological options for energy efficiency improvements e.g. a few EAF based scrap melting units, hot-rolling mills and cold rolling mills. One of the main outputs of the study will be a guide "Energy Efficiency Manual" for Thailand iron & steel industries highlighting relevant technological options and standard operating practices. The manual will be useful for the local industries to pick and choose various technological options for adoption in their respective units. Financing options for industry will also be explored as a part of the CTCN assistance. A national workshop on benchmarking study will be organized on completion of project activities for dissemination of findings amongst all key stakeholders.

1. Overview of the CTCN technical assistance

1.1 Technology aspects

CTCN would provide technical support for benchmarking of 'specific energy consumption' (SEC) and GHG emissions of iron and steel industries in Thailand. The benchmarking tool is expected to support iron & steel industries in Thailand to evaluate their existing performance with respect to other industries operating in their country as well as in other countries around the world. An Energy Efficiency Manual will be prepared with a specific reference to Thailand iron & steel industries. The manual would help the user industries in identifying relevant energy efficient (EE) technologies for adoption and improving their performance level.

1.2 Objectives (outcomes)

The main objective of the Response Plan is to benchmark SEC and GHG emissions of energy intensive segments of iron & steel industries of Thailand. The benchmarking would serve as an indicator of present level of performance and available energy saving potential for improvements.

1.3 Results (outputs expected from CTCN assistance)

The expected outputs from CTCN assistance in iron & steel industries of Thailand would include the following:

- (i) Benchmarking of SEC and GHG emissions in key energy intensive segments of iron & steel industries
- (ii) Energy Reporting Guide (ERG) for reporting of data on energy consumption by iron & steel industries
- (iii) Energy efficiency manual providing details on Energy Efficient Technologies (EETs) and 'Standard Operating Practices' (SOPs) to help as a guide for Thailand iron & steel industries in identification of technologies
- (iv) Potential financing options that would help iron & steel industries to invest in high cost technologies.

1.4 Expected use of outputs

The benchmarking would help various individual iron & steel units in Thailand to understand their existing status in terms of energy as well as environment performance. The exercise would help evaluate potential scope for individual units in key iron & steel segments for energy and environmental improvements. The manual on EETs and SOPs would act as a guide for individual industries to identify relevant energy efficient technological options for adoption. The Energy Reporting Guide would help policy makers in regular accessing data and information pertaining to iron & steel industries. The benchmarking exercise in the longer term will serve as an important tool for policy makers to set guidelines on technology interventions in iron & steel sector.

2. Description of the Assistance

The share of industry sector in total final energy consumption of Thailand is about 16% (17,329 ktoe¹). The iron & steel sector of Thailand is an important sub-sector within industries, accounting for about 11% of total industrial energy consumption of Thailand. A study on "Benchmarking of energy and GHG intensity in the ASEAN iron & steel industry" conducted by the Iron & Steel Institute of Thailand (ISIT) recognizes the potential for energy efficiency improvements and importance of climate change issues through adoption of energy efficient technologies.

Thailand has also established responsible planning and policy making institutions for GHG reductions in the country. Thailand NAMA pledges to reduce GHG emissions by 7-20% in energy and transport sector by the year 2020 in comparison with Business As Usual (BAU) scenario. The Intended Nationally

¹Report on "Benchmarking of energy and GHG intensity in the ASEAN iron & steel industry" submitted to the South East Asia iron & steel institute, Iron & Steel Institute of Thailand, 2015

Determined Contribution² (INDC) of Thailand indicates to reduce GHG emissions by 20% from the projected business as usual (BAU) level by 2030. It further states that the level of GHG reduction could increase up to 25% with enhanced access to technology development and transfer, financial resources and capacity building support through the global agreement under the United Nations Framework Convention on Climate Change (UNFCCC).

To achieve this target, iron & steel sector will have to play an important role. The Energy Conservation Promotion (ENCON) Act, 1992 provides scope, requirements and responsibilities for key energy consuming sectors³. It defines governmental, institutional and financial arrangements along with responsibilities of the government and requirements for entities within energy consuming sectors including industries. Under the ENCON Act, ministerial regulations have been issued for designated large energy users (including industries) to implement and report progress of energy efficiency measures. By comparing existing technologies in iron & steel sector, the Iron and Steel Institute of Thailand (ISIT) has estimated an energy saving potential of 10-33% as compared to international best technologies.

The Thailand Energy Efficiency Revolving Fund (TEERF) established in 2004 with a funding of 2 billion THB (Thai Baht) aims to stimulate energy efficiency investment in large scale energy consuming industrial sectors. The Ministry of Energy, Thailand has developed 20-year Energy Efficiency Development Plan (EEDP, 2011-30) to provide national policy framework and guidelines on energy conservation implementation in the long term. EEDP aims to reduce energy intensity by 25% in 2030 as compared to the level of 2005, or equivalent to reduction of final energy consumption by 20% in 2030.

The technical support provided under CTCN assistance would help in bridging the data gap that exists in iron & steel industries. The Response Plan for iron & steel industries of Thailand envisages four distinct activities that would complement each other and help in achieving project objectives, as shown in the box.

Activity-1:	Designing specific questionnaires for different segments of Thailand iron & steel industry
Activity-2:	Undertaking field survey on energy consumption data
Activity-3:	Benchmarking of energy consumption pattern and developing energy reporting guidelines
Activity-4:	Preparation of energy efficiency manual and assessing financing options

