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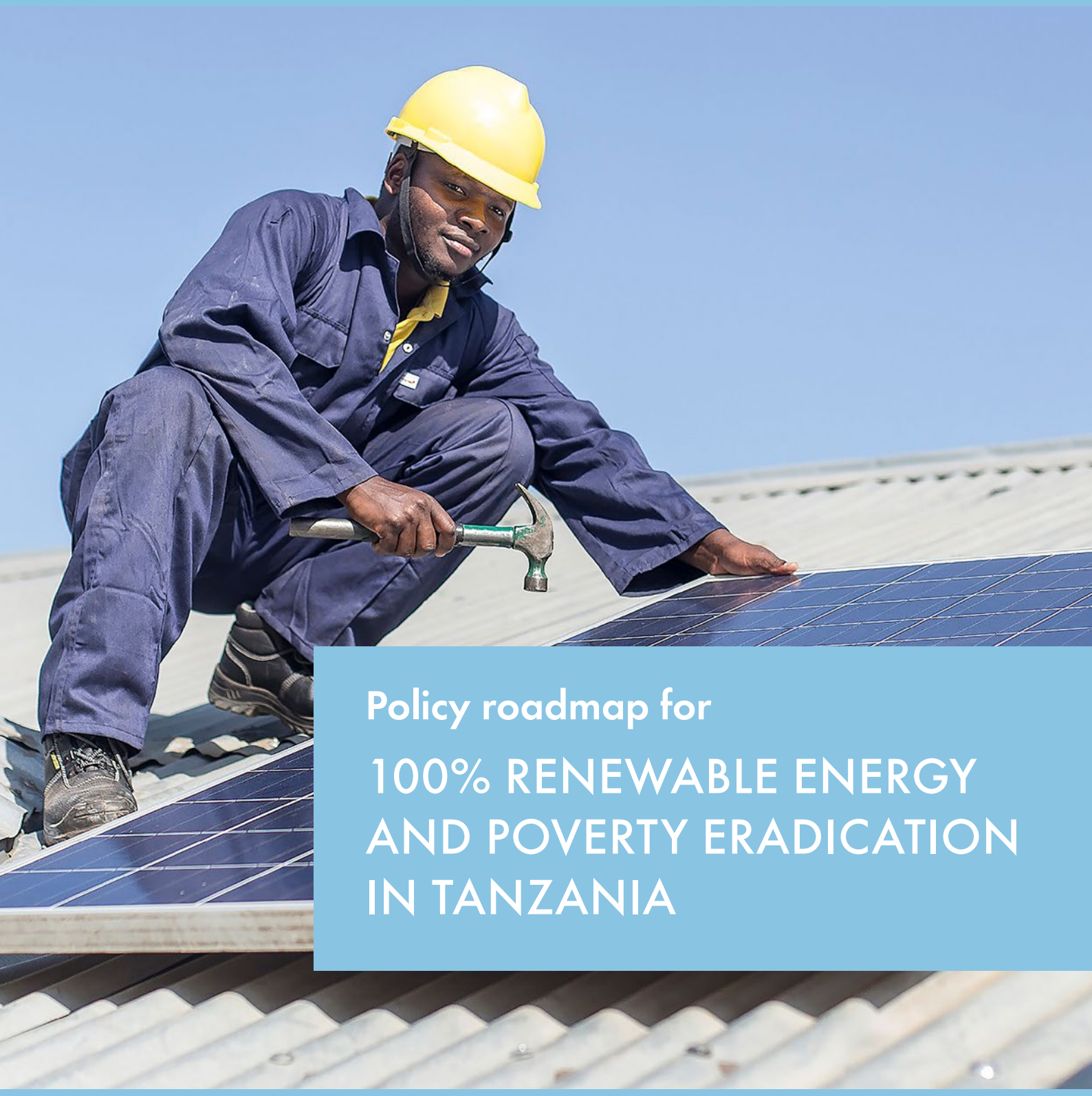
World Future Council

CAN CLIMATE ACTION NETWORK Tanzania



Policy roadmap for

100% RENEWABLE ENERGY AND POVERTY ERADICATION IN TANZANIA

100% RENEWABLES

IMPRESSUM

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1. INTRODUCTION

In November 2016 at the UN COP22 in Marrakesh/ Morocco, 48 countries committed to "strive to meet 100% domestic renewable energy production as rapidly as possible while working to end energy poverty, protect water and food security, taking into consideration national circumstances"[1]. These 48 countries are among the most vulnerable countries and are united as the Climate Vulnerable Forum (CVF). This has probably been the most important outcome of the Climate Conference in Marrakesh. With their declaration these countries proved unique leadership and draw the pathway on what climate action for development looks like. They reaffirmed their commitment to tackle climate change, inequality and poverty, which they already expressed with their signature under the Sustainable Development Goals and the Paris Agreement in 2015.

Tanzania is one of these countries. "With today's declaration, Tanzania proves leadership in bringing electricity to all citizens. By visiting other countries, I have learnt in the past months that renewable energy can overcome poverty and improve people's livelihoods. I therefore welcome Tanzania´s commitment to join the other most vulnerable countries in going to 100% Renewable Energy to limit global warming to 1.5 degrees"[2], said Mr. Doto Biteko, Chair for Parliamentary Committee on Energy and Minerals, Tanzania, welcoming this step.

This report suggests concrete political measures and outlines necessary governmental action to operationalize the target. It captures reflections, experiences and concrete recommendations articulated by Tanzanian stakeholders to scale up Renewable Energy (RE) while spurring sustainable development and eradicating poverty in the East African country. These insights were gathered in a multi-stakeholder policy dialogue, which took place throughout the year 2016.

Tanzanian delegation visiting Solar Home System in rural Bangladesh in April 2016

CAN-Tanzania, the World Future Council and Bread for the World have been engaging with key energy stakeholders 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. The dialogue has taken shape in a variety of formats: bilateral meetings, workshops, political conferences, site visits and consultation rounds. While this took place with stakeholders from government, parliament, and academia, private and financial sector as well as with various civil society organizations in Tanzania, learnings from other countries played a key role in the process. During a study tour to Bangladesh, Tanzanian policy makers explored the Asian country's experience in rapidly expanding first time access to electricity among its citizens with different renewable energy technologies.

By facilitating this multi-stakeholder policy dialogue, CAN Tanzania, the World Future Council and Bread for the World aimed at:

- Inspiring stakeholders and build up hands-on knowledge on how 100% RE adds value to local economic development and community sustainability.
- Strengthening 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.
- Identifying necessary legislation and policy reforms.

After Tanzania's pledge to go 100% renewable energy during COP22, this report can serve the government as a guidance for a way forward, building on the vast expertise the country already has to improved access to energy contributing actively to socio-economic growth.

2. TANZANIA – COUNTRY OVERVIEW

2.1 Demographic

Tanzania is East Africa's largest country, with a population of 53.470.420 million inhabitants, of which 45% is under the age of 15[3]. Ranking 27th in the world in terms of its population[4], Tanzania's population average annual growth rate (1960-2015)) has been 3.1%, and it is expected to reach 87.2 million by 2030[5].

Tanzania's population is widely dispersed, with 70 per cent of the population living in rural regions and a population density of 60 per km².[6] In rural areas the distribution of population varies significantly. For instance, in the arid regions, population density is as low as 1 person per square kilometer, and about 53 people per square kilometer in the water-rich mainland highland[7].

2.2 Political Context

Tanzania is a single state under a presidential parliamentary democratic system. The parliament of Tanzania is based in Dodoma, while the government sits in Dar es Salaam. The current parliament is the 11th of Tanzania, with 369 members. Political power since independence has remained highly centralized around the presidency, with extensive power and in charge of directly appointing key members of the executive and judiciary[8].

In October 2015, Dr. John Pombe MagufulI was elected as the fifth President of the United Republic of Tanzania. In the early days of his presidency, MagafulI promised to boost economic performance and eliminate poor service delivery and corruption from the public sector.

Currently Tanzania is embarked on its second Five Year Development Plan 2016/17-2020/21 (FYDP II)[9] "to bring about fundamental improvements in the lives of Tanzanians", as expressed by the President of Tanzania. With the theme Nurturing Industrialization for Economic and Human Development, the focus, as described by plan has three pillars: industrialization, human development, and implementation effectiveness.

As stated by the Government of Tanzania, the Five Year Development Plan has been designed with the goal of "bringing about fundamental improvements in the lives of Tanzanians" and of "embarking on broader social and economic transformation" for realizing the development aspirations articulated in the Tanzania Development Vision 2025[10]. Published by Tanzania Planning Commission in 1999, Vision 2025 is still the main strategy document in outlining the general development for the country. The goal of Tanzania Vision 2025 is to set "the new driving forces capable to graduate the country from a least developed country to a middle income country with a high level of human development by 2025".

As part of the efforts devised within Vision 2025, Tanzania set the Big Results Now (BRN)[11] initiative in 2012, aiming to speed up project completion in six priority areas; one of which is the energy sector. The prospects of the other five priority areas: Agriculture; Water; Education; Transport; and Mobilization of resources, lean largely on improving the bottlenecks on the energy system, ensuring accessible, affordable and sustainable energy for all. Energy BRN proposes several steps to improve electricity access, strengthen the financial capacity of the public utility Tanzania Electric Supply Company (TANESCO), and develop mini- and off-grid renewable opportunities[12].

As the Tanzanian Ministry of Energy and Minerals outlines in National Energy Plan 2015, the development of the country and their citizens is limited without the opportunity for all citizens to participate in "the mainstream energy economy"[13].

2.3 Economic Context

Tanzania is one of the world's poorest economies in terms of per capita income, $864,9 a year, which is equivalent to less than 9% of the world's average. The country's per capita income is slightly ahead of low income countries average per capita income ($615,6), but still far from lower middle income countries ($1.988,2) and even further from middle income countries ($4736,7)[14].

Nevertheless, the country has achieved high growth rates based on its vast natural resource wealth and tourism. GDP growth in 2009-15 was 6-7% per year[15], making it one of the 20 fastest growing economies in the world. Over the same period Tanzania's inflation has been brought down to a single digit of 5.4% as of March 2016, from an average of 12.6% during 2011. Trade deficit also shrank over the last 5 years, from $5bn in 2010 to $3bn in 2015[16].

The economy depends largely on the agricultural sector, which accounts for more than one-quarter of GDP, provides 85% of exports, and employs about 80% of the work force[17]. Tourism is another key sector. At an average of $2bn a year, tourism has brought Tanzania the largest amount of foreign currency in the past 3 years[18]. Construction, wholesale and retail trade, public administration and manufacturing contribute respectively to 12%, 10%, 7% and 6% of Tanzania GDP[19].

The 2016/17 budget aims at improving the basic infrastructure for the provision of water, power and transportation for industrial development, as well as raising production of agricultural produce which are used as industrial raw materials[20]. More in detail, the government has budgeted TZS 5.47 trillion equivalent to 25.4% of the total budget for infrastructure projects. TZS 4.77 trillion has been budgeted for the education sector, equivalent to 22.1% of the total budget. TZS 1.99 trillion will be targeted to the health sector, equivalent to 9.2% of total budget. About 5% of the total budget (TZS 1.13 trillion) will be directed towards the power sector to ensure availability of reliable power supply for industrial and domestic uses. Among the projects earmarked for implementation include: rural electrification and completion of projects such as KinyerezI I and KinyerezI II gas fired electricity generation plants[21].

