



Technical Assistance Response Plan - Terms of Reference

Country:	Uruguay
Request ID#	2018000018
Title:	Development of a national roadmap for the use of low-temperature geothermal energy for thermal conditioning in the residential, industrial and commercial services sectors
NDE	Ignacio Lorenzo, Director of Climate Change, Climate-Change Division (DCC), Ministry of Housing, Land-Use Planning and the Environment, Montevideo, Uruguay, ilorenzo@mvtoma.gub.uy , secretaria.dcc@mvtoma.gub.uy Jorge Castro, jorge.castro@mvtoma.gub.uy
Proponent	Ruben García, National Director of Energy, National Energy Directorate, Ministry of Industry, Energy and Mining, director.dne@miem.gub.uy Wilson Sierra, Renewable Energies Area, wilson.sierra@miem.gub.uy Carla Zilli, Assistant, Climate-Change Division, Ministry of Housing, Land-Use Planning and the Environment, carla.zilli@mvtoma.gub.uy

Summary of the CTCN technical assistance

Sustained growth in energy demand in Uruguay imposes a need to expand the use of Non-Conventional Renewable Energy (NCRE), as well as deepening energy-efficiency actions. Geothermal energy, one of the priority technologies for mitigating climate change, is an NCRE that is at the very early stages of development in the country.

Thus, this technical assistance will contribute to the development of a roadmap for implementation of low-temperature geothermal energy for thermal conditioning in the residential, industrial and services sectors in Uruguay, to diversify the use of energy sources in the country. For this, we shall set out the general objectives of the roadmap and the actors involved (DINAMA; DINAGUA and DINOT (MVOTMA); DINAMIGE and DNE (MIEM); Local Authorities; MINTUR; UTE; OSE; ANCAP; ICG; NGOs; private-sector representatives; Inter-institutional Board of Women in Science, Technology and Innovation; among others) and shall analyse the current geothermal energy landscape in Uruguay and identify currently-existing barriers to its deployment and measures or recommendations to reduce these. We shall use this information to draft the roadmap and concept note to obtain international climate finance for the use of geothermal energy for thermal conditioning in the residential sector. The duration of the technical assistance will be 12 months.



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Agreement:

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

National Designated Entity to the UNFCCC Technology Mechanism

Name: Jorge Alberto Castro Somoza

Title: Alternate NDE

Date: 06//11/2019

Signature:

Climate Technology Centre and Network (CTCN)

Name: Rose Mwebaza

Title: CTCN Director

Date:

Signature:



1. Background and context

According to the latest published national inventory¹, in 2014, Uruguay's total net GHG emissions were 28,341 Gg CO₂eq using metric GWP100_AR2, or 12,876 Gg CO₂-q using metric GTP100_AR5. Using the latter metric, 37.7 per cent of emissions were attributable to the energy sector (including transport), whereas this proportion drops to 20.1 per cent when using metric GWP100_AR2.

The growth of NCREs meant that in 2018, 62 per cent of Uruguay's primary energy came from renewable sources, which in turn represented 97 per cent of the energy consumed by national electricity generation.² National emissions from the energy sector in relation to the country's GDP (103 gCO₂/USD in 2017) are very low compared with the global average, having halved between 1990 and 2017, despite national energy consumption having tripled over the same period.

Growth in energy demand imposes the need to permanently expand the supply system to meet demand, and optimization of investments in this area basically depends on the following four main variables: demand, the price of the technologies, the price of fossil fuels and the degree of regional integration.³

2. Problem Statement

Uruguay has already embarked on a path towards a diversified energy matrix with a strong domestic renewable energy component. This path was chosen because it is economically and environmentally optimal, in addition to being able to withstand external price variations.

To ensure the robustness of the primary supply matrix, while continuing with the progressive decarbonization of the energy sector, there is a need to accompany the very strong transformation of the electricity sector with the development of complementary sources to provide, for example, the replacement of fossil fuels used for heating in industrial and residential settings.

It is, therefore, necessary to strengthen local capacities in new NCREs, such as geothermal energy, one of the prioritized technologies in the energy sector Technology Needs Assessment (TNA) report for the mitigation of climate change.