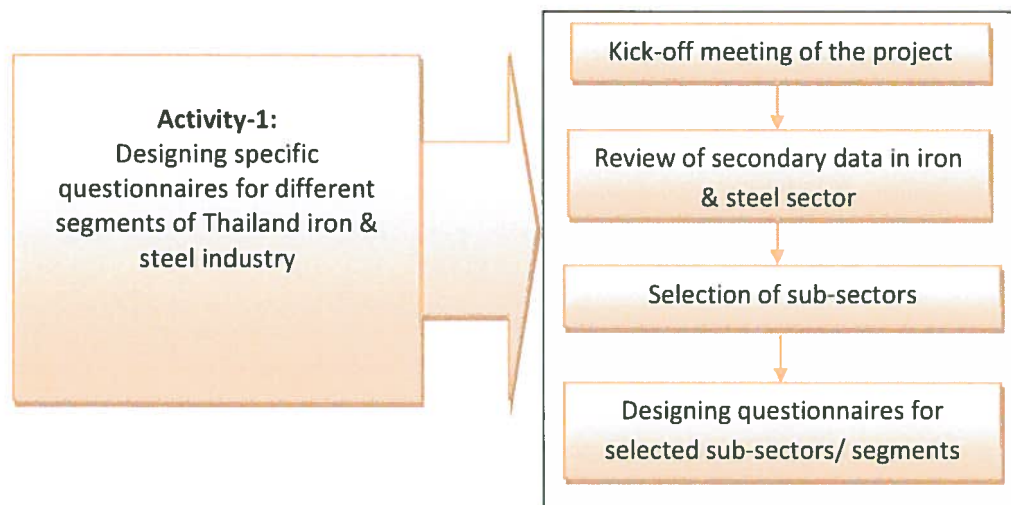
The sub-activities associated with each identified activities are described below.

Activity-1: Designing specific questionnaires for different segments of Thailand iron & steel industry

The first activity under the Response Plan is designing and development of suitable questionnaires required for field survey of iron & steel industries. Since iron & steel industries in Thailand comprise a wide range of segments viz. scrap recycling, finishing (hot rolling and cold rolling/drawing) & coating and forming, it is important to identify and focus on key segments within these industries, which are energy intensive and account for a major share of energy consumption within the sector. The activity would focus on designing specific questionnaires for each of these segments which would be used as the main tool for collection of data and information pertaining to iron & steel sector of Thailand.

² http://www4.unfccc.int/submissions/INDC/Published%20Documents/Thailand/1/Thailand_INDC.pdf

³ <http://epd.iipnetwork.org/policy/energy-conservation-promotion-encon-act>



Sub-activity 1.1 : Kick-off meeting of the project

The project activities will be initiated with a kick-off meeting with all key stakeholders. A video conferencing will be held with all key stakeholders to share various project activities planned under the project.

Sub-activity 1.2: Review of secondary data in iron & steel sector

The project will collate information and data from past studies that were undertaken in Thailand iron & steel sector. For example, the Iron and Steel Institute of Thailand (ISIT), which is one of the key stakeholders, had undertaken a benchmarking study on energy and GHG intensity in the ASEAN⁴ iron & steel industry. It shows there is a significant potential for performance improvements that would help iron & steel industries come closer to or match with best available technologies.

The review of secondary data would help in understanding existing status of iron & steel sector of Thailand in terms of industry structure, energy consumption level, energy share by different segments, specific energy consumptions, number of units in each segment, etc. It would also help in identifying all key stakeholders in the sector. The review and interaction with key stakeholders would also help in preparing a list of iron & steel industries with contact details.

Sub-activity 1.3 : Selection of sub-sectors

The iron & steel sector in Thailand comprises steel making, finishing & coating and forming operations, which are diverse in nature exhibiting variable degree of energy consumption. Of these, some sectors are quite energy intensive and account for higher energy consumption levels. In order to maximize impacts on energy efficiency improvements and GHG reductions, it would be worthwhile to select/shortlist sub-sectors⁵ that are accounting for a major or sizeable share of energy consumption in overall iron & steel industry sector. For example, the benchmarking study by ISIT indicates that processes like scrap recycling (melting in Electric Arc Furnaces)⁶ and hot rolling of long and flat steel products are quite energy intensive, which exhibit higher SECs as well as high energy consumption levels. A set of selection criteria such as production capacity, energy consumption, fuel type, etc. will be prepared, which will be applied for selection of segments for undertaking field survey.

Sub-activity 1.4 : Designing questionnaires for selected sub-sectors/segments

For collection of data and information from selected sub-sectors/segments, suitable questionnaires will be required. These questionnaires will be designed to cover each short-listed segments separately

⁴ Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam

⁵ Type of industries involved in making of same types of products

⁶ Iron & steel industries in Thailand use electric arc furnaces and induction furnaces for melting

for field survey. About four (4 no.) segments in Thailand iron & steel industry will be short-listed in consultation with ISIT. The following short-listed segments that are energy intensive, may be considered for the survey:

- (1) Scrap recycling of long products
- (2) Scrap recycling of flat products
- (3) Hot rolling of long products
- (4) Hot rolling of flat products

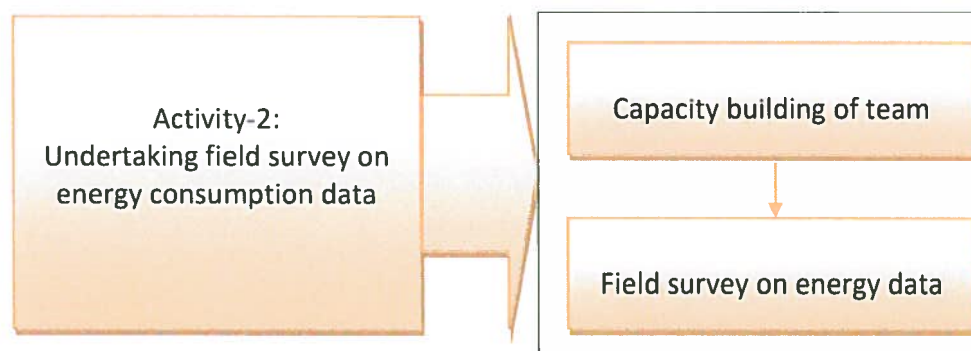
The questionnaires are expected to ensure collection of all relevant data and information required for further analysis and benchmarking. For example, it would include details such as technology used, process employed, key equipment/ system used, types of products, production, capacity utilisation, types of energy used, quantum of different energy forms used, major energy efficiency measures/ practices implemented/ identified, etc.

