

Guidelines:

- This Request Submission Form should be completed by the organisation requesting technical assistance from the Climate Technology Centre & Network (CTCN) in collaboration with the National Designated Entity (NDE) of the country in question
- The Form must be signed by the NDE. Please see updated contact list of NDEs here: <http://unfccc.int/ttclear/support/national-designated-entity.html>
- The Form can be submitted as a Word file containing a digital signature or as a signed and scanned PDF file in combination with an un-signed Word file
- For requests submitted by multiple countries, all the NDEs of the respective countries shall sign identical Forms before official submission to the CTCN
- NDEs have the opportunity to submit CTCN requests in collaboration with National Designated Authorities (NDAs) for the Green Climate Fund (GCF) if targeting the GCF Readiness Programme.

Requesting country or countries:	Ethiopia
Request title:	Development of a Deep Decarbonization Roadmap in the Cement Sector through Advanced Technology Upgradation and Enhanced Standards.
NDE	Ethiopia-Environmental protection Authority, Ms. Yamelakesira Tamene Bekele, Director, Technology Transfer and Technical Support
Request Applicant:	Mineral Industry Development Institute , Ministry of Mines, Ethiopia.

Climate objective:

- Adaptation to climate change
- Mitigation of climate change
- Combination of adaptation and mitigation of climate change

Geographical scope:

- Community level
- Sub-national
- National
- Multi-country

If the request is at a sub-national or multi-country level, please describe specific geographical areas (provinces, states, countries, regions, etc.).

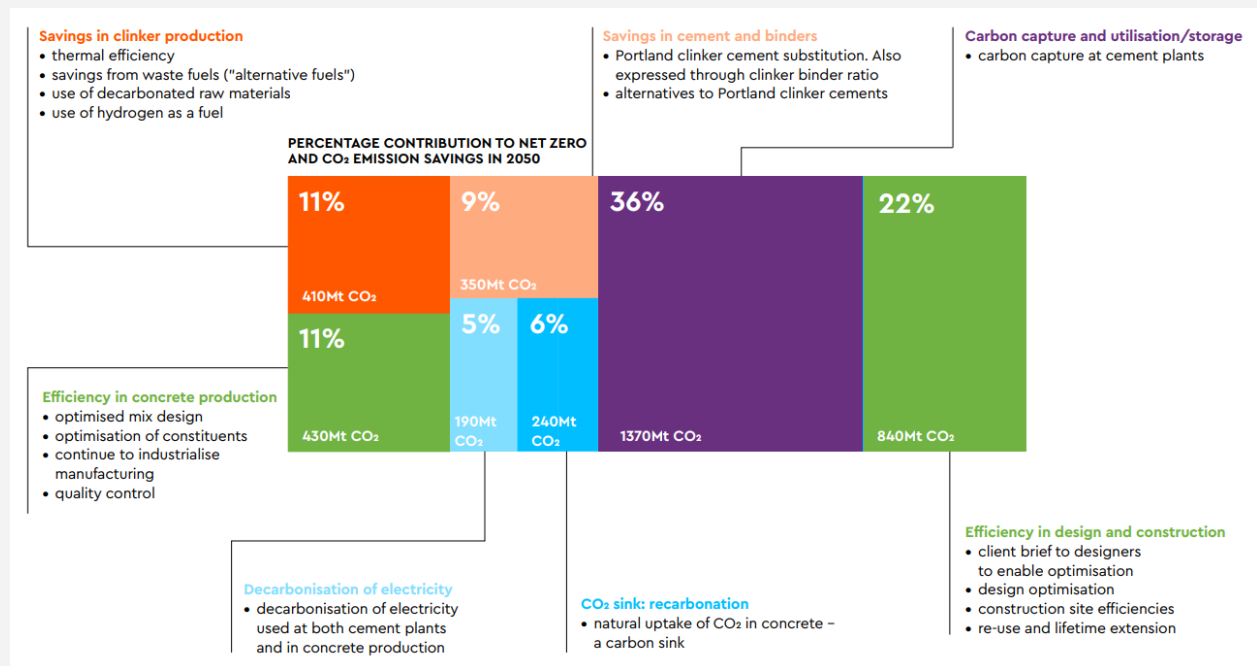
Problem statement related to climate change (up to one page):

Cement is the most widely consumed building product in the world. Due to the huge volume produced, cement production is responsible for around 7 to 8% of man-made CO₂ emissions. In 2020, the level of cement consumption worldwide reached 4.2 billion tons with a constant growth trajectory for the next decades due to rapid urbanization and population increase. Carbon emissions in cement production are 0.81 kg CO₂/kg cement. It is approximately equivalent amount CO₂ emission per tons of clinker production according to IPCC.