While there have been no real assessments so far of geothermal potential for energy purposes in Uruguay, a scientific article published in the journal of the Uruguayan Geology Society (Cernuschi, 2014) posits the existence of the following possibilities, in increasing order of complexity, to take advantage of geothermal energy:

- The warm, overpressured waters of the Guaraní Aquifer System (45°C, >1000 m) have an extraction cost of virtually zero and, in addition to their current recreational use, could be

¹ MVOTMA, SNRCC (2017c). Second Biennial Update Report to the UNFCCC
http://unfccc.int/national_reports/non-annex_i_natcom/reporting_on_climate_change/items/8722.php

² MIEM, DNE (2016). Libro Balance Energético Nacional - Serie Histórica 1965 - 2015.
<http://www.dne.gub.uy/-/balance-energetico-nacion-1>

³ Ruben Chaer, R.; Gurin, M.; Cornalino, E.; Draper, M.; Terra, R.; Abal, G. and Alonso, R. (2014). Complementariedad de las Energías Renovables en Uruguay y valorización de proyectos para el filtrado de su variabilidad. Reporte Final. Ref.: INE /ENE/RG-T1886-SN5. Montevideo, Uruguay. September 2014.
<https://iie.fing.edu.uy/publicaciones/2014/CGCDTAA14/CGCDTAA14.pdf>



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utilized for domestic or industrial heating (greenhouses), reducing consumption of other energy sources and, therefore indirectly reducing GHG emissions from the proportion of energy generated from burning fossil fuels.

- The waters of the possible underlying Carboniferous-Permian aquifers, possibly overpressured ($\leq 75^{\circ}\text{C}$, 2300 m), could be used to generate electricity using binary plants cooled by surface water. If the existence is confirmed of these or other deeper sedimentary rocks ($\leq 150^{\circ}\text{C}$, 4500 m), it would be possible to exploit deep aquifers or create enhanced geothermal systems if groundwater were not to be found. In these cases, larger conventional binary plants could have an impact on national electricity consumption.
- Lastly, it would also be possible to generate electricity in binary plants using an enhanced geothermal system in the granite basement to a depth of $>5,000$ m, in order to find temperatures near 200°C , with the possibility of then generating significant amounts of energy for the country.

There is also interest in proceeding with the use of shallow or low-temperature geothermal energy for thermal conditioning and domestic water heating.

Barriers to the use of low-temperature geothermal energy have been identified, such as the lack of a regulatory framework and lack of knowledge of technologies, applications and benefits.

This project proposes the conduct of a general analysis of potential geothermal sources for thermal use (not electrical power generation) in the country and a technical and economic viability assessment of the development of low-temperature geothermy (open- and closed-system) for the thermal conditioning (heating/cooling) of spaces and water. This needs to include current regulations affecting the development of the technology.

The analysis should include a comparison of this technology with technologies available for these purposes, such as split air conditioners, water-air heat pumps, natural gas, firewood, etc.



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4. Resources required and itemised budget:

Activities and Outputs	Input: Human Resources <i>(Title, role, estimated number of days)</i>	Input: Travel <i>(Purpose, national vs. international, number of days)</i>	Inputs: Meetings/Events <i>(Meeting title, number of participants, number of days)</i>	Input: Equipment/Materials <i>(Item, purpose, buy/rent, quantity)</i>	Estimated cost <i>Please accumulate the costing at Activity and Output level and provide an estimated costing range for each activity and the total Response Plan</i>	
					Minimum	Maximum
Output 1: Development of implementation planning and communication documents	E1, 7 days				3,000	4,000
Activity 1.1: Work Plan	E1, 1 day				400	500
Activity 1.2: Monitoring and Evaluation Plan	E1, 3 days				1,400	2,100
Activity 1.3: CTCN Impact Description (initial and final versions)	E1, 2 days				800	1,000
Activity 1.4: Closure and Data Collection Report	E1, 1 day				400	400
Output 2: Mapping of key actors for the use of low-temperature geothermal energy in Uruguay	E1, 8 days E2, 8 days GE, 1 day				13,000	16,000
Activity 2.1: Mapping of key actors	E1, 7 days E2, 7 days GE, 1 day				9,000	11,000
Activity 2.2: Initial meeting to introduce key actors and	E1, 1 day E2, 1 day	1 international journey	15 participants 1 day		4,000	5,000