Activity-1: Deliverables

Deliverable	Timeline (after project initiation)
Activity 1.1: Kick-off meeting of project	Week # 1
Activity 1.2: Review of secondary data in iron & steel sector	Week # 3
Activity 1.3: Selection of sub-sectors	Week # 4
Activity 1.4: Designing questionnaires for selected sub-sectors/segments	Week # 6

Activity-2: Undertaking field survey on energy consumption data

Field survey will be the key activity towards collection of data and information from industries in selected sub-sectors/segments using questionnaires designed for the purpose. It is important to ensure that survey captures all relevant data and information required for further analysis. A trained and dedicated local team would be required for conducting field survey, who have good understanding of the sub-sectors and have abilities to communicate with industries for collection of data. It is envisaged that the field survey would ensure collection of relevant data required for benchmarking.



Sub-activity 2.1 : Capacity building of team

The field survey on energy data needs to be undertaken by a dedicated team. A local organization having requisite capacities will be identified and entrusted responsibility for carrying out the survey in selected key sub-sectors/ segments of iron & steel industries. Data collection on energy related subjects is not so straight forward in general – there are many smaller aspects and plant level factors/ nuances that need to be understood to ensure that the data collected is relevant and feeds smoothly into the next step of analysis and benchmarking. Hence, it is important that the team that will be involved in field survey is provided adequate orientation and training to undertake the survey. To

accomplish this, a training program will be organized that would help the team to orient towards field survey.

Further, in order to impart on-site training, a 'Pilot Survey' will be conducted covering sample industries in selected key sub-sectors. The pilot survey would further help in confirming suitability of designed questionnaires and making suitable amendments for their finalisation and use them while conducting field survey.

Sub-activity 2.2 : Field survey on energy data

Field survey of iron & steel industries of Thailand by identified organization is an essential component of benchmarking study. The survey would focus on collection of relevant data required. Since there are a number of segments and a large number of industries within each segment operating in Thailand, it is important to select a list of industries under each sub-sector/segment through proper sampling. This would ensure availability of data as required under the project. The sampling is expected to take care of different parameters such as variations in production capacities, types of products, geographical locations of the units, etc.

The survey is expected to cover the following industries operating in iron & steel segments:

- (1) Ten number of industries in scrap recycling of long products (EAF based)
- (2) Two number of industries in scrap recycling of flat products (EAF based)
- (3) Ten number of hot rolling mills producing long products
- (4) Five number of hot rolling mills producing flat products

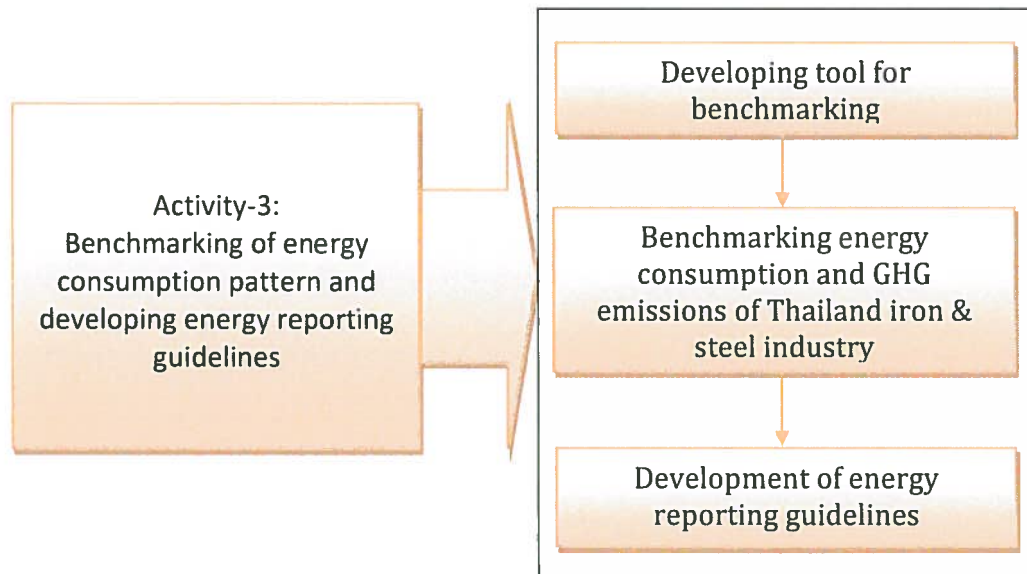
Based on number of samples finalised, the survey team would undertake field visits to industries and interact/ discuss with concerned plant personnel for collection of data and information in order to fill the questionnaires to a satisfactory level. However, in case of non-availability of data, the team will make suitable assumptions based on inputs from respective industries. Thus the field survey would ensure availability of all required data and information required to feed into the benchmarking tool.

Activity-2: Deliverables

Deliverable	Timeline
Activity 2.1: Capacity building of team	Week # 10
Activity 2.2: Field survey on energy data	Week # 22

Activity-3: Benchmarking of energy consumption pattern and developing energy reporting guidelines

Benchmarking exercise helps in understanding existing status/ position of industries in terms of energy efficiency and GHG emissions and provides an idea for scope for improvements. For example, different industries within each segment may be employing different processes and using different energy forms based on local availability. Other factors such as vintage of industries, production capacities, capacity utilization, etc. also influence the performance of the industries. Hence, it is envisaged that iron & steel industries in Thailand may exhibit variations in their energy and environmental performance, thus indicating a need for benchmarking.



Sub-activity 3.1 : Developing tool for benchmarking

An appropriate tool for benchmarking will be required for evolving performance of iron & steel industries. The benchmarking tool will be evolved using appropriate software platform e.g. MS-EXCEL or any other relevant platforms (to be decided by the expert institution). It must be ensured that the tool developed must be user-friendly both in terms of feeding of data and generating outputs/ results that can be easily compared. The tool will include calculation sheets that would help in feeding various data and information pertaining to selected segments of iron & steel industries and generate output in terms of SECs, GHG emissions, etc. Thus, the tool would provide insights on actual performance of individual iron & steel industries.

