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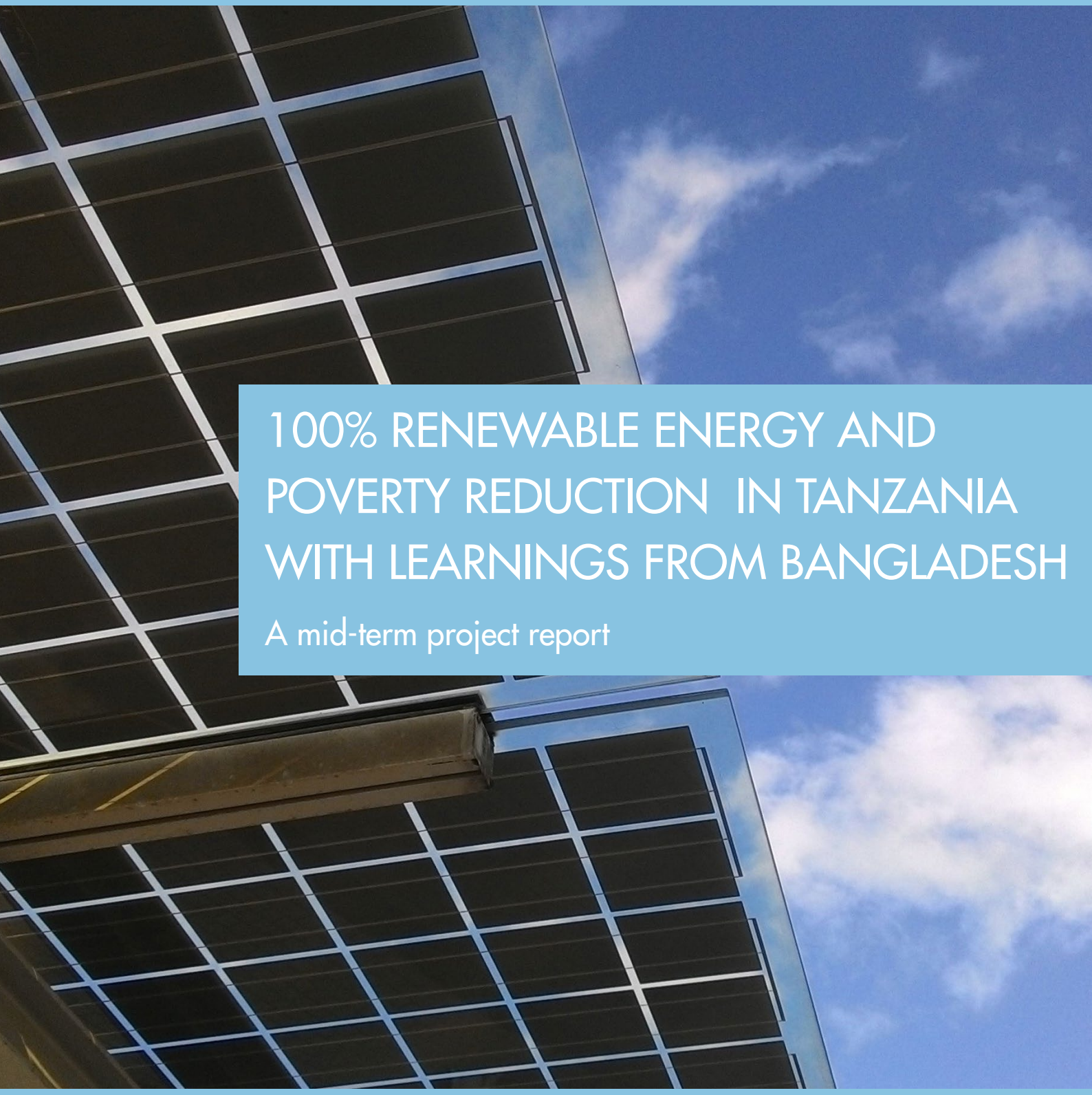

100% RENEWABLE ENERGY AND POVERTY REDUCTION IN TANZANIA WITH LEARNINGS FROM BANGLADESH

A mid-term project report

Imprint

Partners of the project

The World Future Council

The World Future Council consists of 50 eminent global change-makers from governments, parliaments, civil society, academia, the arts and business. The World Future Council works to pass on a healthy planet and just societies to our children and grandchildren with a focus on identifying and spreading effective, future-just policy solutions. The World Future Council was established in 2007 by Jakob von Uexkull, Founder of the "Alternative Nobel Prize". It operates as an independent foundation under German law and finances its activities from donations.

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CAN-Tanzania

CAN-Tanzania is a National Network formed and registered in November, 2011. The network has been formed purposely for promoting and strengthening Tanzanian local Networks, CSO's, and CBO's through enhancing capacity in information sharing and managing community based projects based on mitigation, adaptation and coping strategies of climate change impacts. Currently, CAN-Tanzania has more than 110 members -CSOs working on climate related activities in different parts of the country. These members are working with more than 10 million people.

www.tanzaniaclimateactionet.co.tz

Bread for the World

Bread for the World (Brot für die Welt) – Protestant Development Service is the globally active development and relief agency of the Protestant Churches in Germany. In more than 90 countries all across the globe Bread for the World empowers the poor and marginalized to improve their living conditions. Key issues of Bread for the World's work are food security, the promotion of health and education, the access to water, the strengthening of democracy, respecting human rights, keeping peace and the integrity of creation.

www.brot-fuer-die-welt.de

Contributors

Irene Garcia, World Future Council
Anna Leidreiter, World Future Council
Joachim Fünfgelt, Bread for the World
Sixbert Mwanga, CAN Tanzania
Msololo Onditi, CAN Tanzania
Naim Din, Bright Green Energy Foundation

Design

Camille Josse

Photos

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Introduction

In September 2015 world leaders signed off on a new global 15-year plan to tackle poverty inequality and climate change. In doing so, they pledged to ensure all people have access to affordable, reliable, sustainable and modern energy. Only 3 months later, in December 2015, all nations committed to limit global warming to 1.5 degrees Celsius by phasing out harmful emissions. For this, national governments are invited to communicate by 2020 their mid-century, long-term low greenhouse gas emission development strategies. This essentially requires countries across the world to develop an adequate 100% Renewable Energy strategy. For developing countries with little access to energy services, this is an opportunity to leapfrog fossil fuels and use renewable energy as a tool for socio-economic development.

This is why in 2016, CAN-Tanzania, the World Future Council and Bread for the World have embarked on a 18-month project in Tanzania to develop a coherent strategy on how to implement 100% Renewable Energy (RE) as part of the country's Sustainable Low Carbon Development (LCD) and Poverty Reduction Goals. This project builds on the previous experiences of the project partners for facilitating the deployment of renewable energy in Tanzania.

Through an inclusive and interactive approach engaging local stakeholders and key decision-makers in the energy transformation process, **this project intends to:**

- Inspire stakeholders and build up hands-on knowledge on how 100% RE adds value to local economic development and community sustainability.
- Strengthen synergies, networks and platforms for multi-stakeholder dialogue and follow up at the national level among government, parliamentary committees, policy-makers, civil society, trade unions, churches and media on LCD, poverty reduction and 100% RE.
- Identify necessary legislation and policy reforms.

More specifically, this project aims at:

- Identifying key policy elements and instruments in the power, heating, cooking and transport sector in order to successfully move towards 100% RE.
- Identifying opportunities for the national policy frameworks to trigger action on the local level as well as determine opportunities for local governments to extend their scope of action to address cross-cutting environmental, social and economic sustainability challenges by moving towards 100% RE.
- Demonstrating how 100% RE is enabled by strong coordination between national and city governments, as well as by decentralized municipal-level planning and decision-making capacities.
- Developing concrete recommendations for a way forward where there is multi-stakeholder and cross-sectoral collaboration, and where improved access to energy contributes actively to socio-economic growth.

To deliver the desired outputs, the project undertakes a series of key activities building on each other: a kick-off workshop to engage local actors in the project idea; a study tour to a country with potentially transferrable lessons to Tanzania; a series of round table consultations with different RE stakeholders in Tanzania (Civil Society Organizations, Faith-based groups, Academia, Parliamentarians, Government Officials, Development Organizations, Private sector and media); a multi-stakeholder workshop to develop an implementation strategy for the policy recommendations; and an international

conference to launch a policy paper which includes the findings from this process.

The kick-off workshop "100% RE and poverty reduction in Tanzania" took place in February 25, 2016 in Dar es Salaam and brought together 15 Tanzanian thought-leaders from government, academia, media and civil society to identify opportunities for policy change on the energy sector.