2.4 Social Context

Tanzania is one of the 50 Least Developed Countries (LDCs). The economic growth experienced by the country has alleviated Tanzania's poverty rates, declining to around 28% in 2012, from 34% in 2007. Nevertheless, this growth has not led to a commensurate reduction in poverty. Today, approximately 12 million Tanzanians still live below the national poverty line, almost unchanged from 2007 due to high population growth. And a significant proportion of the population also risks falling back into poverty in the event of socio-economic shocks[22].

Across the country, urban households are better off than their rural counterparts due to high gap in assets ownership, employment and educational attainment. Approximately 90 per cent of Tanzania's poor people live in rural areas[23]. The urban-rural differentials in returns to employment of the households have widened over time, driven mainly by an increase of returns to wage employment in the public and private sectors and to a lesser extent to non-farm businesses in the urban areas[24].

On the education front, poor households seem to have benefitted from the policies for basic education to catch up with their urban counterparts. Today, there is a net primary enrolment rate: 94%, compared with only 59% in 2000. Net secondary school enrolment has also expanded quickly: from 6% in 2001 to over 30%in 2011. Fees for primary school were abolished in 2001[25]. And in 2015, the Tanzanian government issued a circular rolling back the payment of fees for secondary education. This measure is in line with the SDG 4 requiring states to ensure that "all girls and boys complete free, equitable and quality primary and secondary education"[26]. Nevertheless, rural population in Tanzania continues to suffer limited access to basic services.

The current Five Year Development Plan focus on the education sector lays on the improvement of the quality of education at each level. Likewise, it aims at re-orienting the human capital development towards key productive sectors such as agriculture, manufacturing, energy, ICT, transport and tourism[27].

2.5 Energy Context

ENERGY ACCESS

The Government of Tanzania is currently implementing a national energy policy, the National Rural Electrification Program (2013–2022), whose goal is to increase the country's overall electricity access of the population from 36% in 2014 to 50% by 2025 and to at least 75% by 2033.

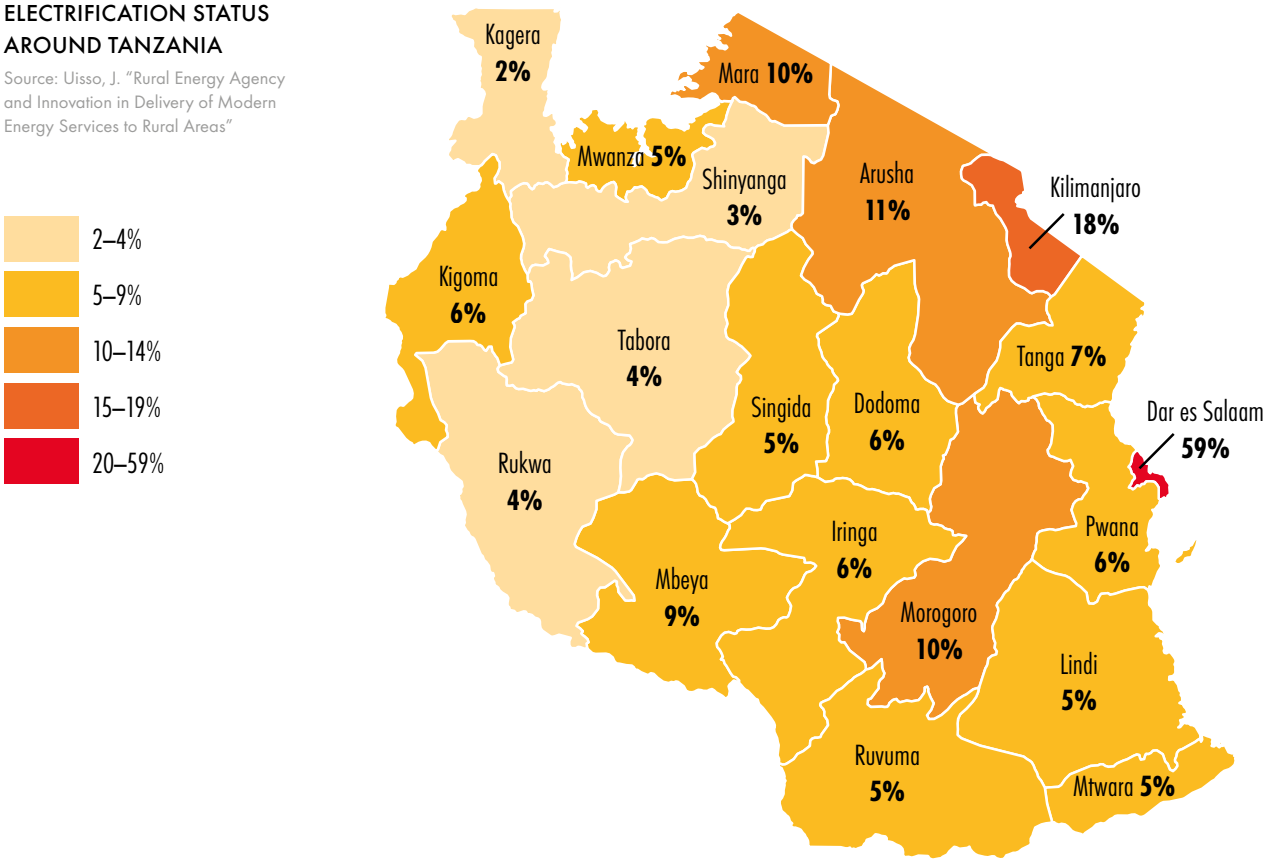
The National Rural Electrification Program led by the Ministry of Energy and Minerals and the Rural Electrification Agency includes both on-grid and off-grid solutions and has four priorities; (i) the connection of new customers to the grid in already electrified settlements; (ii) new connections to the grid; (iii) electrification through off-grid investments; and (iv) the development of distributed technologies, in particular off-grid solar and other renewable technologies[28].

As regards access to the national grid, only 10% of households in Tanzania are connected, and only 1% is able to use electricity for cooking. 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[29], seriously constraining the potential for growth and level of earnings of the population.

Above and beyond, 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.

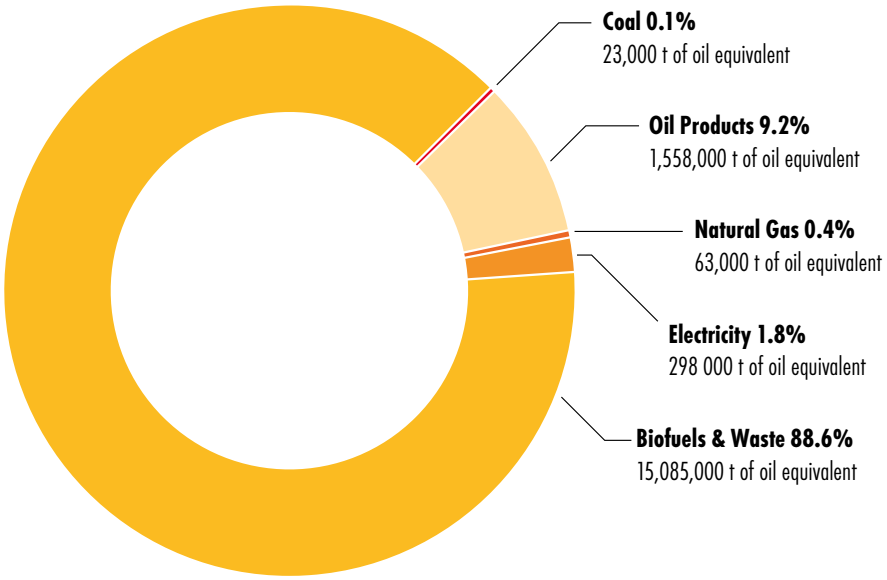
ELECTRIFICATION STATUS AROUND TANZANIA

Source: Uisso, J. "Rural Energy Agency and Innovation in Delivery of Modern Energy Services to Rural Areas"



SOURCES AND END-USES OF ENERGY, 2009

Source: Uisso, J. "Rural Energy Agency and Innovation in Delivery of Modern Energy Services to Rural Areas"



ENERGY CONSUMPTION

In view of the energy access scenario, the national energy balance is dominated by biomass-based fuels: about 88% of total energy consumption is biomass in the form of firewood and charcoal for cooking, with rural areas accounting for about 85% of the total primary national energy consumption (1.102 TOE per capita)[30].

Petroleum products comprise 9.2% of total final consumption, whilst electricity account for just 1,8%. Indeed, Tanzania's per capita electricity consumption is very low, less than 108 kWh per year in 2016, compared to Sub-Saharan Africa's average consumption of 550kWh per year, and 2,500kWh average world consumption per year[31].

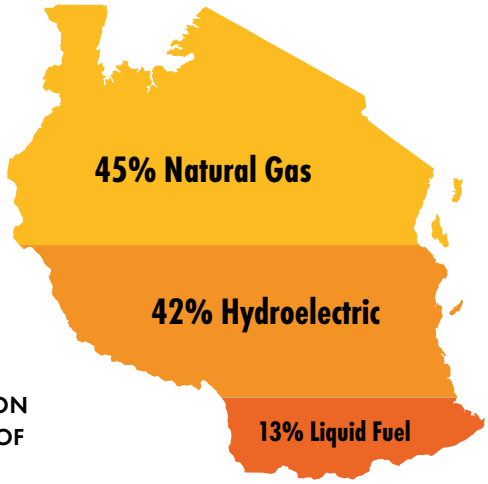
As of August 2014, the electricity demand growth rate was about 10-15% per year and the peak demand was about 905.05 MW. For the coming years, Tanzania public utility, TANESCO, anticipates a sustained increase in electricity demand due to productive investments, increasing population and further expanded electricity access. The government plan under the Big Result Now (BRN) initiative to be implemented by 2020 is to generate 1,500 MW from gas, 160 MW from oil, 100 MW from wind, 60MW from solar, 11 MW from small hydropower and 200 MW from coal, as well as 650 MW from estimated geothermal potential[32].

ENERGY SUPPLY

Electricity generation, transmission and distribution is provided by a central grid, owned by the state public utility TANESCO (responsible for 98% of electricity supply), and by isolated minI grids in remote areas[33]. Currently Tanzania's generation capacity is 1.357,69 MW, composed of hydro 566,79 MW (42%), natural gas 607 MW (45%) and liquid fuel 173,40 MW (13%). Only 59% of total capacity is supplied by TANESCO, while Independent Power Producers (IPP) and Emergency Power Producers (EPP) provide 26% and 13% respectively, which they sell wholesale to TANESCO. In addition, Small Power Producers (SPP) account for 2% of total capacity. They are independent producers with a capacity inferior to 10 MW and they may sell electricity wholesale to TANESCO or to retail consumers. Finally, private, diesel-based captive generation is estimated at 300 MW nationally, with costs exceeding US¢35 per kWh[34].

For about two decades now, hydro systems supplied about 80% of electricity needs in the country[35]. In recent years, due to extensive droughts in the country, the contribution of hydro to the total supply has fallen dramatically. This has forced TANESCO to use extensive load shedding, thermal power plant for base load, and hire emergency power installations, at a considerable financial cost[36].

Hence, the government has embarked on a long-term strategy to: (i) expand production capabilities, from 4,175 GWh in 2010 to 47,723 GWh in 2035; (ii) strengthen transmission capabilities (new high voltage transmission lines of 400 kV are being constructed throughout the country[37]); and (iii) increase installed peak capacity seven-fold by 2035, from about 1,000 MW in 2013 to about 4,700 MW by 2025 and 7,400 MW by 2035[38].