Sub-activity 3.2 : Benchmarking energy consumption and GHG emissions of Thailand iron & steel industry

The data collected during field survey will be used for benchmarking of SECs and GHG emissions of iron & steel industries. It is envisaged that the survey team would have ensured availability of all relevant data for selected sub-sectors as per requirements of benchmarking tool. If any important assumptions have been made by the survey team, while finalising the filled-in questionnaires, the same would be appropriately reflected the final analysis.

Benchmarking exercise would help in evaluating energy and environmental performance of industries covered under the survey. It would help in comparing performance of similar industries within each shortlisted sub-sector/segment in Thailand. Wherever possible, comparisons with international benchmarks can be provided depending upon availability of such data in secondary sources. It would further help in understanding lacuna in local industries and draw conclusions towards improvements.

Sub-activity 3.3 : Development of energy reporting guidelines

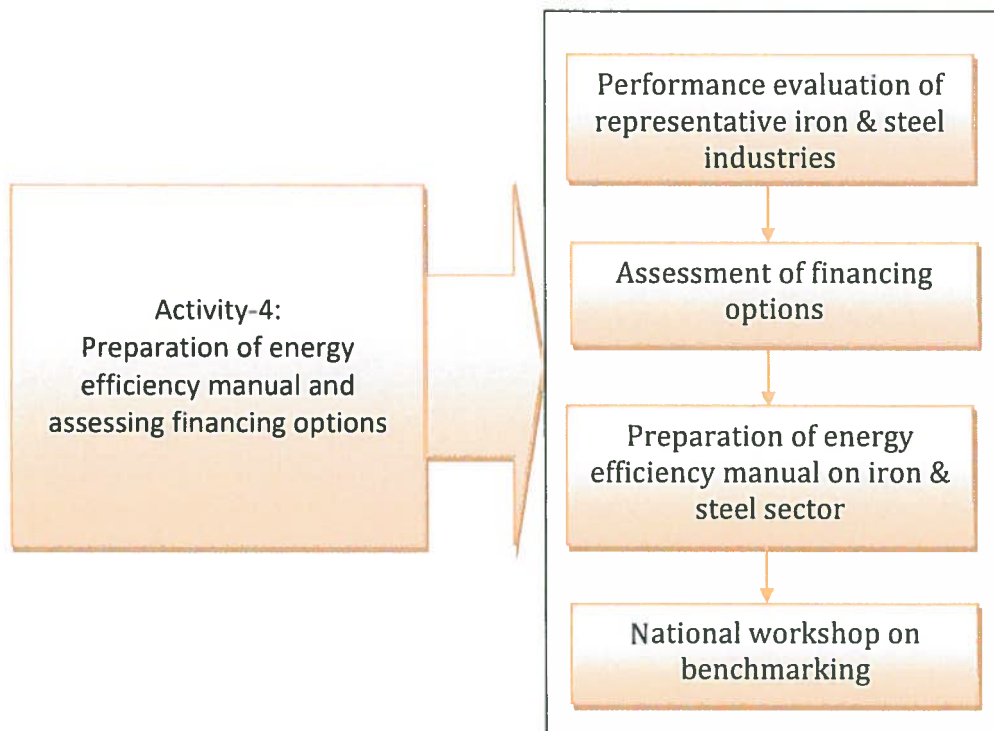
In order to periodically collate energy consumption data of iron & steel sector in Thailand, “Energy Reporting Guidelines (ERG)” will be developed. The Energy Reporting Guidelines would take into account diversified nature of iron & steel industries in Thailand. The energy reporting would be immensely helpful for policy makers in decision making process.

Activity-3: Deliverables

Deliverable	Timeline
Activity 3.1: Developing tool for benchmarking	Week # 22
Activity 3.2: Benchmarking energy consumption and GHG emissions of Thailand iron & steel industry	Week # 32
Activity 3.3: Development of energy reporting guidelines	Week # 36

Activity-4: Preparation of energy efficiency manual and assessing financing options

Benchmarking indicates mainly the scope for overall potential available for performance improvements by individual industries. However, it does not provide directions for achieving the end results i.e. energy efficiency and GHG reduction, which are required by industries. In order to realise potential energy savings identified under benchmarking, performance evaluation of representative iron & steel industries would be required to identify and share specific technologies and practices relevant for Thailand for further adoption along with financing needs.



Sub-activity 4.1 : Performance evaluation of representative iron & steel industries

The overall performance of representative industries in selected sub-sectors will be undertaken to evaluate performance of key process equipment (e.g. melting furnaces, heat treatment furnaces, etc.) and utilities/ auxiliaries (compressors, pumps, cooling towers, etc.). The performance of equipment (e.g. efficiency, SEC, effectiveness, etc.) will be compared with design values as provided by manufacturers/ suppliers and the deviations are evaluated to arrive at potential energy savings.

The energy efficiency measures will be evaluated along with details such as energy saving, monetary saving, GHG reduction, investment requirement, payback period, etc. Industry-specific reports will be prepared for representative units covered under the study, which provides details of energy efficient technologies and standard operating practices (SOP). It is envisaged that a total of 4 units (two in steel making and two in hot rolling) would be studied in depth for such studies. The units would be selected in consultation with ISIT.

Sub-activity 4.2 : Assessment of financing options

It is expected that the technological options identified for iron & steel industries of Thailand would range from Standard Operating Practices (SOP) that involve no or marginal investments to retrofits involving medium level investments and technological changes requiring high investments. Large technological interventions would involve significantly higher capital investments. An assessment of various financing options that exist for the Thai industry would be made and presented as a separate document. This can include various domestic sources e.g. the TEERF managed by the Ministry of Energy and other public /private funding sources available internationally.

Sub-activity 4.3 : Preparation of energy efficiency manual on iron & steel sector

Based on inputs from performance evaluation of representative industries in iron & steel sector (as mentioned under Activity 4.1 above), a manual on energy efficiency in iron & steel sector of Thailand will be prepared. The manual will highlight details of technologies and standard operating practices, etc. along with cost benefit analysis. A print-ready version of manual will be provided to the NDE.