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Activities and Outputs	Input: Human Resources <i>(Title, role, estimated number of days)</i>	Input: Travel <i>(Purpose, national vs. international, number of days)</i>	Inputs: Meetings/Events <i>(Meeting title, number of participants, number of days)</i>	Input: Equipment/Materials <i>(Item, purpose, buy/rent, quantity)</i>	Estimated cost <i>Please accumulate the costing at Activity and Output level and provide an estimated costing range for each activity and the total Response Plan</i>	
					Minimum	Maximum
stakeholders to the technical assistance						
Output 3: Analysis of the current geothermal energy landscape in Uruguay	E1, 14 days E2, 14 days GE, 5 days				22,000	30,000
Activity 3.1: Analyse the current geothermal energy landscape and, especially, low-temperature geothermal energy	E1, 13 days E2, 13 days GE, 5 days				18,000	25,000
Activity 3.2: Presentation of findings to various stakeholders	E1, 1 day E2, 1 day	1 international journey	15 participants 1 day		4,000	5,000
Output 4: Identification of existing barriers to the use of low-temperature geothermal energy in Uruguay	E1, 8 days E2, 8 days GE, 1 day				16,000	25,000
Activity 4.1: Identify barriers to the use of geothermal energy in the country and propose	E1, 7 days E2, 7 days GE, 1 day				12,000	20,000



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Activities and Outputs	Input: Human Resources <i>(Title, role, estimated number of days)</i>	Input: Travel <i>(Purpose, national vs. international, number of days)</i>	Inputs: Meetings/Events <i>(Meeting title, number of participants, number of days)</i>	Input: Equipment/Materials <i>(Item, purpose, buy/rent, quantity)</i>	Estimated cost <i>Please accumulate the costing at Activity and Output level and provide an estimated costing range for each activity and the total Response Plan</i>	
					Minimum	Maximum
measures to reduce these and/or recommendations						
Activity 4.2: Meeting with key stakeholders to present barriers and measures/recommendations.	E1, 1 day E2, 1 day	1 international journey	15 participants 1 day		4,000	5,000
Output 5: Production of a draft roadmap for geothermal energy in Uruguay	E1, days E2, days				23,000	30,000
Activity 5.1: Draft the roadmap for the deployment of geothermal energy in the Uruguayan residential, industrial and services sectors	E1, 15 days E2, 10 days				16,000	22,000
Activity 5.2: Consultation workshop with different stakeholders	E1, 2 days E2, 2 days	1 international journey	30 participants 2 days	Catering	7,000	8,000
Output 6: Development of a concept note for the Green Climate Fund (GCF)	E1, 10 days E2, 10 days				12,000	15,000



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Activities and Outputs	Input: Human Resources <i>(Title, role, estimated number of days)</i>	Input: Travel <i>(Purpose, national vs. international, number of days)</i>	Inputs: Meetings/Events <i>(Meeting title, number of participants, number of days)</i>	Input: Equipment/Materials <i>(Item, purpose, buy/rent, quantity)</i>	Estimated cost <i>Please accumulate the costing at Activity and Output level and provide an estimated costing range for each activity and the total Response Plan</i>	
					Minimum	Maximum
Activity 6.1: Prepare and write a concept note to obtain international climate finance on the use of geothermal energy for thermal conditioning in the residential sector.	E1, 10 days E2, 10 days				12,000	15,000
Estimated range of costing for the entire Response Plan					89,000	120,000



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5. Profile and experience of experts

Experts required	Brief description of required profile
Expert 1 (E1)	Industrial or energy engineer; holds Masters in engineering; minimum of 7 years' experience in geothermal energy and energy efficiency, development of energy policies and roadmaps. Fluent Spanish.
Expert 2 (E2)	Industrial or energy engineer; holds Masters in engineering; 5 years' experience in geothermal energy, energy efficiency and practical experience in low-temperature geothermal installations in the residential, industrial and commercial services sector. Fluent Spanish.
Gender Expert (GE)	Social sciences professional (sociologist, anthropologist or psychologist), expert in gender studies and management of equality policies, with experience in research methodologies and data processing, with at least 7 years' experience. Fluent Spanish.

6. Intended contribution to the expected impact of the technical assistance

The outputs developed during the technical assistance will enable Uruguay to have practical tools to identify, with regard to geothermal energy, key actors and barriers, as well as measures to overcome barriers to the deployment of the technology in the country. All this will facilitate development of a roadmap that will allow the country to gain a deep understanding around the introduction of geothermal energy use in the residential, industrial and services sectors.

7. Relevance to NDCs and other national priorities

Uruguay's contribution to the ultimate objective of the UNFCCC and the goal of the Paris Agreement is centred on being able to carry out national development with the lowest-possible GHG emissions, decarbonizing its economy over time. Thus, Uruguay has commitments to Nationally Determined Contributions (NDCs): the incorporation of NCRE, an (unconditional) 24 per cent intensity reduction (CO₂ emissions per unit of GDP) by 2025, compared to 1990 values, and a 29 per cent intensity reduction conditional upon specific additional means of implementation. Introducing the use of geothermal energy into the residential, industrial and services sectors will contribute to reducing the country's energy intensity.

