CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

CTCN Technical Assistance

Request Submission Form

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:	South Africa
Request title:	Capacity development for the deployment of demand response (DR) in South Africa to mitigate against carbon emissions and electricity supply shortages. As a demand side management (DSM) tool, DR has the potential to provide the flexibility required in the power system to allow for higher penetration of renewable energy technologies leading to the elimination or limiting the operation of carbon-intensive peaking power plants during periods of peak demand.
NDE	Department of Science and Innovation (DSI) Dr Henry Roman Director: Environmental Services and Technologies Henry.roman@dst.co.za 627 Meiring Naude Rd Brummeria Pretoria South Africa
Request Applicant:	Council for Scientific and Industrial Research (CSIR) Dr Peter Mukoma Principal Researcher: Energy Efficiency and Demand Response pmukoma@csir.co.za 627 Meiring Naude Rd Brummeria Pretoria South Africa

Climate objective:

☐ Adaptation to climate change

X☐ Mitigation of climate change

☐ Combination of adaptation and mitigation of climate change

Geographical scope:

☐ Community level

☐ Sub-national

X☐ 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):

This section should answer the question "what is the problem?" Please summarise the problem related to climate change and/or the negative impacts of climate change in the country that the request aims to address.

About 90% of electricity supplied in South Africa is produced from coal and carbon emissions from coal power plants account for around 80% of total emissions in the country. To mitigate against the effect of carbon emissions from power generation, the government has approved an Integrated Resource Plan (IRP) 2019, detailing the procurement of renewable energy sources up to 2030. According to this resource plan, renewable energy will make up about 37% of the power to be generated by 2030. Among the largest contributors will be wind and solar power. Due to the high dependency on weather conditions, electricity generation from these sources is variable and hard to predict. Consequently, major challenges for the electricity grid regarding system stability and security of supply will arise.

To effectively integrate renewable energy resources into the grid, Eskom and the municipalities will need to address the potential load shape challenges driven by variability. At the same time, they need to confront ongoing challenges; costly transmission and distribution (T&D) upgrades, the retirement of old power plants, and the need to design for resilience in the wake of climate change and natural disasters.

Demand Response is becoming a very important resource to meet energy demand and flexibility in power systems as the world moves fast with the integration of renewable energy generation and other technologies such as electric vehicles (EV) and energy storage. South Africa is facing serious electricity supply capacity challenges and Eskom has resorted to load shedding to reduce peak loads resulting in disruptions to businesses and normal lives of everyone in South Africa. Demand Response has the potential to reduce peak demand and provide the required flexibility to sustainably allow the integration of a high proportion of renewable energy in the power system. The current demand response programs run by Eskom need to be expanded beyond energy intensive users and include residential and small to medium size industrial and commercial customers.

Although Eskom has established DR programs to assist it with managing peak demand, the uptake of these programs is very low especially amongst the small to medium size industrial and commercial

customers. It is non-existent amongst residential customers. Due to advances in technology such as smart meters, electric vehicles, energy storage and the integration of renewable energy in the power generation mix, the need for a wider deployment of demand response is becoming necessary. The CSIR would like to lead the country in mainstreaming the uptake of demand response by all electricity consumers across various end-use sectors. Capacity building will be required to upskill and acquire the necessary experience and tools to conduct the necessary DR potential assessments and deployment. The simulation software required will be for DR forecasting, load response predicting and load analysis.

The following are the anticipated benefits for the country as the result of wider DR deployment:

- Climate change: Demand response will facilitate higher penetration of renewable energy in the power system as it will provide the necessary demand flexibility required to balance electricity supply and demand. During peak demand periods, demand response will enable load reduction and load shifting thereby minimizing the need for Eskom to operate carbon intensive peaking power plants.
- Cost of electricity: Demand response has the potential to reduce the cost of electricity that consumers pay as they will be able to reduce their demand during peak periods and mitigate against operating expensive peaking plants that contribute towards the high cost of electricity during peak demand periods.

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

This section should answer the question "what has been done or is currently being done to address the problem?" Please describe past and on-going processes, projects or initiatives implemented in the country or region to tackle the climate problem as described above.