GENERATION CAPACITY OF TANZANIA

Source: TanzaniaInvest.com

ENERGY SECURITY

Tanzania is mostly dependent on imported fossil fuels for its electricity. During the financial year 2014–2015 the country imported a total of 4.6bn l of petroleum products[39]. Tanzania also imports about 16MW of power from Kenya, Uganda and Zambia[40].

This represents a heavy burden for the country's socio-economic development and energy plans. 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. Preliminary studies indicate that carrying out the government's plan to increase rural electrification ratio to 26% and urban electrification ratio to 75% will require an investments of about $3,5 billion[41].

In addition, the nearly 1 million tons of charcoal consumed each year produces 20–50 million tons a year in CO2 emissions, and requires an estimated 30 million m3 of wood, with annual average loss in forest cover at 100,000–125,000 hectares[42]. This energy supply and end use structure reflects Tanzania's low level of development and contributes to the intensification and perpetuation of poverty.

2.6 Development Perspectives

The prospects of Tanzania's socio-economic development lean largely on improving the bottlenecks on the energy system. This would improve the management of the energy infrastructure, the delivery of health and education services, and the environment conducive to business development and productivity (notably in key areas such as agriculture).

This is even more critical if we consider:

- Population growth prospects: it is expected to reach 87,2 million by 2030.
- Increase in energy demand: Tanzania's energy demand is growing at the rate of 9-10% each year.
- Newcomers to the employment market: With approximately 800,000 youth entering into labor force every year, nurturing energy infrastructure to allow for productive jobs to those new is critically important for the socio-economic development of the country[43].

At present Tanzania is undertaking a nationwide 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, the 5-year Development Plan and the recent pledge in the Marrakesh Vision to go 100% renewable energy as soon as possible is testimony to that fact.

During consultation rounds of the project, Tanzanian RE stakeholders were asked to explore further and identify the core values and strategies supporting Tanzania's socio-economic development.

WHEN WOULD TANZANIA REACH THE STATUS OF A MIDDLE-INCOME COUNTRY? (IN PERSPECTIVE WITH VISION 2025 AND THE 5-YDP OF TANZANIA)

Arguments from advocates of Tanzania becoming a middle-income country by 2020-2025:

- There is strong political will from the government, underpinned by specific energy and environmental policies implemented or in process (5-YDP, National Energy Policy, NDCs after the Paris Agreement, commitment from the government with the SDGs)
- The new government likewise determined to boost the industrial sector.

Arguments from advocates of Tanzania becoming a middle-income country after 2050:

- Tanzania is facing numerous challenges related to the lack of: coordination, research support, strong foundations, education (20% of the population is illiterate), as well as basic knowledge of the energy sector and its implications, which hinders the progress of the policies and the involvement of the citizens.

WHEN COULD TANZANIA REACH A MIDDLE-INCOME STATUS IF THE COUNTRY IS IMMEDIATELY TAKING THE ROAD TOWARDS 100% RENEWABLE ENERGY?

- Most of the respondents consider the country could become a middle-income country by 2030 given the key role renewables can play in expanding economic opportunities, ending energy poverty and ensuring sustainable development.

WHAT DOES IT MEAN TO BECOME A MIDDLE-INCOME COUNTRY? WHAT ARE THE INDICATORS?

Presence of livestock	■ At present Tanzania is wasting great amounts of primary products (fruits, vegetables, etc.) which could be instead reused to come up with an efficient and strong market with different kind of products. This would characterize Tanzania as a middle-income country.
Industrial Development	■ Development of processes and industries to guarantee the development and evolution of Tanzania; ■ Moving from rainfall agriculture to irrigation agriculture, to increase production and employment; ■ Diversification of technologies and economic sectors; ■ Promotion of economic incentives for industrial development (including the building up local production); ■ Training of the population with skill matching the renewable energy industry needs.
Better education system	■ The population has the capacity to go to school, access education facilities and receive an education of quality.
Good and connected infrastructures	■ Reconnecting and establishing a good transportation system (building roads and improving the current axis) allowing to ensure that main social and economic services can be carried out smoothly.
Energy access	■ Guaranteeing reliable and affordable energy for all, consumed close to where it is produced (not exported while local people suffer energy poverty).
Political commitment	■ Political will and multi-stakeholder engagement to improve Tanzania's level of socio-economic development; ■ Stable institutional framework and regulations; ■ As we move to a middle-income country, the government has budgeted 53% of its development budget to energy. This is a good indicator.

Tanzanian stakeholders sharing perspectives at workshop in Dar es Salam, February and July 2016

3. TANZANIA'S INSTITUTIONAL SYSTEM – FROM VISION TO ACTION IN THE ENERGY SECTOR

3.1 The policy framework

Over the course of the project, stakeholders highlighted specific available energy and environmental policies both at the national and international level which can complement and help move Tanzania 2025 vision forward.

National-level

NATIONAL ENERGY POLICY

The National Energy Policy (NEP) 2015 aimed 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". This current NEP was preceded by similar reports, beginning in 1992 when Tanzania released its Energy Policy, stating "Energy is a critical input into the development project. There cannot be sustainable development and satisfaction of basic need of society without sufficient and efficient supply and use of energy."[44] These early plans gave way to the 2003 National Energy Policy focusing on introducing market mechanisms to facilitate a balance between national and commercial interests to achieve an efficient energy sector.

Other national plans have followed, leading to plans for the liberalization and growth of the Tanzania energy markets. The establishment of the Rural Energy Act in 2005, created the autonomous Rural Energy Board, with a mandate to electrify rural Tanzania with projects producing less than 10 MW. Another important national level plan is the 2009 Electricity Act, which will lead to plans for unbundling of the state owned and controlled TANESCO utility, often cited as a major impediment to the growth of an efficient and resilient electrical sector in Tanzania.

Currently the progress of the NEPs is highlighted in the drafting of the National Energy Plan and National Energy Policy (NEP) 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".

The progression of detail in these plans demonstrates the growth of understanding of how Tanzania fits into the larger energy market and the details included in these NEPs provide private investors with the plans and security that have been lacking in previous NDP planning. However, the 2015 NEP still identifies bottlenecks in the energy market that are similar to preceding energy plans:

> *"Energy Sector faces a number of bottlenecks including: low private sector participation in large scale power generation; over-reliance on few generation sources; unreliable and expensive energy supply; overdependence on Government subsidies; low access to modern energy services; inadequate human resource with requisite skills and knowledge; low participation of Government and Tanzanians in the petroleum value and supply chain; inadequate financial resources to develop the sector."*[45]

The consistency of these NEPs over the past 20+ years demonstrates that Tanzania desperately wishes to improve the energy sector to improve economic and social development in the country. However, it also demonstrates that attempts to foster a centralized, fossil fuel related energy infrastructure is not the pathway to success in Tanzania. The introduction of renewable energy and their development is an obvious way forward for the expansion of Tanzania's energy sector and the inclusion of strong national policy focus on renewable energy technologies will greatly enhance the goals of all subsequent national energy plans.

SECOND GENERATION SMALL POWER PRODUCER FRAMEWORK

According to the Electricity Act from 2008, the Energy and Water Utilities Regulatory Authority (EWURA) is given mandate to make rules prescribing activities and performance of licensees for small power producers.[46] In that context, the First Generation Small Power Projects (SPP) Framework has existed since 2008 and was reviewed by the authority to tackle some of the experienced challenges. The Second Generation SPP Framework covers the development of small hydro, biomass, wind, and solar energy projects of capacity ranging from 100kW up to 10MW, and is based on two approaches: a Renewable Energy Feed-in Tariff ("REFIT") approach for small hydro and biomass) projects; and a competitive bidding approach for wind and solar projects with a capacity above 1MW up to 10MW.[47] In February 2016, the Energy and Water Utilities Regulatory Authority approved the Competitive Bidding Framework for Solar and Wind Small Power Projects (SPP) under the Second Generation SPP Framework. Solar and Wind SPPs up to 1 MW will be based on the approved REFIT of a 500 kW biomass project connected to the main grid plus a 5% premium and a 15 % premium for those connected to Isolated MinI Grid[48]. It is worth mentioning that stakeholders engaged in the dialogues were not aware of or engaged in these policy developments.

LONG-TERM PERSPECTIVE PLAN (LTPP)

Several national level development plans have been created as actionable policy responses to the Vision 2025, such as The Long-term Perspective Plan (LTPP), the National Five Year Development Plans (FYDP) and National Strategy for Growth and Reduction of Poverty (MKUKUTA).

The Long-term Perspective plan (2010/11-2026/26) was created in June 2012 and was meant to provide the "Roadmap to a Middle Income Country", which is similar in its scope to the Vision 2025 plan.

> *The long-term planning horizon enables the country to systematically incorporate issues that particularly require long-term planning such as climate change, environment protection into the national development agenda. The Plan provides the minimum targets, strategic direction, guiding principles and objectives for all main sectors and cross-cutting issues.*[49]

The LTPP speaks specifically to the need for infrastructure development, particularly energy infrastructure as key to economic and social development. And it provides three Five Year Development Plans, the current plan being the FYDP II.

NATIONAL FIVE YEAR DEVELOPMENT PLANS (FYDPII)

FYDP II does provide recommendations for the inclusion of 'renewable green energy' with specific proportions; 50% by 2021 and 70% by 2026[50]. In this context, it is important to note that there are references to 'liquefied petroleum gas' being a renewable green energy. References are also made to renewable energy related to tax revenue from the introduction of a Rural Energy Fund, to be used for renewable energy funding and a policy recommendation. There are further references in Table B5 & B19, calling for the "development of a Green Growth Strategy to increase renewable energy sources."[51] Although the Government of Tanzania has included and made reference to renewables, there must be much more clear and forceful languages, including specific timeframes and panning details in future development reports.

NATIONAL STRATEGY FOR GROWTH AND REDUCTION OF POVERTY (MKUKUTA)

Another national plan implemented as part of the FYDP II, is the National Strategy for Growth and Reduction of Poverty (NSGRP), commonly referred to by the SwahilI acronym, MKUKUTA. There have been two MKUKUTA plans, the second nearing completion at the end of 2016. The MKUKUTA II plan is a "medium-term mechanism"[52] to help reach Vision 2025's stated objectives and was designed to link Tanzania's national poverty reduction goals to the UN's Millennium Development Goals (MDG). Primarily, the MKUKUTA II outlines three general paths to development; accelerating economic growth to reduce poverty, improving the quality of life and standard of living, and improving governance and accountability. These are then broken down into more specific areas of implementation.

The main thrust of the MKUKUTA II plan is the reform and modernization of Tanzania's economic system to allow for the revenue necessary to realize social and human development goals.

Each of these specific goals has been broken into more detailed operational targets. Although all these plans recognize the role to be played by energy, they don't give details and the role of renewable energy in particular.

International level

Meanwhile Tanzania can benefit from the international momentum.

SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Energy access has been given a special attention at a global level. In 2015, the United Nations adopted the Sustainable Development Goals (SDGs) by consensus of the 1 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"[54].

The Ministry of Finance and Planning participated in a SDGs implementation workshop, stating "Tanzania has been in the process of mainstreaming the SDGs into its national policy frameworks, which include the national development plan and monitoring and evaluation systems."[55] However, any chance to have meaningful and successful accomplishment of SDGs will need to be accompanied by renewable energy development, particularly off-grid community renewable energy technologies in rural Tanzania.

