Climate Investment Funds

SREP/SC.IS.3/2
July 23, 2013

Intersessional Meeting of the SREP Sub-Committee
Brussels, Belgium
July 25, 2013

INVESTMENT PLAN FOR TANZANIA

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF ENERGY AND MINERALS

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Ref. No: CBE 88/407/01/VII/77

28th May, 2013

Ms. Patricia Bliss-Guest
Programme Manager
Climate Investment Fund
Administrative Unit
1818 H Street NW
Washington DC 20433
USA

Re: SUBMISSION OF TANZANIA SCALING UP RENEWABLE PROGRAMME-INVESTMENT PLAN (SREP-IP) TO SREP SUB-COMMITTEE

On behalf of the Government of the United Republic of Tanzania (URT) and on my own behalf, I wish to express our sincere gratitude for selecting Tanzania to be one of the pilot countries for the project on, "Scaling Up Renewable Program (SREP)".

I would also like to thank the Sub-Committee of SREP for accepting to discuss our (Tanzania) SREP-IP before the November, 2013 meeting.

I am now submitting the SREP IP of the URT for consideration by the SREP Sub-Committee.

Your cooperation is highly appreciated.

Prof. Sospeter M. Muhongo (MP)
MINISTER FOR ENERGY AND MINERALS

SCALING-UP RENEWABLE ENERGY PROGRAMME (SREP)

INVESTMENT PLAN FOR TANZANIA

May 2013

UNITED REPUBLIC OF TANZANIA

SCALING-UP RENEWABLE ENERGY PROGRAMME (SREP)

INVESTMENT PLAN FOR TANZANIA

Submitted to
SREP Sub-Committee
Strategic Climate Funds
Climate Investment Funds
The World Bank
Washington, DC

Submitted by
United Republic of Tanzania
Ministry of Energy and Minerals
Dar es Salaam

May 2013

The glaciers atop Mount Kilimanjaro may be gone by 2020

Changes to the local ecology, coupled with global and regional climatic change, are causing profound—and possibly irreversible—changes to the majestic and iconic Mount Kilimanjaro.

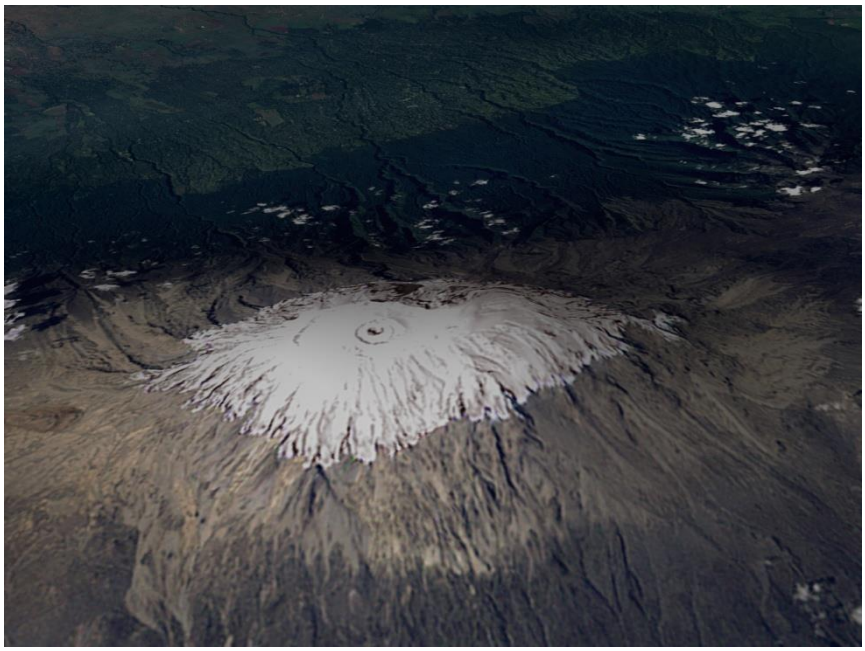
Between 1912 and 2007, Mount Kilimanjaro glaciers retreated by 85 percent. About a quarter of the glacial mass present in 2000 had disappeared by 2010. From 2000 to 2007, the ice thickness at the summits of the Northern and Southern Ice Fields declined by 3.6 percent and 24 percent, respectively.

The NASA Landsat images at right, taken in 1993 (top) and 2000 (bottom), show the accelerated decline in glacier size over that seven-year period.

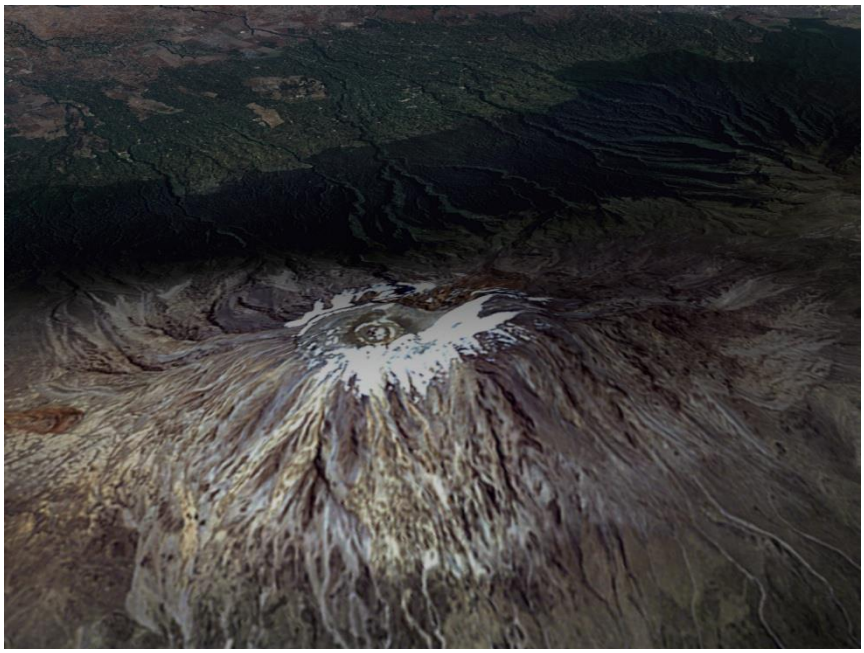
The reasons attributed to the glacier retreat are complex. They include extensive deforestation at the foothills (see vegetation difference in the top and bottom images), which has reduced the available moisture at the top of the mountain, as well as more regional free-air changes and global climate change.*

* N. C. Pepin, W. J. Duane, and D. R. Hardy, "The Montane Circulation on Kilimanjaro, Tanzania and Its Relevance for the Summit Ice Fields: Comparison of Surface Mountain Climate with Equivalent Reanalysis Parameters." *Global and Planetary Change* 74(2): 61–75.

Photos courtesy of NASA Earth Observatory, EOS Project Science Office, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA.



MOUNT KILIMANJARO, 17 FEBRUARY 1993 (NASA LANDSAT 5 IMAGE)



MOUNT KILIMANJARO, 21 FEBRUARY 2000 (NASA LANDSAT 7 IMAGE)