The Paris Agreement is a legally binding international treaty on climate change which was adopted by 196 Parties at COP 21 in Paris on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

The Global Cement and Concrete Association (GCCA) representing 80% of the world cement capacity outside China, has decided to follow the 1.5 degrees Celsius objective. In order for the cement industry to achieve this objective GCCA has elaborated a global Roadmap that is to be adapted to each country individually, the “Net Zero Accelerator Roadmap”. The roadmap will follow and thus tackle all the levers identified by GCCA.

The graphic below, produced by the GCCA in the context of their Concrete Future Roadmap to 2050, illustrates the different decarbonization options for cement production in more details.



In line with the GCCA roadmap, the IEA emphasizes that reduction levers such as carbon capture and clinker content reduction in cement have been determined to provide the largest cumulative CO₂ emissions reductions.

Further among the principal CO₂ reduction levers for the cement industry developed by the International Energy Agency (IEA), reducing clinker in cement is by far the most effective. Moreover, of

the different potential alternatives to clinker, calcined clay is the most sustainable and promising. Limestone together with calcined clay is unique among supplementary cementitious material (SCMs), as they not only offer excellent properties when used in combination with cement, but conversely to other SCM's their availability is unlimited. Limestone calcined clay cements (LC3) are blended cements that combine clinker, calcined clay, limestone, and gypsum. They take advantage of the high reactivity of calcined clay and the synergistic reaction between limestone and clay, offering equivalent mechanical performance to Ordinary Portland Cement (CEM I/OPC), with the benefit of decreasing clinker factors to 50%. LC3, while retaining the mechanical behavior of OPC, also significantly improves some relevant properties such as resistance to chloride ingress and alkali silica reaction as compared to other cements. Furthermore, limestone and calcined clays are among the few raw materials available in the quantities required to constitute a technology suitable for coping with the projected worldwide demand for cement. In addition to these technical advantages of LC3, this technology also allows significant CO₂ emission savings. A detailed assessment of the environmental benefits of the LC3-50 formulation, as compared to OPC, shows that this technology can offer up to 40% CO₂ savings beyond that of the technology used to produce calcined clay and clinker. Such technology has also the advantage of using locally available raw material in countries relying so far on imported clinker or cement, therefore further reducing the emissions related to seaborne freight and saving hard currencies for the local central banks.

Other important immediately available lever is the use of Alternative Fuels instead of nonrenewable coal and pet coke. Some cement plants in Europe generates up to 90% of their energy needs from Alternative Fuels whether it is municipal waste, agricultural waste, industrial waste, etc. Such waste has generally much less CO₂ emissions than standard fuels. In case of biomass the IPCC considers the emissions to be "0". Using locally available waste instead of imported nonrenewable fuel will also reduce the emissions from freight and save hard currencies for the local central banks.

For sustainable development program many countries using alternative raw material and fuel for partial replacement to decrease the greenhouse gas emissions, Minimize the harmful environmental impacts and CO₂ emission, Reduce the consumption of natural resources use as source of alternative energy for cement production. Usage of alternative fuel (AF) and raw material that partially substitute becomes more popular to the cement manufacturer due to increasing fossil fuel prices ,limited fossil fuel resources and reduce impact of climate change

Cement industries rotary kiln is able to burn a wide range of materials due to the long residence time at high temperatures 1450°C.

About 50% of emissions are process emissions that happen during clinker production, 40% come from the burning of the fuels to heat the cement kiln, and about 10% come from electricity use and transportation. The reduction of CO₂ emissions from cement production is therefore an important and urgent task for the cement sector. The four main levers for CO₂ reductions are: Energy efficiency, via modern dry-process technology, the use of Alternative fuels (incl. biomass) to replace coal and peat coke in the cement kiln heating process, the substitution of clinker with other mineral components in cement; and carbon capture and storage.

Finally, depending on the age and technology of the production units, energy efficiency levers like for example waste heat recovery, clinker cooler, co-generation shall be assessed.

In order to guide the decarbonization of the cement and concrete industry at a country level, a national decarbonization roadmap is required that identifies and prioritizes effective technology and policy levers. Furthermore, the introduction or updating of cement standards is to be conducted, in countries were need be. The collaboration of the public and private sector in the development of such roadmaps will be key to its success.