Participants of the kick-off workshop in Dar es Salaam

To further build capacity on the potential of RE for development, especially in rural areas, a study tour to Bangladesh was organized from April 17-23, 2016, with a high-level political conference chaired by Dr. Tawfiq-e-Elahi Chowdhury Bir Bikram, Bangladesh Ministry of Energy. During the 5-day study tour 10 representatives from the Tanzanian government, parliamentarian and civil society explored Bangladesh`s experience in rapidly expanding first time access to electricity

Dr. Tawfiq-e-Elahi Chowdhury, Bangladesh Ministry of Energy, welcoming of the Tanzanian delegation to Bangladesh

among its citizens with different renewable energy technologies. The tour was organized with the support of Bright Green Energy Foundation (BGEF), a leading renewable energy organization in Bangladesh which has been successfully working with Solar Home System, Solar Irrigation Pump, bio-gas, Improve Cook Stove, and women empowerment.

In this report, **key findings of the kick-off workshop as well as the study tour are captured. It outlines the status of discussions around RE** in Tanzania, incl. the potential as well as main challenges. Documenting the experiences from the study tour, this report also presents an analysis of Bangladesh`s policy framework for rural electrification.

Hereby, this report provides the starting point for discussing how to scale up RE to spur sustainable development and eradicate poverty in Tanzania.

Energy in Tanzania

Tanzania, East Africa's largest country with a population of 49.25 million inhabitants, is also one of the 50 Least Developed Countries (LDCs), with a GDP per capita of 606.66 US dollars in 2014, equivalent to 5% of the world's average, as recorded by the World Bank. The main challenge for Tanzania is thus widespread and persistent poverty, with 67.87% of the population living below $1.25 a day.

This situation is compounded by the low level of electrification, where only 7% of rural people, and 40% of urban people have access to electricity. In turn, lack of access to modern energy services exacerbates rural poverty due to persistent limited production opportunities and social facilities. Today, only 10% of households have access to the national grid, and only 1% is able to use electricity for cooking. Consequently, throughout the country, household's energy consumption is characterized by a high consumption of traditional energy biomass, such as firewood and charcoal, which account for 90% total primary energy consumption in the country, with electricity representing 1.5% and petroleum products 8%.

Above and beyond, available data reveals that the poor spend about 35% of their household income on energy while the better-off spend only 14%. And, even those connected to the grid opt nevertheless for burning cheaper biomass in an attempt to avoid paying high electricity prices. At the same time, Tanzania vastly relies on imported fossil fuels for its electricity, which is associated with an increased burden to the country's economy and rural communities. This is mainly due to the fact that prices of imported fossil fuels are volatile and have been hindering efforts to rural energy access. Additionally, due to problems with maintenance and supply, the country suffers regular power cuts and high electricity losses (21-23%).

The low level of electricity access, energy security and unreliable energy supplies is unsurprisingly increasing social and environmental vulnerabilities. The unsustainable harvesting of inefficient bio-energy is leading to deforestation and soil erosion, which, in turn, contributes to the intensification and perpetuation of poverty. And an increasing dependence on fossil fuels is causing fuel price shocks, inflation and it is hindering government efforts to expand energy access due to the scarcity of financial resources.

During the workshop, participants highlighted that Tanzania, as a country that is seeking to accelerate economic growth, tackle poverty and increase standards of living for the population, urgently needs to take strong actions to promote energy access for all. Those actions need to be taken in the light of the urgent fight against climate change. Protecting the climate and achieving sustainable development solutions must go hand in hand. As Gertrude Mongella outlined, poverty is among the drivers of environmental degradation in the country as a majority of poor people depend on what the nature provides. Developing and using Low Carbon Development Strategies (LCDS) which are economically and socially beneficial should be the way forward in thinking about energy access for all.

Gertrude Mongella, WFC Honorary Councilor and Special Advisor to the ECA Executive Secretary and UNESCO Director General

In fact, Tanzania is endowed with abundant, high-quality renewable resources, which could play a significant role in meeting the county's energy needs. However, this potential remains largely untapped. As Mary Swai from TaTEDO presented during the kick-off workshop, renewable energy (excluding large hydro) currently accounts for only about 4.9% of generation capacity of which the major share derives from biomass. The contribution of the private sector is significant and encouraged. 59% of total capacity is supplied by the Tanzania Electric Supply Company (TANESCO), while IPPs and Emergency Power Producers (EPPs) provide 26% and 13% respectively, which they sell wholesale to TANESCO. The Public-Private-Partnership projects are primarily driving large-scale hydro and geothermal projects. Solar technology is currently only used for small-scale irrigation systems and electricity provision on household level. Finally, the presented examples how that renewable energy are not domesticated in Tanzania and projects are donor-based driven.

The government of Tanzania is aware of the energy challenges the country is facing. As the Tanzania Ministry of Energy and Minerals outlines in their documents, the development of the country and their citizens is limited without the opportunity for all citizens to participate in "the mainstream energy economy". This is why the government has set the target to provide access to 50% of the population by 2025 and at least 75% by 2033.

As highlighted in the drafting of the National Energy Plan and National Energy Policy 2015 by the Government of Tanzania, the "energy sector plays a critical role in the socio-economic development of a country. All productive sectors of the economy are driven by an adequate, reliable, affordable and sustainable energy supply. At present, affordable, reliable and accessible electricity is identified consistently as a major constraint in achieving desired socio-economic transformation in Tanzania".

Furthermore, National Development Vision 2025, National Five Year Development Plans and National Strategy for Growth and Reduction of Poverty (MKUKUTA), also acknowledge that reality by clearly stating and recognizing that without energy most development objectives cannot be met. Therefore, renewable sources play a key role. The workshop participants in fact highlighted that despite its small share, renewables already respond to the challenges of the present and future in Tanzania. They enhance energy security, generate income, provide employment opportunities and hereby support poverty eradication. Finally, they reduce the pressure on local ecosystems and support climate change mitigation. Among the key drivers, participants underlined the cost-competitiveness and the socio-economic benefits that renewable energy provides. Also, the urgent need to mitigate climate change encourages RE.

As the draft Tanzania National Energy Plan by the Ministry of Energy and Minerals signals, the political will to scale up renewables to meet sustainable development goals exists. The drafted plan includes:

- Facilitate scaling-up of application and utilization of solar energy technologies;
- Enhance wind utilization for electricity generation;
- Promote and scale up efforts of bio-electricity generation;
- Enhance geothermal resources governance and mitigate exploration and development risks.

Benefits of renewable energy in Tanzania

Renewable energy sources including solar and wind provide a window of opportunity to transform the electricity production and supply of Tanzania. Participants of the workshop highlighted that "wind speed at Kititimo and Makambako are 9.9 and 8.9 miles per second respectively; there are between 2,800-3,500 hours of sunshine per year; and there is a geothermal potential exceeding 650 MW".

In a country where the levels of annual solar radiation range between 4–7 kWh per m2 per day, solar photovoltaic can play a key role in the provision of affordable, sustainable and locally generated electricity for lighting, heating and ventilation systems, drying; notably in areas where connection to the main grid is not economically viable. Small-scale off-grid wind turbines along the coastline and in the islands also hold great potential in a country where areas of wind power potential cover more than 10% of the country. Put another way, an area equivalent to the size of Malawi, and with a greater potential than the US State of California, as underlined in a recent report published by the World Bank[1].

Today, there are already signs of what could become a vibrant market for renewable energy, with widespread socio-economic and environmental benefits. Mary Swai (TaTEDO) introduced to participants of the workshop the "Sustainable Energy Project for Improving Education, Health and Business Services" in off-grid areas which Tatedo is implementing in Tanga, Kilimanjaro, Arusha, Shinyanga, Simiyu and the Coast region. These areas suffered from inadequate quality social services. The introduction of solar PV systems in health centers have provided light for maternity wards, and power for microscopes and vaccine storage. In schools, classrooms, laboratories and computers are now powered by solar PVs. In individual households, businesses and hostels, the installations of solar water heaters are becoming popular for lighting, water heating and cellphone charging. Further, there are companies such as Mobisol which have installed more than 40.000 pre-paid SHS in Tanzania and Rwanda. But Tanzania can perform much better and at larger scale.

Mary Swai, Tatedo, highlighting the benefits from RE technologies in Tanzania

Due to the decentralized nature, renewable energy are unfolding their impacts mainly locally and regionally. The deployment of renewable energy have improved the provision of social services like education and health. Business opportunities are on the rise for the villagers, who are opening up small businesses such as mobile phone charging shops. This situation has also enabled communities in remote areas where electricity has previously been unknown to charge their mobile phones using solar energy by paying a small amount of money. In turn, the use of mobile phones in rural areas have contributed in markets expansion for different products, easy and timely acquisition of business materials and information from different places.

As asserted by the various participants of the project: "With electricity access at their localities, rural communities in Tanzania have managed to devote more time and efforts to improve their socio-economic welfare. Interestingly, women have greatly benefited from the access to energy because there is a significant cut down on long hours they

1 For further information, see: The World Bank (2015) "**Tanzania: Solar and Wind Potential Could Help Meet Future Power Generation Goals**"

used to spend in manual work at home and in the field. Currently, several families in rural areas are able to utilize their time in a more positive way and spend little amount of money for fuel".

