CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

CTCN Technical Assistance
Request Submission Form

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

Requesting country:	*Ecuador*

Request title:	*Technology transfer and spread of gasifiers and biodigesters of residual biomass to minimize greenhouse gas emissions from MSW*

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
Contact person:	*Angel Valverde*	*Eduardo Noboa*
Position:	*Undersecretary of Climate Change*	*Executive Director*
Organization:	*Ministry of Environment of Ecuador*	*National Institute of Energy Efficiency and Renewable Energy*
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Technology Needs Assessment (TNA):

{Select one of the three boxes below:}

☒ *The requesting country has conducted a TNA in June 2013*

☐ *The requesting country is currently conducting a TNA*

☐ *The requesting country has never conducted a TNA*

This request relates to "Technology needs assessment for energy production from municipal solid wastes" focused on gasifiers and biodigesters technologies.

Geographical focus:

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

☐ *Community-based*

☒ *Sub-national*

☒ *National*

☐ *Multi-country*

The sub-national level corresponds to Autonomous Decentralized Governments of Ecuador (municipalities).

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:

Energy and waste.

Problem statement *(up to one page):*

Ecuador produces about 11114 Ton/day of municipal solid wastes (MSW) at national scale. This amount corresponds to an average per capita production of 0,72 kg/person/day. The data show that as average, 59 ± 14 % of the MSW are made of biodegradable residues and in some municipalities this percentage could be as high as 80%. The anaerobic decomposition of this MSW fraction generates methane and CO2 as main residual gases which are freely released to the atmosphere.

During 2010, 160 from a total of 221 Autonomous Decentralized Governments (hereafter municipalities) disposed of its MSW at open air rubbish tips, therefore producing severe ground, water and air pollution. The remaining 61 municipalities have sanitary landfills with different degree of technical management. Moreover, only 94 municipalities have differentiated garbage collection systems at the source. Inadequate waste disposal at municipalities is the origin of environment pollution especially in the form of greenhouse gas emissions, toxic leachate and soil deterioration. This could be interpreted as a combination of lack of awareness, weak local capacities and or lack of financial schemes.

Most municipalities are unable to improve their MSW disposal systems due to high costs of implementing adequate solutions, lack of technological alternatives and limited technical advisory for implementing specific technology alternatives. This problem hampers reuse and recycling of MSW as well as its exploitation as energy source and/or fertilizer. Additionally, a gap between the sources and users of technology for MSW treatment has been identified, which is related with funding and technology transfer mechanisms.

It is intended with this measure to take advantage and to enhance locally-developed technology with potential to contribute to an environmental problem, identifying sound technology transfer mechanisms and possible funding schemes to pave the way for an efficient diffusion and deployment of these technologies.

Past and ongoing efforts *(up to half a page):*

The National Institute of Energy Efficiency and Renewable Energy (INER) has developed a new model of gasifier that utilizes MSW to generate syngas and liquid biofuels. The prototype is installed in the city of Santo Domingo in the Coast Region of Ecuador. At the moment, the institute has intellectual property rights over this gasifier. This point is very important, because the institute has the opportunity to develop, use and transfer locally developed technology that is another facet in fighting

climate change. INER will start scaling up studies in order to take their prototypes to commercial stage.

The gasification technology developed by INER was implemented to process 50 kg/h of municipal solid wastes (MSW) in a pilot plant that can be easily replicated and scaled-up. The early stages and design of the mentioned pilot plant took place in 2013, and in 2014 the plant was fully operative. The developed gasification technology produces a high-quality SYNGAS that contains near 14% in volume of hydrogen; which makes it suitable for synthetic fuels production through the Fischer-Tropsch process, or for energy generation through the use of engines and turbines.

Additionally, INER counts on technical equipment and staff for making the necessary analysis of MSW composition. This is very important for technology specification and adaptation to local conditions.

Finally, as was previously stated, MEER and MAE have programs oriented to improve the MSW treatment at national scale.

