

<b>Country:</b>	Tanzania
<b>Request Identification Number:</b>	2015000076

<b>Title:</b>	Promoting the sustainable use of solar photovoltaic technology in Tanzania
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### Summary of the CTCN Technical Assistance

The main objective of this CTCN assistance is to enhance access to solar photovoltaic (PV) technology for off-grid and sub-urban electrification.

A low percentage of Tanzania's population has access to grid electricity, particularly in rural settings where the majority of the population resides. In rural Tanzania access to electricity is 6.6%, with 4.6% being provided by the grid and 2% by PV [Source: Baseline Survey Report for Energy Access and Use in Tanzania Mainland, 2011, Tanzania Rural Energy Agency]. The United Republic of Tanzania (URT) is unable to extend the grid to cover the entire country due to a diverse number of challenges. As a result URT encourages off-grid communities to access sustainable electricity using off-grid renewable energy technologies such as PV systems.

Tanzania has promoted use of PV since the early 2000's. The acceptance of the technology by rural and sub-urban off-grid communities has been high, as reflected in the trend of annual sales of PV components that grew from 100kW in the year 2005 to 4MW in the year 2014. Households are the main segment of the population that has adopted solar photovoltaic technology followed by institutions [Source: Sida/MEM Solar PV Project 2010 and TAREA Market Trend 2015].

The growth of the market has resulted in high inflow of PV products in Tanzania. However, loopholes in the standards framework have resulted in the sale of substandard products. The Tanzania Renewable Energy Association (TAREA) conducted a study in January 2015 on the quality of PV products in the Tanzanian market and found that most of the products are of sub-standard quality. Such products generally show characteristics of having paper cells, colour paint imitating the solar cells, and non water-proof housing. Most of the panels do not generate electricity indicated on the data plate and have prematurely short life spans. In September 2015 Tanzania Bureau of Standards announced that among the 17 shops that underwent market surveillance, all were found selling substandard solar products. Furthermore, solar installations that were visited were found to be of the poor workmanship resulting underperforming systems. Substandard products have negative impacts on the economy and on the health of the affected communities.

The request proposes to address these challenges through the development of recommendations for an accreditation program for VETA's consideration and training program for PV technicians/installers as well as retailers and regional energy officers to improve their ability to 1) recognize substandard PV products and 2) plan and install PV systems.

## 1. Overview of the CTCN technical assistance

### 1.1 Technology aspects

The CTCN assistance aims to support Tanzania in developing intervention strategies and facilitating their implementation and dissemination to increase access to high-quality PV technologies and installations. The government is requesting support as access to grid electricity is very low, and

increasing electrification through PV is a priority. However, in the past, most PV products in the country were found to be of sub-standard quality, and installations were deemed to be of poor workmanship.

## **1.2 Objectives (outcomes)**

TAREA trainers have validated a solar PV installation training and recommendations for an accreditation program for VETA's consideration through an initial Training Workshop and their capacity to deliver similar trainings in the future has been enhanced. PV technology technicians/installers have been trained to assess the quality of PV cells and modules, identify inferior goods entering the market, install the technology effectively, and inform and consult end-users accordingly. The training will focus on off-grid solar photovoltaic up to a system size that could power a community center. Additional participants, including retailers and regional energy officers have participated in the initial Training, and thus been given further awareness of and capacity to assess quality of PV technology. Stakeholders in the country will have access to training material serving as guidance to identify low quality PV technology and correctly install PV technology.

## **1.3 Results (outputs expected from CTCN assistance)**

- Recommendations for a Training program for PV installers and retailers for VETA's consideration, including: PowerPoint presentations and training materials (guidance/manuals in hard-copy), including delivery of a pilot Training. The training materials will be made accessible by TAREA for stakeholders in the country
- A Workshop with TAREA trainers to validate the training program

## **1.4 Expected use of outputs**

The training materials can be adjusted and adopted by TAREA and used for ongoing capacity building activities under VETA.

## **2. Description of the Assistance**

### **2.1 Activities**

#### **Activity 1 – Develop Accreditation-through-Training Program for Solar PV Installers**

Activity 1 includes developing a training program for TAREA to implement for those with electrician skills. The training will be designed specifically to meet the needs of solar PV installers, with retailers and regional energy officers being additional potential audiences. Needs include the ability to determine and recognize the quality of PV cells/modules and to install the technology in an effective, safe, and sustainable way. The first part of the training would focus on quality and would be mandatory for all participants, and the second part would be centered on installation (e.g., sizing and siting) and maintenance and operations and would be voluntary for retailers.