Undeniable, renewable energy has played out differently in each case, shaped by the various purposes of individuals, businesses and communities. However, the deployment of renewable energy technologies has translated overall into:

- More time to students for reading in the evening hours
- More conducive and hygienic medical environment
- Saved time and money
- Income generation and employment creation
- Facilitated communication to improve markets and exchange information on prices
- Well cooked food
- Reduced in-door air pollution
- Reduced deforestation
- Protection of water supply from natural streams

Tanzanian parliamentarians, policy makers and opinion leaders on Earth Day

Barriers for renewable energy scale-up in Tanzania

So far, Tanzania's potential to shift to renewable energy and the development of a low-carbon economy remains virtually untapped. Despite its acknowledged role to provide security of energy supply, economic development and environment protection, currently renewable energy (excluding large hydro) accounts for only about 4.9% of generation capacity.

While also the potential of renewable energy for rural electrification is recognized, the government is prioritizing the strategy of energy access through grid extension. But the few prospects that financial resources will become available to undertake the electrification of the country is raising people's concern, worried that the massive investment needed could result in delays and denial of access to energy to the majority of the rural population in the near future. Ongoing plans to generate electricity from natural gas, coal plants and nuclear power are neither considered as beneficial as renewables to the wider population. And hydro power, one of the biggest sources of electricity accounting for 66.5% of total installed capacity, has become too unreliable due to low water levels in the hydro dams caused by recurring droughts.

These encumber efforts to guarantee rural and majority energy access, and to support the deployment of solutions that are technically, economically and financially viable and more profitable to the population. As it was emphasized during the discussions, poor people and their families are particularly more vulnerable because they have few assets to fall back on and limited ability to afford energy related costs and effects.

Exposure to such expenses has been a trap to millions of people living in poverty and undermines their efforts to escape it. It is on bases of this situation where by different barriers that hinders efforts to scale up RE in Tanzania were identified.

First and foremost, stakeholders from different backgrounds highlighted the lack of long-term financing available for renewables. Renewable energy technologies tend to have higher up-front costs and low operating costs, which is why access to long-term financing is crucial. Absent this, high upfront costs act as a major deterrent and get individual, businesses and communities' investment decisions biased towards conventional energy technologies.

The difficulty in securing long-term financing is partially due to investors' perception of renewable energy technologies. Often, investors consider that renewable energy is more risky than fossil fuels, meaning that investors it is highly likely they will not obtain a return from their investments. This is either due to lack of knowledge to assess the risks involved, or to a perception of regulatory risk. Participants of the workshop stressed that RE projects are quite vulnerable to changes and amendments in the policy framework. And public financing alone is not enough to ensure the mass deployment of renewable energy that is required to respond to Tanzania's energy challenges.

If used wisely, however, public funding and support can leverage private investment. However, currently, "there is overdependence on donors", as indicated by Gertrude Mongella. She highlighted that, it is crucial to own relevant technologies for RE sustainability and avoid the traditional practice of relying on donors to do everything in expenses of local people. Further Mongella added that the lack of long-term policy making is another challenge that prevents Tanzania from scaling up renewables: "Many of the pledges are practically impossible because in several initiatives, enough time is required to realize the goals. But when it comes to politicians, they use their platforms to promise success within a short time. Politicians should be held accountable in sustainable initiatives like RE especially on professional discourses".

This is why a robust policy framework is crucial. Setting clear policy targets is hereby essential to provide investment security, mobilize stakeholders as well as improve the allocation of resources. The workshop showed that in Tanzania, there is no such a clear framework, which is further compounded

by the lack of inter-ministerial coordination.

As one of the barriers, participants highlighted the fact that ministries work in isolation. A lack of coordination among key ministries including the Ministry of Energy and Minerals, Vice President's Office Division of Environment, Ministry of Finance and Planning, Ministry of Natural Resources and Tourism, as well as Ministry of Transport cause unsustainability of RE projects and difficulties in RE governance in Tanzania.

Sixbert Mwanga, CAN-Tanzania, summarizing the interventions at the kick-off workshop

Technical barriers add up to the challenges in renewable energy deployment. Even though local learning by doing is taking place in Tanzania, participants highlighted that shortage of technical expertise for the design, installation and maintenance of the renewable energy technologies renders the projects more expensive.

Similarly, a low number of professional advisors and technicians for eligible technologies lead every so often to not use professional companies for the selection and installation of technologies, failing to meet the standards required and to address the communities' energy needs. This can hold back renewable energy deployment in Tanzania, and create social acceptance risks if they are not aware, nor do they expect to enjoy the benefits of renewable energy.

In a nutshell, barriers to scale up of renewable energy identified by participants of the workshop can be summarized as follows:

- Political barriers: These barriers relate to the regulatory framework of the renewables (with unclear strategy about the role of renewables and lack of policy consistency), as well as the government role in driving the deployment of renewables.
- Financial barriers: These barriers are associated with the lack of clear long-term financing mechanism with overdependence on donors and public funding, high perceived risks and up-front capital costs and long payback time.
- Technical barriers: These barriers concern the import-driven nature of the renewable energy sector in Tanzania, with shortage of trained people for the designing, planning, installation and maintenance of renewable technology.
- Behavioral barriers: These barriers are primarily related to the low level of awareness of the population regarding the benefits of renewables and erosion of consumer confidence because of inappropriate system standards.

How to overcome challenges to renewable energy in Tanzania

This situation calls for a review and reform of the existing policies for energy deployment in Tanzania to ensure reliable and sustainable energy services for all, to tackle energy access setbacks, to ensure multi-stakeholder participation, to strengthen local governments in their fight against poverty and to advance finance mechanisms for renewable energy deployment. The development of a comprehensive and robust policy framework would not only make a significant contribution to the existing country's energy production and supply system, but would also move Tanzania quickly towards achieving the goal of becoming a middle income country, as envisioned in the Tanzania National Development Vision 2025.

The discussions at the workshop provided further details on the elements to be included in the policy framework:

Policy elements

At present, there is no effective mechanism or legal framework for facilitating energy access for the majority and enhancing inter-sectoral coordination among key sectors such as energy, environment, forestry, agriculture, land use, health, and social development. Accordingly, the production, transmission and consumption of energy are managed in a disharmonized and not interlinked manner. Ensuring the coordination and participation of policy makers and actors in all sectors across the entire energy value chain is crucial. The policy framework needs to be embedded in the national economic development plan, with a focus on marginalized communities lacking energy access, and with strategies fostering the industrialization of the country through RE deployment.

Financing elements

Coherent and robust policy framework incorporating the necessary infrastructure investments and guarantees are needed to provide security and unlock the financial bottleneck facing RE sector in Tanzania. Participants also called for policy makers to consolidate Public Private Partnership.

Technical elements

The lack of human and institutional capacity is a drawback for renewable energy technology adoption. In order to realize RE in Tanzania, participants highlighted the need for domestication of RE related technologies and expertise. An integrated policy framework in Tanzania should put more emphasis on capacitating local experts about RE technologies coupled by industrialization (including small scale industries/factories), and mainstream the use of RE as a direct engagement of local people especially those in need of efficient and reliable access to energy.

Further, exchange of knowledge and cooperation with other RE champions as a base for enhanced technological transfer is needed.

Behavioral elements

Investment in capacity building and awareness raising on the merits of RE among key stakeholders, policy makers and actors in all sectors across the entire energy value chain is crucial. For this, one crucial step is the gathering of information from good practice in RE sector both in Tanzania and abroad, as a base for disseminating knowledge to a wide audience through a variety of multi-stakeholder dialogues. Even more important, community inclusion and scientific studies are to be insisted in policies to facilitate the development and implementation of successful national RE planning and poverty reduction in bases of local priorities. This will avoid repeating previous mistakes and will allow to link community thinking with the relationship between energy, environment and livelihood.

These recommendations developed by participants during the workshop underline that no single action or not one specific institution will be able to address the challenges. Rather, the government must ensure a policy framework with:

- A holistic approach, with a clear, long-term and ambitious strategy to integrate RE deployment into Tanzania's economic development plan and clearly articulate actual number of potential employment opportunities that will be a result of implementation of RE projects;

• The involvement of a wide array of stakeholders across sector and governance levels (both horizontally and vertically) with discussion platforms, alliances, inter-ministerial linkages to identify needs and gaps, and related investment opportunities and job creation;

• A coordinated strategy and joint initiatives to scale up renewable energy deployment and leverage awareness on the socio-economic and environmental benefits of renewables.

Tanzanian delegation in Bangladesh visiting the solar irrigation pump system in Poradaho

What Tanzania can learn from Bangladesh

Bangladesh Energy Context

Bangladesh is one of the most densely populated countries in the world, with 162 million inhabitants on a territory of 147,570 km2. At the beginning of the century, Bangladesh was one of the poorest countries of the world, with 42% of the population considered extremely poor[1]. Moreover, the country was standing at a crossroads in terms of energy access, which further constrained the socio-economic development of the population. Only 30% of the people of Bangladesh had access to electricity. Therefore, for the area not connected to the gird, life comes at a standstill after the sun. Even for those connected to the grid supply was hardly reliable due to the lack of power generation capacity (3115 MW in 2000[2]). Furthermore, overall demand for electricity was rising by about 10 per cent annually. Infrastructure was deficient, poorly managed and could not reach many rural areas (where 75% of the population lives) due to inaccessibility and remoteness[3].