Furthermore, prioritizing the renewable energies subsector, especially geothermal NCRE technology, among others, arises as a result of the first phase of the Technology Needs Assessment (TNA) project. The TNA project Barrier Analysis and Enabling Framework report focused exclusively on barriers to the development of wave energy in Uruguay, although some of these barriers are common to geothermal energy.

8. Linkages to relevant parallel on-going activities

Uruguay currently has no geothermal energy initiatives, projects or programmes in the public or private sectors, since knowledge of this technology is very limited.

To date, the interest of the country has focused, with little success, on incorporating these technologies into the research promoted by the National Agency for Research and Innovation (ANII) and into the clean technologies component of the Law on the Promotion of Investment.

9. Anticipated follow-up activities after this technical assistance is completed

This technical assistance will be the start of a set of activities that will lead to the development of a

roadmap for the deployment of geothermal energy in Uruguay. However, the future and continuity of this initiative will be supported by the following actions:

- a) Communication and promotion of the roadmap within government, business, academia and civil society organizations
- b) Dissemination of outcomes and potential benefits from application of the roadmap in Uruguay
- c) Fulfilment of commitments by public and private actors for the deployment of geothermal energy
- d) Creation of programmes to support geothermal energy projects by development organizations or corporations in the country
- e) Institutionalization of this initiative in order to continually update the list of stakeholders and promote the development of national and regional strategies
- f) Updating and monitoring of NDC commitments

10. Gender and co-benefits

<p>Imbedded in design of activities</p>	<p>Consideration of the active inclusion of women is mandatory at each stage, ensuring that their participation is mainstreamed at every level of decision making and that the dignity of and respect for women is taken into account. This is why this condition is clearly designed into this TA, in activity 3.1. The roadmap must mainstream gender; the challenge that this brings is of assessing how this analysis, and geothermal energy baseline (and the subsequent roadmap) are able to generate gender-disaggregated economic, social and environmental consequences.</p>
<p>Gender and co-benefits intended as result of the activities</p>	<p>The technical assistance will provide inputs for the definition of mechanisms to enable the development of geothermal energy with the primary objective of reducing domestic GHG emissions, and with other economic, environmental, social and cultural, and, especially, gender co-benefits. The following co-benefits are particularly noteworthy:</p> <ul style="list-style-type: none"> • Contribution to energy sovereignty as a result of reduced dependence on oil • Reduced costs in a scenario of rising fossil-fuel prices • Smoothing fluctuations in electricity generation by using geothermal as a complement to other renewable energy sources • Reduction in polluting emissions associated with combustion in thermal power stations • Potential generation of skilled employment opportunities in one of the most socioeconomically depressed parts of the country (the north west). • Settlement of the rural population and increased demand for services around the creation of a new energy industry • Synergies with other economic activities, since in certain technologies, residual geothermal potential may be used in the tourism (hot springs) or other industries (heating horticultural greenhouses, heating stables for animal breeding, etc.)

	<ul style="list-style-type: none"> Contribution to generating a culture of sustainable development among the public <p>Regarding gender equality, the project will ensure that men and women participate equitably in decision making in relation to development of the national roadmaps for the development of geothermal energy. Furthermore, gender issues will be addressed when assessing current capacities, in terms of ongoing and underpinning research and in demonstration and development projects: the gender balance in the sector will be ascertained and measures proposed to reduce gaps.</p>
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11. Main in-country stakeholders in implementation of the technical assistance activities

In-country stakeholder	Role in implementation of the technical assistance
Climate-Change Division, MVOTMA	Partner and main node for inter-agency coordination through its role as coordinator of the National Climate-Change Response System (NDE).
National Energy Directorate, MIEM	The central body responsible for preparing and implementing energy policy and its directives, it would be the main institutional sponsor. It would also monitor and evaluate the output of the technical assistance. Applicant for technical assistance.
UTE	Publicly-owned electricity generation, transmission and distribution company. It centralizes competence and the application of technical standards in this area. Possible stakeholder in medium- and long-term NCRE developments.
OSE	Publicly-owned company providing the water supply throughout the country and sanitation services in the interior of the country. Stakeholder.
ICG (FCIEN, UdelaR)	Geological Sciences Institute, an academic area that concentrates skills fundamental to the development of geothermal energy and a local partner for international cooperation in the technological area of this energy.
DINAMA (MVOTMA)	Responsible for granting initial environmental authorization and operating authorization for energy-generation projects, and for monitoring their impact through monitoring their environmental performance, emissions and environmental quality of the surrounding area.
DINAGUA (MVOTMA)	Manages surface and groundwater resources so that their use contributes to and is compatible with productive, economic and social development and preservation of the hydrological cycle. Stakeholder.
DINAMIGE (MIEM)	Responsible for the sustainable use of geological resources and for the evaluation and conservation of groundwater resources. Also responsible for giving a view on the impact of geothermal energy on these resources.