MKUKUTA II

GENERAL PATH	SPECIFIC GOAL
Growth for Reduction of Income Poverty	■ Inclusive and accelerated growth achieved and sustained ■ Employment opportunities for all, including women and youth ■ Good economic governance enhanced and ensured
Improvement of Quality of Life and Social Well Being	■ Quality of life and social well-being for enhancing capabilities, with particular focus on the poorest and most vulnerable groups, improved ■ Inequities in accessing economic opportunities and social services along geographical areas, income, age and gender reduced
Good Governance and Accountability	■ Democracy, good governance, human rights and rules of law are deepened and ensured ■ Peace, political stability, social cohesion and national unity is consolidated and sustained ■ Accountable, responsive, effective, and efficient leadership in public service is ensured

Source: Ministry of Finance and Economic Affairs[53]

Nearly all the SDGs, including social development goals will be greatly enhanced by the expansion of electrical access and connection. This can be facilitated by greater inclusion of local government agencies and civil society groups, as stated by the Economic and Social Research Foundation in Tanzania: "to enhance capacity building of the local institutions especially the Local Government Authorities (LGAs) and human capital, partnership and stakeholder participation must be a priority throughout the SDGs implementation."[56]

(INTENDED) NATIONALLY DETERMINED CONTRIBUTIONS UNDER THE PARIS AGREEMENT

Preparing for COP21 in Paris, all countries were asked to outline what post-2020 climate actions they intended to take under the new international agreement. These documents are known as Intended Nationally Determined Contributions (INDCs). The Government of Tanzania's INDCs for the energy sector includes the following:

- Exploring and investing in the energy diversification system to ensure overall energy security for economic development through enhanced availability, affordability and reliability while contributing towards energy emissions intensity reduction over time.
- Promotion of clean technologies for power generation; and diverse renewable sources such as geothermal, wind, solar and renewable biomass.
- Expanding the use of natural gas for power production, cooking, transport and thermal services through improvement of natural gas supply systems throughout the country.
- Promoting energy efficient technologies for supply, transmission/transportation and demand side as well as behavioral change in energy use.
- Promoting rural electrification.

These publicly stated aims can all be facilitated directly by the introduction of renewable energy and decentralized, off-grid electric generation and distribution. The introduction of these technologies into non-connected rural areas will greatly limit the deforestation underway in Tanzania, due to the over consumption of biomass for cooking and heating needs. There are also clear and defined renewable energy targets expressed in the 'Mitigation Contributions' section of the same report.

> *"Beyond enhancing carbon sinks through forest conservation, afforestation and reforestation, the country is embarking on...expanded use of renewable energy sources such as geothermal (with a potential of 5 GW); solar with average sunshine of more than 9 hours per day; hydro with a potential of 4.7 GW (while the installed capacity is 561 MW); and wind with speed of 0.9 – 9.9 m/s across many parts of the country."*[57]

Tanzanian stakeholders from policy, academia, civil society and private sector discuss at Tanzanian energy situation in July 2016

With the Paris Agreement now in place, governments agreed to come back in 2018 to take stock of initial progress toward the collective goals and to inform new or updated Nationally Determined Contributions put forward by 2020. After 2020, this will be followed by global stocktaking every five years starting in 2023.

SEA4ALL INITIATIVE

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. In July 2016, SEA4all initiative was launched in the country, confirming plans to achieve the UN SE4ALL goals through massive investment from both the public and private sectors in the energy industry.

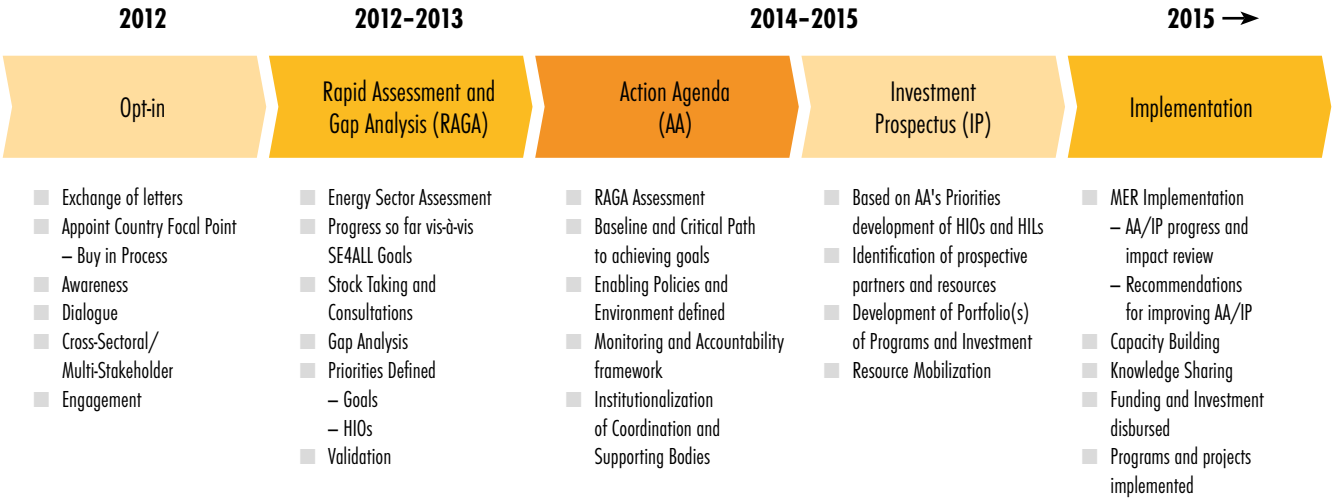
The SE4All Action Agenda from December 2015 demonstrates that Tanzania has fully embraced the SE4All objectives but has yet to involve Renewable Energy in a meaningful and impactful manner, "In 2012, the baseline year, RE represented 37% of the resources (including large hydro) used in power generation. Based on the PSMP 2012, this participation is not projected to increase significantly. The potential impact of the gas reserves may delay further the increase of RE in the mix of power generation." SE4All sees this lack of RE uptake and reliance on fossil fuels, including heavy future investment in coal, as negative for RE uptake in Tanzania.

Although SE4All has identified several governmental planning documents, including Vision 2025, LTPP, FYDP II and MKUKUTA II as containing language related to renewable energy, there is a lack of specific renewable energy planning, language and financing on behalf of the Government of Tanzania. Recommendations from SE4All to improve uptake of renewable energy into the country's future energy plans and development revolve around much more specific language and policies directly enacting Wind, Solar and Microgrid projects to limit private investment uncertainty in renewable energy commitments in Tanzania.

THE AFRICAN RENEWABLE ENERGY INITIATIVE

Launched by African heads of state at COP21 in Paris, African Renewable Energy Initiative (AREI) aims at delivering 10 GW of new and additional renewable energy generation capacity by 2020 and mobilizing the African potential to generate at least 300 GW by 2030[59]. The African Renewable Energy Initiative (AREI) primarily intends to achieve "sustainable development, enhanced well-being, and sound economic development by ensuring universal access to sufficient amounts of clean, appropriate

PROPOSED ACTIONS AND TIMELINE FOR TANZANIA



Source: Tanzania Ministry of Energy and Minerals[58] (2015)

and affordable energy." By enhancing renewable energy significantly with "particular consideration being paid to applications that meet the needs of poor people", African governments want to support "low-carbon development strategies while enhancing economic and energy security"[60]. Hereby, AREI is unique as it is the first Africa-owned and Africa-led effort addressing this topic.

To implement AREI, African governments are required to present nationally determined plans to roll-out the envisioned transformative pathway. In the framework of the stakeholder dialogues, AREI was presented to stakeholders such as the ministry of energy and parliamentary standing committee for energy and minerals. The chairperson of the committee highlighted that Tanzania should strive to benefit from AREI and assigned CAN Tanzania to make follow up and advice both the government and the parliamentary committee on how Tanzania can join and benefit from AREI.

It is equally important to note that 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. In the end, different international efforts 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.

Workshop in Dar es Salam in July 2016

3.2 Stakeholders with mandate to move Tanzania's energy transition forward

Throughout the workshop and consultation rounds organized by CAN-Tanzania, the World Future Council and Bread for the World, participants were asked to identify which stakeholders could move the energy transition forward and make a reality both Vision 2025 and Tanzania 100% RE:

KEY INSTITUTIONS WORKING ON RE	
Ministry of Energy and Minerals	■ Formulation of policies and regulations (not adoptions) for power and cooking, any energy-related issue; ■ Proposes and manages budget ■ Creates investment environment for RE ■ Reports to Parliament about budget spending (quarter, half year, full year)
Parliament of Tanzania	■ Approves budget ■ Monitors & evaluates of budget spending ■ Ensures accountability of funds
Rural Energy Agency (REA)	■ Funds RE projects ■ Project developer (currently focus on solar and biogas) ■ Targets the cooking sector ■ Receives funding from "rural electrification tax" on petroleum (1 Schilling per Liter) for infrastructure development ■ Electrifies public buildings in rural areas ■ Develops mini-grids in rural areas ■ Provides electricity as social service
Tanzania Electric Supply Company (TANESCO)	■ Project developer ■ Utility ■ Owner: production, distribution and transmission ■ Electrifies public buildings in cities
Tanzania Commission for Science and Technology (COSTECH)	■ Supports research and development, innovation, technology transfer, infrastructure (RE is cross-cutting research issues (main sections: physical, life, social, innovation and commercialization); ■ Links community, Parliament and research ■ Informs about scientific facts to policy makers ■ Reviews policies (work with planning position) ■ Receives funding from government

WHAT OTHER GOVERNMENTAL INSTITUTIONS HAVE A MANDATE TO WORK ON RE AND ENERGY ACCESS?

- Energy and Water Utilities Regulatory Authority: EWURA
- National Environmental Management Council: NEMC
- Ministry of Water
- Ministry of Finance
- Ministry of Land
- Ministry of Industry
- Ministry of Investment
- Ministry of Natural Resources and Tourism
- President's office Planning Commission (POPC)
- Vice-President Office – President's office Regional Administration and Local government (VPO – PORL)
- Department of Energy and Minerals in Zanzibar
- Tanzania Parliamentarians Friends of the Environment (TAPAFE)
- ZESCO (Zanzibar Electricity Supplies Company)
- Tanzania Bureau of Standards (TBS), established under the Ministry of Industry and Trade
- Tanzania Investment Center
- National Entrepreneurship Training Framework (NETF)
- Tanzania Forestry Research Institute (TAFORI)

WHO ARE THE CHANGE AGENTS TO IMPLEMENT OUR VISION?

- Government
- Private sector
- Civil Society Organizations
- Regulation/Monitoring agencies
- Media (main media: Tanzania Broadcasting Corporation, IPP Media, Radio Free Africa, Press Services Tanzania, The Guardian, The Citizen, Daily News)
- Development Partners
- Faith-based organizations – The Interreligious Council for Peace, Zanzibar Interfaith Center
- Academic and research institutions: University of Dar es Salaam, University of Dodoma, Sokoine University of Agriculture, COSTECH, Tanzania Industrial Research and Development Organization

While stakeholders during the projects highlight that all the institutions have, to some extent, a mandate to work on renewable energy, they pointed out that there is not a single dedicated institution with capacity and expertise to set the country on track towards the 100% renewable energy target embraced by Tanzania during COP22.

Tanzanian delegation with Bangladesh host Mr. Dipal C. Barua in Dhaka, Bangladesh in April 2016

4. WHAT ROLE FOR 100% RENEWABLE ENERGY

Stakeholders engaged in the project showed optimist about the future deployment of renewable energy in the country. When asked to estimate 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.

