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.

Country:	*South Africa*

Date	*30 November 2015*

Title	***Substantial GHG emissions reduction in the cement industry by using waste heat recovery combined with mineral carbon capture and utilization***

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 Proponent**
Contact person:	*Dr Henry Roman*	*Dr Dhiraj Rama*
Position:	*NDE-RSA*	*Executive Director*
Organization:	*Department of Science and Technology*	*Association of Cementitious Material Producers (ACMP)*
Phone:	*+27(0)12 843 6434*	*+27(0)823737706*
Fax:		
Email:	*Nde-rsa@dst.gov.za*	*dhirajr.acmp@mwebbiz.co.za*
Postal address:	*Private Bag X894* *Pretoria* *0001*	*P. O Box 168* *Halfway House* *1685*

Geographical focus:

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

☐ *Community-based*
☐ *Sub-national*
☒ *National*
☐ *Multi-country*

{If the request is related to the sub-national or multi-country level, please indicate here the areas concerned (provinces, states, countries, regions, etc.)}

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:

{Please indicate here the main sectorsrelated to the request. e.g. energy, industry, transport, waste, agriculture/fisheries, forestry, water, ecosystem/biodiversity, coastal zones, health, education, infrastructure/human settlement, tourism, businesses, early warning/disaster reduction, institutional design and mandates, cross-sectorial}

Cement Industry

Problem statement *(up to one page):*

{Please describe here the difficulties and specific gaps of the country in relation to climate change, for which the country is seeking support from the CTCN. Please only provide information directly relevant to this request, and that justifies the need for CTCN technical assistance.}

The South African government has indicated the importance of and need to grow the country's green economy[1], and has committed to reducing carbon emissions produced in the country whilst indicating the increased expense on infrastructure to be spent on housing, schools, economic zone development, and bulk service delivery infrastructure; all of which requires cement. The Association of Cementitious Materials Producers (ACMP), place high value on development that is sustainable and their members recognise the threat that climate change poses to development.

Currently, GHG sectoral target for the cement industry is a reduction of 34 % by 2020 below the 1990 level. In addition the RSA INDC mitigation target is to reduce by 42% below business as usual the GHG emissions growth trajectory by 2025[2]. To meet these targets, ACMP have to implement the most appropriate energy conservation technologies through its membership and further adopt innovative technologies such as the use of alternate resources as well as Carbon Capture and Storage (CCS).

IPCC AR5 reports that, in addition to existing technologies, new innovative ones are needed to attain the 2 degree Celsius target, such as CO_2 sequestration using CCS technology. This technology, however, requires a vast amount of R&D and investment costs as well as understanding from local stakeholders. Therefore, in order to fulfill the immediate mandatory target on the cement industry, the industry needs to adopt a safe carbon capture technology with a low marginal GHG abatement cost.

After reviewing technical literature on potential technologies, ACMP recognized that a mineral carbon capture and utilization (MCC&U) technology is a potentially safe CO_2 sequestration method. Dr. Iizuka of Tohoku University, Japan, has published several research papers[3-6] on this technology where CO_2 is chemically sequestered using industrial waste concretes and the mineral carbonates generated from the process can be commercialized for environmental products. This technology has already been applied by a concrete products manufacturer in Japan.

In order to challenge safe and immediate large-quantity of CO_2 reduction measures for the cement industry, ACMP learnt that the hybrid low carbon technology of Waste Heat Recovery (WHR) combined with MCC&U could be one of the most promising options for the cement industry. The technology is in line with the current mitigation potential analysis report published by the Department of Environmental Affairs, South Africa.

Since this technology is expected to have little technical and economic barriers, RSA would like to conduct a feasibility study to assess whether this technology can be an effective GHG emissions reduction measure in the country. Furthermore, if several by-products generated through the carbonation process can be sold in the RSA market, this technology can become unique from a view of sustainability to reduce net operation cost as well as a view of resources efficiency. Furthermore, it is expected that a large part of GHG emitted from other sectors will be captured by the MCC&U

technology in the future and this will result in an additional GHG emissions reduction at a country level. Since a detailed analysis on the cost-effectiveness is required to obtain funding for roll-out across the cement industry.

However, to assess cost effectiveness, there is a need for a technical expert in MCC&U and currently there is no such expert in RSA. As chemical compositions of carbonates would differ from compositions of exhaust gas from WHR and recycled resources, site visits and sample analyses are required to examine the potential of producing marketable by-products at the plants in RSA. Therefore, a technical assistance (T/A) to conduct the feasibility study on the technology is requested to adapt the Japanese case study to RSA.