To revert the situation, in the year 2000 the government of Bangladesh set the target to provide 100% energy access through affordable and reliable electricity by 2020. This target was seen as a strategic articulation of the government's aspiration to fight against chronic poverty and attain middle-income country status [4]. Not surprisingly, renewable energy played a critical role in the energy transformation of Bangladesh. Because of its cost-competitive nature, renewables off-grid solutions became the best energy resource other than conventional fossil fuels to provide energy access to the rural population. And up to day, more than 4 million Solar Home Systems (SHS) have been installed in the country, benefitting over 24 million rural people.

Today, Bangladesh presents much brighter energy scenario to the one it had two decades ago, when the energy sector was one of the largest bottlenecks for the socio-economic development of the country. Presently, most of the urban population has access to electricity (nearly 99%). In rural areas, 62% of the population has access to electricity. The country has 13,265 MW capacity.

An electricity generation of 7,787 MW, of which 4,049 MW comes from the public sector, 3270 MW from the private sector, and 468 MW is imported (Zobair[5], 2015). And if current trends persist, SHS alone are expected to generate 1000 MW by 2020 (Barua[6], 2016). Bangladesh has maintained an impressive track record on growth and development too. In the past decade, the economy has grown at nearly 6 percent per year, and poverty has dropped by nearly a third (World Bank[7], 2016). How did this happen?

Vision 2020 to achieve 100% electricity access

Access to affordable, reliable and sustainable energy services is important in economic development and addressing poverty reduction. In Bangladesh, the lack of energy service was having deep economic consequences, the serious demand supply-gap was resulting in losses of at least 3.5% of the country's Gross Domestic Product (GDP) with deep economic consequences for the poorest regions in the country (Hasan[8], 2011).

In the year 2000, in recognition of the socio-economic development challenges, the Ministry of Power, Energy and Mineral Resources of Bangladesh developed the "Vision Statement on

1 For further information, see: Mahmud (2015): "**Can we eradicate extreme poverty in Bangladesh?**"

2 For further information, see: Power Cell (2006): **Bangladesh Power Sector Database**

3 **Sea4all**, 2012

4 For further information, see: **Bangladesh Vision 2021**

5 Zobair, S. (2015) "Sustainable and Renewable Energy Development Authority (SREDA) of Bangladesh: Role and Responsbility"

6 Barua, D. (2016) "**Bright Green Energy Foundation**"

7 The World Bank (2016) "**Bangladesh. Context**"

8 Hasan, N. (2011) "**Solar Energy in Urban Bangladesh: An Untapped Potential**"

Power Sector Reform", setting the goal to provide affordable and reliable electricity to the whole nation by 2020.

To materialize the vision, the Ministry envisaged the following reforms[1]:

1. Segregation of power generation, transmission and distribution functions into separate services.
2. Corporatization and commercialization of emerging power sector entities.
3. Establishment of Power Market under regulatory regime.
4. More private participation.
5. Development of alternative/renewable energy resources.

Only in 2001 and 2002, electricity generation increased, new transmission and distribution lines were constructed, load shedding was reduced, 1.7 million population got electricity access, maximum demand increased by 583 MW and revenue increased by approximately USD 31 million (ESCAP[2], 2005).

However, reliance on grid electricity alone would not allow the country to achieve its vision of 100% electricity access for the whole nation. The disperse nature of its rural areas, with access limitations, and the presence of numerous rivers made grid electrification difficult in expensive. In areas not connected to the grid, solar energy was therefore the only realistic option for electricity to provide energy access to the population.

"Bangladesh is recipient of sufficient sunshine round the year with daily average solar radiation ranging between 4~6.5 kWh / m^2. And solar technology can be easily installed and maintained with little customer training", as highlights Mr. Islam, Chief Financial Officer and Head of Operations of IDCOL, the Bangladesh government-owned development financial institution set in 1997 to catalyze and promote private sector participation in infrastructure, renewable energy, and energy efficient projects.

On this backdrop, in the year 2003, IDCOL launched the Rural Electrification and Renewable Energy Development (RERED[3]), aiming to support Bangladesh's efforts to raise levels of social development and economic growth by increasing access to electricity in rural areas through Solar Home System. The aim was to install 50,000 solar home systems in five years. To start the program, IDCOL received credit and grant support from the World Bank and GEF and relied on 6 partner organizations (POs) for the implementation.

Among them was Grameen Shakti ("village energy" in Bengali), a company established in 1996 with the bold and pioneer objective in the country to provide electricity to rural population through solar energy. They had installed around 11.000 systems before IDCOL came in. "In a country with over 300 days of direct sunlight, solar energy was the best solution to empower rural people with access to electricity to generate income, reduce poverty, and improve their quality of life", as highlights Dipal Barua, co-founder of Grameen Shakti and founder of the Bright Green Energy Foundation.

For this, they put in place an integrated financial model consisting of:

1. 50% down payment to install the system and the remaining 50% in monthly installment-based payment method which reduced the cost of a solar home system close to the equivalent of monthly kerosene costs.
2. A strong effective after sales, repair and maintenance network, involving local technicians and especially women technicians / entrepreneurs who repair and assemble solar accessories in their communities.

IDCOL customized this micro-credit model. Under the scheme put in place, IDCOL received funding from the World Bank and

1 **Ministry of Power, Energy and Mineral Resources of Bangladesh** (2005)

2 ESCAP (2005) "**Electric Power in Asia and the Pacific 2001 and 2002**"

3 For further information, see: **Rural Electrification and Renewable Energy Development**

other international organizations through the government. First, the government added 2.25% of charges to cover the foreign currency risk and then it lent to IDCOL. Then, IDCOL in turn lent to its Partner Organizations at an interest rate of 6 to 8% and a fixed subsidy (currently US$20 per system installed). And Partner Organizations would lend it to the costumers. The result was the installation of the 50,000 solar home systems target in just two years and half, against a target by 2008. This project was the first of its kind in Bangladesh. A new target for the installation of 6 million SHS by 2017 would follow.

2008: Adoption of Bangladesh Renewable Energy Policy

The pace and success of the implementation led the government of Bangladesh to take the SHS up. In the year 2008, the government of Bangladesh adopted the Renewable Energy Policy[1] to create an enabling environment and legal support for the promotion of renewable energy in the country. In the policy, the Ministry of Power, Energy and Mineral Resources of Bangladesh recognized that "efficient utilization of renewable energy resources is yet to assume commercial dimensions and hence rational policy dissemination on renewable energy is essential".

By virtue of this policy, the government set the target of 5% of total generation capacity from renewable energy sources by 2015 and 10% by 2020 and 2030. This translates into 800 MW power from RE by 2015, 2000 MW by 2020, and 4000 MW by 2030.

To achieve this goals, the government established the Sustainable and Renewable Energy Development Authority (SREDA) as a focal point for sustainable energy development and promotion, 'sustainable energy' comprising renewable energy and energy efficiency. SREDA's main responsibilities are the following:

- Develop legal, regulatory and policy framework to coordinate and facilitate the development of RE (labelling, audit, standardization, etc.)
- Fundraising and channeling for RE projects development
- Collect data and assess the RE resource base, especially in the context of rural energy master plan
- Give logistic & technical support to interested groups for private sector investment
- Support demonstration of new technologies and new business models for renewable energy technologies
- Dissemination of RE Technology, Awareness Building through workshop, seminars, etc (Zobair [2], 2015).

In conjunction with the Power Division, Ministry of Power, Energy and Mineral Resources, SREDA is also responsible for determining the priorities for renewable energy technology development and program implementation. Lastly, to ensure multi-stakeholder participation, SREDA set a board comprised of representatives of stakeholders including business community, academics and/or representative from Bangladesh Solar Energy Society, NGOs, financial institutions and implementing agencies.

Furthermore, the Renewable Energy Policy provided a series of investment and fiscal incentives for the deployment of RE, such as:

- Tax holiday for 20 years
- Exemption from charging 15% VAT to renewable energy equipment and related raw materials in producing renewable energy equipment.
- With the support of the Bangladesh Central Bank, promotion of green finance with single digit interest through local schedule banks to provide financial support for purchases of renewable energy equipment.
- Subsidies provision to utilities for installation of solar, wind, biomass or any other renewable energy project.

1 For further information, see: **Bangladesh Renewable Energy Policy 2008**

2 Zobair,, S. (2015), "**SREDA: Role and Responsibility**"

- Incentive tariff considered for electricity generated from RE sources which may be 10% higher than the highest purchase price of electricity by the utility from private generators.
- Simplification and strengthening of lending procedure for RE projects (Islam[1], 2014). At present, SREDA is playing a key role as the nodal institution for the overall promotion of renewable energy. For Mr. Alauddin, Joint Secretary, Power Division, Ministry of Power and Mineral Resources "If you want to bring in a new technology, you also need an institution that has the skills, capacities and mandate for this. This is why we established SREDA".