Assistance requested *(up to one page):*

INER has developed local technology of gasifiers and biodigesters suitable for the characteristics of local MSW with the potential to make use of it with energy purposes while reducing the amount of wastes that is disposed into landfills or rubbish tips at the same time. These technologies could have an important impact on solving the MSW problem described above and also on the promotion of locally developed technology use. The proposal considers the elements described below:

*-**Identification and analysis of technical and administrative aspects.** This activity is oriented to identify the administrative and technical characteristics of the MSW management that are required for a prompt implementation of demonstrative pre-commercial pilot plants. According to the characteristics, needs and capabilities of each possible implementation site, it will be defined the correct technology (gasifiers and/or biodigesters).*

*-**Development of enabling mechanisms**. This activity could be described as a combination of three sub activities: The first one is focused on the identification and operation of technology transfer mechanisms. This stage implies the recognition of the enabling framework and barriers for technology transfer to the municipalities, therefore, new or improved mechanisms from the source (INER, who has developed local gasifier and biodigester technologies) to the users should be proposed.*

The second sub activity comprises the identification of financial mechanisms for technology adoption and sustainable operation due to the fact high costs are identified as one of the most important barriers for technology adoption and improvement of MSW treatment systems. Consequently, one important action within this proposal is to identify the possible range of financial mechanisms and the design of innovative mechanisms that permit municipalities match its own economic resources with other sources of monetary flows. Within this activity, other relevant national and/or international actors, as well, as financial sources should be identified. Strategies for converting a potential waste-to-energy project implementation into a continuous waste management process will also be evaluated.

Finally, the third sub activity will consider the implementation of demonstration plants that will show the technical advantages and benefits of different waste management alternatives that are applicable to the local characteristics. This action will pave the way for a proper and coherent diffusion and technology transfer process and also will solve specific waste management problems by applying the

technology developed by INER.

-Dissemination and scaling-up strategy. *This activity could also be split into two sub activities called energy management model and market development for technology diffusion.*

Within the energy management model, the most suitable and economic forms of energy use from biodigesters and gasifiers will be identified according to the characteristics of municipalities.

The types of energy vectors from these technologies are biogas, syngas, liquid fuels or electricity; therefore, several different alternatives of energy usage will be analyzed taking into account the socio-economic aspects of each municipality. Sustainability strategies previously identified will be analyzed into the management model proposal.

Market development and technology diffusion consists of developing several information mechanisms, which highlight the features, benefits and economic viability of the new technology. Workshops and visits will be conducted with focus on users, industrial units, policy makers and other stakeholders. As a part of the diffusion strategies, field visits will be organized to other users and stakeholders in order to show benefits of technology under operation. Field visits will encourage and enable the stakeholders to actively get involve in promotion measures for wide dissemination of the technology.

-Building local capabilities*. Technical and administrative staff in charge of MSW management should enhance their knowledge, awareness and technical capabilities in order to implement adequate MSW treatment systems, as well as, gaining insight into the possibilities of using MSW as energy and other valuable materials source.*

It is important to promote locally-developed technology (e.g. gasifier local technology developed by INER) since they are adapted to the particular characteristics of MSW. This will allow that municipalities generate proper internal processes for adopting and implementing new suitable technologies and treatment alternatives by their own initiative. Some examples of these processes could be: garbage sorting at the source, diffusion campaigns and enhancement of productive entrepreneurship for energy usage and/or utilization of residual fertilizers. These alternatives will be also evaluated as technology transfer options.

Expected benefits *(up to half a page):*

This measure seeks to implement a bridge between demand and supply of technology for MSW management. Normally these technologies are too expensive or too sophisticated to be operated for the municipalities. Locally developed technologies have the potential to reduce costs of implementation and operation.

Additionally, this measure will contribute to the following benefits:

- *Minimizing the amount of MSW that are disposed of in open air garbage tips or sanitary landfills.*
- *Minimizing the emission of greenhouse gases that are produced during the biodegradable fraction decomposition of MSW. These gases are freely released to the atmosphere.*
- *Generating and strengthening local capacities at municipality level for technical treatment of MSW and hence, reducing diseases, contamination and GHG emissions.*
- *Contribute to the technology diffusion and transfer by putting attention on adequate, locally developed technologies for MSW treatment.*
- *Contribute to the use of MSW as a source for recycling, reusing, energy generation or*

fertilizers production. This could help to identify and implement productive entrepreneurships at local level.

- *Give support to the municipalities to identify and apply to financial mechanisms for technology adoption and implementation.*
- *Potential additional aspects:*
  - *Creation of proper job opportunities specially for poor people that are nowadays involved in an informal and unsecure way in the MSW treatment.*
  - *Reduction of potential diseases for the population and other problems associated with wildlife and nature due to improved waste management and reduced residues quantities.*

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

INER will receive the model gasifier patent. As INER is a non for profit, scientific organization, the patent will be an instrument for technology transfer and dissemination. It is expected that some start-ups and/or other initiatives will arise from it.