DINOT (MVOTMA)	Responsible for conducting appropriate actions for coordination and cooperation between national, <i>departmental</i> and local public institutions with regard to the planning and environmental management of the land at all territorial scales.
Local Authorities of Paysandú, Salto and Artigas	<i>Departmental</i> governments in the areas with the greatest solar and geothermal potential. Together with the third tier of governance of municipalities, these would have to harmonize their local policies with national policies.
MINTUR	Responsible for tourism policy. MINTUR would contribute its views on the impact of geothermal development on some of the most highly-valued areas of the country for tourism.
ANCAP	State-owned enterprise responsible for the supply of fuel, with tens of alliances and partnerships with national and international institutes and research centres. In the field of production and exploration and as part of hydrocarbons prospecting in the north of the country, it continually gathers information essential for evaluating geothermal energy potential.
NGOs	NGOs related to environmental issues or whose activities could be affected by the development of certain renewable energy projects (e.g. surfers' associations, artisanal fishers, tour operators, etc.)
Inter-institutional Board of Women in Science, Technology and Innovation	This body aims to raise awareness of the under-representation of women in the education and work environment, bringing together education and opportunities to develop capacities in science, technology, engineering and mathematics (STEM) and the generation of proposals on various levels and aimed at a range of stakeholders to reverse this under-representation.

12. SDG Contributions

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs)
1	End poverty in all its forms everywhere	
2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote lifelong opportunities for all	
5	Achieve gender equality and empower all women and girls	
6	Ensure availability and sustainable management of water and sanitation for all	
7	Ensure access to affordable, reliable, sustainable and modern energy for all (consider adding Goal 7 targets)	
	7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	The TA contributes to achievement of this target, especially in stand-alone solutions
	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	The TA will contribute through the increase in geothermal energy in the primary energy matrix



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	7.3 By 2030, double the global rate of improvement in energy efficiency	
	7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	
	7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support	
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	The project is expected to open up opportunities for the development of enterprises associated with the technology and new jobs
9	Build resilient infrastructure, promote sustainable industrialization and foster innovation	
10	Reduce inequality within and among countries	
11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	<i>All TAs should indicate relevance to Goal 13 and at least one target below (13.1 to 13.b).</i>
	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	
	13.2 Integrate climate change measures into national policies, strategies and planning	The TA will be used to draft a geothermal energy roadmap and concept note for use specifically in the residential sector, to be reflected in due course in national policies, strategies and plans and climate commitments.
	13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	
	13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	
	13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
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	
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	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	

13. Classification of technical assistance

<i>Please tick all relevant boxes below</i>	<i>Primary</i>	<i>Secondary</i>
<input type="checkbox"/> 1. Decision-making tools and/or information provision	X	
<input type="checkbox"/> 2. Sectoral roadmaps and strategies	X	
<input type="checkbox"/> 3. Recommendations for law, policy and regulations		X
<input type="checkbox"/> 4. Financing facilitation		X
<input type="checkbox"/> 5. Private sector engagement and market creation		
<input type="checkbox"/> 6. Research and development of technologies		
<input type="checkbox"/> 7. Feasibility of technology options		
<input type="checkbox"/> 8. Piloting and deployment of technologies in local conditions	X	



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<input type="checkbox"/> 9. Technology identification and prioritization		
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Please note that all CTCN technical assistance contributes to strengthening the capacity of in-country actors.

14. Monitoring and Evaluation process

Upon contracting of the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. The monitoring and evaluation plan must include specific, measurable, achievable, relevant, and time-bound indicators that will be used to monitor and evaluate the timeliness and appropriateness of the implementation. The CTCN Technology Manager responsible for the technical assistance will monitor the timeliness and appropriateness of the Response Plan implementation. Upon completion of all activities and outputs, evaluation forms will be completed by (i) the NDE about overall satisfaction level with the technical assistance service provided; (ii) the Lead Implementer about the knowledge and learning gained through delivery of technical assistance; and (iii) the CTCN Director about timeliness and appropriateness of the delivery of the activities and outputs.