Materials created would include translated PowerPoint presentations (i.e., from English to Kiswahili) to be used for instruction and to be printed out in hard-copy form for training attendees. Materials would also include thumb drives with the power point presentations as well as related manuals and reference materials. Also provided would be a listing of minimum accreditation requirements and a hard copy brochure that could be replicated by TAREA.

All materials would be developed in close collaboration with Tanzania Vocational Education and Training Authority (VETA) and TAREA through remote means (phone discussions, collaborative work on electronic documents, and in person discussion and refinement). VETA has recently released

curriculum for renewable energy technicians. VETA is in process of developing the procedure for accreditation of “Recognition of Prior Learning,” which will be used to certify the technicians without formal training at VET Centre.

**Activity 1 – Deliverables**

<b>Deliverables</b>	<b>Delivery date</b>
1.1 Initial meeting in person to review training program objectives, confirm primary audience, verbally outline key content of the training materials and accreditation requirements, identify target dates for the training and potential attendees (who and how many), and identify TAREA and VETA trainers to co-conduct the pilot Training along with the Response Expert Team	Week 4
1.2 Draft outline of training agenda and PowerPoint training materials	Week 6
1.3 Draft content of PowerPoint training materials	Week 10
1.4 Draft of accreditation requirements	Week 10
1.5 A meeting with TAREA and VETA trainers to gather feedback from review of materials and secure final details prior to the initial training	Week 14
1.6 Finalize training materials, including a hard-copy training manual and reference materials created in electronic thumb drive form <sup>1</sup>	Week 14-16

**Activity 2 – Conduct a Pilot Training**

The training developed in Activity 1 will be piloted with the Response Expert Team, TAREA and VETA trainers for the PV installation industry, retailers, and regional energy officers, as appropriate. Feedback will be gathered from all attendees at the conclusion of the training, and will be incorporated in the training materials for future use.

**Activity 2 – Deliverables**

<b>Deliverables</b>	<b>Delivery date</b>
2.1 Pilot Training	Week 15
2.2 Post-Training debrief (by phone)	Week 17
2.3 Final Meeting with All Stakeholders involved in organizing the training (by phone)	Week 20

**2.2 Synergies and Baseline Setting**

All materials would be developed in close collaboration with VETA and TAREA. The VETA curriculum for renewable energy technicians, and procedure for accreditation of “Recognition of Prior Learning,” to certify the technicians without formal training are in line with the proposed initiative.

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<sup>1</sup>All trainings materials are to be provided in English. If translation services are needed, additional budget and time will need to be allocated.



## 2.4 Expertise required

<b>Activity 1</b>	
<i>Expert 1</i>	PV expert with experience with micro-small scale distributed and off-grid PV, particularly in an international and LDC context, 100 hours
<i>Expert 2</i>	PV expert with workforce development experience, including developing curriculum and conducting train-the-trainer activities, 100 hours
<i>Materials</i>	Translation services and for creating hard copy training materials and USB flash drive for each participant
<b>Activity 2</b>	
<i>Expert 1</i>	PV expert with experience with micro-small scale distributed and off-grid PV, particularly in an international and LDC context, 60 hours
<i>Expert 2</i>	PV expert with workforce development experience, including developing curriculum and conducting train-the-trainer activities, 60 hours
<i>Travel</i>	Travel including airfare, hotel, and per diem for two people; no labor hours included

### Meetings Required:

<b>Activity</b>	<b>Meeting Description</b>	<b>Delivery date</b>
1	Initial meeting in person to review training program objectives, confirm primary audience, verbally outline key content of the training materials and accreditation requirements, identify target dates for the training and potential attendees (who and how many), and identify TAREA and VETA trainers to co-conduct the pilot Training along with the Response Expert Team	Week 4
1	A meeting with TAREA and VETA trainers to gather feedback from review of materials and secure final details prior to the initial training	Week 14
2	Pilot Training	Week 15
2	Post-Training debrief (by phone)	Week 17
2	Final Meeting with All Stakeholders involved in organizing the training (by phone)	Week 20

## 2.5 Main partners

<b>Stakeholder</b>	<b>Role to support the implementation of the CTCN assistance</b>
Tanzania Commission for Science and Technology	NDE
Tanzania Renewable Energy Association (TAREA)	Lead counterpart, involved in preparation and execution of the training
Vocational Educational and Training Authority	Training support