Key stakeholders:

The following table lists the main stakeholders:

Stakeholder	Role to support the implementation of the assistance
Ministry of Electricity and Renewable Energy (MEER)	*Designing policy for using energy from MSW.*
Ministry of Environment (MAE)	*Base line information about the MSW situation in Ecuador.* *Responsible for the National Program for MSW integral management (PNGIDS).*
Municipalities	*Main actors in this proposal. They are in charge of MSW management as well as technology adoption and implementation.*
CTCN	*Technical support for the measure.*
National Institute of Energy Efficiency and Renewable Energy (INER)	*Technology developing, testing, diffusion and transfer of technologies for MSW treatment within the context of the National Program of MSW integral management.* *Capacity building in operation & maintenance activities for the technology receptors.* *Technology monitoring for securing correct functioning.* *Human and equipment resources for MSW analysis.*

Alignment with national priorities *(up to half a page):*

The Ministry of Electricity and Renewable Energy (MEER) has an important line of action in the field of distributed energy from biomass, which is the main component of MSW in Ecuador. MEER has carried out a project for deployment and use of biodigesters and biogas for energy purposes. These biodigesters were implemented in food markets of Quito city. During this Project, around 440 people were trained in the use and maintenance of these biodigesters. At the moment, this Ministry is interested in continuing the project.

It is important to establish that "National Program for MSW integral management" seeks to improve

the MSW treatment through designing and implementation of standardized management procedures, encouraging recycling entrepreneurship, implementation of policies and to prepare and manage technical inputs for collection, transportation, disposal, exploitation and energy usage of MSW. As it was mentioned, it is expected that all the open air rubbish tips will be eliminated, to disseminate the public policy oriented to technical management of MSW and to enhance recycling and use of MSW as source of energy and materials as a contribution to the productive matrix transformation.

The current proposal has been developed in order to fit the waste management and renewable energy policy dictated by the local environmental and energy authorities, under the competences of INER. As a research centre, the proposal of INER considers to gather and process information about specific issues of the MSW exploitation change in order to deliver technical outcomes that aid local policy makers in their task. At the same time, applied research is proposed as an option to solve specific problems suitable for reaching scaling-up stages.

Finally, Ecuador through its national government encourages the energy matrix diversification in order to minimize fossil fuels consumption. The diversification of energy sources that can generate electricity or biofuels and that not compete with food crops or jeopardize food security as a national priority. This policy pursues at the same time, the minimization of greenhouse gases emissions generated through fossil fuels combustion.

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

The Ministry of Environment of Ecuador (MAE) is the National Designated Entity who issued during 2013 the document entitled "Technology needs assessment for energy generation from MSW". This document shows some important figures and facts about the current status of greenhouse gas emissions from MSW and the availability of a range of technologies for energy generation from MSW in Ecuador.

A detailed analysis of the existing technologies for energy generation from MSW was developed as well as different alternative technologies were assessed through a multi criteria analysis. This assessment was based on the characteristics of two reference provinces: Santo Domingo de los Tsáchilas and Chimborazo, where data about garbage composition, climatic conditions and socio-economic aspects were taken into account. Based on this information, generation and usage technology of biogas from anaerobic digestion for energy purposes was highlighted.

MAE is currently ruling the "National Program for MSW integral management (PNGIDS)" which aims to design and implement a national plan for integral waste management based on its proper exploitation and disposal and reinforcement of cleaning services. The main goal of the program is to replace dump yards by sustainable waste disposal alternatives by 2017.

Its specific objectives are described as:

- *Design and implementation of an integral waste management policy.*
- *Design and implementation of a standard model of waste management based on population characteristics, amount and characteristics of waste and geographical parameters.*
- *Support on issuing equipment and technical inputs for cleaning services reinforcement.*
- *Support local industry in recycling and energy exploitation of waste.*
- *Implementation of an integral management for hazardous and special waste by involving producers and importers.*

This proposal represents an opportunity to further develop action plans to integrate people to disseminate projects related to this field. It additionally will provide an opportunity for people to adapt

to the effects of climate change and create local resilient economies.

Expected timeframe:

It is anticipated that this assistance will take place over a period of 18 months.

Background documents:

Monitoring and impact of the assistance:

{Read carefully and tick the boxes below.}

☒ 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.

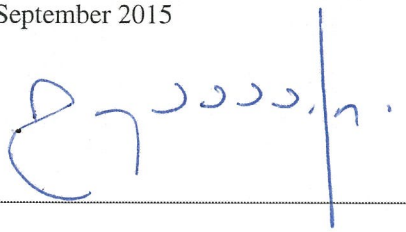
☒ I understand that, after the completion of the requested assistance, I shall support CTCN efforts to measure the success and effects of the support provided, including its short, medium and long-term impacts in the country.

Signature:

NDE name: Ministry of Environment

Date: 17th September 2015

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