CTCN Technical Assistance
Request Submission Form

Please fill in the form in the grey spaces, by following the instructions in italic.

Requesting country:	*IRAN (Islamic Republic of)*

Request title:	*Optimization of Environmental Aspect and Energy Saving of Basic Oxygen Furnace (BOF) Waste Gases by Replacing New Fume Treatment and Energy Recovery System Instead of Utilizer Boilers in Esfahan Steel Company (ESCO)*

Contact information:

{Please fill in the table below with the requested information. The request proponent is the organization that the request originates from, if different from the National Designated Entity (NDE).}

	National Designated Entity	**Request Applicant**
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Technology Needs Assessment (TNA):

{Select one of the three boxes below:}

☐ *The requesting country has conducted a TNA in .... (please insert date of TNA completion)*

☐ *The requesting country is currently conducting a TNA*

■ *The requesting country has never conducted a TNA*

{If the requesting country has completed a TNA, please indicate what climate technology priority this request directly relates to. Please indicate reference in TNA/TAP/Project Ideas.}

CTCN Request Incubator Programme:

{Please indicate if this request was developed with support from the Request Incubator Programme:}

☐ *Yes*

■ *No*

Geographical focus:

{Select below the most relevant geographical level for this request:}

☐ *Community-based*

☐ *Sub-national*

■ *National*

☐ *Multi-country*

Theme:

{Select below the most relevant theme(s) for this request:}

☐ *Adaptation to climate change*

■ *Mitigation to climate change*

☐ *Combination of adaptation and mitigation to climate change*

Sectors:

Mitigation, Energy, Steel Industry

Problem statement*:*

A:Introduction:

Globally, the iron and steel industry contributes 6.7 percent to worldwide CO_2 emissions. Governments around the world are setting ambitious targets for reduction of stationary carbon emissions from industrial installations such as the steel industry. So, energy recovery and CO_2 emission reduction have become one of the key issues in steelmaking.

Recycling carbon emissions from steel industry provides an important new source for fuels and chemicals production while simultaneously reducing a steel industry's carbon footprint. Off-gases generated from iron and steel production, contain significant amounts of carbon monoxide (CO), carbon dioxide (CO_2) and sometimes also hydrogen (H_2).

Generally, utilizer boilers and GCPs (Gas Cleaning Plant) are the energy recovery and off-gases cleaning systems in steel industry. The thermal and chemical energy of BOF gas arising during the converter process is converted to steam by utilizer boilers then collected by the primary gas collection system.

There are several technological solutions for energy recovery and gas cleaning in basic oxygen furnaces (BOF). The first method is the conversion of the thermal and chemical energy of the hot converter waste gas (BOF Gas) to medium pressure steam in a boiler-type cooling stack (utilizer boilers). The second method is the recovery of cleaned, carbon-rich converter gas (BOF Gas) as a substitute for other sources of energy (through technologies such as LT).

B. Problem description:

In ESCO (Esfahan Steel Co.), utilizer boilers are used for fume treatment and energy recovery of the converters. There are 3 converters (each 130 ton capacity) in ESCO. Maximum off gas flow rate is 65.000-75.000 Nm^3/h per each convertor. The calorific value of BOF Gas is more than 2000 $kcal/Nm^3$ and the temperature at convertor out let is about 1600°C. The chemical composition of the gas is as follow:

H_2O: 2 %, N_2: 1.5-2 %, O_2: 2-4 %, CO: 84-90 %, CO_2: 2-10 %.

In normal condition, utilizer boilers produce a superheated steam by consuming the thermal and chemical energy of the converter waste gas. This steam with 42 bar pressure can be used in BF (Blast furnace) blower station.

Currently the utilizer boilers of ESCO (old Russian design) cannot endure the required pressure (42 bar) to be used in BF blower station. The steam pressure which is produced in utilizer boilers of ESCO is about 30-35 bar. In this situation the produced steam can't be used, so usually it purged to the atmosphere which it means so many energy and water loss. In addition, ESCO needs to use another source of energy for steam boilers of BF blower station to produce 42 bars steam by local boilers instead of utilizer boilers. Also, existing gas cleaning plant is not efficient and stack outlet is not acceptable.

Considering existing condition, ESCO has decided to replace its utilizer boilers with the brand new fume dedusting system such as LT technology. The purpose of the technologies such as LT is to collect, cool, clean and storage all the BOF gases produced during the periodical lancing stage of converters.