Tanzania Bureau of Standards	Provide information on standards
Local Government Authorities	Awareness raising and system development
Ministry of Energy and Minerals	Energy policy development
National Environment Management Commission	Environmental regulation
Ministry of Education, Science, Technology and Vocational Training	Education and training authority, policy development and promoter of technology and innovation development and utilization
Ministry of Health	Health authority and public technology user
Ministry of Home Affairs	Technology users and law enforcement
NGOs (To be identified) KAKUTE, Solaraid, Solarsisters, Franciscan Sisters, Woodstar, TAREBI, KARADEA etc.	Technology user promoters
Retailers	Technology use distributors
Solar installers	System planning and installation

### 2.6 Indicative 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/Material <i>(Item, purpose, buy/rent, quantity)</i>	Estimated cost	
					Minimum	Maximum
Activity 1 - Develop Accreditation-through-Training Program for Solar PV Installers	PV expert with experience with micro-scale distributed and off-grid PV, particularly in an international and LDC context, US\$ 27,000, 12.5 days  PV expert with workforce development experience, including developing curriculum and conducting train-the-trainer activities, US\$ 23,000, 12.5 days	Initial meeting in person to review training program objectives, confirm primary audience, verbally outline key content of the training materials and accreditation requirements, and identify target dates for the training and potential attendees (who and how many), one or two travelers for one week (depending on travel costs), US\$ 8,000	Initial meeting, 10 participants, 5 days of meetings, cost included under human resources, travel, and equipment/material  Status update meeting conducted via Webinar to gather feedback from review of materials and secure final details for the training	Translation services and for creating hard copy training materials and USB flash drive for each participant, US\$ 7,000	US\$ 65,000	US\$ 75,000

<p>Activity 2 - Conduct a Pilot Training</p>	<p>PV expert with experience with micro-scale distributed and off-grid PV, particularly in an international and LDC context, US\$ 17,000, 7.5 days</p> <p>PV expert with workforce development experience, including developing curriculum and conducting train-the-trainer activities, US\$ 14,000, 7.5 days</p>	<p>International travel for two experts from Denver to Tanzania for one to two weeks (depending on travel costs), US\$ 15,000</p>	<p>Pilot training workshop), 40 participants, 3 days, including venue, meals for all and hotel and transport for 30 external participants, US\$ 15,000</p> <p>Post-training debrief (by phone)</p> <p>Final Meeting with All Stakeholders (by phone)</p>	<p>Hard copy training materials, US\$ 2,000</p>	<p>US\$ 63,000</p>	<p>US\$ 73,000</p>
<p>Measures, evaluation and learning</p>	<p>Two PV experts to have feedback discussions with Tanzania and to develop and analyze results from a questionnaire to workshop participants; also for developing outcomes summaries for the CTCN to use in communications materials, US\$ 10,000, 5 days</p>				<p>US\$ 10,000</p>	<p>US\$ 12,000</p>
<p>Estimated range of costing for the implementation of the entire Response Plan</p>				<p>US\$ 138,000</p>	<p>US\$ 160,000</p>	

Implementation of this Response Plan will be coordinated by the Climate Technology Centre (including selection, contracting, supervision and monitoring of implementation partners) in close coordination with the corresponding National Designated Entity and relevant national actors. A CTCN Consortium Partner or Network member will be selected to implement the Response Plan.

### 2.7 Gender considerations

- It will be ensured that female retailers and technicians will be represented in the training
- It will be ensured that women are included in the development of training materials and women's interests are considered during the development
- Involved TAREA trainers should include women

### 2.8 Risk identification and risk mitigation

<b>Risk</b>	<b>Consequence</b>	<b>Probability</b>	<b>Mitigation measure</b>
The training program does not adequately address Tanzania's needs in terms of appropriately training solar PV industry personnel	Solar PV systems are not installed appropriately and have resulting safety risks and under performance	10%	Regular discussions with TAREA and VETA to ensure that the training is designed to meet Tanzania's needs in terms of market requirements
The training program is not adopted by local institutions	The training program does not have the maximum impact and solar industry personnel remain under-qualified	50%	Frequent conversations with TAREA, VETA, and other stakeholders throughout the development of the response to make sure that the training program meets their requirements and that there is local buy-in.