Indeed, Tanzanians RE stakeholders 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. Last but not least, the urgent need to mitigate climate change encourages RE in Tanzania, which is also reflected in the Marrakesh Vision by the Climate Vulnerable Forum´s declaration from COP22.

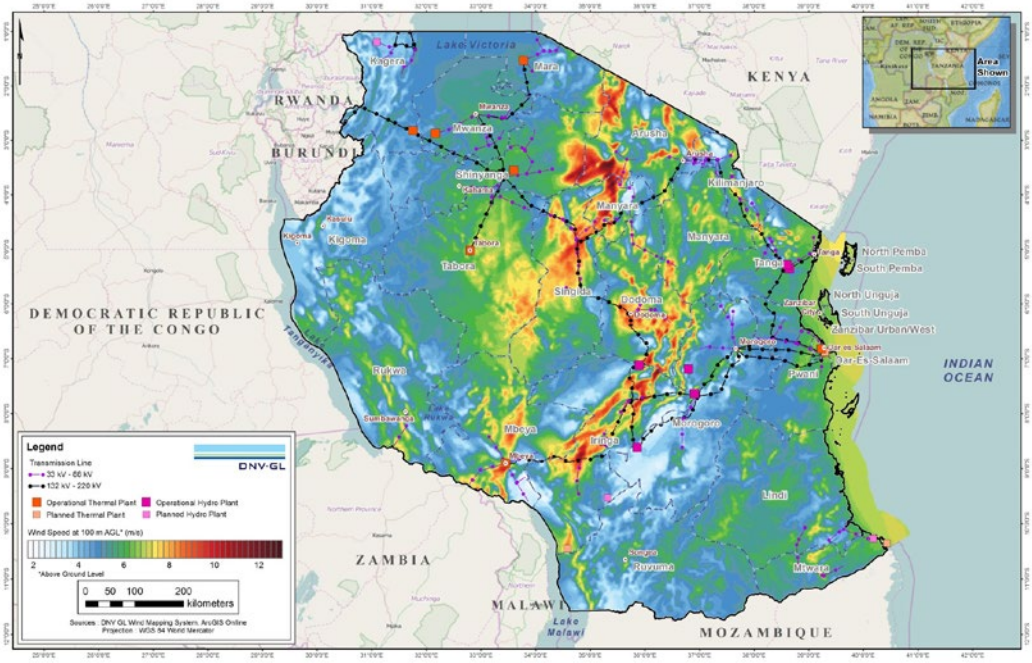
4.1 Tanzania RE potential

Tanzania is endowed with abundant, high-quality renewable resources, much of which is untapped. As stated in one of the project workshops "renewable energy (excluding large hydro) currently accounts for only about 4,9% of generation capacity of which the major share derives from biomass. And The Public-Private-Partnership projects are primarily driving large-scale hydro and geothermal projects" (Mary Swai, TaTEDO, responded July 2016).

However, Tanzanians energy stakeholders highlighted during the different dialogues that "through effective deployment and utilization, renewables could play a significant role in meeting the country's energy needs and poverty reduction initiatives at large. 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".

PRELIMINARY AND INVALIDATED MESOSCALE WIND SPEED MAP AT 100 M AGL

Source: World Bank[64] (2015)



WIND

Based on the available information, Tanzania has plentiful wind resources, with much of it located around the Great Lakes, the plains and the highland plateau regions of the Rift Valley. Wind resource assessments indicate that areas such as Kititimo (Singida) and Makambako (Njombe) have adequate wind speed for grid-scale electricity generation. Small-scale off-grid wind turbines along the coastline and in the islands also hold great potential in Tanzania, where areas of wind power potential cover more than 10% of the country. To put it 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[61] published by the World Bank.

Currently, wind energy is used to pump water for irrigation and to meet domestic and livestock water needs. However, most of the areas are currently under assessment[62]. Moreover, so far, a very limited number of attempts have been made to harness wind energy for water extraction and there is one known installation of wind turbines for electricity generation of 8,5 kW[63].

SOLAR

Tanzania enjoys average annual solar radiation levels of between 4 to 7 kWh/m2/day. As grid electricity reaches about only 1 % of the rural population in Tanzania, the use of solar electricity seems to be an attractive option as the country enjoys abundant sunlight. Indeed, for the last three years, it is estimated that more than 500 kWp of PV has been installed countrywide for various applications in Tanzania, and 30-40% of the total installed capacity consists of Solar Home Systems (SHSs). Nevertheless, solar cooking, pasteurizing and advanced solar crop drying technologies application is not practiced. And, taken as a whole, solar photovoltaic and thermal technologies are under development, as indicates John F. Kitonga, senior engineer at the Ministry of Energy and Minerals of the United Republic of Tanzania in the report "Tanzanian energy sector under the universal principles of the Energy Charter"[65].

To date, only about 5,3 megawatt peak (MWp) of PV solar have been installed. But in a country with such a potential for solar power capacity solar photovoltaic can play a key role in the provision of affordable, sustainable and locally generated electricity for lighting, heating and ventilation systems, as well as drying; notably in areas where connection to the main grid is not economically viable.

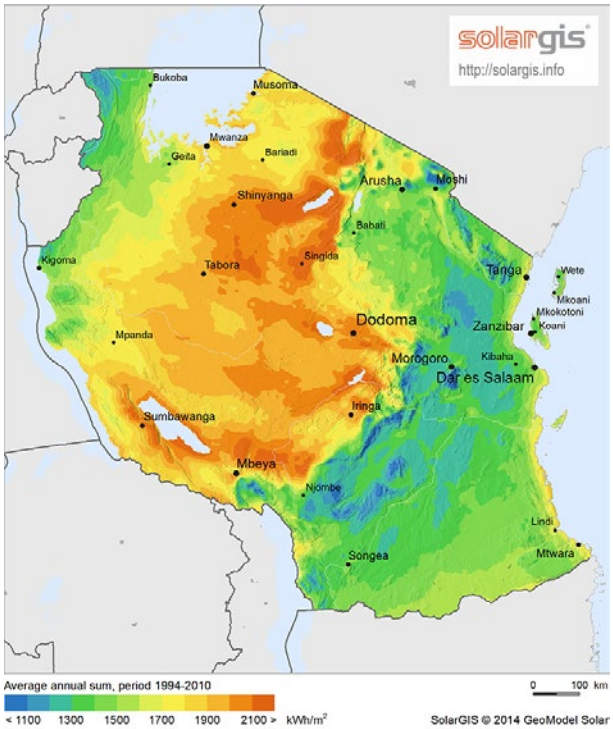
GEOTHERMAL

Tanzania has geothermal potential in most parts of the East African Rift Valley System, with some of the prominent sites being: Songwe (Mbeya), LuhoI (Rufiji), Lake NatronI (Manyara), and KisakI (Morogoro). In addition, some coastal areas also show surface manifestations of geothermal resources. Estimates about Tanzania's geothermal potential indicate the country may generate about 650 MW of electricity. However, this potential has not yet been used and has only been explored to a limited extent[67].

BIOMASS

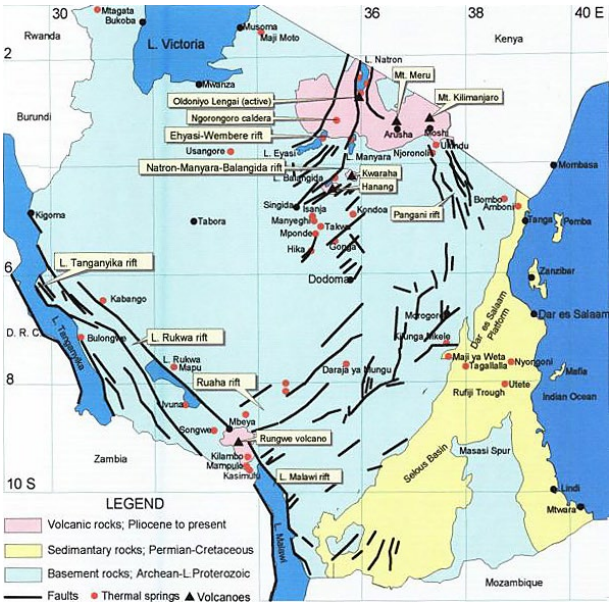
The country has considerable biomass resources from forest and agricultural residues. There are about 15 million tons/annum of crop residues, animal droppings from 14 million cattle and 11 million goats and sheep, 200.000

DIRECT NORMAL IRRADIATION TANZANIA



Source: Solar GIS[66]

TANZANIA'S GEOTHERMAL POTENTIAL



Source: Mnjokava[68] (2012)

tons of volatile solid sisal waste and 1,1 million tons per year of forest residues. There is an estimated potential of 500 MW[69]. In addition to this, with more than 17.000 hectares of sugarcane plantations, there is an estimated co-generation potential of more than 315 GWh per year, which is 11% of current national electricity generation[70].

4.2 Current RE projects in Tanzania

Today, there are already signs of what could become a vibrant market for renewable energy if Tanzania's vast potential is to be exploited.

As highlighted in a project workshop by Mary SwaI (TaTEDO), TaTEDO is implementing the "Sustainable Energy Project for Improving Education, Health and Business Services" in off-grid areas of Tanga, Kilimanjaro, Arusha, Shinyanga, Simiyu and the Coast region. The main activities are "electrifying 28 social institutions and business enterprises with solar PV systems; installing 14 solar water heaters in appropriate institutions and business enterprises; constructing 28 improved woodfuel cook-stoves in schools and SMEs; strengthening existing revolving fund for scaling up sustainable energy services and providing core support for managing and implementation of the project".

These pilot projects are spreading socio-economic and environmental benefits to areas which suffered from inadequate quality social services. SwaI explains that "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"[71].

Tanzania's energy stakeholders also pointed to the Rural Lighting Competition, a World Bank supported competitive grant program started in 2010 with Tanzania's Rural Energy Agency (REA). The overall objective of the competition is to reward up to 20 projects that provide clean, affordable, sustainable and environmental friendly energy services. So far, there have been three competitions, in 2010, 2012 and 2014. And the maximum award size for grant winners has been TZS 232.170.000 per proposal ($US100.000 approx.)[72].

One of these projects was carried out by ARTI Energy, which wanted to demonstrate that solar energy powered lighting can be accessed by the low income rural population. The project initially took place in Bagamoyo District of the PwanI region and was to include 4 District wholesalers. However, within 6 months of the project the number of wholesalers reached 14 in 2 Districts[73].

Furthermore, there are companies such as Mobisol Tanzania, the Tanzanian subsidiary of the Germany-based solar service provider Mobisol. "The company started in Arusha in 2011 offering SHS solutions designed for households and small commercial use. In 2013 the company employed already 30 staff members and 500 customers in Tanzania. Today (July 2016) Mobisol fully covers most of Tanzania, employs a team of about 400 professionals of which most are sales agents and local technicians and counts over 50.000 customers. The goal of Mobisol is to install 1 m systems in Tanzania by 2020", explains T. Kasperidus, Chief Operating Officer at Mobisol.

MOBISOL'S BUSINESS MODEL AS AN EXAMPLE*

Under Mobisol's *modus operandi*, Solar Home Systems are sold by cash or loans through monthly payments. If the system is paid through the latter option, it is a called a **rent-to-own system**: Under this mechanism, payments are made through M-Pesa, a mobile phone-based money transfer, financing and microfinancing service. There is a small down payment of the amount at the beginning of the transaction. After this, the customer pays off the loan as due monthly balances are paid so they can eventually become the owner. When the full amount has been paid off, the system belongs to the customer, i.e. becomes his or her property. In the event of nonpayment, Mobisol can switch off the system remotely. For a period of 30 days, the customer is offered a so called grace period, after which the system will eventually be repossessed if the customer cannot afford the monthly payments anymore.