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ACRONYMS AND ABBREVIATIONS

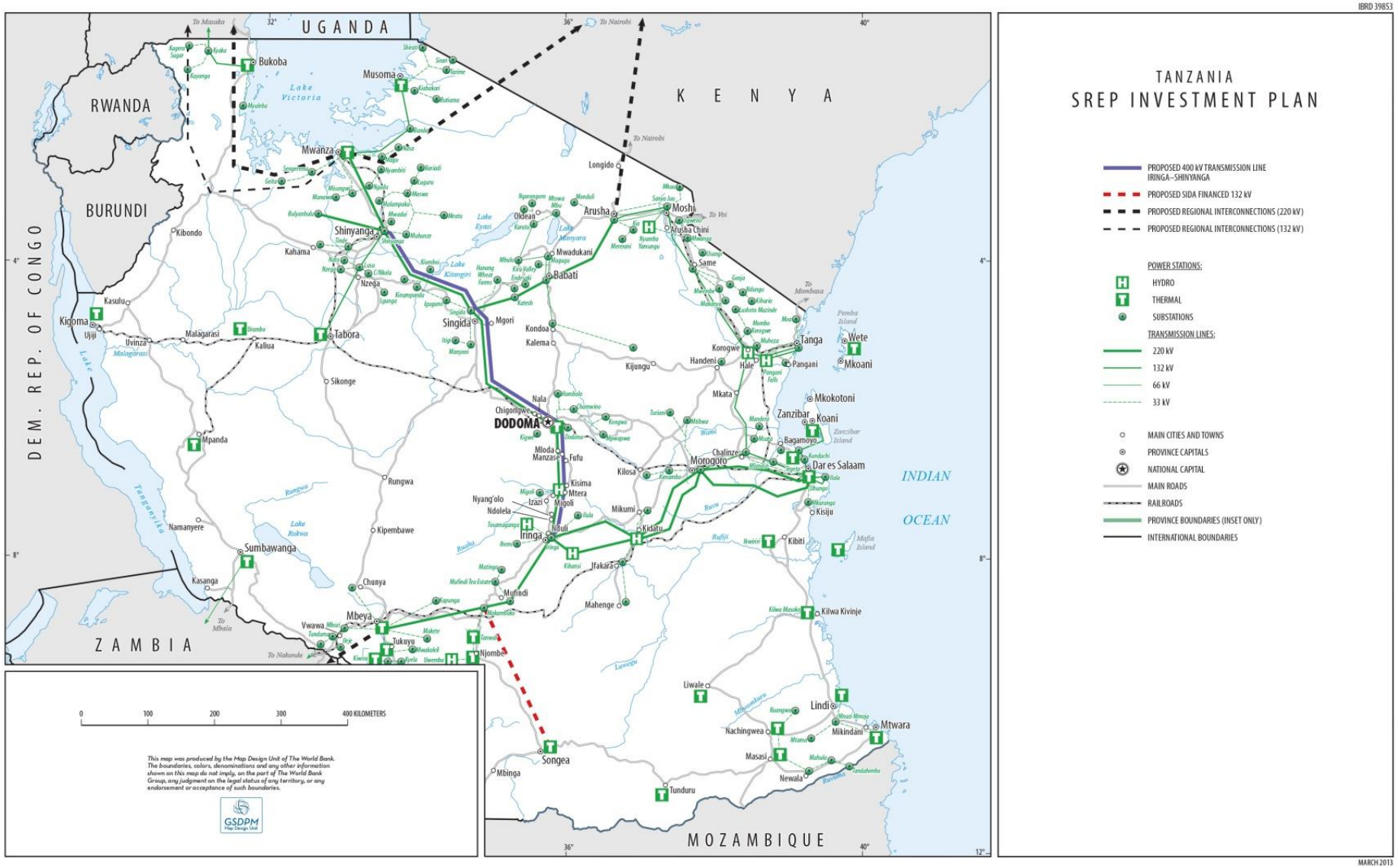
AFD	French Development Agency	MEM	Ministry of Energy and Minerals
AfDB	African Development Bank	MEPI	Multidimensional Energy Poverty Index
ARGeo	African Rift Geothermal Facility	MTOE	Million tons of oil equivalent
BEST	Biomass Energy Strategy Tanzania	MTPY	Million tons per year
BGR	German Federal Institute of Geosciences and Natural Resources	MWh	Megawatt hour
CDM	Clean Development Mechanism	NEMC	National Environmental Management Council
CIF	Climate Investment Funds	NGO	Nongovernmental Organization
COSS	Cost of Service Study	NORAD	Norwegian Agency for Development Cooperation
COSTECH	Tanzanian Commission for Science and Technology	PPP	Public Private Partnership
DFID	UK Department for International Development	PSMP	Power System Master Plan
E&S	Environmental and Social	PV	Photovoltaic
EPP	Emergency Power Producer	RAP	Resettlement Action Plan
ESIA	Environmental and Social Impact Assessment	RE	Renewable Energy
ESMF	Environmental and Social Management Framework	REA	Rural Energy Agency
EWURA	Energy and Water Utilities Regulatory Authority	REF	Renewable Energy Fund
GDP	Gross Domestic Product	RPF	Resettlement Policy Framework
GHG	Greenhouse Gas	SIDA	Swedish International Development Cooperation Agency
GTZ	German Technical Cooperation Agency	SPP	Small Power Producer
GWh	Gigawatt hour	SPPA	Small Power Purchase Agreement
HDI	Human Development Index	SREP	Scaling-Up Renewable Energy Programme
IEA	International Energy Agency	TANESCO	Tanzania Electric Supply Company
IFC	International Finance Corporation	TAREA	Tanzania Renewable Energy Association
ILS	Information and Lessons Sharing	TASF	Transactions Advisory Services Facility
IP	Investment Plan, SREP	TaTEDO	Tanzania Energy Development Organisation
IPP	Independent Power Producer	TBS	Tanzania Bureau of Standards
JICA	Japan International Cooperation Agency	TEDAP	Tanzania Energy Development and Access Project
kWh	Kilowatt hour	TZS	Tanzanian Shilling
LED	Light Emitting Diode	UNDP	United Nations Development Programme
M&E	Monitoring and Evaluation	UNFCC	United Nations Framework Convention on Climate Change
MDB	Multilateral Development Bank	USAID	United States Agency for International Development

Currency Exchange Rate

March 2013

1 US$ = TZS 1,618

MAP OF TANZANIA



FOREWORD

Eliakim C. Maswi, Permanent Secretary, Ministry of Energy and Minerals

Tanzania is endowed with diverse forms of renewable energy resources, ranging from biomass and hydropower to geothermal, solar, and wind. Much of this potential has not been fully exploited. Without doubt, if properly utilised, such renewable resources would contribute significantly to Tanzania's energy supply, thus moving the country closer to achieving middle-income status, as envisioned in the Tanzania National Development Vision 2025.

Recognising the potential contribution of renewable energy to the country's future energy mix, the Government of the United Republic of Tanzania is ambitious to foster the development of low-carbon energy initiatives through harnessing its renewable-energy resource base. Renewable energy, which is environmentally benign, can improve access to sustainable modern and cleaner energy services with the potential for contributing to job creation, income generation, and improved livelihoods of marginalised social groups, particularly women and children in rural areas.

As a result of climate change, Tanzania has witnessed increasingly unreliable rainfall patterns and more frequent and prolonged droughts over the past two decades, which, in turn, have paralysed the country's power sector due to its heavy dependence on hydropower. This situation has induced power crises and increased dependence on expensive, environmentally polluting fossil fuels, which must be imported. The aforementioned experiences are a strong impetus for us to diversify our energy mix to attain a more robust, resilient energy supply that is less subject to oil price shocks.

No doubt, the Scaling-Up Renewable Energy Programme (SREP) is amongst several key interventions that will guide Tanzania in the years ahead as we strive to achieve energy security, with the ultimate goal of attaining universal access to modern energy services. The SREP-Tanzania Investment Plan outlines the activities that we must undertake to increase access to modern energy. It establishes specific goals, objectives, and targets that all stakeholders—government, development partners, businesses, private sector, financial institutions, civil society, and local communities—must achieve by working together. Special attention is given to increasing power generation from renewable energy resources that are available in abundance throughout the country. This will lead to

providing more than 75 percent of Tanzania's residents—the majority of whom live in rural areas—access to electricity by 2035.

The role of the SREP is to catalyse the large-scale deployment of renewable energy resources in addressing the issue of energy poverty for our country and communities through delivery of energy from geothermal and other renewable energy sources. The SREP will help Tanzania move along a low-carbon development pathway, increase energy security, generate new economic opportunities, and widen access to modern energy services through mobilising and leveraging the capacities of our dynamic private sector. This approach is in line with the United Nations initiatives on Sustainable Energy for All (SE4All) and its Post 2015 Global Sustainable Development Agenda.

I deeply appreciate the work undertaken by the SREP Task Force in preparing the SREP-Tanzania Investment Plan, the support we received from the Multilateral Development Banks, development partners, and all other stakeholders involved in the consultative process. This SREP Investment Plan well portrays the desired sustainable energy future needed by all Tanzanians; its implementation will mark a critical step toward realising that future.

Eliakim C. Maswi
Permanent Secretary
Ministry of Energy and Minerals
Dar es Salaam, United Republic of Tanzania

21 May 2013

EXECUTIVE SUMMARY

Introduction

1. Tanzania is one of the pilot countries selected to benefit from the Scaling-Up Renewable Energy Programme (SREP) in Low Income Countries. The SREP, which operates under the Strategic Climate Fund, part of the Climate Investment Funds (CIF), aims to demonstrate the economic, social, and environmental viability of a low-carbon development pathway by creating new economic opportunities and increasing energy access through the production and use of renewable energy. The objective of the SREP-Tanzania Investment Plan is to catalyse the large-scale development of renewable energy to transform the country's energy sector from one that is increasingly dependent on fossil fuels to one that is more balanced and diversified, with a greater share of renewable energy sources. Harnessing the country's renewable energy potential will enhance energy security, generate new economic opportunities, and widen access to energy services through mobilizing and leveraging private-sector capacity.

2. The rationale for selecting Tanzania as one of the pilot countries to benefit from the SREP is based on the critical, far-reaching energy-related challenges facing the country, combined with efforts already undertaken by the Government of Tanzania to meet them. Key issues include a climate change–induced energy crisis, high rates of energy poverty, high population and economic growth, rapidly increasing energy demand, and diverse and abundant renewable energy resources that remain largely untapped. The government is strongly committed to developing the nation's renewable energy resources and has made significant efforts to create an enabling legislative and institutional framework conducive to generating private sector interest.

3. The SREP-Tanzania Investment Plan was prepared under the leadership of the Government of Tanzania, through a National Task Force led by the Ministry of Energy and Minerals (MEM) with support from the Multilateral Development Banks (MDBs). This country-led program is in line with the government's strategy for renewable energy development, as stipulated in the Tanzania National Development Vision 2025, the National Energy Policy of 2003, and the National Strategy for Economic Growth and Reduction of Poverty, as well as the key principles of the National Climate Change Strategy. It takes an outcome-focussed, programmatic approach to scaling up renewable energy. A participatory process, involving many stakeholders, took into account preparatory work of the SREP National Task Force on key barriers and bottlenecks to ensure that sustainable, transformative changes occur.

Energy Sector Challenges

4. Tanzania's energy sector faces a number of significant challenges; amongst the most crucial are:

- *Increasing electricity demand*. Although Tanzania's current per capita electricity consumption is under 100 kWh per year, demand is increasing rapidly owing to accelerating productive investments and a steadily growing population. The Power System Master Plan (PSMP) (2010–35) expects the country's electricity access rate to rise from 18.4 percent of the population to at least 75 percent by 2035, whilst demand from connected customers is expected to grow significantly as the country reaches middle-income status, as projected in the Tanzania Vision 2025. Meeting pent-up demand

will require greater diversification of generation sources and a favourable climate for private-sector investment.

- *Risk of disruption to generation and associated electricity price shocks due to the increasing unpredictability of hydropower*. Changing rainfall patterns and recent droughts have dramatically reduced large hydropower output, resulting in extensive load shedding and running expensive emergency fossil fuel–based power plants as base load. Large hydro currently comprises 35 percent of total generation capacity, down about two-thirds from a decade ago.

- *Uncertain creditworthiness of the utility.* For the past several years, TANESCO, the state-run utility, has suffered from poor technical and financial performance. A prolonged drought in 2012 has resulted in widespread load-shedding and subsequent acquisition of high cost emergency generation, which now constitutes 13 percent of total installed capacity. As a result, TANESCO is now experiencing mounting losses, as revenues are insufficient to meet rising operating costs due to its increasing dependence on thermal power. This affects its ability to borrow and, consequently, make much-needed investments. The government is committed to addressing this situation and is executing a plan comprising both short- and medium-term measures, including acceleration of gas infrastructure investments to replace emergency generators, restructuring TANESCO, and implementing a loss-reduction programme and other revenue-enhancing measures. The positive impact of these actions however, is unlikely to be seen until a few years from now.