### 3. Long-term impacts of the assistance

#### 3.1 Expected climate change-related benefits

	<b>CTCN climate technology impact</b>	<b>Anticipated contribution from CTCN assistance</b>
<b>1</b>	Climate technologies adapted to national context are identified and prioritized to enable their deployment and/or transfer in the requesting countries	CTCN will assist, through this project, to adopt the use of suitable technologies in the target regions and in the long run to diffuse these technologies to other areas of the country
<b>2</b>	New national Technology Needs Assessment (TNA) and Technology Action Plan (TAP) as a result of the response	
<b>3</b>	Progress made against mitigation objectives (i.e. energy and carbon intensity reduction) as a result of the response	Improved knowledge and quality of installers should help to grow the local solar PV market.
<b>4</b>	Progress made against adaptation or resilience objectives (e.g. climate vulnerability index improvement) as a result of the response	
<b>5</b>	New mitigation or adaptation technology projects/initiatives implemented as a result of the response	The training of solar installers will support new solar PV projects.
<b>6</b>	New or strengthened policies/ laws developed, approved and enacted as a result of the response	
<b>7</b>	New policies/laws where climate change was mainstreamed as a result of the response	
<b>8</b>	Country integrating climate change mitigation and/or adaptation issues into its planning and policies as a result of the response	
<b>9</b>	New or strengthened Public-Private Partnerships (PPP) created directly as a result of the response	
<b>10</b>	New or strengthened twinning arrangement created as a result of the response	
<b>11</b>	Capacities to access and attract public and private finance increase to enable financing of technology deployment	
<b>12</b>	Post-response intervention funding	

	attributable to the response.	
<b>13</b>	Framework and analysis of local production developed to enable deployment of national production of climate technologies	

### 3.2 Co-benefits

	<b>Sustainable Development Goal</b>	<b>Contribution from CTCN assistance</b>
<b>1</b>	End poverty in all its forms everywhere	Solar PV can provide lost-cost energy and job opportunities
<b>2</b>	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	
<b>3</b>	Ensure healthy lives and promote well-being for all at all ages	Reduced health effects due to promotion of solar PV as an energy source
<b>4</b>	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	Solar PV can provide energy for lighting, enabling studying after dark
<b>5</b>	Achieve gender equality and empower all women and girls	Access to solar energy can enhance gender equality by removing or reducing the need to gather other energy sources and by enabling new entrepreneurial endeavours
<b>6</b>	Ensure availability and sustainable management of water and sanitation for all	Solar PV can be used for irrigation and water pumping
<b>7</b>	Ensure access to affordable, reliable, sustainable, and modern energy for all	Will contribute to achieve this nation goal of providing modern energy especially in rural areas
<b>8</b>	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Solar PV can provide job opportunities as well as enhance the efficiency of current enterprises
<b>9</b>	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
<b>10</b>	Reduce inequality within and among countries	Solar PV can provide cost-effective energy for the energy impoverished
<b>11</b>	Make cities and human settlements inclusive, safe, resilient and sustainable	Solar PV can reduce pollution from other energy sources (e.g., wood burning and charcoal).
<b>12</b>	Ensure sustainable consumption and production patterns	Solar PV energy can reduce the need for other energy sources, such as firewood.
<b>13</b>	Take urgent action to combat climate change and its impacts	Solar PV energy provides for a low emitting energy source
<b>14</b>	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	Solar PV can reduce pollution from other energy sources (e.g., wood burning and charcoal).
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	

### **3.3. Post-assistance plans and actions**

TAREA will evaluate the effectiveness of the training by checking the quality of solar PV systems put in place by sampling installations completed by participating installers. The evaluation will be used to confirm the approach and ideally to scale the training program to other topics and recipients and to secure additional funding and mainstreaming by Tanzanian enterprises and agencies.

### 3.4 Monitoring and Reporting of technical assistance results and impacts

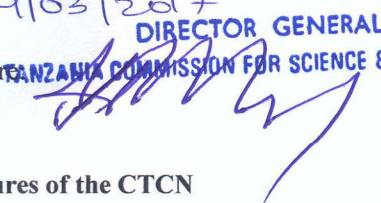
<b>Performance indicators of CTCN Assistance</b>				
<b>Response output</b> <i>(linking to sec 1.2)</i>	<b>How output will be used to ensure creation of result</b>	<b>Expected result</b>	<b>Expected outcome of result</b> <i>(linking to sec 1.1)</i>	<b>Anticipated impact that outcome will produce</b> <i>(linking to section 3)</i>
Delivery of pilot training (Activity 2)	Feedback on the initial training used to finalize the approach to the training program	Solar PV market personnel participate in the training	Training participants will have an improved understanding of the requirements for a high-quality solar PV installation and maintenance program	Training participants support the installation of high quality solar PV systems that are safe, that meet local needs, and that efficiently produce energy at competitive prices.


4. Signatures

Signatures of the requesting country

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NDE

Name: HASSAN MSHINDA  
Title: DIRECTOR GENERAL  
Date: 9/03/2017  
Signature:   
**DIRECTOR GENERAL**  
**TANZANIA COMMISSION FOR SCIENCE & TECHNOLOGY**

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Signatures of the CTCN

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CTCN Director

Name: Jukka Uosukainen  
Title: Director, CTCN  
Date: 12.3.17

Signature: 