The project entails carbon capture and utilization technology using mineral carbonation reaction (MCC&U). Basically concrete sludge and concrete wastes, etc. and the exhaust gas from WHR are fed into the MCC reactor to generate useful carbonates as a result of the chemical reaction.

It is important to compare the marginal abatement costs of other possible clean energy technologies to the proposed MCC&U technology. The ACMP seeks technical assistance to assess the cost efficiency for WHR to compare the marginal abatement costs of other possible clean energy technologies.

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

{Please describe here past and on-going processes, projects and initiatives implemented in the country to tackle the difficulties and gaps explained above. Explain why CTCN technical assistance is needed to complement these efforts, and how the assistance can link or build on this previous work.}

ACMP investigated the GHG emissions reduction potential in the cement industry in RSA through a feasibility study on low carbon technology diffusion (e.g. waste heat recovery) supported by the Ministry of Economy, Trade and Industry (METI) of Japan[7] in 2012.

ACMP has already investigated the investment and operation costs of existing technologies and the GHG emissions reduction potential in the cement industry in RSA and also identified barriers for implementation of each technology through the feasibility study on clean energy technology diffusion supported by METI of Japan in 2012.

The 2012 study helped the association to estimate the GHG reduction potentials of WHR in RSA. However, ACMP needs further assistance in conducting GHG emission reduction potential using a hybrid system of WHR and MCC&U, as there is no accumulation of experience in this field. In order to effectively achieve our sectoral reduction target, it is important to compare the hybrid technology option in terms of the marginal abatement costs to other possible clean energy technologies.

Assistance requested *(up to one page):*

{Please describe here the scope and nature of the technical assistance requested from the CTCN and how this could help address the problem stated above and add value vis-à-vis the past and on-going efforts. Please note that the CTCN facilitates technical assistance and is not a project financing mechanism.}

The technical assistance will be to assess the cost efficiency for the hybrid system of WHR and MCC&U including a net marginal abatement cost calculated by subtracting the market price of the potential by-products in RSA from the MCC operating cost at the specific test plant. It is also

expected that CO2 emitted from other sectors can be captured by using this technology, and it will lead to a substantial GHG reduction in the country.

Goal 1 : CTCN experts will analyze chemical components of exhaust gas from an existing cement kiln and concrete wastes such as concrete sludge to make a recommendation of appropriate reaction conditions and to estimate its operational cost. Furthermore, GHG reduction will be calculated by estimating the recycled volume of the wastes.

Goal 2 : CTCN experts will provide technical assistance on the reaction condition of the by-product which meets market demands in RSA and estimate the marginal abatement cost by subtracting the market price of by-product in RSA from the MCC&U operating cost.

Goal 3 : CTCN experts will develop a business plan including policy recommendations (e.g. collection guidance of alkali-rich wastes from site) by integrating the result of the feasibility study on MCC&U with the 2012 project outcomes (WHR).

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

{Please outline here the medium and long-term impacts that will result from the CTCN technical assistance, including how the assistance will contribute to mitigate and/or adapt to climate change.}

Reduction potential of this hybrid GHG reduction technology in RSA could be significant in terms of CO2 emissions from the cement industry and if the cement industry including ready mixed concretes, concrete products and aggregates manufacturers will establish a carbon capture network with other sectors which generate alkali-rich industrial wastes from coal-fired power, paper and steel, a massive reduction in GHG is expected.

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

{Please describe here how the results of the CTCN technical assistance will be concretely used by the applicant and national stakeholders, to pursue their efforts of resolving the problems stated above after the completion of the CTCN intervention (list specific follow-up actions that will be undertaken).}

Post technical assistance there is a need to undertake a bench-scale project investigating the hybrid technology. This is to be followed by a large-scale demonstration. In order to undertake these two aspects a single proposal will be submitted to either the Green Climate Fund or the GEF fund. RSA has accredited evaluation bodies for both these funds. This proposal will be to implement the roll-out plan provided the demonstration shows the potential for mitigation tied to economic development through the sale of value-add products emanating from the process.