PRICE OF THE SOLAR HOME SYSTEM (data from July 2016, due to the dynamic market, figures have changed)	
80 W The price of the 80 W system is similar to the price of kerosene per week (1000 TZS per week)	31.000 TZH/month
120 W	39.000 TZH/month
200 W	47.000/month

FINANCE MECHANISM

Mobisol is receiving funding from international investors, namely Investec, IFC and FMO. And it is increasingly tapping into national institutions, banks (local banks and saccos) to provide loans in local currency.

THE TECHNOLOGY

There is a warranty of 3 years for the installation. After the warranty, the customer can extend it for a small monthly amount. When a battery needs to be replaced Mobisol collects it and gives the customers the possibility to purchase a new battery. At present, Mobisol is collecting the batteries and is investigating further recycling schemes to make sure no waste is being produced.

AFTER-SALES SYSTEM

AS part of the 3 year warranty, Mobisol is offering a 48 hour intervention guarantee. Each system provides data which Mobisol monitors to foresee if a system is operating correctly or not. This allows them to even predict in advance if a system is going to need maintenance and communicate with the household via sms so that they change their power use, maximize the potential and protect the RE system.

PERSONNEL RECRUITMENT PROCESS

Mobisol has a training academy for technicians in Arusha, Mwanza and Mbeya. Students only pay the transportation to get to the training academy and Mobisol assumes the food and accommodation. Regular training lasts one week and is validated after an exam.

BUSINESS OPPORTUNITIES

The system can represent about 20-25% of the household's income. That's why it's so important to maximize the potential use of it.

Today, mobile phone charging businesses and solar hair cutting businesses have emerged out this system. Solar technology is also boosting restaurant businesses. Some restaurants are resorting to solar to power a TV, some lights and a speaker, which is attracting a great number of customers to their business. Mobisol has also thought of solar for capturing the business potential of fishermen at night. This way, instead of spending a lot of money in kerosene, fishermen can charge the lamps they use with their solar PV or at a shop with a solar system device.

DOMESTICATION OF RE TECHNOLOGY

It is not very difficult for the population to understand the functioning of the technology. At first they are mostly interested in:

- Price
- Productivity: how does the service work and what are the benefits of it.

AWARENESS RAISING

Conferences, workshops open to the media, radio programs and ads are some of the channels used by Mobisol to explain a community the advantages of RE technology. Saccos is another channel to reach out to costumers. Since saccos collect the money in a community and their members decide who's going to get the loan, it is important that they know about the benefits of RE. Finally, Mobisol is trying to engage schools to start a dialogue about climate change, RE technologies and the benefits of deploying them.

* Note: These information date back to July 2016. As the market and the business model is very dynamic, figures and conditions may have changed. For current updates, please contact Mobisol directly.

4.3 Socio-economic benefits of RE in Tanzania

Due to the decentralized nature, renewable energies are unfolding their impacts mainly locally and regionally. Over the course of the project, stakeholders shared experiences and reported on how deployment of renewable energy has 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 and even entertainment kiosks/centers. 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 has 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 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

4.4 Barriers for RE scale up

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. According to the findings of this project, this indeed hinders Tanzania´s development towards a middle income country:

WHAT STANDS IN THE WAY FOR TANZANIA TO BE A MIDDLE INCOME COUNTRY?

- Limited power connection. There is no enough reliable and accessible energy.
- Limited and uncoordinated political will on implementing energy projects and individual motivation.
- The policy and decision-makers are sometimes not aware and/or knowledgeable on what they are implementing.
- Limited of local expertise from the community (not enough specialists, manufacturers but also controversies about the political officers taking decisions when they are not experts). Technical and legal expertise is coming from outside.
- Lack of long-term energy strategy: only looking to hydro and natural gas and not solar.
- Bureaucracy and corruption are slowing down the development of RE.
- Taxes are discouraging private investors to come and invest in Tanzania.
- Information gap between leaders and citizens. Citizens are not knowledgeable about what is happening and not really understanding the 2025 goal.
- Regular modification in the government priorities, which do not help to assess the evolution and the effectiveness of policies and strategies.
- Limited access to reliable and enough data and other relevant information. Also no specific platform to know the prices and the decisions in the energy sector.
- High expectations when an energy project is implemented / misconception about energy projects.

To unlock the potential and spur development with renewable energy in Tanzania, various barriers need to be overcome. In fact, the policy dialogue unveiled that renewable energy technology changes the current energy infrastructure of the country fundamentally: Fossil and nuclear resources are one-time endowments, characterized by complex centralized infrastructures where the fuel is transported to the power plant, transformed into energy. Energy production and distribution is held in one hand and only serves a small part of the population. RE technology with its decentralized and fluctuating nature requires a paradigm shift in how think about energy. Most renewable energies offer opportunities for more decentralized energy production and consumption. They have a horizontal supply chain and require innovation in infrastructure and energy markets. New stakeholders – including citizens, farmers and small businesses – are entering the system. They claim ownership rights and have direct impacts on the implementation.

Through various interactive activities, stakeholders identified numerous obstacles to this transformation, which can be clustered in policy, finance, technology and culture.

POLICY BARRIERS

Policy barriers relate to the regulatory framework as well as the government´s role in driving the deployment of renewables.

Participants of the workshops highlighted that the Parliament approved a major share of the development budget for energy development. Part of this was also allocated to renewable energy. While this is an important signal, it also clearly shows the government´s ambition to build fossil fuel based energy infrastructure. Renewable energy technologies are currently a minor part of the energy mix. Therefore, the potential of renewables remains untapped and locks the country in extraction-based energy pathways. Further, the budget devoted to RE is mostly dedicated to hydropower. As various stakeholders pointed out (see chapter 4.1), Tanzania has vast potential in wind and solar technology which is currently unexploited political decision makers. Stakeholders highlighted that the main challenge is to mobilize these untapped sources.

Further it was stated that the lack of long-term policy making is another challenge that prevents Tanzania from

Dr. Getrude Mongella and other participants of the workshop in Dar es Salaam in February 2016

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”.

As the current centralized energy infrastructure excludes the majority of the population and causes unreliability, a decentralized system could help to overcome this, especially in isolated areas. However, decentralization is not the current path taken by the government as policies signal strong commitment to a centralized and monopolized system (see chapter 3). In fact, stakeholders pointed out that the National Security Act prohibits anyone apart from the governmental energy regulator TANESCO to distribute electricity, as it is a necessary service. Further, production and selling of electricity above 1MW is based on a tender policy. Participants stress that this monopolistic position of TANESCO in distributing and producing electricity is a major obstacle as the company´s business model does not include RE, which leads to high electricity costs for the consumers.

This encumbers 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 workshops, poor are particularly vulnerable because they have few assets to fall back on and limited ability to afford energy related costs and effects.

As outlined in chapter 3, there are several laws and policies as well as institutional bodies that address renewables. However, there is no dedicated renewable energy legislation or institution. This is further compounded by the limited inter-ministerial coordination. Participants highlighted the fact that ministries work in isolation. This limited coherence and coordination among key ministries like the Ministry of Energy and Minerals, Vice President’s Office Division of Environment, Ministry of

Finance and Planning, Ministry of Natural Resources and Tourism, Local Government Authorities, Ministry of water and irrigation, ministry of land housing and settlement development as well as Ministry of Transport cause unsustainability of RE projects and difficulties in RE governance in Tanzania. The lack of a renewable energy law and institutional body leads to the fact that tasks are rather divided with different responsibilities. Consequently, this limited coordination and connectivity between sectors and stakeholders hinders the engagement of civil society, academia, investors and the private sector.

Especially for civil society organizations, there is no platform to work on RE. For the industry, the Tanzania Renewable Energy Association (TAREA) which was founded in 2000, is a useful facilitator. But so far, civil society organizations and researchers have not been fully engaged. It was highlighted that there is a gap in communication and information dissemination.

Finally, while renewable energy technologies unfold their benefits and potential locally, local governments in contrast do not have any mandate in energy politics. Municipalities and cities are rather energy consumers. In addition, corporate and income taxes as well as the Social Development Levy largely go to the central government. This particularly hinders rural development and a decentralized deployment of RE.

FINANCIAL BARRIERS

Financial 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.

Stakeholders from different backgrounds emphasized 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.

Currently, the main financing mechanism in the renewable energy sector is Public Private Partnerships. This essentially means that there is private investment in production, backed with a purchase guarantee by the government (TANESCO). Due to several failures is TANESCO´s business model, high subsidies are needed to ensure TANESCO´s continuity. However, also these government dues are not being paid, which leads to further insecurity.

Further, there are Serving and Credit Community Society (SACCOS) and AMCOS (SACCOS for agriculture), which serve as financers on community level. Currently, these are not engaged in financing energy services but according to several stakeholders, could be brought in the field.

Private companies offer micro-credit schemes. Finally, there are projects funded by the donors such as the European Union and other development agencies. Even though public funding and support can leverage private investment, stakeholders highlighted that there is overdependence on donors in Tanzania. Participants in the workshops expressed that it is crucial for Tanzanians to own relevant RE technologies and avoid the traditional practice of relying on donors.

After studying other country´s RE finance schemes such as the one from Bangladesh, stakeholders emphasized the lack of finance mechanisms for households and communities to incentivize investments in RE. Micro-credit schemes from private companies are an exception and accessing funding as an individual or as a community remain very difficult. General high interest rates between 9 and 24% hinder developments of new business models. Political barriers such as the monopolistic position of TANESCO or a lack of a RE legislation add to this situation as it leads to investment insecurity. Governmental initiatives such as from the Rural Electrification Agency focus only on public buildings. While stakeholders welcome the existence of national energy infrastructure plans, it was also highlighted that they are often not implemented which causes uncertainty. In some regions, governmental plans for instance project the expansion of national grids but it is never implemented. Meanwhile, investors do not develop alternative decentralized infrastructure as this would have competed with the government´s plan.

Another key financial barrier is tax and import duties. While there is an exemption for example "solar lights", other equipment such as wires which are needed for the renewable energy product to operate, is heavily taxed, which makes a system expensive again. Generally,

specialized equipment for development and generation of solar and wind energy is meant to be exempted. However, reality shows that this does not necessarily include all products. a "solar lantern" for example is a very popular and famous device, because it is moveable. As toilets or kitchens are often in separate buildings, people have to walk in the dark to reach there and solar lanterns help especially women and children in this situation. If a family has a solar home system, these lanterns can be charged with this system, using a 5V-DC source (typical USB port like for smartphone charging). As one could theoretically take such a smartphone charger and charge this lantern with the national grid or another AC source, solar lanterns are not regarded as specialized solar equipment. Most customers however do not have any other source of electricity available and if a solar home system provider wants to offer this solar lantern as an additional device, it becomes rather expensive.

Finally, the difficulty in securing long-term financing is partially due to investors' perceived risks of renewable energy technologies. Often, investors consider that renewable energy is more risky than fossil fuels, meaning there is a fear of not obtaining a return on 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. Meanwhile public financing alone is not enough to ensure the mass deployment of renewable energy that is required to respond to Tanzania's energy challenges.