GAS HOLDER (huge gas storage tank with movable top roof to supply the constant pressure) stores the CO-containing gas (cleaned BOF gas) then transfers it to consumers by pipe. Gas holder guarantees the possibility of continues supplying of the BOF gas for fuel gas consumers. It is noticeable that by this solution, the recovered gas can be used as fuel, not only in steam boilers of BOF blower station but also in all parts of the factory especially in thermal power plant.

Past and ongoing efforts*:*

The electrostatic precipitators together with a conditioning tower are suitable for the building of new converter melt shops. Thanks to the high efficiency and separating output, low residual dust contents can be attained and ambitious environmental standards observed.

ESCO is the only company in Iran that uses BOF for steel making. Utilizer boilers are used for fume treatment of BOF off gas of ESCO. At present the company has decided to replace the utilizer boilers with new fume treatment system.

In addition to ESCO, ZARAND Steel Plant and Bafgh Kasra Steel Plant which are now under construction will use BOF for steel making. New fume treatment system will be used for heat recovery of the BOF gas in these plants.

Assistance requested*:*

The fume treatment system is designed to protect both the occupational health inside the steelmaking facility and the outside environment. The primary CO-containing gas is recovered, and stored in a gas holder, when its heating value is adequate for subsequent use as a fuel.

By taking into account all the mentioned reasons, ESCO is interested in cooperating with international reputable companies having an excellent background in engineering, procurement and construction (EPC) on these plants. ESCO is interested in collaboration with some companies in order to reach its goals mentioning as follows:

1- Recovering the heating value of the BOF gas and consuming recovered gas as a source of energy in Power Plant

2- Reducing gas emissions

3- Attaining safety for the ESCO's personnel

4- Constructing of the whole plant including the process units and utilities.

5- Technology transfer.

6-Using of chemical energy of BOF gas (or steam generation) under more controllable procedure

Expected benefits:

In new fume treatment of converter off gas, precipitators effectively clean the CO-containing process gases while keeping costs low and thereby meet the most stringent safety and environmental standards. The dust-laden gas arising during the converter process is collected by the primary gas collection system via the converter mouth and conducted to the cleaning and recovery units. The gas is cooled in the conditioning tower before cleaning is performed in the dry-type electrostatic precipitator.

Here, extremely small dust particles are efficiently separated. The electrostatic precipitators achieve a degree of separation of well over 99.8 %. In the downstream spray-cooling tower, the cleaned gas is cooled in order to reduce its volume. Depending on the operating phase of the converter, the gas is either conducted to the flare or sent to the gas holder for intermediate storage. For this, the changeover station ensures reliable switch-over. From the gas holder, the converter gas is fed to other consumption points in the works via a pressure-boosting station. The energy contained in the combustible converter gas is used in place of other energy sources. Both the energy costs and the output of CO_2 are thereby reduced considerably.

To elucidate the importance of this Project, some benefits are briefly mentioned as follows:

1- *Separating extremely small dust particles efficiently through electrostatic precipitators and preventing dust emission*
2- *Recovered heating value is adequate for subsequent use as a fuel*
3- *Consuming recovered energy in Power Plant*
4- *Reducing GHG emission and mitigating climate change.*
5- *Profiting by selling its precious products (power) in the global marketing.*
6- *Using of chemical energy of BOF gas (or steam generation)under more controllable procedure*

Post-technical assistance plans *(up to half a page):*

1- Technology transfer include:
1.1. Identifying Technology owners
1.2. Negotiation with technology owners
1.3. Receiving and Reviewing the proposals
1.4. Sign Contract and countersuit agreement.
2- Technology Adapt to local conditions (market demand, skilled manpower, facilities, etc.)
3- Production (basic and detail design, construction, installation of equipment, etc.)
4- The uptake of technology (encompassing technology is introduced into the workers and public education)
5-Technology development(integrating technology into the domestic skills and experience to achieve a new technology)
6- Technology dissemination (improved knowledge and skills learned at the regional level)

Key stakeholders:	
Stakeholder	*Role to support the implementation of the assistance*
Ministry of Petroleum	*Implementing the government policies and regulations related to the energy sector & gas branching supply as driving force.*
Ministry of Energy	*Implementing the government policies and regulations related to the energy sector and providing required infrastructures for electricity.*
Private Sector	*Financing, supply, installation, after-sales services of equipment*
Department of Environmental	*Reporting the reduction of carbon emissions*