Sub-activity 4.4 : National workshop on benchmarking

A national level workshop will be organised focusing on dissemination of outcomes of the benchmarking study. Through the workshop, the industries and other key stakeholders will be able to understand (1) existing status of their iron & steel industries, (2) potential opportunities for energy saving and (3) technology options available for adoption in Thailand’s iron & steel sector.

Activity-4: Deliverables

Deliverable	Timeline
Activity 4.1: Performance evaluation of representative iron & steel industries	Week # 32
Activity 4.2: Assessment of financing options	Week # 40
Activity 4.3: Preparation of energy efficiency manual on iron & steel sector	Week # 44
Activity 4.4: National workshop on benchmarking	Week # 50

2.2 Synergies and Baseline Setting

ISIT is one of the main organisations involved in technical assistance to iron & steel industries in Thailand. In the past, it was involved in studies in iron & steel industries in Thailand. The Government of Thailand has specific focus on energy efficiency improvements in large industries through its ENCON Act and provisions of revolving fund (e.g. TEERF) for investment on technologies. The major function of the Board of Investment (BOI) of Thailand includes promotion of investments in high performance technologies.

Further, Thailand’s INDC intends to reduce GHG emissions by 20% from the projected business as usual (BAU) level by 2030 that would require developing a suitable roadmap, especially for industries like iron & steel, which account for significant share of energy consumption. The project will ensure synergies with all on-going activities/schemes/ programs to ensure that the support provided by CTCN is complementary to other on-going activities, if any.

2.3 Timeline

The proposed timeline for carrying out benchmarking study of iron & steel industries of Thailand is 12 months. The breakup of timeline for proposed activities is shown below.

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1. Designing specific questionnaires for different segments of Thailand iron & steel industry												
1.1 Kick-off meeting of the project												
1.2 Review of secondary data in iron & steel sector												
1.3 Selection of sub-sectors												
1.4 Designing questionnaires for selected sub-sectors/segments												
2.0 Undertaking field survey on energy consumption data												
2.1 Capacity building of team												
2.2 Field survey on energy data												
3.0 Benchmarking of energy consumption pattern and developing energy reporting guidelines												
3.1 Developing tool for benchmarking												
3.2 Benchmarking energy consumption and GHG emissions of Thailand iron & steel industry												
3.3 Development of energy reporting guidelines												
4.0 Preparation of energy efficiency manual and assessing financing options												
4.1 Performance evaluation of representative iron & steel industries												
4.2 Assessment of financing options												
4.3 Preparation of energy efficiency manual on steel sector												
4.4 National workshop on benchmarking												

M - Month

2.4 Expertise required

Activity 1	
Expert No. 1	Iron & steel sector expert
Expert No. 2	Energy sector expert
Event No. 1	Kick-off meeting of the project
Activity 2	
Expert No. 1	Iron & steel sector expert
Expert No. 2	Energy sector expert
Event No. 2	Capacity building and pilot training on benchmarking survey
Activity 3	
Expert No. 1	Iron & steel sector expert
Expert No. 2	Energy sector expert
Activity 4	
Expert No. 1	Iron & steel sector expert
Expert No. 2	Energy sector expert
Event No. 3	National level workshop on benchmarking in iron & steel industries in Thailand

2.5 Main partners

Stakeholder	Role to support the implementation of the CTCN assistance
Ministry of Industry	Support project towards access to industries
National Science Technology and Innovation Policy Office, Ministry of Science and Technology	Official counterpart (National Designated Entity)
Iron & Steel Institute of Thailand	Coordination and bridging between industries, project members & government and can help in surveys as well
Iron and Steel Club, Federation	Coordination and bridging between industries
Individual industries in selected iron & steel sub-sectors	Cooperate with project in providing relevant plant data

2.6 Indicative budget (please note that the budget is only indicative and interested bidders must provide a competitive technical and financial offer to implement the Response Plan).

Activities	Estimated Indicative Budget (USD)
Activity 1 : Designing specific questionnaires for different segments of Thailand iron & steel industry	5,250
Activity 2 : Undertaking field survey on energy consumption data	52,150
Activity 3 : Benchmarking of energy consumption pattern and developing energy reporting guidelines	55,250
Activity 4 : Preparation of energy efficiency manual and assessing financing options	82,400
Measures, Evaluation and Learning	15,600
Total	210,650

A detailed activity-based budget for the CTCN assistance will be finalized by the CTCN and selected Implementer.

2.7 Gender considerations

The proposed technical assistance request does not include specific gender considerations. However, it is envisaged that different activities as proposed would strive to include participation of women e.g. pilot survey, dissemination workshop, etc. Further, the survey would include in its questionnaires the level and type of involvement of women in different sections of iron & steel industries in Thailand.

2.8 Risk identification and risk mitigation

Risk	Consequence	Probability	Mitigation measure
Poor participation by iron & steel industries during survey	Sufficient data may not be available	Low	Close coordination with ISIT, Ministry of Science and Technology and Ministry of Energy would ensure required level of participation by iron & steel industries for providing required data during questionnaire survey.
Results of benchmarking study are not shared with industry stakeholders	Industries do not realize potential energy saving available	Low	The national level dissemination workshop and availability of energy efficiency manual specific to iron & steel industries of Thailand would help the industries to identify relevant technology options, potential energy savings and investment estimates. These would encourage individual iron & steel industries to undertake steps for adoption of technologies and standard operating practices towards energy efficiency improvements.