TECHNICAL BARRIERS

Technical barriers add up to the challenges in renewable energy deployment. While there might be technological obstacles to tackle in order to achieve 100% RE in the country, stakeholders in this policy dialogue were mainly concerned with the fact that renewable energy technology is imported in Tanzania which goes together with a shortage of trained people for the designing, planning, installation and maintenance of renewable technology. 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 holds back renewable energy deployment across the country and creates social acceptance risks.

Researchers underlie the few examines conducted on renewables. In fact, the majority of researches is based on donor support and are rather scattered. This is another signal that RE is not one of the government priorities. Stakeholders from different constituencies therefore

criticized that policies are not necessarily based on academic research. Even though there is the governmental Commission for Science and Technology (COSTESH), there is a lack of RE research and participants particularly mentioned the lack of information dissemination leading to duplication of efforts and researches.

CULTURAL AND EDUCATIONAL BARRIERS

Cultural barriers are primarily related to the low level of awareness among the population as well as among political decision makers regarding the benefits of renewables and erosion of consumer confidence because of inappropriate system standards. In fact, pioneering jurisdictions prove that awareness raising and education of various actors in different constituencies is key to enhance the deployment of renewable energies. It is a matter of encouraging these actors to systematically favor and adopt the use of renewable energies within the framework of their activities. To transition to 100% Renewable Energy, new business models and therefore innovative entrepreneurs are needed. However, in Tanzania, this is hindered by a lack of education and capacity.

Stakeholders highlighted the lack of knowledge among policy-makers and technical personnel for implementing RE projects. In many cases, legislators and government officials are not well familiarized with the technology, its challenges and advantages. Participants of the workshops insist on the need to facilitate a continuous policy dialogue to share information and exchange experiences so policy makers become familiar with the benefits which renewable energies offer.

Education and building capacity is also crucial within the broader population. Especially civil society organizations working with communities across the country shared various examples which prove that there is a lack of the general culture sustaining renewable energies and their added value. Contrarily, if the public is aware of energy issues, citizens tend to better accept renewable energy technologies.

In this context, ensuring high quality technologies and services is a prerequisite. Especially after visiting Bangladesh, stakeholders highlighted the lack of quality monitoring and standardization in Tanzania. In fact, this leads to resistance and disseminates myths about RE technologies. Stakeholders therefore highlighted that there is the need to gain trust and confidence of people for RE by focusing on consumer needs and providing high quality services including consumer friendly product design, installation, training of clients on proper use of technology, reliable after sales support and strict quality control.

5. WHAT TANZANIA CAN LEARN FROM BANGLADESH

5.1 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[74]. 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 grid, 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 (3.115 MW in 2000[75]). Furthermore, overall demand for electricity was rising by about 10 per cent annually and infrastructure was deficient, poorly managed and could not reach many rural areas (where 75% of the population lives) due to inaccessibility and remoteness[76].

Reverting 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[77]. 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 the present, more than 4 million Solar Home Systems (SHS) have been installed in the country, benefitting over 24 million rural people.

As a result, today Bangladesh presents a 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. Overall the country has 13.265 MW capacity, an electricity generation of 7.787 MW, and if current trends persist, SHS alone are expected to generate 1000 MW by 2020 (Barua[78], 2016).

But Bangladesh has maintained an impressive track record on growth and development too. In the past decade, the economy has grown at nearly 6% per year, and poverty has dropped by nearly a third (World Bank[79], 2016). How did this happen?

Bangladeshi women cooking on biogas

5.2 Vision 2020 to achieve 100% electricity access

Access to affordable, reliable and sustainable energy services is a key element to boost economic development and reduce poverty. 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[80], 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 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[81]:

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

Accordingly, only between 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[82], 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 and 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 around the year with daily average solar radiation ranging between 4-6.5 kWh / m2. 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.

Against this backdrop, in the year 2003, IDCOL launched the Rural Electrification and Renewable Energy Development (RERED[83]), aiming to support Bangladesh's efforts to raise the level 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 the Global Environment Facility 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.

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

- 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.

- 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 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. This project was the first of its kind in Bangladesh. a new target for the installation of 6 million SHS by 2017 would follow.

5.3 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[84] 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, 2.000 MW by 2020, and 4.000 MW by 2030.

To achieve these 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[85], 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 representatives 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 exemption 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.
- 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[86], 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".

5.4 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, offering 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 qualify, 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). 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. 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

MODE OF FINANCING: AN EXAMPLE

(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 Instalment Amount	USD 4
(f)	IDCOL Refinance [70%~80% of (e)]	USD 80~70
	Loan Tenor	5~7years
	Interest Rate	6~9 p.a.

Source: (Pavel, 2016)

AT THE BEGINNING

50% down payment to install the system and remaining 50% in 6 monthly installments

AFTER FEW YEARS OF EXPERIENCE

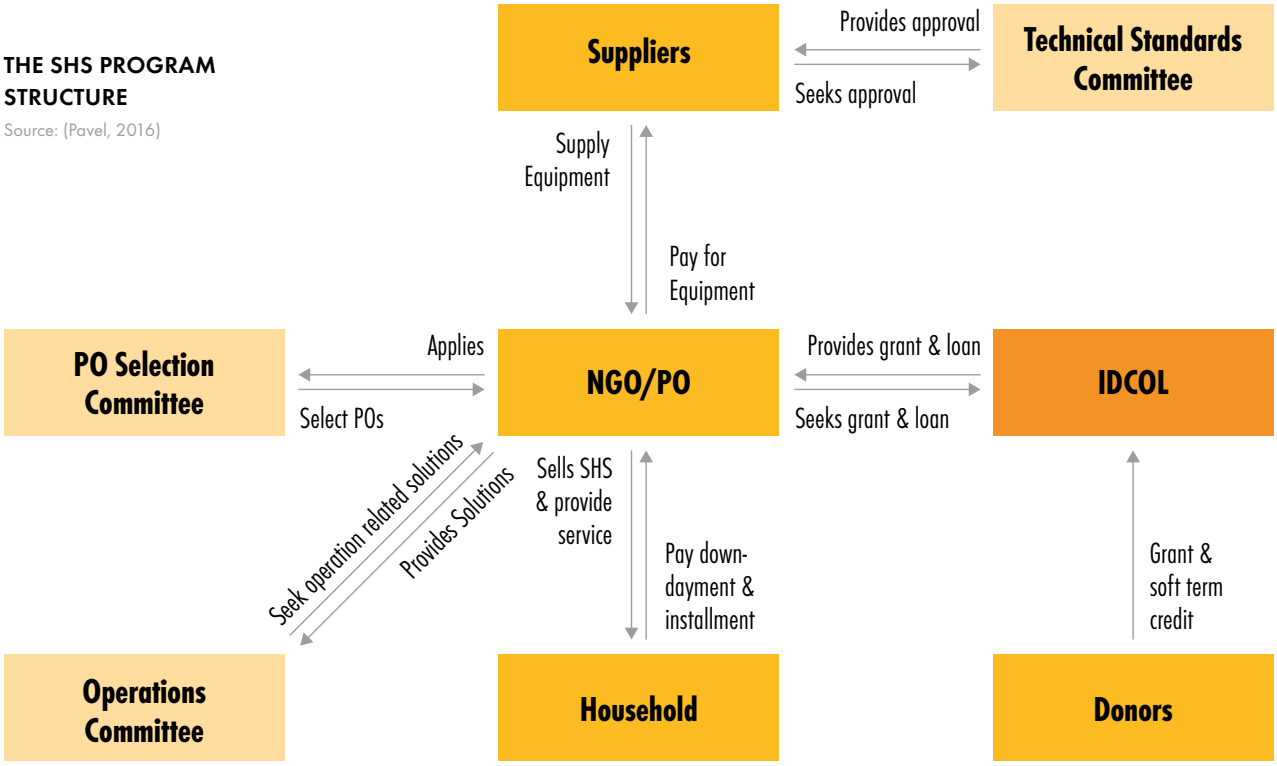
25% down payment to install the system and remaining 75% in 24 monthly installments

PRESENT SITUATION

15% down payment to install the system and remaining 85% in 12/24/36 monthly installments

THE SHS PROGRAM STRUCTURE

Source: (Pavel, 2016)



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.

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 watt. The refinancing from IDCOL covers 80% 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. 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.

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, 2016).

5.5 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 a probability of default in loan repayment below 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 this 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[87] figures, investing even in the most basic 15kW SHS (costing 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 they've become 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.

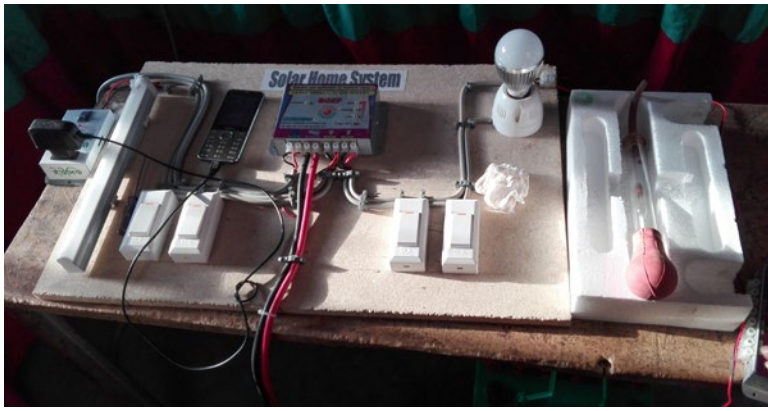
"There was no awareness among the rural population. We had to train our engineers to become 'social engineers' and go from door to door demonstrating the effectiveness of renewable energy and gaining the trust of the population. Then, thanks to SHS, people started to see the benefits and, little by little,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

Women being trained on solar home system at Modhukhali in rural Bangladesh



Solar Home System Appliances

quality services including consumer 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 setting 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.

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.

5.6 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 for at least one season to produce 3 crops per year. Nowadays, due to less rainfall and drought, 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, 2.500 MW of power demand is solely required for running the electric pumps. And diesel powered pumps consume over 1.100 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.

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)

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 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, 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 Bangladesh International Development Association* (IDA) and Japan International Cooperation Agency 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[88], 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 in 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[89], 2014).

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 to 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 175.000KWh, with an expected revenue of US$0,36- US$0,38 (Ahmed[90], 2016).

Under the proposed business model by IDCOL, grant is available up to 50% of capital costs. The remaining 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

* The International Development Association (IDA) is the part of the World Bank that helps the world's poorest countries. Overseen by 173 shareholder nations, IDA aims to reduce poverty by providing loans (called "credits") and grants for programs that boost economic growth, reduce inequalities, and improve people's living conditions.

Bangladeshi farmer and participants from the Tanzanian delegation discussing Solar Irrigation Pump Systems in Poradaho in rural Bangladesh

Solar PV on the rooftops of Dhaka, Bangladesh

TECHNICAL CHARACTERISTIC

System size	Battery capacity	Appliances	Supplied system components	Operating time	System cost in BDT	System cost in US$	Warranty
20 Wp	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
50 Wp	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
85 Wp	100 AH	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

period of 2 years. The funding sources are KfW, DFID, GPOBA, USAID and ADB (IDCOL, 2016).

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[91]. Hands-on training provided by local technical 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 enable 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 1.000 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 played 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 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[92] 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.

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[93], 2016).

Solar mini-grids also face operational, financial and policy challenges. Due to the remote location of sites, the 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 rate loans, incentives for supplying electricity from renewables and total Tax or VAT exemption[94].

5.7 Learnings 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

Stakeholders from Bangladesh and Tanzania analyzing the challenges to scale up renewable energy at a workshop in Dhaka, Bangladesh in April 2016

revolution. New 65.000 SHS 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 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 attracts 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 1.000 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, 1.500 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.