To mitigate against carbon emissions associated with energy consumption, energy efficiency measures are introduced and implemented to reduce energy consumption during peak and off-peak periods. This happens without affecting the quality of service provided. Energy efficiency programs are designed to replace technologically more advanced equipment to produce the same (or higher) level of end-user services (e.g., lighting, heating, colling, drive power, etc) with less electricity. On the other hand, demand response entail load management via direct load control at peak periods, interruptible load tariffs and other incentives. Energy efficiency and demand response are both Demand Side Management (DSM) measures that have been tried and tested to work in many electricity markets, especially in the US. Energy efficiency requires investment in advanced end-use technologies, and this is the biggest challenge in South Africa. Despite numerous efforts by the Department of Mineral Resources and Energy (DMRE) providing incentives for energy efficiency implementation in programs such as the 12L Energy Efficiency tax incentive, the development of the National Energy Efficiency Strategy (NEES) and other regulations, energy efficiency has not produced the desired results.

In South Africa, demand response is used by Eskom to manage peak demand and so far, participation has been focused on large energy consumers with significant loads. Demand response has not enjoyed the same level of publicity and support from the DMRE. There is significant potential in load reduction or shifting to provide stability to the grid and this potential need to be realized. Recognizing that no

single energy source or demand side management program can meet our nation's growing energy needs, energy efficiency and demand response technologies can give the nation time to rebuild and modernize the power system infrastructure.

Specific technology[1] barriers (up to one page):

This section should answer the questions "what are the technology barriers that hinder national efforts described above" and "how will the CTCN technical assistance complement these efforts?" Building upon the problem statement and taking into consideration the existing efforts described above, please describe the specific technology barriers encountered by the requesting applicant to identify, assess or deploy climate technology(ies) in an effort to address the problem statement. The described barriers should be within the scope of the requested CTCN technical assistance (described in the section below).

Since the electricity sector is highly regulated, the barriers to the wider adoption and deployment of demand response is not only technological but regulatory as well.

The first thing required is to make sure that electricity consumers understand what DR is, how they can participate and benefit from its deployment. A lack of understanding of DR, and the benefits that it may bring, is a considerable barrier. In particular, a lack of understanding of DR restricts interest in the development of appropriate tools, such as a systematic cost benefit analysis models for development of business cases. Improve the understanding of the value of DR amongst decision-makers and general education on DR and its benefits amongst customers will go a long way in unlocking its value.

For the implementation of DR programs, it is essential to have an effective communication infrastructure that provides connectivity to different energy consuming systems, devices and applications. The general communication requirement is a two-way flow of information between the entities participating in the DR program. However, from the network point of view, there are other important operational requirements for the effective and reliable communications between various elements including quality of service, interoperability, scalability, flexibility, security and compatibility with IEC 61850.

The ability of IoT components to communicate with each other, e.g., to send control signals or to submit bids and offers is a huge barrier to the development of DR. The centrality of technology to DR and the whole Smart Grid necessitates consideration of ICT aspects. In the context of DR and the Smart Grid the internet of things (IoT) may be used interchangeable with ICT. ICT underpins local metering (to determine DR flexibility and delivery), transactional communications (between DR provider and purchaser) and on-premises automation (to enact DR). ICT that can enable DR has been readily available for some time, albeit DR services have been the preserve of large industrial operations.

Lack of standardisation is a barrier. Without the necessary standardisation flexibility cannot be identified and exploited. Lack of standardisation on the interoperability of various components may also be a concern if it is thought that various devices may interfere with each other. Further, lack of standardisation may prove a barrier if there is concern on the part of investors that they may become "locked-in" to a particular supplier. This may result in constraints on future decisions which lead to sub-optimal outcomes.

[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)*

There is a lack of adequate metering infrastructure at most consumer premise. Without accurate metering, it is not possible to measure and verify the load that is being shifted or reduced.