Past and on-going efforts to address the problem (up to half a page):

The Cement Industry Technology Roadmap produced in April 2018 by the IEA and Cement Sustainability Initiative (CSI) built on the December 2015 Paris Agreement's objective to limit the rise in global temperatures this century to less than 2°C above preindustrial levels. Realizing this 2-degree Celsius Scenario (2DS) by 2050 implies a 24% reduction in current levels of global direct CO₂ emissions from cement manufacture, despite a projected increase in global cement production. An updated Roadmap has since been developed by the Global Cement and Concrete Association (GCCA), aligning to the 1.5-degree Celsius target. GCCA has been founded in 2018 as a CEO-led industry initiative that drives the shift to a net-zero cement and concrete industry with strong engagement of private and public sector entities. GCCA has already been successful in supporting the development of net-zero roadmaps at corporate and national levels, such as in [Countries] and for [companies].

Actions to decarbonize the cement and concrete industry are taken at multiple levels, including through technology and policy levers. The last years have seen a diversification of technology, process and material innovation to reduce GHG emissions in the cement industry, reaching from energy efficiency optimization, material substitution, renewable energies utilization and carbon capture. On a policy level, European countries have published an updated version of the cement standards EN-197-5 to allow for the production of a new generation of cement (LC3) with only 50% clinker content versus 65% of the former EN-197. A corresponding application in concrete (EN-206) will be published in March 2023. Though EN-197-5 is not the only cement standard (US standard is ASTM), most African countries will follow the EN-197-5.

Ethiopian endowed in clay potential to implement material substitution to clinker reduce carbon emission .Ethiopia also has huge biomass and urban waste potential to generate thermal energy for the cement industry.

Specific technology¹ barriers (up to one page):

On the path to decarbonizing cement and concrete at a national level, countries are confronted with challenges related to a lack of transparency on economically viable decarbonization options, of standards and incentives, and of governance. These challenges are further detailed below:

- **Decarbonization options:** Multiple decarbonization options are available with some being technically mature and others still in an R&D phase, and with a higher and lower CO₂ reduction potential. Countries require transparency on viable options for the national context as the choice strongly depends on production volumes, technology setup and raw material.
- **Standards and incentives:** Outdated or a lack of standards and policies for cement and concrete products, but also for energy performance of buildings lead to excess material usage, energy inefficiency and a lack of transparency.
- **Emissions Monitoring and Reduction:** Cement plants, like other energy intensive operations,

¹ *"any equipment, techniques, practical knowledge and skills needed for reducing greenhouse gas emissions and adapting to climate change" (Special Report on Technology Transfer, IPCC, 2000)*

produce air emissions (other than CO₂) that must be controlled and mitigated.

- **Automated industry:** Over a period of time, the development of automated machine tools and material handling devices has possibility to use energy efficiently to reduce carbon emission.
- **Homogenous product:** Since there are only a few fundamental varieties of cement (Ordinary Portland, White cement, low heat of hydration, sulfate resistant Pozzolana, blast furnace) in terms of production process, switching costs for consumers are low in the absence of any significant product differentiation.
- **Absence of real substitutes:** Unlike other products, cement practically has no real substitutes. Other building materials such as steel, glass, stone and fabricated building products can function as partial substitutes for cement. However, specific applications could mandate the use of certain building materials depending on the structural characteristics and government regulations.
- **Governance:** A clear and actionable decarbonization roadmap, as well as monitoring, verification, and enforcement (MV&E) with regards to transparency on CO₂ emissions and reduction targets is fundamental for the path to decarbonize cement and concrete.

Sectors:

Please indicate the main sectors related to the request:

- | | | | |
|---|---|--|--|
| <input type="checkbox"/> Coastal zones | <input type="checkbox"/> Early Warning and Environmental Assessment | <input type="checkbox"/> Human Health | <input type="checkbox"/> Infrastructure and Urban planning |
| <input type="checkbox"/> Marine and Fisheries | <input type="checkbox"/> Water | <input type="checkbox"/> Agriculture | <input checked="" type="checkbox"/> Carbon fixation |
| <input checked="" type="checkbox"/> Energy Efficiency | <input type="checkbox"/> Forestry | <input checked="" type="checkbox"/> Industry | <input checked="" type="checkbox"/> Renewable energy |
| <input type="checkbox"/> Transport | <input checked="" type="checkbox"/> Waste management | | |