3. Long-term impacts of the assistance

3.1 Expected climate change-related benefits

	CTCN climate technology impact	Anticipated contribution from CTCN assistance
1	Climate technologies adapted to national context are identified and prioritized to enable their deployment and/or transfer in the requesting countries	The assistance would focus on identification of energy saving & GHG reduction potential along with suitable technological options relevant for Thailand's iron & steel industries which accounts for a significant share of energy consumption among industry sector among industry sector. This would also help in supporting the set target of Thailand's NAMA and INDC.
2	New national Technology Needs Assessment (TNA) and Technology Action Plan (TAP) as a result of the response	No new TNA or TAP is envisaged. However, the technical assistance would help in technology assessment of iron & steel industries and would provide guidance for implementation of energy efficiency options.
3	Progress made against mitigation objectives (i.e. energy and carbon intensity reduction) as a result of the response	The assessment will make available benchmarking of SECs and GHG emissions of iron & steel industries of Thailand that is expected to provide scope for energy and environmental improvements in this sector.
4	Progress made against adaptation or resilience objectives (e.g. climate vulnerability index improvement) as a result of the response	The Response does not address this subject.
5	New mitigation or adaptation technology projects/initiatives implemented as a result of the response	The technical assistance would provide identification and direction for iron & steel industry for adoption of energy efficient and state of the art technologies.
6	New or strengthened policies/ laws developed, approved and enacted as a result of the response	The assistance would complement existing ENCON Act as it focuses on implementation and reporting on energy efficiency measures by large industries that include iron & steel sector.
7	New policies/laws where climate change was mainstreamed as a result of the response	No new policies/laws are envisaged as a result of this response
8	Country integrating climate change mitigation and/or adaptation issues into its planning and policies as a result of the response	The technical assistance by CTCN would help in strengthening existing policies of Thailand e.g. Energy Conservation Promotion Act, NAMA, INDC, etc.

	CTCN climate technology impact	Anticipated contribution from CTCN assistance
9	New or strengthened Public-Private Partnerships (PPP) created directly as a result of the response	The assistance from CTCN would foster understanding between industry sector and the government with a common goal of energy efficiency improvement and climate change mitigation.
10	New or strengthened twinning arrangement created as a result of the response	Twinning arrangements are not envisaged.
11	Capacities to access and attract public and private finance increase to enable financing of technology deployment	The technical response would require large to medium level capital investments by iron & steel industries of Thailand for adoption of technologies. The need for high level of investments is expected to attract both public and private financing. The response would provide different financing options that could be utilised by the Thai iron & steel industry.
12	Post-response intervention funding attributable to the response.	The outputs of the response include identification of technologies and potential energy efficiency improvements. It is envisaged that wide scale adoption of technologies by iron & steel industries in Thailand would require funding for interventions in the sector. Larger scale funding requirements could be assessed after the completion of the response.
13	Framework and analysis of local production developed to enable deployment of national production of climate technologies	The envisaged adoption of new technologies and practices among iron & steel industries in Thailand would help in developing opportunities and skills at country and local levels.

3.2 Co-benefits

	Sustainable Development Goal	Contribution from CTCN assistance
1	End poverty in all its forms everywhere	Not directly applicable
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	Not directly applicable
3	Ensure healthy lives and promote well-being for all at all ages	Not directly applicable
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	Not directly applicable
5	Achieve gender equality and empower all women and girls	Not directly applicable
6	Ensure availability and sustainable management of water and sanitation for all	Not directly applicable
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	Promotion of energy efficient technologies and practices would help in increasing competitiveness of iron & steel industries due to energy

	Sustainable Development Goal	Contribution from CTCN assistance
		saving thereby enhancing sustainability of the industries.
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Not directly applicable
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Not directly applicable
10	Reduce inequality within and among countries	Not directly applicable
11	Make cities and human settlements inclusive, safe, resilient and sustainable	Not directly applicable
12	Ensure sustainable consumption and production patterns	The benchmarking exercise would provide direction for iron & steel industries towards sustainable consumption of energy use and production thereby making them globally competitive.
13	Take urgent action to combat climate change and its impacts	The benchmarking would indicate the scope for GHG emission reductions in iron & steel sector along with associated actions to be taken that include adoption of best technologies and practices.
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	Not directly applicable
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Not directly applicable
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	Not directly applicable
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	Not directly applicable

3.3. Post-assistance plans and actions

The benchmarking study would be the first step for iron & steel industries in Thailand towards identifying opportunities for energy savings in iron & steel industries that would help them in becoming globally competitive sector. The key technologies identified under Activity-4 of the Technical Assistance would need prioritization for effective implementation at local level. For large investments projects, it would be important to enhance confidence level of the industry through “pilot demonstrations” of energy efficiency projects. Further linkages with BOI and other government schemes such as TEERF would help in scaling up technology adoption. For example, BOI provides support for investment in machinery replacement for energy conservation, reduction of environmental impacts, improvement of production efficiency, etc.

3.4 Monitoring and Reporting of technical assistance results and impacts

The Lead Implementing Agency (LIA) will be responsible for successful implementation of all project activities as outlined with close support and guidance from NDE-Thailand. A detailed activity chart

outlining sub-activities will be prepared by LIA. It will submit Quarterly Activity Report (QAR) to CTCN to share details of completed activities and plan for next quarter. Wherever required, LIA will supplement QARs with detailed annexures. Successful completion of each activity will be reported in appropriate QARs along with challenges and learning. The Reporting Log frame will be updated on quarterly basis. Project Progress Meetings (PPMs) will be held on quarterly basis to present project progress.

Performance indicators of CTCN Assistance				
Response output <i>(linking to sec 1.2)</i>	How output will be used to ensure creation of result	Expected result	Expected outcome of result <i>(linking to sec 1.1)</i>	Anticipated impact that outcome will produce <i>(linking to section 3)</i>
Finalization of sub-sector specific questionnaires	The questionnaires will be sub-sector/ segment specific for iron & steel industries for collection of collect data in a common format	Availability of sub-sector/ segment specific questionnaires in iron & steel industries in Thailand	Common formats for data collection will be available for iron & steel industries under short-listed segments	The questionnaires will be useful for collection of data from iron & steel industries
Data collated from field survey	The data collected through field survey will be used to feed benchmarking tool	Necessary data will be collected from selected iron & steel industries	A vast set of data related to iron & steel industries will be available in common format	Data suitable for benchmarking study will be available
Benchmarking of iron & steel industries	The benchmarked SECs and GHG emissions would showcase the position of Thailand's iron & steel industries with respect to best performing industries Energy reporting guidelines will be useful for collection of data from iron & steel industry	SECs and GHG emissions of selected industries Energy related data can be collected from iron & steel industry	Benchmarking of energy consumption i.e. SEC and GHG emissions in iron & steel industries Guidelines for energy reporting by iron & steel industry	Iron & steel industries under selected segments will be able to evaluate their own performance in comparison to others on energy and environmental aspects Energy related data of iron & steel industries will be useful for decision making by policy makers
Energy efficiency manual and assessing financing options	The iron & steel industries will have access to informational related to various technological options relevant to their segments. The financing options would be useful for Thai iron & steel industry for making potential investments on energy efficiency projects	Technological options will be available for selected iron & steel industries Various financing options will be collated for Thai iron & steel industry	Energy efficiency manual specific to Thailand iron & steel industries is available in public domain Document on financing options available for Thai iron & steel industry	Individual industries would be able to access to information on technological options related to iron & steel sector. Enhanced awareness by Thai iron & steel industries on financing options for energy efficiency projects