Financing the Solar Home System program

The government of Bangladesh has also played a substantial role in creating a viable market for the scale up of RE and addressing the key concerns about affordability of RE projects. This has namely been done through grant funding and low-interest refinancing schemes delivered through IDCOL.

Today, the Solar Home System program has been expanded and IDCOL is receiving additional financing from GIZ, KfW, ABD, IDB, GPOBA, JICA, USAID and DFID. IDCOL has likewise expanded the number of Partner Organizations. IDCOL offers grant support, refinancing and technical assistance to 53 Partner Organizations (POs) who implement the program. The exponential growth of IDCOL has encouraged local industry and an ever-increasing number of organizations are applying to become a PO. In order to be accepted by IDCOL selection committee[2], they must have sold 1.000 units of SHS already in the country.

Once POs are accepted, they must seek approval from the Technical Standards Committee (TSC) to before they purchase and install the system components from suppliers. The Technical Standards Committee of IDCOL was formed with the view to provide a minimum set of technical requirements that shall be followed in the design, specification and installation of the qualified SHS. The goal is to ensure adequate levels of safety, performance, reliability and system lifetime to ensure the successful promotion of SHS in Bangladesh[3]. The TSC is comprised of personnel from IDCOL and key experts in the renewable energy field in Bangladesh coming from the government, academia, private sector, and civil society.

After receiving the approval from the TSC, the Partner Organization can purchase the system components and install it to the household. Presently, the financial mechanism developed by IDCOL allows households to pay only a 15% down payment for the installation of the SHS, and the remaining 85% is repaid in monthly installments during a 1-3 year credit period, ensuring that the technology is cost-effective compared to the cost of kerosene. Households are also offered a discount price if they accept shorter repayment period or if they pay in cash. Moreover, when the life of the battery is over, households have a buy-back and replacement option[4].

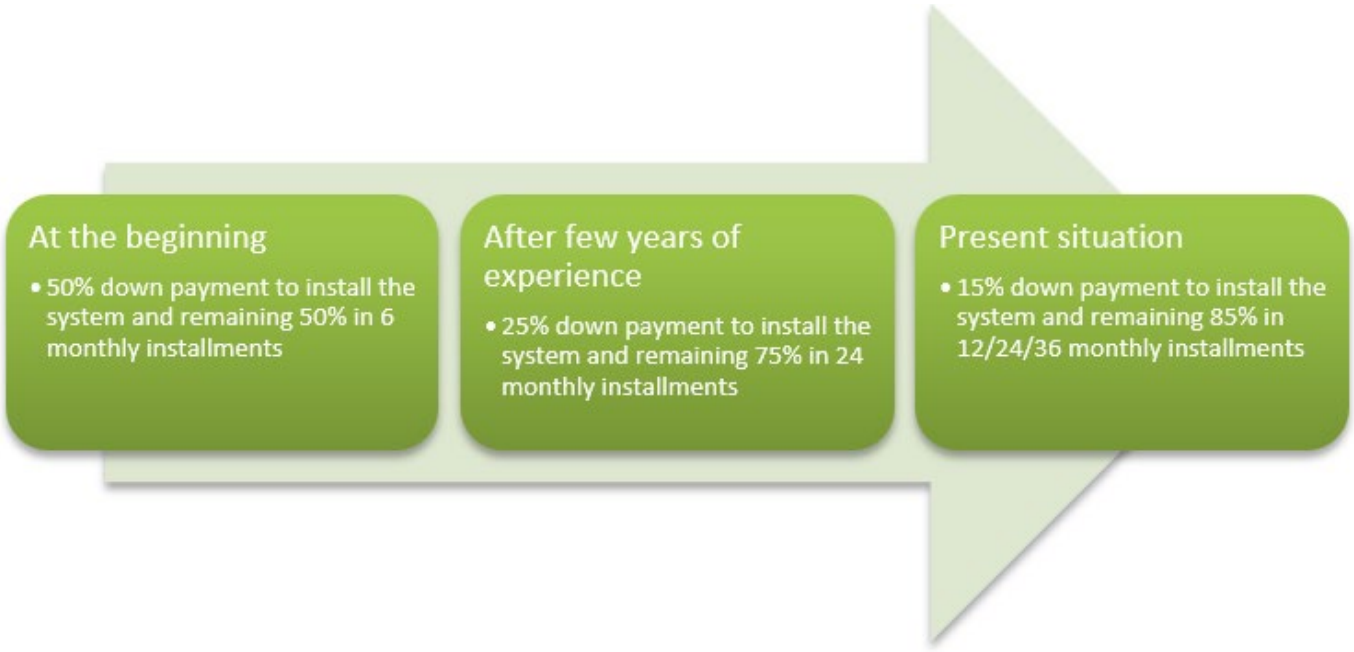
Following the installation of the SHS, POs can apply for refinancing of the micro-credit extended to households and a grant from IDCOL for small systems up to 30 watts. The refinancing from IDCOL covers 80 percent of the micro-credit, and has a 6-9% flat interest rate for a period of 5-7 years. This mechanism is intended to enable POs to purchase the technology below market rates and reduce the costs of SHS to household.

1 Islam, M (2014): **IDCOL Solar Home System Program**

2 IDCOL initiates the application through national newspapers mentioning the qualification and documents required. An appraisal committee accepts the application which includes the representative from IDCOL (CEO, CFO and Head of RE) and RE experts from different background and professions.

3 For further information, see: IDCOL: **Solar Home Systems Component Specifications**

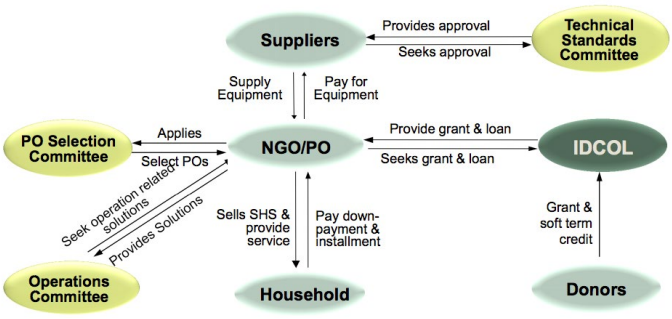
4 Customers need to inform any PO working in the particular area to collect and replace his warranty expired battery. POs collect the battery from household and receives US$5 as collection grant from IDCOL and customers get 25% discount from their new replaced battery if replaced by POs. IDCOL also provides incentive to battery manufactures to offer 25% discount on battery replacement.



The grant was originally set at US$90 per SHS, and is now at up to US$20 because of the drop in solar technology prices. IDCOL also provides an additional US$ 3 subsidy to new POs to assist them with up-front costs. After physical verifications and a technical audit to ensure that only the system components approved by the TSC have been used, IDCOL releases the credit and the grant to the PO, providing them with funds to install more systems. IDCOL has also set an Operations Committee in charge of program oversight and support POs with operational solutions. Further being a debt financier and providing technical assistance and quality control, IDCOL is also involved in training and capacity development for its staff and the POs. So far the institution has trained more than 1.500 professionals in SHS installation, maintenance, troubleshooting and market development. Lastly, IDCOL also conducts awareness raising activities to popularize SHS across the country.

(a) Market Price of 20 Wp SHS	USD 138
(b) Buy-down Grant (Grant A)	USD 20
(c) System Price for Household [(b)-(a)]	USD 118
(d) Down Payment from Household to PO [15% of (c)]	USD 17.7
(e) Loan Payable from Household to PO [(c)-(d)]	USD 100.3
Loan Tenor	3 years
Interest Rate	16% p.a.
Monthly Installment Amount	USD 4
(f) IDCOL Refinance [70%~80% of (e)]	USD 80~70
Loan Tenor	5~7 years
Interest Rate	6~9% p.a.

Mode of financing: an example (Pavel, 2016)



The SHS program structure (Pavel, 2016)

Overall figures of the program performance are impressive. More than 4 million SHS have been installed in the country, with an average installation growth of 58% per year. By 2011, Bangladesh had overseen the installation of 1 million systems. By early 2014, this figure had doubled. And IDCOL set the target to triple it within two years, to reach 6 million households by 2017. Until date, the program replaces 180,000 tons of kerosene per year, having an estimated value of $US225 million. Further, over 30,000 people are directly employed in RE section and over 70,000 are employed in RE related sectors such as battery, charge controllers, solar panels, wires, switches and accessories manufacturing. The total is over 100,000 (IDCOL[1], 2016).

Domestication of RE technology

The policy framework and financial mechanisms need to take into account key practical aspects for an effective deployment of renewable energy technologies. Especially important is the need to deploy technologies that are mature, can be operated and maintained by local expertise, and have potential to generate socio-economic benefits along the different segments of the value chain.

Further, specific skills and institutional arrangements are required for implementing, operating, adapting and improving the systems.

In Bangladesh, many of these practical aspects and skills have been ensured through distinctive after sales service model innovated by Partner Organizations. They have taken due care of the quality assurance and installation maintenance service, have ensured their sustainability and have achieved with probabilities of default in loan repayment less than 5%.