- *Low access to reliable electricity.* Electricity access is estimated at 18.4 percent nationally, and only 7 percent in rural areas. Access to modern energy services is vital to agricultural productivity, income generation, and education. Women, who shoulder a disproportionate responsibility for household fuel and water collection, food preparation, and agriculture, are especially affected by an unreliable energy supply. The vastness of the country, coupled with low population densities, makes grid extension too expensive for many difficult-to-reach areas, creating a significant market potential for off-grid electrification schemes.

- *Health risks and environmental degradation from household reliance on biomass energy.* In 2009, biomass represented 88.6 percent of total energy consumption, most of it used by the residential sector to meet household cooking needs. The incomplete combustion of fuelwood in traditional biomass stoves results in indoor air pollution, linked to respiratory and other diseases that disproportionately affects women and children. The loss of forest cover from charcoal production, with nearly 1 million tons consumed annually, is estimated at about 100,000–125,000 hectares.

Constraints to Renewable Energy Development

5. Tanzania is endowed with abundant, high-quality renewable resources, which could play a significant role in meeting the county's energy needs. Currently, however, renewable energy (excluding large hydro) accounts for only about 4.9 percent of generation capacity. The government has set a target for this share of the energy mix to reach 14 percent (complemented by 26 percent large hydro) by 2015. Achieving this goal, however, will require removing key constraints, as follows:

- *Institutional, Regulatory, and Legal*. The limited role for renewable energy in the PSMP reflects inadequate data and unavailable power planning tools and methods to more effectively integrate a wide range of renewable energy options, especially distributed generation. The preparation and approval process for renewable energy projects is lengthy and complex. The policy and regulatory framework for renewable energy is incomplete. For example, there are no feed-in tariffs or other clear incentives for renewable energy larger than 10 MW, and there is no specific legal and regulatory framework in place for geothermal development. There is also a lack of incentive to develop mini-grid projects due to uncertainty of grid expansion. In addition, unregulated biomass resource extraction from forests has led to unsustainable harvesting of firewood and charcoal.

- *Knowledge and Capacity*. Tanzania has limited expertise in undertaking feasibility studies, detailed design, and construction for renewable energy power plants. There is a lack of information on the needed quality and duration of the resources, especially for mini-hydroelectricity and geothermal. Sound forest resource information and sustainable harvesting plans are lacking. Consumers are unaware of product standards, available technology choices, and efficient alternative production methods. The banking sector and investors have limited experience with financing renewable energy projects.

- *Economic and Financial*. Renewable energy projects generally have a high capital cost, and typical financing instruments available on the Tanzanian market are not well suited to the development of renewable energy projects, which require low cost, long-term debt. Equity financing is quite scarce. Renewable energy projects also face significant risks, including off-taker (especially payments by the utility), resource, and currency risks. The time required from the pre-feasibility phase to financial closure is quite lengthy. In many rural areas, there is limited ability to pay for electricity services, especially for the high upfront costs of electricity connections or stand-alone renewable energy systems. Access to financing to improve fuelwood/charcoal production efficiencies is difficult owing to the informal nature of the industry.

Key Achievements

6. In the past decade, Tanzania has taken important steps to create the enabling conditions for the development of renewable energy resources.

- *Policies, Legislation, and Institutional Framework*. The government has instituted a range of energy-sector reforms, a major aim of which has been to attract private-sector investment to boost electricity supply. Key policies and legislation include the Energy and Water Utilities Authority Act, 2001 and 2006; National Energy Policy, 2003; Rural Energy Act, 2005; Electricity Act, 2008; and Public Private Partnership Act. No. 18, 2010. Additional legislation has focused on biomass energy, environment, and land. Outcomes from these efforts are beginning to have a profound, positive effect on renewable energy development. These include establishment of the Rural Energy Agency (REA) and related Rural Energy Fund (REF); establishment of the Energy and Water Utilities Regulatory Authority (EWURA) and application of the Small Power Producers Programme; and development of the Medium Term Strategic Plan (2012–16), Power Sector Master Plan, and Rural Electrification Investment Prospectus.

- *Private-Sector and NGO Participation.* The private sector—Independent Power Producers and Small Power Producers—has become a key contributor to economic growth in numerous sectors. Currently independent power projects contribute about 40 percent of the national grid's effective generating capacity. Instituting the regulatory framework for small power projects (SPPs) has resulted in 3 SPPs selling power to the grid, one operating an isolated mini-grid and 8 additional small power producer agreements (SPPAs) signed with TANESCO. In addition, various nongovernmental organizations (NGOs) promote access to sustainable and renewable energy.

- *Contribution of Development Partners*. There is a well-coordinated and inclusive partnership of development partners who are committed to supporting sustainable energy development in Tanzania. Their harmonised assistance is aligned with the country's national priorities and strategies. For example, a well-coordinated working group of development partners involved in the energy sector, chaired by the Swedish International Development Cooperation Agency (SIDA), meets regularly to discuss key sector issues and challenges, as well as development partners' approaches and interventions to address them.

- *Environmental and Social Aspects*. The MEM and REA have policies and procedures in place to ensure compliance with social and environmental safeguards. The government has developed the National Adaptation Plan for Action 2007 and the Sector Environmental Action Plan 2011–2016. In addition, the National Climate Change Strategy will integrate the climate change dimension into national policies and programmes. The REA recognizes the centrality of women in its energy access programmes and is working with the World Bank's Gender and Energy program to mainstream gender into its organization and operations.

- *Rural Energy Access Expansion.* Outcomes of the off-grid component of the World Bank-supported Tanzania Energy Development and Access Project (TEDAP) have included TANESCO signing the Standardized Power Purchase Agreements (SPPAs) with 11 developers to supply 46 MW of power and TANESCO signing Letters of Intent with another six developers for 31 MW of power, with four SPPs already in operation. The REA performance-based grant support to mini-grid and stand-alone systems and the innovative Lighting Rural Tanzania project will benefit more than 100,000 households. The REA is processing additional grant-co-funding to prepare 60 mini-grid projects and stand-alone solar projects to benefit many more consumers. The TEDAP-funded re-financing facility for small renewable energy projects has resulted in the first two long-term loans for small hydropower projects extended by commercial banks to local private-sector developers; additional loans are being considered. The REA is preparing a Rural Electrification Investment Prospectus that is for the first time integrating grid-based electricity access planning with renewable energy-based mini-grid and stand-alone electrification options.

Renewable Energy Viability

7. Today, Tanzania's electricity generation capacity on the main grid is 1,564 MW. Should business-as-usual conditions prevail, by 2035, meeting the energy demand envisaged in the PSMP will require an additional 9,000 MW in capacity, most of it met by coal (41 percent), large hydro (35 percent), and oil and gas (21 percent). Much of the early capacity requirements would be met by oil

and gas generators, which require shorter lead times than coal and large hydro, which would predominate in later years. Despite the high potential for other renewable energy providing lower-cost electricity using locally available resources, only 3 percent is considered in the PSMP because of insufficient resource information needed for investment decisions, and inadequate planning and project development.

8. Given that Tanzania's main electricity demand centres are located far from major gas and coal areas, the transmission costs and losses are bound to be high. This, combined with the risks associated with over-dependence on large hydro, make a portfolio of highly diversified power sources with a wide geographical spread highly desirable. For grid-connected generation, all renewable energy options have economic levelized costs of US¢12 or less per kWh; the cost of geothermal, once the resource is proven, is about US¢6–8 per kWh, meaning it is competitive with gas-powered generation without the risk of future price increases. Solar PV is less costly than diesel generation and its levelized electricity will decline further as capital costs are expected to decline to under US$1,000 per kWp in the near future.

9. The Rural Electrification Investment Prospectus estimates that about half of the rural population might be more cost-effectively served by mini grids and off-grid options. Twenty percent could benefit from renewable energy mini grids and 32 percent from stand-alone and micro-grid solar PV. Diesel is not an economically viable option. The prospectus will define a least-cost investment plan for 2013–22, aimed at electrifying 1,200 development centres (about 6,000 localities) with the highest potential. The prospectus will define the least-cost path for grid electrification and will identify those districts and communities that cannot be cost-effectively reached by grid and should be targeted for private sector–driven, off-grid electrification investments. Expected to be ready in mid-2013, the prospectus will guide the SREP-Tanzania off-grid electrification investments.

Program Description

10. ***Inclusive and Participatory Process in Program Identification***. A participatory process involving many stakeholders under the leadership of the Government of Tanzania, represented by the MEM, with support of the MDBs, helped to formulate the SREP-Tanzania Investment Plan. The process took into account preparatory work done by the SREP National Task Force on key barriers, bottlenecks, and opportunities; conclusions of various technical consultations and meetings with key stakeholders; a consultative workshop held during the Joint Mission; and the comments received from an independent reviewer and from the on-line consultation process on the final draft of the Investment Plan.

11. The Government of Tanzania applied both SREP and additional national screening criteria to identify the renewable energy technologies and potential investments that correspond with national priorities. In this way, SREP investments will have the optimal transformational impact. Three categories of technologies were considered: (i) national grid power supply, (ii) off-grid electrification, and (iii) direct thermal applications. The grid-connected technology choices were geothermal, solar or wind, small hydro, and biomass power. Off-grid choices were renewable-energy mini grids and stand-alone solar; the thermal option was biomass fuels.

12. The three top priority choices that emerged to support national development priorities were geothermal power development, renewable energy for rural electrification (RERE), and alternative biomass supply options. The Government of Tanzania decided to focus on the first two priorities, with

the understanding that additional SREP resources, if they become available, would be used to implement the strategy to emerge from the Biomass Energy Strategy Tanzania (BEST) initiative now under development.

13. ***Program Development Objective***. The Program Development Objective (PDO) of the SREP-Tanzania Investment Plan is to scale-up renewable energies to transform the country's energy sector, mainly the electricity subsector, from one increasingly dependent on fossil fuels to one that uses a more balanced supply of diverse energy sources. Achieving this goal will help Tanzania move along a low-carbon development pathway, while increasing energy security, generating new economic opportunities, and widening access to energy services. Consistent with the SREP Programming Modalities, the proposed PDO will be achieved through an integrated approach that recognises that improving energy market conditions, sector financing, and creating the conditions to gain investor confidence at all levels are indispensable to achieving transformational change.