Annex 1: Response Logframe

Activity	Description of sub-activities conducted by the CTCN	Output/ Deliverable	Expected Outcome	Main national partners involved	Objectively Verifiable Indicator	Means of Verification
Designing specific questionnaires for different segments of Thailand iron & steel industry	1.1 Kick-off meeting of the project	Project activities shared with key stakeholders	Meeting held with key stakeholders	ISIT	Summary of kick-off meeting Questionnaires for iron & steel industries of Thailand	Report providing questionnaire formats designed as per requirements of Thailand industries
	1.2 Review of secondary data	Report comprising questionnaires for selected iron & steel sub-sector	Structured questionnaires for collection of data from steel industries			
	1.3 Selection of sub-sectors	Report comprising data and information collated from iron & steel industries	Energy and emissions related data of selected iron & steel industries			
	1.4 Designing sub-sector specific questionnaires	Report elaborating on benchmarking of iron & steel industries of Thailand Energy reporting guidelines prepared	Benchmarked SEC and GHG emissions for steel industries. Data from steel industry based on energy reporting guidelines will be useful in decision making			
Undertaking field survey on energy consumption data	2.1 Capacity building of team	Report providing details of assessment carried out in iron & steel industries	Manual on energy efficient technologies and practices	ISIT, Technical agency (national/international) for undertaking performance evaluation study	List of industries covered under the survey	Report providing list and details of field survey
	2.2 Field survey on energy data	Energy reporting guidelines prepared	Document of financing options			
	3.1 Developing tool for benchmarking	Report providing details of assessment carried out in iron & steel industries	Financing options for energy efficiency projects in iron & steel industry			
	3.2 Benchmarking energy consumption and GHG emissions of Thailand iron & steel industry	Energy reporting guidelines prepared	Financing options for energy efficiency projects in iron & steel industry			
Benchmarking of energy consumption pattern and developing energy reporting guidelines	3.3 Development of energy reporting guidelines	Report providing details of assessment carried out in iron & steel industries	Manual on energy efficient technologies and practices	ISIT, Technical agency (national/international) for undertaking performance evaluation study	List of industries covered under the survey	Report providing list and details of field survey
	4.1 Performance evaluation of representative iron & steel industries	Financing options for energy efficiency projects in iron & steel industry	Document of financing options			
	4.2 Assessment of financing options	Energy reporting guidelines prepared	Financing options for energy efficiency projects in iron & steel industry			
	4.3 Energy efficiency manual on steel sector	Report providing details of assessment carried out in iron & steel industries	Manual on energy efficient technologies and practices			
Preparation of energy efficiency manual and assessing financing options	4.4 National workshop on benchmarking	Report providing details of assessment carried out in iron & steel industries	Manual on energy efficient technologies and practices	ISIT, Technical agency (national/international) for undertaking performance evaluation study	List of industries covered under the survey	Report providing list and details of field survey
		Report providing details of assessment carried out in iron & steel industries	Manual on energy efficient technologies and practices			

Annex 2: Indicative Response Budget

Activity	Notes	Quantity	Unit	Unit Cost (\$)	Total Cost (\$)
Activity 1 : Designing specific questionnaires for different segments of Thailand iron & steel industry					
Sub-activity 1.1: Kick-off meeting	Sharing proposed activities with key stakeholders				
Personnel					
<i>National staff - Professional</i>		1	<i>Person day</i>	350	350
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	1	<i>Person day</i>	350	350
sub-activity 1.2: Review of secondary data in iron & steel sector	Review of existing data related to iron & steel industries in Thailand				
Personnel					
<i>National staff - Professional</i>		1	<i>Person day</i>	350	350
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	3	<i>Person day</i>	350	1,050
Sub-activity 1.3: Selection of sub-sectors	Short-listing of sub-sectors for benchmarking study				
Personnel					
<i>National staff - Professional</i>		1	<i>Person day</i>	350	350
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	1	<i>Person day</i>	350	350
Sub-activity 1.4: Designing questionnaires for selected sub-sectors/ segments	Preparation of questionnaires for selected sub-sectors/segments for collection of data				
Personnel					
<i>National staff - Professional</i>		2	<i>Person day</i>	350	700
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	5	<i>Person day</i>	350	1,750
Component sub-total					5,250
Travel					
Component sub-total					0
Sub-total activity 1					5,250

Activity	Notes	Quantity	Unit	Unit Cost (\$)	Total Cost (\$)
Activity 2 : Undertaking field survey on energy consumption data					
Sub-activity 2.1: Capacity building of team	Training of team and undertaking pilot survey				
Personnel					
<i>National staff - Professional</i>		8	<i>Person day</i>	350	2,800
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	8	<i>Person day</i>	350	2,800
Sub-activity 2.2: Field survey on energy data	Conducting field survey of identified segments and collection of data as per required formats				
Personnel					
<i>National staff - Professional</i>		108	<i>Person day</i>	350	37,800
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	5	<i>Person day</i>	350	1,750
Component sub-total					45,150
Travel					
<i>DSA for Iron & steel sector expert and energy sector expert</i>	<i>DSA (Thailand)</i>	24	<i>DSA</i>	200	4,800
<i>Ticket for Iron & steel sector expert and energy sector expert</i>	<i>Round trip ticket to Thailand</i>	2	<i>Ticket</i>	1,100	2,200
Component sub-total					7,000
Sub-total activity 2					52,150