Sectors:

Please indicate the main sectors related to the request:

☐ Coastal zones	☐ Early Warning and Environmental Assessment	☐ Human Health	☐ Infrastructure and Urban planning
☐ Marine and Fisheries	☐ Water	☐ Agriculture	☐ Carbon fixation
X☐ Energy Efficiency	☐ Forestry	X☐ Industry	X☐ Renewable energy
☐ Transport	☐ Waste management		

Please add other relevant sectors:

Cross-sectoral enablers and approaches:

Please indicate the main cross-sectoral enablers and approaches

X☐ Communication and awareness	X☐ Economics and financial decision-making	X☐ Governance and planning	☐ Community based
☐ Disaster risk reduction	☐ Ecosystems and biodiversity	☐ Gender	

Technical assistance requested (up to one page):

Founded on the problem statement, past/on-going efforts and technology barriers, please describe the requested technical assistance. The technical assistance should clearly contribute to mitigation or adaptation to climate change as described in the problem statement and contribute to overcome the specific technology barriers.

- **Overall objective**

South Africa is currently facing severe electricity supply challenges resulting in frequent power cuts. One of the solutions is to increase the amount of low carbon renewable energy into the grid. Due to the intermittent nature of these resources, the power system is likely to be unbalanced and would require demand flexibility. DR has proved to provide the required flexibility and the CSIR is considering launching research and development in DR with the main objective of assessing the DR potential of the end-use sectors in South Africa. Should the potential be substantial, the goal will be to engage the DMRE and National Energy Regulator (NERSA) and advocate for the creation of a broader DR program in order to assist the power system of the country and reduce its carbon intensity. A study is required

to assess the operational feasibility as well as the cost and benefits for the country before deciding upon actual implementation of DR as a firm resource within the South African's grid balancing system. Due to a lack of experience and skills required to carry out this study and eventually lead the creation of this broader DR market, the CSIR would like to request for technical assistance to start the program and build capacity from working with international technical experts.

- **Anticipated groups of activities to be performed by the technical assistance**

The following activities will make up the requested technical assistance:

a) **Qualification of addressable needs:** Conduct a high-level economic assessment of demand for DR services from a systems perspective. Clarify South African challenges to set a common relevant framework. Mapping with relevant standard DR programs.

b) **Demand Response potential assessment across South Africa**: Sectorial analysis of South African electricity consumption structure and use international stanadards to estimate DR potential.

c) **Assessing potential value creation of DR**: Given the South African actual system needs and DR resouces potential, assess current value creation potential for the different stakeholders, with cross-value considerations and sensitivity analaysis. This will include understanding the benfits of DR for the integration of renewables.

d) **Technology requirements for actual implementation:** High level definition of the business processes, identification of functional requirements for a DR management system and technical requirements

e) **Regulatory framework for DR implementation:** Understand current regulatory framework governing DR services and the challenges arising from a broader deployment. Recommendations to resolve these regulatory challenges based on international best practice.

f) Capacity building and training of the research team

- **Anticipated products to be delivered by the technical assistance.**

The following deliverables are expected from the above activities:

a) For activities a), b) and c), appropriate models are expected to be developed with local input. The models must be developed in such a way that changes are allowed to accommodate new input such as changes in the price of electricity.

b) For activities d) and e), appropriate reports will be expected as deliverables.

c) For activity f), the CSIR team should be introduced to the appriopriate modelling software, trained to use the software. Trained in the methodollogies for DR assessment and value creation. Training materials and software should be provided.

Expected timeframe:

Please indicate the expected duration period for the requested technical assistance. Please note CTCN technical assistance is limited to a maximum duration of 12 months.

The following are the projected timelines for providing the requested technical assistance:

Activity	Duration (months)
a) **Qualification of addressable needs:**	2
b) **Demand Response potential assessment across South Africa**:	2
c) **Assessing potential value creation of DR**	2
d) **Technology requirements for actual implementation:**	1
e) **Regulatory framework for DR implementation**	1
f) Capacity building and training of the research team	1
Total	**9**

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

Please describe the activities with gender linkages as well as the anticipated gender and other co-benefits (e.g. biodiversity, economic, social, cultural, etc.) that are likely to be generated as a result of the technical assistance.

For more information you can find guidelines on the CTCN's website here: https://www.ctc-n.org/technologies/ctcn-gender-mainstreaming-tool-response-plan-development

Further reading on gender can be found on the CTCN website here: https://www.ctc-n.org/technology-sectors/gender.

The deployment of DR has the potential to reduce the frequency of load shedding. Load shedding affects smaller businesses more than bigger ones because they do not have the resources for standby power generation. Most smaller businesses like hair salons and food cooking businesses are run by women who get adversely affected during load shedding.