14. ***Expected Results and Transformational Effects***. The main results expected from the SREP investments are as follows:

- Improved access and reliability of the electricity services used by Tanzania's rural and urban populations.
- Increased supply of electricity from renewable energies and scaling up innovative energy delivery solutions.
- Substantive and substantial private-sector participation in all aspects of renewable-energy project development and in investing and operating renewable energy projects.
- Increased gender-equitable access to renewable energy by rural and urban populations.
- Creation of jobs related to the adoption of renewable energy for women and men in the targeted areas.
- Improved enabling environment through optimization of the legal and regulatory framework and increased capacity of relevant government authorities to carry out negotiations with the private sector.
- Additional financial resources leveraged and appropriate financial instruments utilised for renewable energy projects.
- Reduce GHG emissions compared to the business-as-usual option.

15. ***Investment Projects***. The SREP-Tanzania Investment Programme will consist of two distinct and complementary investment projects with a combined generation potential of about **147 MW**.

a. *Project 1: Geothermal Power Development Project*. This project aims to (i) catalyse the development, mainly by the private sector, of low-cost and reliable geothermal power by removing uncertainties of the resource, in order to contribute significantly to Tanzania's electric power, and (ii) establish an enabling environment for large-scale geothermal development through establishing the legal and regulatory framework, capacity building, and risk mitigation. The project will be developed in two main phases. Phase 1 will include (i) preparation of the enabling environment for geothermal development and (ii) geothermal resource assessment, including exploratory well drilling and feasibility studies. If resources are confirmed, the project will enter Phase 2, which consists of (iii)

power-generation project development and (iv) power project investment and operation. The proposed indicative budget for both phases totals **USD 536.8 million**. The SREP contribution of USD 25 million will be used mainly to mitigate risks at the resource confirmation and power development stages to lower investor risk and the cost of capital. It will also be used to strengthen the legal and regulatory frameworks, improve power-planning capacity, and increase institutional and human capacity. The MEM will serve as the lead national implementing agency, while the African Development Bank (AfDB) will be the lead MDB. The expected project outcome is a PPP project that has successfully developed, constructed, and commissioned the operation and maintenance of **about 100 MW** of geothermal power supplying about **700 GWh per year** to the national grid. Total avoided GHG emissions from this project, covering both phases, are about 555 590 tons CO2eq.

b. *Project 2: Renewable Energy for Rural Electrification (RERE) Project*. This project aims to (i) build an efficient and responsive development infrastructure for renewable energy-based rural electrification, and (ii) demonstrate its effectiveness by supporting a time-slice of private-sector investments in off-grid electricity enterprises. The project encompasses three off-grid electrification schemes: mini grids, micro grids, and sustainable solar market packages (SSMPs). The proposed indicative budget amounts to **USD 182.45 million**. The SREP contribution of USD 25 million will be used to make a major, rapid shift from a traditional approach to rural electrification to one that adopts quick-response and innovative methods using renewable energy, and that catalyses private-sector capabilities and financial resources. The REA will serve as the lead national implementing agency, while the World Bank Group will be the lead MDB. The project expects to generate a renewable energy potential of **47 MW** directly co-funded with SREP resources and directly benefitting about half a million people and to create a pipeline of RERE projects that will eventually help 2.2 million people. Total avoided GHG emissions from this project are about 141 755 tons CO2eq.

Funding Sources and Rationale for SREP Financing

16. ***SREP-Tanzania Estimated Budget***. The total estimated budget for the SREP-Tanzania is **USD 719.25 million** with a SREP contribution of USD 50 million. The program is seeking contributions from the MDBs and other development partners, including USD 45 million from the AfDB to finance the Geothermal Power Development Project and USD 50 million from the World Bank Group to support the RERE Project. Also critical to success is the mobilising of financing from the private sector and commercial banks.

SREP Indicative Financing Plan

SREP Project	SREP	Gov't. of Tanzania	World Bank Group	AfDB	Private Sector	Commercial Banks	Other Development Partners	Total
Geothermal Power Development	25.00	1.50	-	45.00	142.50	317.50	5.30	**536.80**
Renewable Energy for Rural Electrification	25.00	2.40	50.00	-	30.48	28.03	46.54	**182.45**
Total	**50.00**	**3.90**	**50.00**	**45.00**	**172.98**	**345.53**	**51.84**	719.25
SREP Leverage 13:1								

17. Not shown here is the investment financing needed for additional geothermal power projects beyond the first 100 MW and the additional pipeline of mini grids and SSMP projects beyond the first 47 MW.

18. ***Rationale for SREP Financing***. Without SREP financing for the geothermal power development project, the private sector would not take the risk to invest, and the energy sector's vulnerability to climate variability and price shocks would be exacerbated, hindering social and economic development and thus prospects for the country's goal of achieving middle-income status by 2025. Without the SREP's demonstration of the scalability of renewable energy for off-grid electrification, the government would be hard-pressed to select second-best options, such as diesel generators or extending grids to non-viable areas, thereby increasing transmission and distribution costs and losses, and possibly adding more fossil fuel–based power plants. Such options are not only detrimental to the global environment; the status quo would be harder to change at a later stage. Because non-renewable energy infrastructure has decades of life, its continued use would spew more CO_2 emissions into the atmosphere for decades. Thus, lack of or delay in SREP support could have relatively severe global environmental repercussions.

Concluding Remarks

19. The SREP-Tanzania Investment Plan offers a unique opportunity to propel Tanzania's future development along a low-carbon pathway**.** The appropriate exploitation of the country's abundant renewable energy resources has great potential to move it toward achieving universal access to modern energy services. A more reliable, less volatile electricity supply at more predictable prices, economic savings to the nation and financial savings to consumers from lower-cost electricity, and a better enabling environment resulting from the proposed SREP interventions can create the conditions for transformative change. The Government of Tanzania, with support from the international community, is committed to adopting the green growth pathway reflected in this report to ensure immediate, as well as longer-term social, economic, and environmental benefits from a well-performing and sustainable energy sector.

1 PREAMBLE

The Investment Plan (IP) for Tanzania's Scaling-Up Renewable Energy Programme (SREP) is a country-level, outcome-focused programmatic approach to scaling up renewable energy. The IP is in line with the nation's strategy for renewable energy development, as stipulated in the following documents: Tanzania National Development Vision 2025, National Strategy for Economic Growth and Reduction of Poverty or MKUKUTA (Kiswahili acronym), Millennium Development Goals (MDGs) by 2015, and National Energy Policy of 2003, amongst others. The SREP-Tanzania IP brings various power sector, renewable energy and climate change policies together into a single cohesive document, and proposes a strategic development path leading to greater utilisation of renewable energy.

The Government of Tanzania recognises that climate change could hinder the ambitious development goals set forth in the Tanzania National Development Vision 2025.[1] Indeed, the effects of a changing climate are considerably evident in the country. These include a warming trend in temperatures, as exemplified by the decreasing snow cap on Mount Kilimanjaro, as well as increased variability in rainfall linked to more frequent and prolonged droughts witnessed in recent years.

Tanzania's energy sector, which relies significantly on hydropower generation, is particularly vulnerable to changing weather patterns. Today, hydropower accounts for 35 percent of the country's electricity generation mix, down from more than 50 percent prior to the droughts experienced in the year 2000 and again in late-2010 through 2012. Reduced hydro generation resulting from these droughts led to severe energy shortages, which culminated in load shedding. Blackouts and power rationing caused by low water levels in hydropower dams forced the Tanzania Electric Supply Company (TANESCO), the state-owned utility, to shift to backup oil- and gas-fired emergency generators and increasingly turn to thermal projects to compensate for reduced current capacity and to increase future capacity. Power rationing for both domestic and industrial use has resulted in an economy that is more vulnerable to climate change–related disasters, which has led to inefficiencies in public-service provision. This situation calls for diversifying the energy mix—tapping into renewable energy sources less vulnerable to climate variability and change.

Currently, Tanzania contributes little to global climate change, with CO_2 emissions at just 0.2 tons per capita in 2009.[2] Of this amount, the transport sector accounts for 50 percent, the electricity and heating sector comprises 25 percent, manufacturing 15 percent, and other sectors the remaining 10 percent. However, according to the UK Department for International Development (DFID),[3] under current 25-year projections (2005–30), greenhouse gas (GHG) emissions could double, whilst fossil fuel–based emissions could increase sevenfold. Over the past decade, energy-sector emissions are estimated to have increased by as much as 50 percent. The CO_2 intensity of the country's economy and that of the energy sector are strongly correlated. Under a business-as-usual scenario, continued economic growth will increase demand for energy, leading to increasing quantities of CO_2 emissions. Clearly, business-as-usual is not an acceptable option.

[1] National Adaptation Plan for Action 2007 and Sector Environmental Action Plan 2011–2016, Government of Tanzania.
[2] World Bank DataBank (http://databank.worldbank.org/ddp/home.do?Step=1&id=4).
[3] DFID with Development Partner Group, "Economics of Climate Change in the United Republic of Tanzania."

Given the importance of energy to Tanzania's economic growth and ambitious development goals, the country must continue expanding its power-generation capacity to meet growing demand; but it must do so in a sustainable manner that diversifies the energy portfolio. The government recognises that a strategy that utilises indigenous sources of renewable energy has the potential to reduce the risk of supply disruptions, avoid price shocks, reduce pressure on the local and global environment, and improve socioeconomic development outcomes.

Tanzania has a unique opportunity to propel its future socioeconomic development following a low-carbon pathway. As one measure of climate change mitigation and adaptation, the government has developed the National Adaptation Plan for Action 2007 and the Sector Environmental Action Plan 2011–2016. In addition, the National Climate Change Strategy will integrate the climate change dimension into national policies and programmes.