Activity	Notes	Quantity	Unit	Unit Cost (\$)	Total Cost (\$)
Activity 3 : Benchmarking of energy consumption pattern and developing energy reporting guidelines					
Sub-activity 3.1: Developing tool for benchmarking	Benchmarking tool to be prepared for evolving performance of iron & steel industries on energy consumption and GHG emissions				
Personnel					
<i>National staff - Professional</i>		5	<i>Person day</i>	350	1,750
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	30	<i>Person day</i>	350	10,500
Sub-activity 3.2: Benchmarking energy consumption and GHG emissions of Thailand iron & steel industry	Data analysis of field survey will be done and benchmarking exercise on energy consumption and GHG emissions carried out				
Personnel					
<i>National staff - Professional</i>		5	<i>Person day</i>	350	1,750
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	45	<i>Person day</i>	350	15,750
Sub-activity 3.3: Development of energy reporting guidelines	Energy reporting guidelines are formed with a view to analyze data on periodical basis				
Personnel					
<i>National staff - Professional</i>		10	<i>Person day</i>	350	3,500
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	20	<i>Person day</i>	350	7,000
Component sub-total					40,250
Travel					
<i>DSA for Iron & steel sector expert and energy sector expert</i>	<i>DSA (Thailand)</i>	64	<i>DSA</i>	200	12,800
<i>Ticket for Iron & steel sector expert and energy sector expert</i>	<i>Round trip ticket to Thailand</i>	2	<i>Ticket</i>	1100	2,200
Component sub-total					15,000
Sub-total activity 3					55,250

Activity	Notes	Quantity	Unit	Unit Cost (\$)	Total Cost (\$)
Activity 4 : Preparation of energy efficiency manual and assessing financing options					
Sub-activity 4.1: Performance evaluation of representative iron & steel industries	Detailed performance evaluation of key process equipment and utilities will be carried out along with energy efficiency options, investments and benefits				
Personnel					
<i>National staff - Professional</i>		15	<i>Person day</i>	350	5,250
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	120	<i>Person day</i>	350	42,000
Sub-activity 4.2: Assessment of financing options	Assessment of financing options available in Thailand including international sources				
Personnel					
<i>National staff - Professional</i>		5	<i>Person day</i>	350	1,750
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	5	<i>Person day</i>	350	1,750
Sub-activity 4.3: Preparation of energy efficiency manual iron & steel sector	Based on performance evaluation studies, an energy efficiency manual on Thailand iron & steel sector will be prepared				
Personnel					
<i>National staff - Professional</i>		5	<i>Person day</i>	350	1,750
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	60	<i>Person day</i>	350	21,000
Sub-activity 4.4: National workshop on benchmarking	The outcomes of the study will be disseminated among key stakeholders in the workshop				
Personnel					
<i>National staff - Professional</i>		2	<i>Person day</i>	350	700
<i>Consultant</i>	<i>Iron & steel sector expert, Energy sector expert</i>	4	<i>Person day</i>	350	1,400
Component sub-total					75,600
Travel					
<i>DSA for Iron & steel sector expert and energy sector expert</i>	<i>DSA (Thailand)</i>	8	<i>DSA</i>	200	1,600
<i>Ticket for Iron & steel sector expert and energy sector expert</i>	<i>Round trip ticket to Thailand</i>	2	<i>Ticket</i>	1100	2,200
<i>Workshop</i>	<i>Rental , Lunch, coffee breaks, stationery, communication</i>	1	<i>Day</i>	3000	3,000
Component sub-total					6,800
Sub-total activity 4					82,400
TOTAL BUDGET					195,050

Annex 3: Indicative list of performance indicators

Overall Activity	Specific Activity	Indicator
Designing specific questionnaires for different segments of Thai iron & steel industry	1.1 Kick-off meeting of the project 1.2 Review of secondary data in steel sector 1.3 Selection of sub-sectors 1.4 Designing sub-sector specific questionnaires	Questionnaires for key iron & steel sub-sectors/segments in Thailand
Undertaking field survey on energy consumption data	2.1 Capacity building of team 2.2 Field survey on energy data	Data on selected iron & steel industries collected
Benchmarking of energy consumption pattern and developing energy reporting guidelines	3.1 Developing tool for benchmarking 3.2 Benchmarking energy consumption and GHG emissions of Thailand iron & steel industry 3.3 Development of energy reporting guidelines	Benchmarked SEC and GHG emissions for individual steel industries Energy reporting guidelines
Preparation of energy efficiency manual and assessing financing options	4.1 Review of secondary data 4.2 Assessment of financing options 4.3 Energy efficiency manual on steel sector 4.4 National workshop on benchmarking	Manual outlining EE technologies and standard operating practices relevant for Thailand iron & steel industries National workshop held on benchmarking

Abbreviations

ASEAN	:	Association of Southeast Asian Nations
BAT	:	Best Available Technologies
BAU	:	Business As Usual
BOI	:	Board of Investment
EE	:	Energy Efficient
EEDP	:	Energy Efficiency Development Plan
EET	:	Energy Efficient Technologies
ENCON	:	Energy Conservation
ERG	:	Energy Reporting Guidelines
GHG	:	Greenhouse Gases
INDC	:	Intended Nationally Determined Contribution
ISIT	:	Iron & Steel Institute of Thailand
LIA	:	Lead Implementing Agency
PPM	:	Project Progress Meetings
PPP	:	Public Private Partnership
QAR	:	Quarterly Activity Report
SEC	:	Specific Energy Consumption
SOP	:	Standard Operating Practices
TAP	:	Technology Action Plan
TEERF	:	Thailand Energy Efficiency Revolving Fund
THB	:	Thai Baht
TNA	:	Technology Needs Assessment
UNFCCC	:	United Nations Framework Convention on Climate Change