Key stakeholders:

{Please list in the table below the main stakeholders who will be involved in the implementation of the requested CTCN technical assistance, and what their role will be in supporting the assistance (for example, government agencies and ministries, academic institutions and universities, private sector, community organizations, civil society, etc.). Please indicate what organization(s) will be the main/lead counterpart(s) of CTCN experts at national level, in addition to the NDE.}

Stakeholder	Role to support the implementation of the assistance
ACMP	*Providing information on collection of local waste concretes and supporting surveys regarding market research of the by-products.*
Department of Environmental Affairs (Chemical and Waste Branch / Climate Change Branch)	*Providing legal and policy direction on collections of waste concretes, GHG emissions reduction and soil decontamination in RSA.*
Department of Energy through its entity SANEDI	*Providing direction with regards to CCS.*
A local cement plant	*Providing information on site layout, cement production and geologic circumstances to install the pilot equipment*
Local concrete products and ready mixed concrete manufacturers	*Providing information on waste concretes such as concrete sludge from their activities and feeding them continuously to the carbonation reactor*

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

{Please demonstrate here that the technical assistance requested is consistent with documented national priorities (examples of relevant national priorities include: national development plans, poverty reduction plans, technology needs assessments (TNAs), LEDS, NAMAs, TAPs, NAPs, sectorial strategies and plans, etc.). For each document mentioned, please indicate where the priorities specifically relevant to this request can be found (chapter, page number, etc.).}

The South African government has indicated the importance of and need to grow the country's green economy, and has committed to reducing carbon emissions produced in the country. The proposed technology is in line with the current mitigation potential analysis report published by the Department of Environmental Affairs.

Furthermore, this proposed project gives effect to South Africa's Climate Change Technology Needs Asssessment[8] dated 2007.

In the case of the National development Plan (NDP)[9], the project supports many of the objectives inlcuded. Some of these include:

- Waste reutilisation
- Recycling infrastructure
- Emergence of small, medium and micro enterprises for the relevent waste management steam contributing to reducing unemployment and income inequality
- Reduction in landfill space demand, etc.

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

{Please explain here how the request was developed at the national level and the process used by the

NDE to approve the request before submitting it (who initiated the process, who were the stakeholders involved and what were their roles, and describe any consultations or other meetings that took place to develop and select this request, etc.)}

The NDE-RSA held a nationwide roadshow to inform the South African stakeholders of the CTCN and the technical facility being offered. Following the roadshow country requests were submitted by stakeholders of which this is one of those that have passed through the evaluation process of the NDE-RSA.

The request was first processed using the Evaluation Matrix developed for the NDE-RSA by the CSIR. Subsequently the request was evaluated by the National Advisory Committee (composed of National Government Departments with commitments to Climate Change) to the NDE-RSA. Finally the request was presented for noting to the South African Intergovernmental Committee on Climate Change.

A further consultation was held with the ACMP to refine the country request and re-submitted to the NDE-RSA.

Expected timeframe:

{Please propose here a duration period for the assistance requested.}

12 months.

Background documents:

{Please list here relevant documents that will help the CTCN understand the context of the request and national priorities. For each document, provide weblinks if available, to attach to the submission form while submitting the request. Please note that all documents listed/provided should be mentioned in this request in the relevant question(s), and that their linkages with the request should be clearly indicated.}

1. The New Growth Path (http://www.economic.gov.za/communications/51-publications/151-the-new-growth-path-framework)
2. South Africa's Intended Nationally Determined Contributions (https://www.environment.gov.za/sites/default/files/docs/sanational_determinedcontribution.pdf)
3. Y. Katsuyama& A. Iizuka, et al. "Development of a Process for Producing High-Purity Calcium Carbonate CaCO3) from Waste Cement Using Pressurized CO2" Environmental Progress Vol.24, No.2, 162 (July 2005)
4. A. Iizuka et al. "Bench-Scale Operation of Concrete Sludge Recycling Plant Utilizing Carbon Dioxide," Ind. Eng. Chem. Res., 51, 6099–6104 (2012)
5. A. Iizuka et al. Cost Evaluation for a Carbon Dioxide Sequestration Process by Aqueous Mineral Carbonation of Waste Concrete", J. of Chemical Engineering of Japan, Vol. 46, No. 4, pp. 326–334 (2013)
6. Y. Abea& A. Iizuka et al. "Dissolution rates of alkaline rocks by carbonic acid: Influence of solid/liquid ratio, temperature, and CO2 pressure" chemical engineering research and design 9 1 933–941 (2013)
7. Feasibility Study Report on Bilateral Offset Credit Mechanism Project for Clear Energy Technology Diffusion in Cement Sector in the Republic of South Africa (http://www.meti.go.jp/meti_lib/report/2013fy/E003499.pdf)
8. South Africa's Climate Change Technology Needs Assessment (http://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/TNR_CRE/e9067c6e3b97459989b2196f12155ad5/9ecba2a40fe04948859b9930a40be9f7.pdf)
9. National Development Plan: Vision for 2030 (http://www.gov.za/documents/national-development-plan-vision-2030)

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: Henry Roman (PhD)

Date: 17 December 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