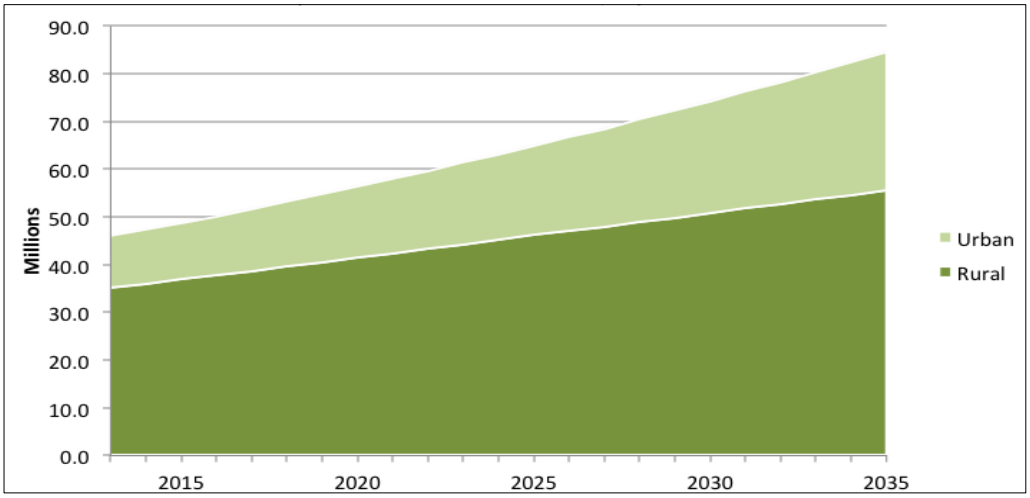
Low-carbon development can be facilitated by a dynamic private sector that is active in renewable energy development. Given that Tanzania is endowed with an abundant array of renewable energy resources, their appropriate exploitation has a great potential to contribute to achieving the goal of universal access to modern energy services. By providing new opportunities to women, it can also contribute to strengthening gender equity in Tanzania.

Therefore, the Government of Tanzania, with support from the international community, is committed to adopting a green growth pathway by increasing the share of renewable energy in the national energy mix.

2 COUNTRY CONTEXT

Tanzania's total land area is about 945,203 km^2, with a total estimated population of 44.9 million (2012 figure).[4] The current rate of population growth is 2.9 percent per year. If this trend continues, the population will reach 64 million by 2025 and 83 million by 2035. However, the growth rate is expected to slow as economic development progresses. Today about three-fourths of Tanzanians live in rural areas; by 2035, it is projected that urban populations will have increased, although rural ones will still constitute the majority of residents (Figure).

FIGURE 1 POPULATION PROJECTIONS TO 2035



Source: United Nations Department of Economic and Social Affairs 2012.

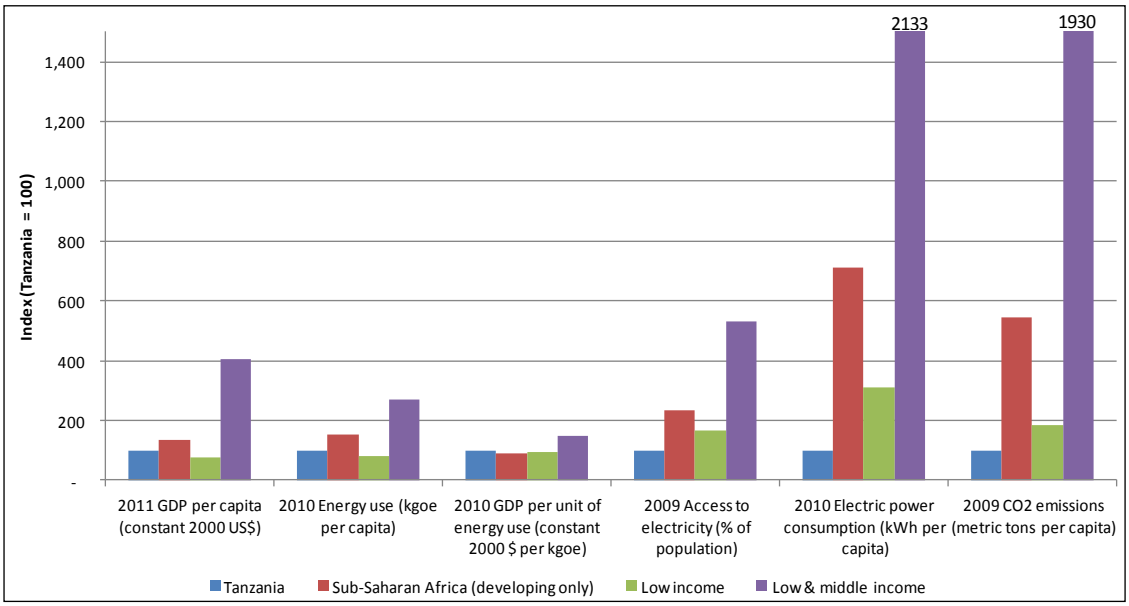
By 2025, Tanzania envisions having transformed itself into a newly-industrialising, middle-income country, with a prosperous, globally competitive economy and a high quality of life in a clean and secure environment. This vision is reflected in the country's long-term development strategy, Tanzania National Development Vision 2025, which identifies increased access to modern energy as one of the enabling conditions for socioeconomic transformation. Currently, Tanzania ranks about the same as or below other Sub-Saharan Africa developing countries and low- and middle-income countries on several key energy indicators. In particular, the percentage of the population with access to electricity and per capita electricity consumption are lower in Tanzania than in the other three regional/economic groups (Figure 2).

Over the past two decades, Tanzania has made significant progress toward achieving and maintaining macroeconomic stability, becoming one of the best economic performers in Sub-Saharan Africa. According to the Bank of Tanzania, economic growth has held at about 7 percent per year since 2000, and annual GDP per capita was about US$560 in 2011. Sound macroeconomic policies, market-oriented reforms, and debt relief have ensured a positive environment for the country's steady economic growth. Tanzania's economy depends heavily on the service sector, particularly tourism, which accounts for nearly half of GDP. Agriculture accounts for nearly one-quarter of GDP, employing two-thirds of the work force. Other key growth sectors are construction, manufacturing,

[4] According to the National Bureau of Statistics (www.nbs.go.tz/).

and mining. The country has significant underdeveloped mineral reserves whose planned development will contribute to economic growth and increased energy demand.[5] The manufacturing, mining, and service sectors require a reliable, low-cost, and sustainable electricity supply.

FIGURE 2 COMPARATIVE INDICATORS FOR TANZANIA AND OTHER REGIONAL/ECONOMIC GROUPS



Source: World Bank DataBank.

Despite such progress, economic growth has not translated into a corresponding reduction in poverty. The 2007 Household Budget Survey reveals disappointing results since 2001, with only a marginal decline in the poverty headcount ratio (from 35.6 to 33.6 percentage points). Given the substantial population growth, the absolute number of poor people is estimated to have increased by 1.3 million.

If Tanzania is to achieve both significant poverty reduction and accelerated economic growth, a number of road blocks to the development of energy and transport infrastructure, human capital, and natural resources must be removed. Infrastructure bottlenecks are a serious constraint to growth and attracting private investment. Whilst some sectors are gradually improving their performance and institutional setup, continued improvement in the energy sector and the Public-Private Partnership (PPP) policy framework will be critical to unlocking the situation.

2.1 TANZANIA ENERGY SECTOR

According to the International Energy Agency (IEA), Tanzania consumed a total of 19.6 million tons of oil equivalent (MTOE) in 2009, of which 1.7 MTOE consisted of net imports; the government estimated that the total would have risen to 22 MTOE by 2010. Of total imports, amounting to about US$1.5 billion, energy—mostly petroleum products—represented 23 percent. In 2009, biomass represented 88.6 percent of total energy consumption.[6] Charcoal made from wood was the single largest source of household energy in urban areas, with about half the annual consumption occurring in Dar es Salaam. Petroleum products comprised 9.2 percent of the total energy consumed, whilst

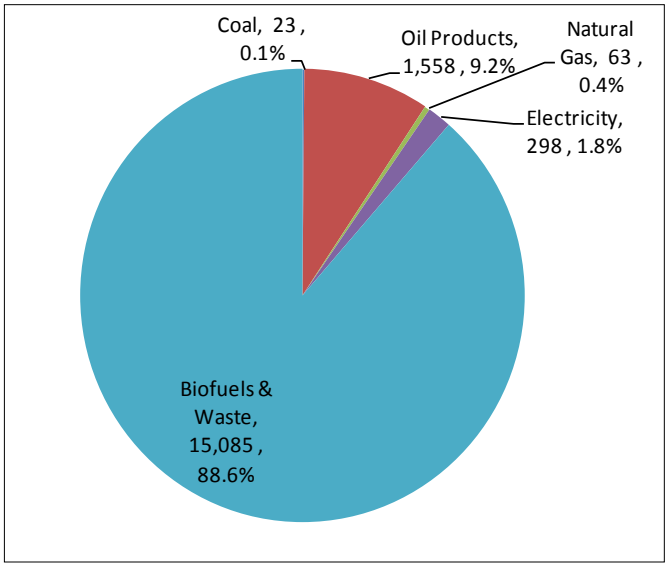
[5] Tanzania has an estimated 140 million tons (MT) of gold reserves, 536 MT of coal, 33 trillion ft.^{3} of gas reserves, and abundant reserves of other minerals.
[6] See IEA, *Energy Balance for Tanzania*, 2009 (www.iea.org/stats/balancetable.asp?COUNTRY_CODE=TZ).

electricity accounted for just 1.8 percent (Figure 3). Other energy sources, including solar, represented a small share.