This is a model which brings technology to the people by coupling innovative financing with technology transfer through effective community involvement. The key elements of the integrated sustainable entrepreneur based business model are:

Innovative financing mechanisms

Providing no direct subsidies but innovative financing schemes based on installments that make the technology affordable and cost effective compared to traditional energy alternatives and it creates ownership. Solar Home Systems of 15 to 30 watts have become popular in Bangladesh to light rural shops and rural households. In a country where 31% of the population lives on less than $1.90 a day, according to World Bank[2] figures, investing even in the most basic solar home 15kW SHS (US$120) can be daunting unless there is a financial mechanism in place. Today for the cost of kerosene they can light their homes through solar power, and are owners of a system which lasts, at least, for 20 years of more.

Awareness-raising

Creating awareness for renewable energy technologies through motivational programs and social activities that involve the community.

"There was no awareness among the rural population. We had to train our engineers to become "social engineers" and go from door to door demonstrating the effectiveness of renewable energy and gaining the trust of the population. Then, thanks to SHS, people started to see the benefits and, little by little the transformation happened", indicates Dipal Barua.

"After SHS was installed, we got bright clean light as good as daylight. Now we can watch TV and charge mobile phones", as highlights one of the SHS owners the Tanzanian delegation spoke to during the field visit to Faridpur.

Trust-building

Gaining the trust and confidence of the rural people by focusing on consumer needs and providing high quality services including consumer

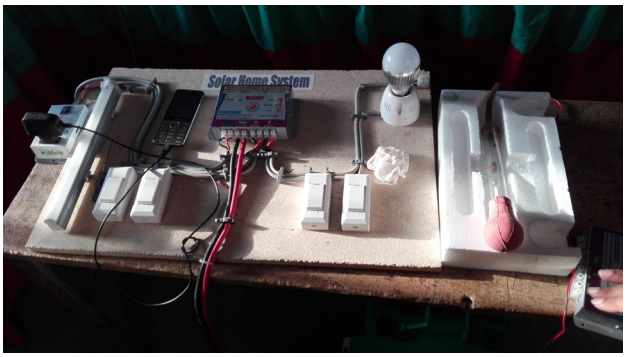
1 IDCOL (2016) "**Solar Home System Program**"

2 For further information, see: World Bank (2016) "**Bangladesh: data**"

friendly product design, installation, training, of clients on proper use of technology, free monthly after sales support, and strict quality control. To better accomplish this, the Bright Green Energy Foundation established a network of rural based branches throughout Bangladesh.

Capacity-building

Focusing on women as the main actors and entrepreneurs of change and set up green technology centers to train, make the technology user-friendly and empower rural women who are working independently as renewable energy technicians and entrepreneurs. After the training, they provide after sales service and product support to the rural household who uses renewable energy technology for their energy needs. They assemble and repair solar accessories such as charge controllers, lamp shade circuits, switches and other spare parts of the SHS.



Solar Home System Appliances

Women being trained on SHS at Modhukhali

Value creation

Linking the technology to income generating activities and creating opportunities for entrepreneur development. As Barua underlines: "I encourage micro-utility initiatives allowing the technology owner to generate an additional income, and encourage community based manufacturing by purchasing and assembling accessories locally. Currently, over 100,000 people work in the solar and renewable energy sector across the country".

In a nutshell, a high commitment from organizations supporting the RE initiatives has also been a key success factor in deploying SHS and unfolding socio-economic benefits locally.

Beyond Solar Home Systems

Following Bangladesh's success in expanding solar home systems, the government is supporting the deployment of other configurations, such as Solar Irrigation Pumps. Traditionally, Bangladesh agricultural sector depends on rain water for irrigation. Earlier highland required power irrigation at least one season to produce 3 crops per year. Nowadays, due to less rainfall and draught, irrigation is required along the year posing a big challenge.

At present, Bangladesh has 1.71 million irrigation pumps, of which 85.3 % run on diesel and require 550 million liter diesel per year. The remaining 17% are electricity-operated. During the peak irrigation period, 2500 MW of power demand is solely required for running the electric pumps. And diesel powered pumps consume over 1100 million liters of diesel per year. If these pumps could be replaced by solar irrigation pumps, this electricity could be diverted for other developing sectors and the savings in subsidies invested in national development. Only in 2013 the government provided US$59 million cash subsidy on diesel pumps.

The subsidies cost and seasonal crisis, together with other hassles such as maintenance requirement, fuel carriage, etc, made the government of Bangladesh develop a program to introduce solar irrigation pumps and replace diesel pumps. Currently there are 314 solar irrigation pumps installed, 235 pumps under installation and 449 approved. And the government has set the target of 50.000 by 2025, with a pilot phase of 1.500 solar irrigation pumps up to 2018. Solar irrigation systems involve minimum maintenance as they are designed for robust application, and "there is a scope for saving of 760 MW of electricity and 800 million liters of diesel", according to Bakr Khan, from Bangladesh Solar & Renewable Energy Association.

The financing structure consists of a "tri-party" commercial business model involving commercial bank-NGO-Farmers. It was first launched in the area of Rangpur, and farmers are now able to grow rice, robi crops and vegetables. Further, the installation of solar irrigation pumps in the area has produced an extra annual income of US$255 per family, which has played a major role in poverty alleviation. In addition to this, IDCOL has its own business model in which it provides 15% return on equity, a 50% grant on the investment, and a 35% capital investment loan. The grant is provided by BCCRF, KfW, GPOBA, USAID and ADB, the loan is offered by IDA and JICA and "today the total cost represents 2/3 the price farmers are currently paying for diesel pumps", says Mr. Barua. After installation, the irrigation pumps are operated commercially by the installer as a first step to ensure a revenue for the installer and make it commercially viable (Bakr Khan[1], 2016).

Additionally, to increase access to electricity for commercial and productive use in off-grid areas, Bangladesh is starting to promote solar hybrid mini-grid systems. The first 100 kW solar mini-grid was launched in 2010 the remote island of Sandwip, which is not accessible during some months due to the Himalayan water and other natural disasters. The project's cost totaled US$ 730.000, financed through a 50% grant, 30% loan and 20% equity. Today the solar mini-grid serves 50 households and businesses, 5 schools and 5 health centers, and it has a distribution line of 4 kilometers (Khan[2], 2014).

Key features of typical Solar Irrigation Pumps in Bangladesh

Particulars	11 kWp Pump	4 kWp Pump
PV capacity	11.0 kWp	4 kWp
Flow rate	900,000 liter/day	250,000 liter/day
Total head	14 meter	
Major equipment	Pump and PV panel	
Project cost	USD 32,000	USD 8,500
Grant	USD 12,800	USD 3,400
Land coverage	Paddy: 5.4 hectare; Others: 8 ~9 hectare	Paddy :2.2 hectare; Others: 4~5 hectare
Irrigation charges	USD 260~300/hectare for paddy (Boro)	

Source: IDCOL (2016)

IDCOL has played an instrumental role in disseminating solar mini-grid projects in rural Bangladesh and has set the target to finance 50 by 2018. Currently there are 7 mini-grids in operation, 11 under construction and 21 in the pipeline. A typical mini-grid of project size 140-150 KWp costs around US$760.000 - US$820.000. This type of mini-grid can serve 800 customers with average load demand of 20KW. In the context of Bangladesh, such mini-grids can generate 175000KWh, with an expected revenue of US$0.36- US$0.38 (Ahmed[3], 2016).

Under the proposed business model by IDCOL, grant is available up to 50% of capital costs. The rest 50% is composed of 20% equity and 30% project soft loan with an interest rate of 6% over a 10 year period and a grace period of 2 years.

1 Khan, B. A. (2016) "Solar Irrigation in Bangladesh – A Sustainable Energy Access" Conference on Green Finance for Sustainable Development, Dhaka, Bangladesh

2 Khan, H. (2014) "Experience from First Solar Mini Grid Service in Bangladesh"

3 Ahmed, S.I. (2016) "Solar Hybrid Mini-grid: Sustainable Rural Energy Access", presented at Conference on Green Finance for Sustainable Development, Dhaka, Bangladesh

The funding sources are KfW, DFID, GPOBA, USAID and ADB (IDCOL, 2016).

WFC Councilor, Founder of the Bright Green Energy Foundation, Dipal Barua, introducing Bangladesh SHS financial mechanism

Expanding the power generation capacity: current challenges

Bangladesh is at the forefront of Solar Home System dissemination. The country has succeeded in deploying off-grid solar solutions to rural population to help fill their energy needs. By 2018, 6 million Solar Home Systems will have been deployed in the country since 2003 through suitable microfinance mechanisms, benefitting 12% of the population, creating more than 75.000 direct and indirect jobs, and saving 242.000 tons of kerosene as highlighted by Mr. Pavel, IDCOL's Head of Renewable Energy[1]. Hands-on training provided by local technical of POs enable low skill people to operate and maintain SHS without supervision. The low operational costs, together with the substituted costs for conventional fuels such as kerosene, ensure households' ability to repay. The economic, health and environment benefits derived from SHS have quickly attracted the interest from family, friends and neighbors of the households installing and owning SHS. As a result, SHS represent a key pathway to achieve clean wide-energy access for all by 2020.