6. POLICY RECOMMENDATIONS FOR TANZANIA

The current situation in Tanzania calls for a review and reform of the existing policies for energy deployment in Tanzania to ensure reliable and sustainable energy services for all, tackle energy access setbacks, ensure multi-stakeholder participation, 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.

6.1 Policy elements

Establishing a robust political framework requires enhancing policy coherence. As outlined in the previous chapter, there is scattered action but no effective mechanism or legal framework for facilitating energy access for all 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.

Learnings can be taken from other sectors: For example platforms such as the Tanzania Disaster Relief Committee (TANDREC) at the National level have been operational since 1990s. The Committee is composed of Permanent Secretaries from Ministries of Finance, Defense, Planning, Agriculture, Lands, Water and Livestock, Education, Works, Communication, Community Development, Home Affairs, Energy and Minerals plus heads of early warning Institutions namely: Tanzania Meteorological Agency (TMA), Food Security Department and Fire and Rescue Department. Its main function has been to oversee and coordinate activities of the Government, designed to secure effective prevention of disasters, preparedness and operation of affairs in an event of a disaster. Having this kind of platform dedicated for energy can be a key leverage for addressing and linking energy and other national priorities such poverty reduction and social services. Another solution proposed to build coherence and coordination is a database, which could be led by the National Bureau of Statistics (NBS) for RE data.

While the Ministry of Energy is the custodian for energy issues, there needs to be a platform dedicated for renewable energy with broad representation and integration of all stakeholders. It was mentioned, that leaving this crucial development only to the Ministry of Energy might create conflicts. Therefore, as a result of this project, a multi-stakeholder taskforce was established. The idea is that representatives from different sectors and backgrounds meet regularly and produce recommendations and advices. For this, building on TATEDO`s work as well as on CAN Tanzania has been an important approach. Through such a task force, reviewing policies and strategies, integration and participation of the different stakeholders can be facilitated and achieved. For instance, in the workshops, stakeholders shared some difficulties in the Ministry of Agriculture when drafting the Climate Change Resilient Plan. These were overcome by integrating end-users to build on practical knowledge. a multi-stakeholder task force for renewable energy could serve in a similar way when developing effective energy policies. Another process to learn from in this context is mainstreaming gender policies. Stakeholders shared how a forum that convened different ministries, civil society organizations and faith-based organizations facilitated a dialogue on how gender could be mainstreamed in the different sectors. The newly established renewable energy task force is facilitated by CAN Tanzania and has started its regular meetings in January 2017.

Learning from other countries such as Bangladesh, stakeholders suggested that a dedicated governmental institution for renewable energy would enable Tanzania

Participants of a workshop in Dar es Salaam in July 2016

to draw together the country's commitments made under various political 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.

To provide the necessary investment security and a mid-term commitment of the government, stakeholders suggest developing a dedicated RE law. Key policy elements which this law should incorporate are:

- a reasonable target which is in line with international pacts such as the Paris Agreement, the Climate Vulnerable Forum Declaration and the Sustainable Development Goals (SDGs),
- building on the potential of all renewable energy technologies,
- ensure a purchase obligation,
- guarantee access to the grid for all,
- grid priority for renewable energy
- empower new business models and stakeholders to enter the market and
- build on efficiency principles
- favor a more territorialized and decentralized approach to energy policies
- develop simple and efficient administrative procedures

It was proposed to design this process in a participatory way, calling concerned sectors to feed in a draft. Hereby, effective implementation and law enforcement may also be alleviated. Such a process must be transparent and align with anti-corruption principles.

Finally, such a 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. Setting clear policy priorities across policy areas is essential to provide investment security, mobilize stakeholders as well as improve the allocation of resources. Existing frameworks such as the National Strategy for Growth and Reduction of Poverty must incorporate renewable energy specific language into planning documents, to enable their installation and spread.

As proven by pilot projects in Tanzania as well as from international experiences, the increased share of RE in the energy mix opens new opportunities for innovation and value creation at local level. Renewable energies create more jobs per unit of energy produced than fossil fuels and in 2015 the sector already employed 8.1 million people worldwide, 5 % above the 2014 level and in contrast with the crisis of the fossil energies market.[95] In

fact, the socio-economic effects pf renewable energies can be measured all along the value chain. One of the key tasks for the Tanzanian government would be to explore where in the RE value chain job creation is the most fruitful and support the implementation of the Tanzania National Development Vision 2025.

For instance, in an initial phase most technologies are imported from countries offering advanced and competitive technologies, such as China. Thus the first tasks for the Tanzanian governments to show that employment will not be created in production but in international trade, project management, installation and construction, entry into service and maintenance. a range of indirect employment can arise from this sector in research and development, logistics, transport, consulting and administrative and regulatory work. In the long-term Tanzania may also benefit from the development of local industries linked to production. The political and legal framework must direct this development.

6.2 Financing elements

A coherent and robust policy framework incorporating the necessary investments in infrastructure and production capacity is needed to provide security and unlock the financial holdup. Stakeholders called for policy makers to consolidate Public Private Partnership and provide sufficient finance opportunities to avoid dependence on donor funding. Despite being cost competitive on a life-cycle basis, the relatively high capital-to-operational cost ratio compared to conventional systems continues to be a key barrier for renewable energy systems in Tanzania. The process of this project unveiled that a different understanding to energy is needed: While in a conventional energy system, continuous costs for fuel determined the finance model, a renewable energy based infrastructure generates electricity at zero fuel costs. Therefore, only the upfront costs for building the infrastructure must be tackled. Overcoming this requires access to end-user financing that is tailored to the consumers' income, cash flow and current expenditures on energy services (e.g. Kerosene, candle lighting, mobile charging etc.).

Concrete recommendations deriving from the policy dialogues include:

- Creation of a dedicated trust fund on RE within the Ministry of Finance.
- Incentivize private investment incentives through tax exemptions and reduce bureaucracy.
- Incentivize new business models such as energy cooperatives for electricity production.

Regarding tax and import duties exemptions, it was highlighted that they should be more "usage/purpose oriented". This would mean that companies that import products that are required for development, generation and usage of renewable energy should get a full exemption. To avoid misuse, companies should commit, that they do not use certain items for anything else. Such a "usage oriented" approach would help promoting the solar sector as comprehensive solution and real alternative to the national grid. In order to implement this, companies should be able to explain and reason their business model and outline the end-user purpose to the inspectors, doing the tax and import assessment. This requires implementation of procedures and policies by governmental bodies (like TRA, TPA, etc.) and the government should become the authority to validate the information provided by an importer at any time.

Learning from other countries such as Bangladesh as well as from private enterprises, stakeholders highlight the necessity to develop a comprehensive national finance mechanism for individuals and households to access funds to invest in RE. It was suggested that the government starts a pilot project in which the Rural Electrification Agency builds on the Bangladesh´s learnings and replicate the IDCOL system (see chapter 5.4).

In addition, an enabling environment to deliver downstream financing is needed. This involves dedicated lines of affordable credit, reduce currency risks and align interest rates with these policy priorities.

Finally, stakeholders stressed the importance of monitoring and tracking financial flows and to ensure the transparency of funded and selected projects. Principles such as money against performance like in Feed-in Tariff systems are crucial achieve effective implementation.

6.3 Technical elements

The grid infrastructure and in particular the transmission network is a central asset for going towards 100% RE. Also for a full transition across all sectors, the vocation of the electricity transmission network is to adapt to means of production and to consumption needs. Today the major flows of renewable based electricity and solidarity between territories constitute the main vectors for the evolution of the network and present new challenges to it. An intelligent mix of grid extension and off-grid /mini-grid solutions is crucial, thus it needs to be carefully examined where grid extension is needed and where not.

Growing power demand, especially at peak periods and variations in energy flows impose certain constraints on the transport and distribution networks. With the increasing penetration of RE, there is an increase of fluctuating resources. One of the challenges to overcome is thus the reconciliation of heterogeneous regional balances, disparate production potentials and irregular consumption profiles. In a large country like Tanzania, where people live in scattered, rural off-grid regions, technical feasibility studies and resource maps are needed to ensure effective and efficient infrastructure development. Stakeholders highlight that a technical and economic energy scenario, modelling 100% RE in the country would be helpful to inform the next steps.

In this context, one of the imperatives emphasized by the stakeholders is the large-scale integration of RE production. Case studies from other countries suggest that to diminish the variability of RE is to connect several RE sources to each other so that current variations from intermittent sources are reduced. To successfully carry forward this strategy, Tanzania must facilitate and accompany technical and structural changes necessary to an energy system only fed by RE.

For this, the current lack of human and institutional capacity must be overcome as it is a drawback for renewable energy technology adoption. In order to realize 100% 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 and educating local experts on 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. For this, Innovation Labs were proposed to ensure the diversification of products and the promotion of certain technologies. Further, exchange of knowledge and cooperation with other RE champions as a base for enhanced technological transfer is needed.

Academic stakeholders underlined the need for more support from the government. The lack and absence of budgets for research in RE in Tanzania leads to the fact that the models and generation of technical knowledge is done by international consultants. By improving coordination between researchers and incentivize research in RE, improve the academia-industry interface as well as by developing engineering trainings and schools, expertise and therefore economic activities can be built in the country. Stakeholders propose to improve scholar activism and support publishing articles to advocate this topic. Some researchers are interested in the creation of an online portal on RE, summarizing what is done and where is the lack of knowledge to be filled.

6.4 Behavioral elements

As pointed out already, investment in capacity building and awareness rising on the merits of RE among all stakeholders across the entire energy value chain is crucial. For this, an important step is gathering of information from good and bad practice in the RE sector both in Tanzania and abroad, as a base for disseminating knowledge to a wide audience through a variety of multi-stakeholder dialogues. Here, advocacy initiatives can build on a vast pool of campaign tools, content and experience. Pilot projects can further help to bridge the gap and introduce the new technology in communities.

In additional, 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. This will avoid repeating previous mistakes and will allow to link community thinking in the broader framework of 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;

According to participants, this would also help the promotion of an entrepreneurial mindset and leadership skills to avoid the failure of projects. In fact, many installations break or fail because of the very low level of adoption from communities. Therefore, participatory approaches and engagement must be at the core of all technical projects.

Workshop in Dar es Salam in February 2016

7. CONCLUSION

The wide-ranging role of energy to unlock Tanzania´s potential for economic growth and achieve broad-base poverty alleviation is extensively acknowledged. Nonetheless, the energy sector 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 fossil resources and inefficient, pollutant and high-cost traditional biomass, such as charcoal and firewood. Further, average demand for electricity is growing at 10-15% 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 technologies provide an opportunity for the country to break out of this path. Particularly solar energy pilot projects already result in socio-economic advantages. 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 the Climate Vulnerable Forum declaration, the SDGs, Paris Agreement or AREI, reinforce this trend and encourage the country and its citizens to move towards

Participants of the Study Tour with Bangladeshi farmers in April 2016

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 pioneers such as Bangladesh illustrate, 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 concrete opportunities to identify synergies and complementarities among the three challenges faced by Tanzania: energy security, socio-economic development and climate change mitigation.

This report laid out specific policy recommendations on how such a policy framework can be built. Crucial elements 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:

- Explore opportunities within the newly established taskforce to feed the policy recommendations in the new National Energy Plan and Renewable Energy budget allocation.

- 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.

- Develop a 100% Renewable Energy scenario to prove the technical and economic feasibility of such a vision for the country.

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.

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