Please add other relevant sectors:

Cross-sectoral enablers and approaches:

Please indicate the main cross-sectoral enablers and approaches

- | | | | |
|---|---|---|--|
| <input checked="" type="checkbox"/> Communication and awareness | <input checked="" type="checkbox"/> Economics and financial decision-making | <input checked="" type="checkbox"/> Governance and planning | <input type="checkbox"/> Community based |
| <input type="checkbox"/> Disaster risk reduction | <input type="checkbox"/> Ecosystems and biodiversity | <input type="checkbox"/> Gender | |

Technical assistance requested (up to one page):

The objective of this technical assistance is to develop a national deep decarbonization roadmap for the

cement sector which includes assessing evaluating viable technology options and scenarios, and identifying requirements for technology adoption, including standards and policy interventions, MV&E and private sector engagement. The expected outcomes of this technical assistance are on a short- and medium-term to establish the market requirements and incentives for low-carbon cement and concrete technology, and on a long-term to significantly reduce CO₂ emissions in this sector.

This technical assistance will be given by the CTCN. Outputs and activities will be shaped to the country-specific requirements.

Proposed Activities

Activity 1: Analysis of the current (2023) national cement and concrete industry

- Determination of current CO₂ emissions from the cement industry through the main KPI like SPEC, STEC as well as all others KPI's needed.
- Analysis of cement market environment (stakeholders, regulations, laws, standards in place, future demand, etc.), including gender analysis

Activity 2: Evaluation of appropriate low-carbon cement technology options and decarbonization levers

- Identification of appropriate technology options and decarbonization levers along the value chain (based on GCCA low-carbon cement technology options and pathways)
- Workshop series with industry representatives, authorities and other stakeholders to prioritize technology options and decarbonization levers.
- Evaluation of technology and economics viability of prioritized technology options in the national context, including potential co-benefits for gender and youth

Activity 3: Development of a national deep decarbonization cement and concrete roadmap 2030 and 2050

- Roadmap development workshop with industry representatives, authorities and other stakeholders to define a set of objectives 2030 and 2050 for each identified decarbonization lever
- Policy workshop to discuss policy asks with authorities to find common ground and understanding to enable the industry to reach targets
- Development of a national deep decarbonization cement and concrete roadmap 2030 and 2050, including CO₂ reduction targets, activities (technologies, policy asks, etc.), co-benefits (gender and youth), timelines, and budget

Activity 4: Operationalization of roadmap

- Development of a MV&E framework
- Development of GCF concept note(s) for the assessment and implementation of specific technologies of the roadmap
- Provision of capacity building and training

Activity 5: Introduction or updating of cement standards

- Preparation of the draft standard to align to norm EN-197-5
- Public consultation process and workshop to endorse draft standard
- Preparation of standard adoption process

Along the proposed activities, stakeholders from the public and private sector will be engaged regularly in form of a roadmap working group. A steering committee will be created to monitor the roadmap development at international level.

Anticipated products to be delivered

1. National Cement and Concrete Industry Analysis
2. Report on technology options and decarbonization levers
3. National deep decarbonization cement and concrete roadmap
4. MV&E Framework
5. GCF concept note(s)
6. Capacity building report and material
7. Draft cement standard
8. Public consultation report and workshop materials

Expected timeframe:

12 months

Anticipated gender and other co-benefits from the technical assistance:

Considerations for gender, youth and vulnerable groups will be integrated transversally in the technical assistance. The impact and opportunities for gender and youth will be evaluated under the market analysis (Output 2), technology options will consider potential co-benefits (Output 3), and the roadmap will include a consideration for gender and youth (Output 3). Throughout the technical assistance, a fair representation of women will be expected.

Through this technical assistance, improved employment opportunities and other benefits for women and youth should result in the cement and concrete industry.

Key stakeholders:

Please list the stakeholders who will be involved in the implementation of the requested CTCN technical assistance and describe their role during the implementation (for example, government agencies and ministries, academic institutions and universities, private sector, community organizations, civil society, etc.)