The promotion of solar irrigation pumps and solar mini-grids have further enhanced the benefits provided by SHS. Aside the environmental benefits, solar irrigation pumps provide agricultural support for better cultivation and more production and have resulted in better income generation. Now farmers are saving 40% on irrigation against what they were spending before for traditional diesel run pumps. Further, solar mini-grids are bringing grid quality electricity at off-grid remote areas. They are less dependent on fuel fluctuation. Their modular system enables the expansion of the grid with increased demand. They are affordable for investors due to the financial mechanism and offer new possibilities to business. And for the government of Bangladesh it represents low capital expenditure compared to the extension of the national grid.

Nevertheless, the Bangladesh model faces key challenges. First, in a context where the country is embracing a strategy in search for more power generation capacity, the market needs to be open up. As it is designed today, Bangladesh institutional setting does not incentivize newcomers to join the RE market, as IDCOL only accepts and supports those companies having previously sold 1000 units. This limits competition, can distort prices in the market and it is more likely to create a corruption-conducive environment. By the same token, IDCOL financial model has play an instrumental role in developing an RE market for Bangladesh. Nevertheless, the structure cannot be primarily based on development banks funding. To build a mature RE market, Bangladesh needs to create an environment where private investors and commercial banks can take over and move forward. Traditional commercial banks and private investors won't take the challenge unless they have the tools to assess the risks of RE projects and the conducive policy to support their engagement.

But alongside this, each system still faces its own

1 For further information, see: Pavel, K. (2016) **IDCOL Renewable Energy Activities**, presented at the Conference "Study 100 % Renewable Energy: Transferrable lessons from Bangladesh to Tanzania", Dhaka, April 19, 2016

challenges. While SHS has been successfully introduced in the country at an unraveled pace, it has reached only 12% of the population so far. Further, the total power generation capacity of the Solar Home Systems is 151 MW and their use for commercial or industrial purposes remains insignificant. They are small-case autonomous electricity supply appliances for households which can run for 4 to 5 hours a day and can be used for a wide range of uses (lighting, mobile phone charging, watching TV or powering fans, etc.) depending on the capacity. Larger SHS can be installed to power larger loads, but a higher cost, since they require a larger PV array, a larger battery storage system, as well as larger wiring and inverters.

Technical characteristic

System size	Battery capacity	Appliances	Supplied system components	Operating time	System cost in BDT	System cost in US$	Warranty
20Wp	30 AH	3 W LED Lamp: 2 Mobile charger: 1	1 Quantity 20 W/P Solar Panel, 3 Quantity 3 Watt LED Tube, Charge Controller, Structure, Switch, Required Wire	4-5 hours	10.750	143,33	Battery 5 years LED Lamps 3 years Solar Panel 20 years Charge Controller 3 years
50Wp	55 AH	3 W LED Lamp: 5 LED Color TV: 1 Mobile charger: 1	1 Quantity 50 W/P Solar Panel, 4 Quantity 3 Watt LED Tube, Charge Controller, Structure, Switch, Required Wire, 1 Quantity 15" LCD/ LED TV	4-5 hours	19.500	260	Battery 5 years LED Lamps 3 years Solar Panel 20 years Charge Controller 3 years
85Wp	100AH	3 W LED Lamp: 7 LED Color TV: 1 Mobile charger: 1 12 W DC Table Fan: 1	1 Quantity 85 W/P Solar Panel, 7 Quantity 3 Watt LED Tube, Charge Controller, Structure, Switch, Required Wire, 1 Quantity 12 Watt Fan, 1 Quantity 15" LCD/ LED TV	4-5 hours	33.000	440	Battery 5 years LED Lamps 3 years Solar Panel 20 years Charge Controller 3 years

For the deployment of solar irrigation pumps, POs need to create awareness among the farmers and local administration of the cost of water from solar irrigation pumps, the environmental damage caused by diesel run pumps and the year round efficiency about solar irrigation pumps. Further, there is a lack of skilled labor and pump operators, as well as of online banking facilities in rural areas to collect online payments directly from SIP beneficiaries. Lastly, it is necessary to identify the proper SIP site which would benefit both farmers and sponsor (Barua[1], 2016).

Solar mini-grids also face operational, financial and policy challenges. Due to the remote location of sites, they system faces difficulties in matching load. On the operational side, continuous support is required for smooth running of the grid; there is a lack of technical and administrative human resource available in rural areas; and demand side management is required for long-term reliable operation. On the financial side, it requires low cost funding with long tenure, in contrast with commercial banks, site selection is difficult due to risk of arrival of grid within short time of project installation and users have to combine with other users for profitability. On the policy side, there are uncertainties due to undefined polices for scaling up. This would entail defining preferential areas for operation, clear policy regarding status of operators, low or no interest loans, incentives for supplying electricity from renewables and total Tax or VAT exemption[2].

Conclusion from Bangladesh

The policy framework and robust and regulated financial mechanism has helped overcome the initial barriers holding the RE potential back:

- Lack of national renewable energy policy
- Lack of proper financial model design to make SHS affordable
- Limited or no access to finance
- Lack of skilled manpower
- Lack of awareness about the RE solutions
- Lack of public private partnership in the energy sector

As Fazley Rabbi, Senior Manager at Grameen Shakti underlines there were initial challenges: "At the beginning, from 1996 to 2012, it took us about 15 years to achieve this one million milestone. But we have deadlocked our capacity and we strongly believe that we can reach the second million milestone by the end of 2015". Today Bangladesh is experiencing a solar revolution. New 65,000 SHSs are being installed every month. Now rural clinic can resort to a solar refrigerator to store vaccination, children's evening study time is reported to have improved, as well as the health of households' members. And businesses are rising due to longer hours and more varied options of income-generation activities.

Electricity generation through SHS is a proven technology in Bangladesh, which can be customized and launched globally in other inaccessible areas to reach millions of off-grid population. But it has also evidenced some limitations that need to be overcome to ensure widespread clean energy access. This implies first and foremost expanding the portfolio of renewable energy technologies, both to increase power generation capacity and to ensure the use of renewables for service and productive uses. This all goes hand in hand with the need to support sustainable and scalable business models allowing accelerating the speed of RE deployment.

As the system size increases, the capital requirement increases as well, and securing finance is a key challenge. Any renewable energy solution requires capital expense with low interest rates to

1 Barua, D. (2016) "**With a vision to make Bangladesh the First Solar Nation**", presented at the Conference "Study 100 % Renewable Energy: Transferrable lessons from Bangladesh to Tanzania", Dhaka, April 19, 2016

2 Huque, A. (2015) "**Solar mini-grids in Bangladesh**"

make it commercially viable. At the same time, the institutional setting cannot be mainly reliant on development banks finance. To stimulate a large-scale renewable energy market, private investors and commercial banks need to come in and play a leading role. The IDCOL experience can be used to transfer best practices and set a framework which attract the commercial banking sector. Further, the institutional setting should foresee measures to promote further competition in the RE market. At present, only companies having sold more than 1000 units are accepted and supported by IDCOL. This limits the entrance of companies willing to join the RE market but lacking the initial funding required or with no previous record in the sector. Finally, a sustainable model for risk management and long-term performance also requires fostering technology transfer and building human specialized skills and expertise.

So far, the positives outcomes from these policies have only deepened the commitment and support from the government of Bangladesh, key stakeholders and population to the uptake of RE. Once the targeted 6 million SHS, 1500 solar irrigation pumps and 50 solar mini-grids are installed by 2018, they will contribute to 4% of the total electricity generation and covert 20% of the total population of Bangladesh. Devising policies which respond to the aforementioned challenges and respond to a RE market which is no longer in an embryonic stage will certainly further contribute to boost up the deployment of RE and increase its potential to ensure both service and productive uses.

RE stakeholders from Bangladesh and Tanzania analyzing the challenges to scale up RE

Opportunities for policy change in Tanzania

Stakeholders engaged in the project showed optimist about the future deployment of renewable energy in the country. When asked at the workshop in February what they thought would be the share of renewable energy in Tanzania by 2030, the average figure expressed was 55%. The current political scenario in Tanzania also gives confidence that the required transformation of the energy sector might be within reach despite the challenges.

At present Tanzania is undertaking a nation-wide local government reform program with the goal of reducing the proportion of Tanzanians living in poverty, and the purpose of improving quality, accessible and equitable public service delivery, particularly to the poor. The Tanzania Development Vision 2025 aims to coordinate and direct all efforts and natural resources towards the core sectors that will allow the country to achieve its goals: high quality livelihood; peace, stability and unity; good governance; a well-educated and learning society; a competitive economy capable of producing sustainable growth and shared benefits. In this regards, workshop participants reported that renewable energy has a truly transformational role to play. In addition to the Tanzania Development Vision 2025, the government is drafting the National Energy Plan to "unlock challenges prevalent in the energy sector, improve performance and spur prudent and optimal use of the energy resources for the benefit of the present and future generations".