If designed properly, wider adaptation and implementation of DR in the South African market can have a positive impact on everyone. For example, the implementation of DR in the residential sector has the benefits of democratizing the energy sector as it has the potential of enabling individual households to offer power back to the grid through an aggregator and get compensated thereby lowering the energy costs. It also offers the potential for individual households with solar PV installation on their roof tops and standby generators to participate in the electricity market.

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 - Department of Science and Innovation (DSI)	Support the request and monitor its implementation
Request Applicant - Council for Scientific and Industrial	Energy Centre of the CSIR is focused on energy research and will be working with the technical expert to build the capacity of the CSIR research team to spearhead further development of the DR market

Research (CSIR)	in South Africa
Department of Mineral Resources and Energy (DMRE)	Government department responsible for energy policy setting and implementation
SANEDI	Government agency responsible for research in the energy sector
Eskom	Power utility who will benefit from power system balancing
NERSA	National Energy Regulator of South Africa – will have the responsibilities of improving the DR regulatory framework and create the necessary market conditions.
Municipalities	Responsible for electricity distribution and potential implementors of DR to manage the stability of their distribution networks

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)	Demand response is like energy efficiency and is directly required to reduce energy consumption and indirectly carbon emission
Integrated Resource Plan 2019	Set the targets for renewable energy in the power system
National Development Plan	Vision for transition to a low carbon economy
Nationally Appropriate Mitigation Actions (NAMA)	Just like energy efficiency, demand response as a demand side management measure, is a NAMA
The carbon tax and energy efficiency tax incentives	Instruments for paying for carbon reduction measures

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

Please describe 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 initiator of the process was the Council for Scientific and Industrial Research (CSIR). They responded to a call for proposals issued by the NDE-RSA. After consulting with the NDE-RSA regarding eligibility for consideration, was the final proposal submitted to the NDE-RSA.

Upon receipt of the proposal the NDE-RSA did an initial assessment to determine alignment with national priorities. This was followed by a meeting of the NDE-RSA Advisory Committee. The Advisory Committee consists of representatives from the following national Government Departments:

- Department of Forestry, Fisheries and Environment – Climate Change Mitigation; Climate Change Development and International Mechanisms

- Department of Water and Sanitation – Climate Change
- Department of Science and Innovation – Earth Systems Science; Multilateral Environmental Agreements

The role of the Advisory Committee is to review the applications and advise the NDE-RSA on whether they do indeed meet national imperatives or will add to the national efforts to respond to climate change.

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.

The following is a list of documents that will help the CTCN analyze the context of the request are:

1. IPP office. 2020. "Independent Power Producers Procurement Programme (IPPPP): An Overview, as at 31 March 2020." Centurion. https://www.ipp-projects.co.za/Publications.
2. NPC. 2011. National Development Plan 2030: Our Future - Make It Work. Pretoria: National Planning Commission, The Presidency, South Africa. https://www.brandsouthafrica.com/wpcontent/uploads/brandsa/2015/05/02_NDP_in_full.pdf.
3. 2016. "South Africa's Nationally Determined Contribution (NDC). 1 November." Tshwane. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/South%20Africa%20First/South%20Africa.pdf
4. 2019. National Climate Change Adaptation Strategy https://www.environment.gov.za/sites/default/files/docs/nationalclimatechange_adaptationstrategy_ue10november2019.pdf
5. Eskom Non-Dispatchable Demand Response. https://www.eskom.co.za/sites/idm/ManageYourConsumption/Pages/Nondispatchabledemandrespond.aspx
6. Integrated Resource Plan 2019. https://www.gov.za/sites/default/files/gcis_document/201910/42778gon1359.pdf
7. Package of measures to deal with climate change: The Carbon tax and energy efficiency tax incentive https://www.sanedi.org.za/img/wp-content/uploads/ee_tax_by_nt.pdf

- 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 Mechanisms[2].

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 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:	Henry James Roman
Date:	01/06/21
Signature:	Signed by:Henry James Roman Signed at:2021-06-01 21:10:45 +02:00 Reason:Witnessing Henry James Roman

[2] Please see:
https://unfccc.int/files/meetings/marrakech_nov_2016/application/pdf/auv_cop22_i8b_tm_fm.pdf

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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.