Household biomass use has significant environmental and health consequences, with a significant gender dimension. Exposure to indoor air pollution (IAP) resulting from the incomplete combustion of biomass cooking smoke has been linked to numerous respiratory diseases. According to the World Health Organization (WHO), in Sub-Saharan Africa alone, more than half a million people die each year due to IAP-related health problems. Given their traditional roles inside the home, women suffer these health impacts disproportionately.[7]

FIGURE 3 ENERGY SOURCES AND END USES

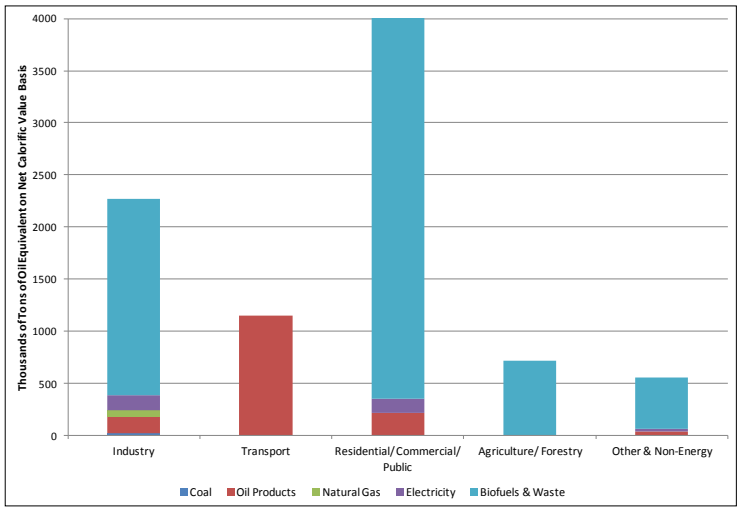
Thousand tons of oil equivalent



Source: IEA 2009.

The nearly 1 million tons of charcoal consumed each year require an estimated 30 million m^3 of wood. The average annual loss in forest cover attributed to charcoal production is estimated at 100,000–125,000 hectares,[8] with 20–50 million tons a year in increased CO_2 emissions, depending on whether fuelwood is removed from forests or other woodlands.[9]

FIGURE 4 SECTORAL ENERGY USE, 2009



Source: IEA 2009.

[7] *Int. J. Environ. Res. Public Health* 4(1): 39–44.
[8] The World Bank, "Environmental Crisis or Sustainable Development Opportunity? Transforming the Charcoal Sector in Tanzania," *World Bank Policy Note*, March 2009.
[9] UN Food and Agriculture Organization, "Forest Resources Assessment and the State of the World's Forests," in Mongabay.com, Climate Change Monitoring (http://rainforests.mongabay.com/deforestation/tanzania.html).

Total primary energy consumption in Tanzania is 0.45 tons of oil equivalent (toe) per capita, one of the lowest in the world and only two-thirds of the average consumption in Sub-Saharan Africa developing countries. The residential sector accounts for most of the energy used, the vast majority of which consists of biofuels and agricultural waste; 80 percent of the biomass used in the residential sector is for household cooking (Figure 4).

2.2 GENDER AND ENERGY IN TANZANIA

Recognising that access to modern energy and development are intrinsically linked is the impetus behind the government's efforts to increase access to modern energy services for its people. Modern energy is essential to generate jobs, support industry, enable efficient transport, and make commerce and agriculture more productive. Energy is needed to process, store, and cook most foods. Education is facilitated by electricity access, including attracting and retaining teachers in rural areas.

Women are disproportionately affected by the lack of access to modern energy services. The Rural Energy Agency (REA) has recognised the centrality of women in its energy access programmes. Working with the World Bank's Africa Energy Access Programme (AFREA),[10] the REA is mainstreaming gender into its organisation and ensuring that gender analysis, operations, and monitoring and evaluation (M&E) are included in its operations (Box 1).

BOX 1 TANZANIA GENDER AND ENERGY ACCESS PROGRAMME

In Tanzania, as in many developing countries, women's traditional gender roles are energy intensive and could benefit from better access to improved energy services. For example, women in Tanzania shoulder a disproportionate burden for household fuel and water collection, food preparation, and agriculture. Many women entrepreneurs run businesses out of their homes supported by an unreliable electricity supply. Typically, women are amongst the poorest energy users with least capability of affording energy access. Across a range of dimensions, women have greater or unique needs that are often overlooked in the design of energy service programmes.

With support from AFREA, the Rural Energy Agency (REA) explored how gender considerations are integrated into programme design, provision of grants to the private sector, competitions like Lighting Rural Tanzania, and monitoring and evaluation (M&E). Based on this gender assessment, a range of tools were developed and are now in use. In early 2013, REA staff members were trained in applying these tools to REA operations. A gender focal unit will be reinforced and trained in providing ongoing gender-mainstreaming support throughout the agency.

The Multidimensional Energy Poverty Index (MEPI) ranks Tanzania amongst the African countries that are severely deprived of access to modern energy services. According to the MEPI classification,[11] Tanzania's energy-deficiency score is 0.84, suggesting that a large majority of the population is energy poor, without access to clean cooking or the many energy services supplied by electricity. For purposes of comparison, the scores of various other countries across the African continent are as

[10] AFREA, a program of the Energy Sector Management Assistance Programme (ESMAP), supports the scale-up of energy access and clean energy in Africa. The first phase, including the gender and energy activity, has been financed by the Netherlands Foreign Ministry.

[11] Patrick Nussbaumer, Morgan Bazilian, Vijay Modi, and Kandeh K. Yumkella, "Measuring Energy Poverty: Focusing on What Matters," OPHI Working Paper No. 42, Oxford Poverty and Human Development Initiative, Oxford Department of International Development, Queen Elizabeth House, University of Oxford, March 2011.

follows (from lowest to highest deprivation): Egypt (0.01), Morocco (0.57), Ghana (0.62), Kenya (0.73), Uganda (0.87), Rwanda (0.88), and Ethiopia (0.90).[12]

2.3 Electricity Demand and Supply

Tanzania's per capita electricity consumption is under 100 kWh per year—20 times less than the world average annual consumption and more than 5 times less than that for Sub-Saharan Africa developing countries.[13] Only about 18.4 percent of the country's population has access to grid electricity. Some obtain access through stand-alone solar photovoltaic (PV) systems and mini-hydro grids operated by local nongovernmental organisations (NGOs) and faith-based groups. The first few privately-run mini and micro grids have emerged recently in response to the enabling financing and regulatory framework that the government has put in place.

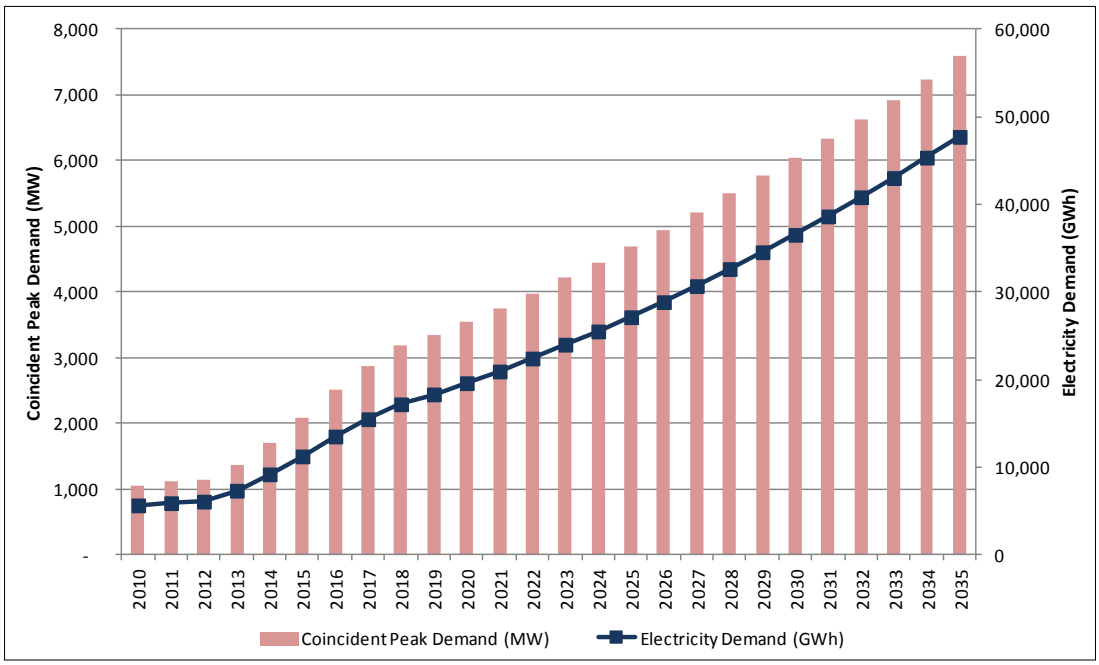
Demand for electricity is increasing rapidly owing mainly to accelerating productive investments, a growing population, and improving access. Significant pent-up demand is being met, in part, by private diesel generators. The Power System Master Plan 2012 Update (PSMP) (2010–35) anticipates that Tanzania's electrification status will rise from 18.4 percent to at least 75 percent by 2035, whilst demand from connected customers will increase significantly as Tanzania reaches middle-income status, as stipulated in the Tanzania National Development Vision 2025.[14]

TANESCO anticipates major demand increases from several mining operations, liquefied natural gas (LNG) plants, factories, and water-supply schemes. Peak demand is projected to increase rapidly, from about 1,000 MW today to about 4,700 MW by 2025 and 7,400 MW by 2035 (Figure 5).

The country's installed electricity generation capacity is 1,564 MW (as of March 2013), of which 1,438.24 MW is available in the main grid, with the balance of 125.9 MW accounted for by Small Power Producers (SPPs), mini grids, and imports. About 62 percent of grid generation capacity is from thermal (32 percent from natural gas and 29 percent from oil), whilst 35 percent is from large hydropower, with the remainder from small renewable-energy power and imports (Table 1). Capacity is supplied by TANESCO (59 percent), Independent Power Producers (IPPs) (26 percent), Emergency Power Producers (EPP) (13 percent), and SPPs (2 percent). TANESCO supplies power to the main grid, as well as isolated grids. The 20 townships in other regions served by TANESCO depend on isolated diesel (18) and natural gas (2) generators and imports. In addition, there is an estimated 300 MW of private diesel generation not connected to the TANESCO grid whose fuel cost is expected to exceed US¢35 per kWh (not accounted for in Table 1).[15]

[12] A score of 1 implies complete deprivation of access to modern energy, and 0 implies no deprivation.
[13] The World Bank DataBank recorded 2010 electricity consumption at 77.85 kWh per capita.
14 Initial results of the Rural Electrification Prospectus, currently under finalisation, show that a total investment of about US$3.5 billion will be needed to increase the rural electrification ratio from 6.6 percent to 36.6 percent and the urban one from 34.2 percent to 75.7 percent; however, these estimates still need to be confirmed (IED, "National Electrification Program Prospectus: Preliminary Discussion on the Draft Version," Presentation to the REA, May 2013).
[15] Ministry of Energy and Minerals, "Final Report on Joint Energy Sector Review for 2010/11," September 2011.