Further, it was highlighted that the new government is receptive for cooperation and partnerships as well as that there is an opportunity for adapting national budgets. For industrialization plans of the government, renewable technologies are an important enabler to deliver the needed energy. Another reason for participants to see the window of opportunity wide open is the fact that the young generation is more aware of environmental issues and is familiar with using technologies.

Meanwhile, as presented during the workshop, Tanzania can also benefit from the international momentum. Energy access has been given a special attention at a global level, e.g. in September 2015, the United Nations adopted the Sustainable Development Goals by consensus of the 193 member nations, with specific targets to be achieved over the next 15 years. Among the key themes agreed was energy, aiming to "ensure universal access to affordable, reliable and modern energy services by 2030" and "increase substantially the share of renewable energy in the global energy mix".

Another UN-led initiative which has generated significant support since its launch in 2011 is the Sustainable Energy for All (SE4ALL - making sustainable energy for all a reality by 2030. One of the first countries to opt-in on this initiative was Tanzania, confirming plans to achieve the UN SE4ALL goals through massive investment from both the public and private sectors in the energy industry.

Launched by African heads of state at COP21 in Paris, The African Renewable Energy Initiative (AREI), under the mandate of the African Union, aims at enabling the installation of large-scale renewable energy capacity on the African continent by 2020. And it plans to mobilize Africa's large expanse of clean energy sources to generate around 300GW by 2030.

With a mandate from countries around the world, IRENA (International Renewable Energy Agency) also encourages governments to adopt enabling policies for renewable energy investments, and provides practical tools and policy advice to accelerate renewable energy deployment. Along the same lines, REN21 (Renewable Energy Policy Network for the 21st Century) is the global renewable energy policy multi-stakeholder network that connects a wide range of key actors to facilitate knowledge exchange, policy development and joint action towards a rapid global transition to renewable energy.

These interrelated initiatives will contribute, in one way or the other, on similar interventions, e.g. moving financial streams towards low carbon development and GHG emissions reduction by

2050. And they all converge in their goal to ensure that African countries leapfrog to RE systems that support their low-carbon development strategies while enhancing economic and energy security.

With a comprehensive and robust policy framework, Tanzania can draw together the commitments made under these various initiatives, and use them to the best advantage of the country, advancing both its national and international agendas to provide energy security, income generation and poverty eradication, as well as environmental protection.

Participants of the kick-off workshop evaluating opportunities for RE deployment in Tanzania

Conclusion and next steps

The wide-ranging role of energy to unlock potential for economic growth and achieve broad-base poverty alleviation is extensively acknowledged. Nonetheless, the energy sector remains a challenging area in many parts of the world, largely lacking in necessary infrastructure systems. The sector is characterized by a lack of access to affordable, reliable and clean energy services (especially in rural areas) and over-dependence on the traditional sources of biomass to meet basic energy needs.

Tanzania epitomizes this reality. The energy system generates extremely limited, unreliable and costly supplies of electricity through grids which do not reach most of the population. As a result, the energy balance in the country is dominated by the use of inefficient, pollutant and high-cost traditional biomass, such as charcoal and firewood. Further, average demand for electricity is growing at 10-15 percent per annum, widening the gap between energy demand and supply. Absent a major transformation, energy will remain a powerful bottleneck on Tanzania's prospects for the desired socio-economic transformation.

Renewable energy has been championed not only as a key source to transform the energy system, but as means to transform entire societies. In addition to improving security of energy supply and mitigating climate change, they are a potential tool for propelling economic development, job creation, reducing dependence on imported fuels while encouraging local value creation. Over the last decade, because of their cost-competitive nature, they have been expanding quickly, notably in rural areas, which tend to be located in sparse and difficult to reach areas, but are endowed with abundant sources of renewable energy.

Tanzania is no exception. Today the country is already ripping the socio-economic benefits of pilot projects. Off-grid renewable energy technologies have created locally both direct and indirect benefits by enhancing the supply of energy, providing lighting in schools, laboratories and hospital, easing the energy burden experienced by low-income population and improving business and agricultural productivity.

External developments, both of initiatives and agreements such as SDGs, Paris Agreement or AREI, reinforce this trend and encourage the country and its citizens to move towards the widespread uptake of renewable energy. Alongside this, major breakthroughs in renewable technologies and fast drop in prices have the potential to bring energy to the rural and urban population of Tanzania within reach, empowering them with electricity, income and health.

Nevertheless, important obstacles are impeding RE progress, such as: no effective mechanism or legal framework for facilitating and incentivizing energy access through RE, difficult access to finance for RE projects, lack of technology standards for RE technology, and insufficient renewable energy skills and citizens' awareness.

As the Bangladesh case illustrates, a proper scale-up of renewable energy solutions requires a comprehensive policy framework and a long-term strategy. A well-designed framework for renewable energy deployment can offer a real opportunity to identify synergies and complementarities among the three challenges faced by Tanzania: energy security, socio-economic development and climate change mitigation.

The findings from the Bangladesh study tour underline the need to rely on a comprehensive, stable and robust regulation, product of a multi-stakeholder process, with a clear vision, commitment and coordinated actions to overcome the political, financial, technical and behavioral existing challenges.

Specific factors to bear in mind include: the integration of RE within a broader national plan, the development of policies aiming at reinforcing RE deployment for widespread energy access, the setting of an institutional structure to promote RE and adopt technology standards, the establishment of financial mechanisms to unlock private sector investment and catalyze a market for RE, and last but not least, the link of RE technologies to

economic activity and local value creation.

The existing political will in Tanzania is a very important force to overcome internal barriers and vested interests to catalyze the renewable energy transformation. To maintain this political momentum, participants of the workshop agreed on the next steps towards influencing action in the current policy framework:

• Identify necessary policy recommendations and strategies for the new National Energy Plan and Renewable Energy budget allocation, where there is multi-stakeholder and cross-sectoral collaboration, and where improved access to energy goes hand contributes actively to economic growth, poverty eradication and environmental protection;
• Win local multipliers and engage leaders: Strengthen synergies, networks and platforms for multi-stakeholder dialogue, including local businesses, parliamentarians, media and civil society groups to build the right level of awareness and intensify the deployment of renewable energy;
• Inspire stakeholders and build up hands-on knowledge on how 100% RE adds value to local economic development and community sustainability, and how the Bangladesh experience can be transferred to the Tanzanian context.

CAN-Tanzania, World Future Council and Bread for the World are committed to support Tanzanian policy-makers in this endeavor. Policy dialogue goes hand in hand with policy learning and is a prerequisite for sustainable development. Therefore, the goal is to enhance the debate and reach out to other stakeholders to achieve the overall Sustainable Development and Poverty Reduction Goals set by Tanzania.

Solar mini-grid

Resources

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Appendices

List of participants of the kick-off workshop

Last Name	First Name	Organization	Position
Mongella	Gertrude	AWA	WFC Honorary Councilor and Special Advisor to the ECA Executive Secretary and UNESCO Director General
Magesse	Ngassani	CCT	Program officer
Mikenze	Regina	AWA	Personal assistant
Zephania	Binto	Ecoho	Chairman
Kalumanga	Elikana	IRA-UDSM	Researcher
Mushi	Lea	TBC	Journalist
Swai	Mary	TaTEDO	Project manager
Kalokola	Friday	Tanzania climate change alert and resilience	Field officer
Nyanda	Emillian	Ministry of Energy & Minerals	Energy officer
Urioh	Tajiel	The GREEN Icon	Director
Kiwasaka	Hildegarda	WRDP	Chairperson
Daniel	Dickson	CAN Tanzania	Member
Berger	Julia	Hanns Seidel Foundation	Resident representative
Kirste	Kathrin	Hanns Seidel Foundation	Intern
Fünfgelt	Joachim	Brot für die Welt	Policy advisor
Garcia	Irene	World Future Council	Policy officer
Mwanga	Sixbert	CAN Tanzania	Director
Leidreiter	Anna	World Future Council	Senior Program Manager

List of participants of the study tour

Last Name	First Name	Organization	Position
Munkuda	Mwanahamisi Athumani	Parliament of Tanzania	Director
Mwaifunga	Hawa Subira	Parliament of Tanzania	Member
Biteko	Doto Mashaka	Parliament of Tanzania	Member
Katani	Katani Ahmadi	Parliament of Tanzania	Member
Makwaya	Nyaso Athumani	Ministry of Energy and Minerals, Tanzania	Electrical engineer
Swai	Mary Emmanuel	Tanzania Traditional Energy Development and Environment Organization	Project manager
Mfugale	Deodatus Marcus	Environmental Journalist Association, Tanzania	Senior journalist and instructor
Magesse	Ngassani William	Christian Council of Tanzania	Officer
Fünfgelt	Joachim	Brot für die Welt	Policy advisor
Garcia	Irene	World Future Council	Policy officer
Mwanga	Sixbert	CAN Tanzania	Director
Leidreiter	Anna	World Future Council	Senior program manager