Alignment with national priorities

Islamic Republic of Iran, while accepting the Kyoto Protocol in 2006, has enacted and implemented several laws for protecting the environment.
One of the most important topics studied in the reduction of carbon emissions, is the production conversion process of energy as well as production and protection of fresh water and natural resources in 5th 5-years Development Plan of Iran (article 133 & 140).
Thought fullness of government in legislation and performance of laws preventing indiscriminate use of energy, and in supporting of proposals for optimization of energy consumption has led to supporting implementation of energy recovery projects in the country, which indicates alignment of the mentioned technology with priorities of the government.
Also this request reflects the prioritization of desalination unit equipped with power generation Technology for immediate action, based on the national GHG inventory and developed within the context of the Iran's 2nd national communication to UNFCCC.
Supporting legal documents can include:
- *Initial Iran's National communication to UNFCCC, pages 114, 3rd bullet.*
- *Iran's second National communication to UNFCCC, chapter 5, section 5.3, pages 160 – 167.*

- *5th 5-years Development Plan of Iran (2011 - 2015), article 133.*
- *5th 5-years Development Plan of Iran (2011 - 2015), article 140.*
- *General policies adjustment of consumption samples, article 7, 8th bullet.*

Development of the request (up to half a page):

Energy use intensity is very high in Iran (2.1 on the basis of GDP in 2012); in addition, easy access to fossil fuels and relative inexpensiveness of them in Iran are among serious obstacles in the way of optimized energy consumption and promotion and stability of renewable energies. Thus, the government has enacted and implemented different laws with the approach of energy prices adjustment from 2010; including energy consumption pattern reform in 2011, which was approved and promulgated in 75 articles and 20 amendments.

Under this law, the Ministries of Oil, Energy, Industry and Mining, have been required to identify and implement energy efficiency methods.

All ministries and government agencies should try and cooperate with other institutions in performing and operating of the related laws in articles 45 and 46 of the Energy Consumption Pattern Reform.

To clarify this problem, according to the reports of Iran's government (Ministry of Energy), this country imports electrical energy (approximately 4000 million KWh/year) from neighboring countries such as Armenia, Turkmenistan, and Azerbaijan.

In this regard, the Ministry of Petroleum as well as Energy is responsible for financial supporting of proposals relating to fuel savings resulting from the use of this technology. Moreover, Ministry of Energy is responsible for supplying of the necessary infrastructure for mechanisms of buying electricity from dispersed producers and connecting them to the network.

Expected timeframe:

Activities/ months	*1-3*	*4-6*	*7-9*	*10-12*	*13-15*	*16-24*
Identifying the companies with technical knowledge						
Business Communication						
technology transfer through purchasing and installation of equipment						
Localization of production of equipment and after sales service support						

Background documents:

- *Initial Iran's National communication to UNFCCC, pages 114, 3rd bullet.*
  http://unfccc.int/resource/docs/natc/iranc1.pdf
- *Iran's second National communication to UNFCCC, chapter 5, section 5.3, pages 160-167.*
  http://unfccc.int/resource/docs/natc/iranc2.pdf
- *5th 5-years Development Plan of Iran (2011 - 2015), article 133.*
  http://parliran.ir/index.aspx?siteid=1&fkeyid=&siteid=1&pageid=3362
- *5th 5-years Development Plan of Iran (2011 - 2015), article 140.*
  http://parliran.ir/index.aspx?siteid=1&fkeyid=&siteid=1&pageid=3362
- *General policies adjustment of consumption samples, article 7, 8th bullet.*
  http://maslahat.ir/DocLib2/Approved%20Policies/Offered%20General%20Policies/policy%2015-04-1389%20adjustment%20of%20consumption%20samples.aspx
- *Energy Consumption Pattern Reform, articles 52 and 63.*
  http://www.ivma.ir/Files/Roles/2014-8-23-2-22-42.pdf
- *Adjustment of energy prices –"Targeted subsidies" - article 8.*
  http://www.parliran.ir/index.aspx?siteid=1&pageid=3070
- *Priorities for Research and Technology of Iran, page 6, section B, first bullet, NO. 4.*

Monitoring and impact of the assistance:

■ By signing this request, I affirm that processes are in place in the country to monitor and evaluate the assistance provided by the CTCN. I understand that these processes will be explicitly identified in the Response Plan in collaboration with the CTC, and that they will be used in the country to monitor the implementation of the CTCN assistance.

■ I understand that, after the completion of the requested assistance, I shall support CTCN efforts to measure the success and effects of the support provided, including its short, medium and long-term impacts in the country.

Signature:

NDE name: Seyed Ali Akramifar

Date: 26.6.2016

Signature: 

THE COMPLETED FORM SHALL BE SENT TO THE CTCN@UNEP.ORG

Need help? The CTCN team is available to answer questions and guide you through the process of submitting a request. The CTCN team welcomes suggestions to improve this form.

>>> Contact the CTCN team at ctcn@unep.org