FIGURE 5 ELECTRICITY DEMAND OUTLOOK, 2010–35



Source: Ministry of Energy and Minerals, Power System Master Plan, November 2012 update.

TABLE 1 POWER GENERATION CAPACITY IN TANZANIA, MARCH 2013

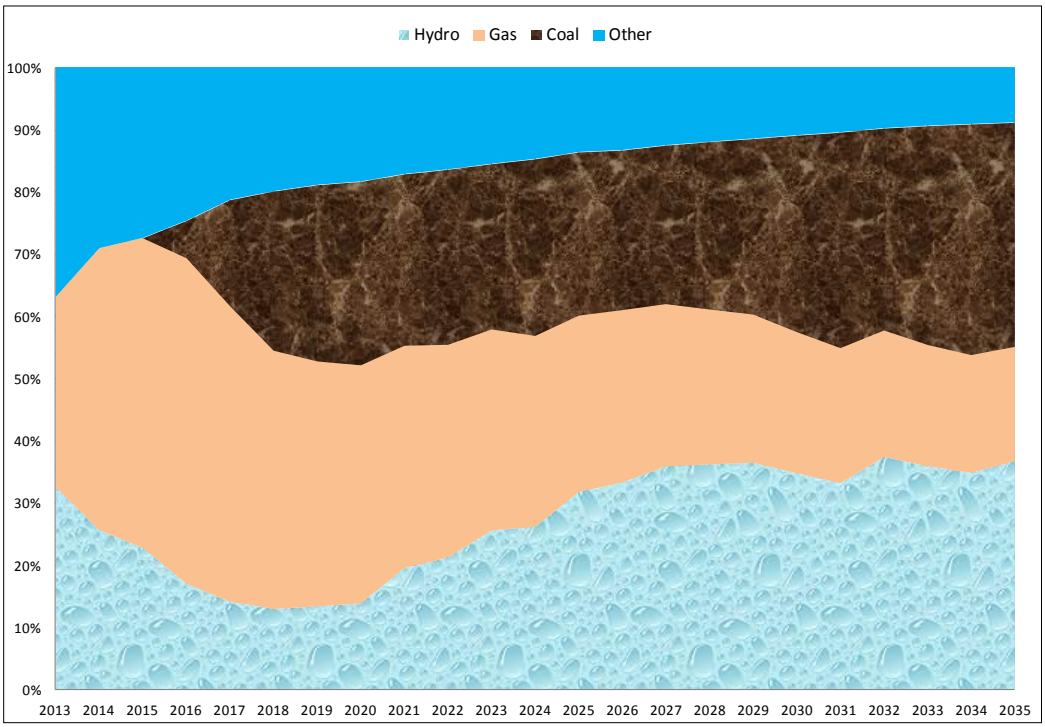
Megawatts

Source	TANESCO	IPP	EPP	SPP	Total	Percent
Hydropower	553.0	-	-	-	553.0	35
Small hydro (< 10 MW)	8.8	-	-	4.0	12.8	0.8
Oil (Jet-A1 and diesel)	88.3	163.0	205.0	-	456.3	29
Gas	252.0	249.0	-	-	501.0	32
Biomass	-	-	-	27.0	27.0	1.7
Imports[a]	14.0	-	-	-	14.0	0.9
Total	916	412	205	31	1,564.1	100
Percent	59	26	13	2	100	

Source: TANESCO 2013.
Note: IPP = Independent Power Producer, EPP = Emergency Power Producer, SPP = Small Power Producer.

Diversification of generation sources is essential to avoid the risk of supply disruptions and price increases, particularly in the face of increasingly unpredictable hydroelectric power resulting from changing weather patterns. This problem is exacerbated by having most hydropower sources located along two river systems now prone to drought. This situation has necessitated extensive load shedding and running expensive thermal power plants as base load. To overcome power shortages up to 2016, the government expects that significant thermal capacity will need to be added, much of it from natural gas (Figure 6).

FIGURE 6 EXPECTED CHANGE IN GRID-CONNECTED GENERATION SHARE BY ENERGY TYPE, 2013–35



Source: PSMP Update 2012.
Note: The 2012 PSMP does not take into account possible scale-up in renewable energy generation resulting from the SREP.

Amongst the previously listed generation projects scheduled to come on-stream during 2013–17 are 2,168 MW gas, 60 MW heavy fuel oil (HFO), 400 MW coal, 100 MW wind, 60 MW solar, and 11 MW small hydro, and 30 MW cogeneration. Most are expected to be IPP projects. Excluded are SPP projects and the expected impact of the SREP on scaling up renewable energy; geothermal is excluded from PSMP projections due to uncertainty of the resource (Table 2). The PSMP covers only grid-connected projects, while off-grid systems planning is covered under the Rural Electrification Investment Prospectus (Section 2.6).

TABLE 2 PSMP SHORT-TERM GENERATION IMPLEMENTATION PLAN, 2010–17

No.	Project name	Capacity (MW)	Expected commercial operation	Fuel type	Status
1	Mwanza Heavy Fuel Oil Fired Plant (TANESCO)	60	2013	HFO	Plant commissioning
2	Kinyerezi I Gas Fired Plant (TANESCO)	150	2014	Gas	Site handed over to EPC contractor
3	Kinyerezi II Gas Fired Plant (TANESCO)	240	2015	Gas	Soliciting finance
4	Somanga Fungu (TANESCO)	8	2015	Gas	Operational, to be connected to the grid in 2015
5	Somanga Fungu (IPP)	210	2015	Gas	PPA approved by regulator
6	Mkuranga	250	2015	Gas	
7	Mgololo(Mufindi)	30	2015	cogen	PPA negotiations ongoing
8	Zinga Bagamoyo CCGT (+/- 25 MW)	200	2015	Gas	MOU under negotiation
9	Kinyerezi III	300	2016	Gas	MOU under negotiation
10	Mtwara (18)	400	2016	Gas	MOU signed
11	Kiwira I	200	2016	Coal	
12	Somanga Fungu	110	2016	Gas	Conversion of no. 5 above
13	Wind I	50	2016	Wind	Financial closure expected in July 2013
14	Solar I	60	2016	Solar	In tendering process
15	Wind II	50	2016	Wind	PPA negotiations awaits transaction advisor
16	Ngaka I	200	2016	Coal	PPA negotiations
17	Hale	11	2016	Hydro	Rehabilitation of existing power plant
18	Kinyerezi IV	300	2016	Gas	MOU under negotiation

Source: MEM

2.4 ELECTRICITY PRICING

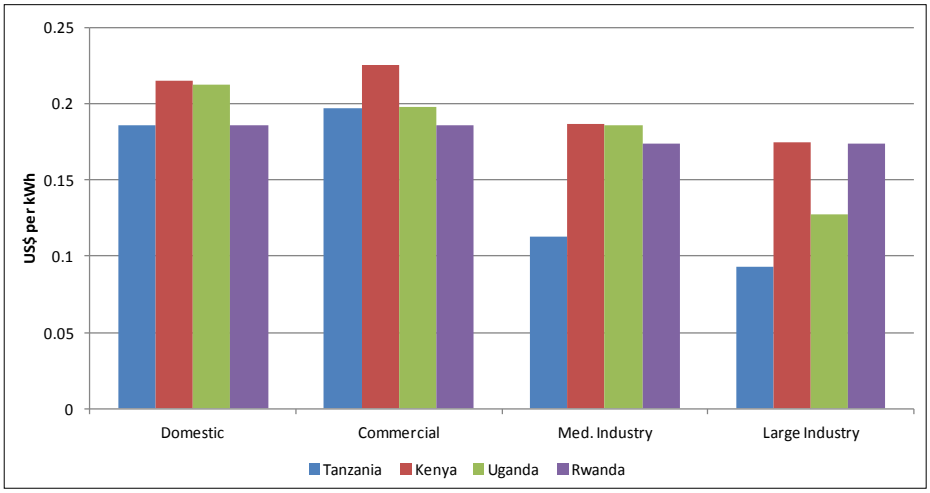
In January 2012, Tanzania raised its electricity tariffs by 40.29 percent; despite this increase, TANESCO continues to incur losses owing to its heavy reliance on high-cost emergency generators contracted after a prolonged drought, which significantly reduced hydropower availability, forcing the utility to resort to widespread load shedding.[16] Emergency generators now account for 13 percent of installed capacity.

The Energy and Water Utilities Regulatory Authority (EWURA), which regulates TANESCO's retail tariffs, conducted a Cost of Service Study (COSS) in November 2012 as part of its assessment on adopting a multi-year, cost-reflective tariff scheme that could bring certainty and attract investment to the

[16] At the peak of the crisis in mid-2011, Tanzania experienced up to 18 hours of load shedding per day in certain parts of the country.

Tanzania electricity supply industry.[17] Results show that TANESCO customers enjoy comparatively lower tariffs than customers in neighbouring countries (Figure 7).

FIGURE 7 RETAIL ELECTRICITY TARIFFS IN SELECTED EAST AFRICAN COUNTRIES



Source: EWURA 2012.

Whilst a low social tariff is available to customers using up to 50 kWh a month, few in that beneficiary group have been able to take advantage of it owing to the high connection fees, which have barred many potential customers from gaining access. In December 2012, the connection fees were significantly reduced. The household connection fee, paid upfront to TANESCO, starts at approximately TZS 177,000 (about US$110) for a rural customer and TZS 320,960 (US$200), down from $300, for an urban customer. This reduction is expected to accelerate grid electrification efforts.