Stakeholders	Role to support the implementation of the technical assistance
National Designated Entity	Environmental protection Authority
Request Applicant	Mineral Industry Development Institute , Ministry of Mines, Ethiopia.
Ministry of Mines	Regulator of cement industries following the issuance of proclamation no 1263/2021 of government of Ethiopia.
Ministry of Finance	Sole authority for financial issues
Environmental Protection Authority (EPA)	NDE

Energy Authority	MRV Calculation
Cement producing industry	Host industries for the decarbonisation project
National cement association	Technical support in bridging the link between government and the industries
Global Cement and Concrete Association (GCCA)	Experience sharing and Bench marking

Alignment with national priorities (up to 2000 characters including spaces):

Please describe how the technical assistance is consistent with national climate priorities such as: Nationally Determined Contribution, national development plans, poverty reduction plans, technology needs assessments, Low Emission Development Strategies, Nationally Appropriate Mitigation Actions, Technology Action Plans, National Adaptation Plans, sectorial strategies and plans, etc.

Reference document (please include date of document)	Extract (please include chapter, page number, etc.).
Nationally Determined Contribution (NDC)	With the inclusion of adaptation in the NDC and with the adoption of the NAP, climate change adaptation is likely to be elevated as a priority for climate action in Ethiopia, which is consistent with the country's level of vulnerability and the imperative as an LDC to safeguard its development from climatic shocks and stressors in key sectors. Page Vi (CRGE)
Technology Needs Assessment	Technological ease, trade-offs, risks, opportunity to leapfrog. Page 60,(NDC)
National Adaptation Plans	Ethiopia's major climate change adaptation commitments are in the sectors of agriculture, and land use and forestry, with additional adaptation contributions in water, health, energy, transport and urban settlements. Agriculture, Forestry and Other Land Use (AFOLU) adaptation actions represent the bulk of the updated NDC's commitments to strengthening Ethiopia's resilience to climate change. Page Xi
Nationally Appropriate Mitigation Actions	The GEM was originally applied to support initiatives led by Ethiopia's Environment Forest and Climate Change Commission (EFCCC) and the Planning and Development Commission (PDC), Ethiopia's Low Emission Development Strategy 2050 (LEDS) and the 10 Year Development Plan (2021-2030), respectively. Page Vi,(NDC)
Add others here as relevant	

Development of the request (up to 2000 characters including spaces):

This multi-country request results from an expression of interest in such a technical assistance at Africa Climate Week 2022 in Libreville, Gabon. The request was developed in coordination with the National Designated Entities, respective Ministries of Environment and Industry and national cement associations and companies, with the support of CTCN and the Global Cement and Concrete Association (GCCA).

Background documents and other information relevant for the request:

- Please list all relevant documents that will help the CTCN analyse the context of the request and national priorities. Please note that all documents listed/provided should be mentioned in this request in the relevant section(s), and that their linkages with the request should be clearly indicated. For each document, please provide web-links (if available) or attach to the submission form. Please add any other relevant information as required.
- Please indicate if this request has been developed with the support of the CTCN Request Incubator.

OPTIONAL: Linkages to Green Climate Fund Readiness and Preparatory Support

The CTCN is collaborating with the GCF in order to facilitate access to environmentally sound technologies that address climate change and its effects, including through the provision of readiness and preparatory support delivered directly to countries through their GCF NDA. These actions are in line with the guidance of the GCF Board (Decision B.14/02) and the UNFCCC, particularly paragraphs 4 and 7 of 14/CP.22 that addresses Linkages between the Technology and the Financial Mechanisms².

The CTCN is therefore implementing some of its technical assistance using GCF readiness funds accessed via the country's NDA. Any application for GCF support, including the amount of support provided, is subject to the terms and conditions of the GCF and should be developed in conjunction with the NDA.

Please indicate whether this request has been identified as preliminarily eligible by the NDA to be considered for readiness support from the GCF.

Initial engagement: The GCF NDA of the requesting country has been engaged in the design of this request and the NDA will be involved in the further process leading to an official agreement for accessing GCF readiness support.

Advanced engagement (preferred): The GCF NDA of the requesting country has been directly involved in the design of this request and is a co-signer of this request, the signature indicating provisional agreement to use readiness national funds to support the implementation of the technical assistance.

NDA name:

Date:

Signature:

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 technical assistance provided by the CTCN. I understand that these processes will be explicitly identified

² Please see:

https://unfccc.int/files/meetings/marrakech_nov_2016/application/pdf/auv_cop22_i8b_tm_fm.pdf

in the CTCN Response Plan and that they will be used in the country to monitor the implementation of the technical assistance following standard CTCN procedures.
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:

Yamelakesira Tamene Bekele

Date:

04/09/2023

Signature:



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

The CTCN is available to answer all questions and provide guidance on the application process.