2.5 CURRENT STATUS OF ELECTRICITY SECTOR AND REVITALIZATION STRATEGY

TANESCO's financial performance has been deteriorating in recent years. A combination of dilapidated distribution systems, high level of network losses, reduced hydropower output, electricity tariffs below the cost recovery level, low network voltages, and inadequate investment have negatively impacted utility revenues. At the same time, since 2002, the cost of electricity generation has been continuously increasing, along with a growing reliance on thermal energy. Large hydropower as a share of total capacity declined by nearly two-thirds between 2002 and 2006 (from 98 percent to 40 percent); and now stands at 35 percent of available capacity, with output declining due to extended droughts.

As a result of the aforementioned issues, and particularly due to the high costs of emergency generation, TANESCO is facing significant revenue shortfalls to meet its operating costs, which, in turn, is impacting its creditworthiness. The government is in the process of instituting interventions to put the power sector on a more sustainable path. Four complementary sets of measures are being put in place, as follows:

- Shift the energy mix away from an expensive, emergency oil-based power supply to more efficient and lower-cost generation. This would reduce the cost of electricity supply and mitigate the risks of major shocks to the power system, such as droughts and oil-price hikes. In

[17] EWURA, "Determination of Multi-Year Cost Reflective Electricity Tariffs in Tanzania," Discussion Paper, November 2012.

the near term, this shift would focus primarily on gas and, over the longer term, on a combination of gas, coal, and renewable energy (including large hydro). The government has prioritized the Mtwara gas pipeline and two gas-fired plants of 390 MW capacity for immediate execution.[18]

- Restructure sector institutions and strengthen investment planning, procurement, and contracts management. This would include leveraging private investment through IPPs, procured through solicited and competitive bidding processes, and increasing market competition in power generation. It would also include restructuring TANESCO and developing a new incentive structure (e.g., performance contracts).
- Balance energy demand and supply in a cost-effective manner. TANESCO has committed to reducing distribution and transmission losses to 15.08 percent by 2015 (from 17.76 percent in 2012).
- Address TANESCO's financial gap through government-supported financing arrangements and revenue-enhancing measures in the interim while medium-term measures are being put in place. The Multilateral Development Banks (MDBs) and development partners are supporting these actions. For example, in March 2013, the World Bank approved the US$100 million Tanzania First Power and Gas Development Policy Operation, whose objectives are to (i) strengthen the country's ability to bridge the financial gap in its power sector, (ii) reduce the cost of power supply and promote private-sector participation in the sector, and (iii) strengthen the policy and institutional framework for managing the country's natural gas resources. The African Development Bank (AfDB) is currently looking at a complementary intervention.

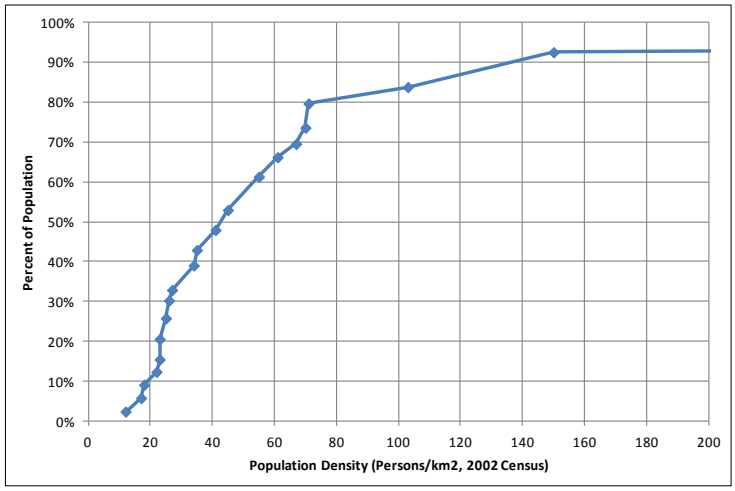
2.6 THE RURAL ELECTRIFICATION CHALLENGE

Rural electrification coverage is low in Tanzania, with less than 7 percent of the rural population (2.2 million) having access to electricity. TANESCO operates 20 diesel-based mini grids, some of which are interconnected to bordering countries. Thirteen communities receive electricity from small-hydro mini grids provided by faith-based institutions,[19] and some use privately-procured or donor-supported solar home systems (SHSs).

The vastness of the country, coupled with low population densities in most regions, makes grid extension an enormously challenging and expensive way to electrify rural areas. In 2002, 80 percent of residents lived in areas where population densities were less than 70 persons per km^2, whilst half lived in regions with fewer than 40 persons per km^2 (Figure 8). Population densities have increased over the past decade, with distribution changes due to internal migration.[20] Nevertheless, the rural electrification challenge remains daunting.

[18] Government of Tanzania, "Vision 2025: Big Results Now," Presentation of the results of the Energy Lab, April 2013.
[19] GTZ, "Tanzania's Small Hydro Energy Market: Target Market Analysis," December 2009.
[20] As of this writing, the 2012 census results were not yet available.

FIGURE 8 POPULATION DISTRIBUTION BY REGIONAL POPULATION DENSITY



Source: 2002 census.

Recognising this situation, to complement grid-based electrification, the REA is supporting renewable energy–based mini grids and stand-alone solar solutions operated by the private sector and NGOs, which are lower cost than diesel operations. The mini grids, powered by mini-hydro and biomass power plants, are either stand-alone or connected to the TANESCO grid and operated by private entities.[21]

To support rural electricity access, the REA and TANESCO are implementing the World Bank and Global Environment Facility (GEF)–assisted Tanzania Energy Development and Access Project (TEDAP) (Box 2). TEDAP has supported the creation of an enabling environment, developed performance-based financing instruments, and provided capacity building for SPPs selling power to TANESCO or retail customers (through mini grids) and for stand-alone PV systems. In addition, various other donors are supporting or contemplating support for off-grid electrification.

The enormity of the electrification challenge demands innovative solutions. With assistance from the Norwegian Agency for Development Cooperation (NORAD), the REA is preparing a Rural Electrification Investment Prospectus, which, for the first time, will fully integrate grid-based electrification with the use of mini grids and stand-alone options. Lessons from the TEDAP and other off-grid electrification solutions are important inputs to the nationwide planning exercise (Annex IV).

[21] Connection to the TANESCO grid offers the advantage of using the grid for balancing supply and demand.

BOX 2 TANZANIA ENERGY DEVELOPMENT AND ACCESS PROJECT

The Tanzania Energy Development and Access Project **(**TEDAP), financed by the World Bank through a US$157.9 million IDA credit and a $6.5 million grant from the GEF, aims to improve the quality and efficiency of Tanzania's electricity service provision and establish a sustainable basis for expanding energy access. The TEDAP includes $113.7 million for TANESCO to upgrade its transmission and distribution networks. The REA received $47.5 million of the IDA credit and GEF grant for the small power electrification component, whose objectives are to (i) increase electricity access in rural and peri-urban Tanzania; (ii) establish a functioning institutional framework for commercially oriented, sustainable service delivery for rural electrification that can be scaled up; and (iii) exploit Tanzania's renewable energy potential. To support private-sector developers of small renewable energy projects, including NGOs and communities, TEDAP has set up various instruments, including:

- Simplified regulatory framework, including standardized power purchase agreements and tariffs, administered by the Energy and Water Utilities Regulatory Agency (EWURA).
- Credit line channelled through local commercial banks, providing long-term liquidity for renewable energy projects.
- Performance grants to buy down costs of connections for mini grids (per connection) and solar home systems (per Wp).
- Matching grants for pre-investment support.
- Sustainable Solar Market Packages (SSMPs), which are competitively awarded to private-sector contractors to install and maintain PV systems for public facilities and commercially market solar home systems (SHSs) to households and businesses within a defined geographic area.

TEDAP is complemented by the World Bank-administered SIDA Trust Fund, which finances technical-assistance and capacity-building activities for the REA, EWURA, and other key government and private-sector stakeholders; and the AFREA-financed Lighting Rural Tanzania grant, which has piloted innovative business models for providing affordable lighting and micro-energy services to rural Tanzanians.

To date, renewable energy–based electrification outcomes have included TANESCO signing Small Power Purchase Agreements (SPPAs) with 11 developers to supply 46 MW of power (currently, 3 projects are supplying about 10 MW to TANESCO) and TANESCO signing Letters of Intent (which precede SPPAs) with another 6 developers for 31 MW of power. The REA performance-based grant support to mini grids, SSMPs, and stand-alone electrification and the innovative Lighting Rural Tanzania project will benefit more than 100,000 households (Annex IV).

2.7 ENERGY POLICY AND STRATEGIC FRAMEWORK

As early as 2003, the Government of Tanzania reiterated, through its National Energy Policy, the objective of reducing dependence on fossil fuels for power supply, suggesting the development of renewable energy options. The government has been keen to provide an impetus to both the geothermal and natural gas subsectors as a way of diversifying the energy mix using clean energy sources. To create a legal and regulatory framework conducive to investment, it has instituted a range of energy-sector reforms, a major aim of which has been to attract private investment in order to boost electricity supply and thus meet demand.

Some of the key policies and legislation governing Tanzania's energy and renewable energy sectors are as follows:

Energy and Water Utilities Authority Act 2001 and 2006. These were promulgated to establish a regulatory authority (Energy and Water Utilities Regulatory Authority [EWURA]), empowered to (i) promote effective competition and economic efficiency; (ii) protect consumer interests; (iii) protect the financial viability of efficient suppliers; (iv) promote the availability of regulated services for all

consumers, including low-income, rural, and disadvantaged groups; and (v) enhance public knowledge, awareness, and understanding of the regulated sectors.

National Energy Policy 2003. The broad objective of this policy is to ensure the availability of reliable and affordable energy supplies and their rational and sustainable use in order to support national development goals. This policy statement unequivocally stated, as early as 2003, the national commitment to sustainable energy production and use. Specific objectives are to (i) enhance the development and utilisation of indigenous and renewable energy sources and technologies, (ii) adequately take into account environmental considerations for all energy activities, and (iii) increase energy efficiency and conservation in all sectors. The main elements of the policy are the development of domestic energy sources, economic energy pricing, encouragement of private-sector participation in the energy market, and enhancement of energy efficiency and reliability. Other key themes in the policy include (i) development of a market economy for energy in the country, (ii) institutionalisation of a clear regulatory regime for the energy sector to aid development, (iii) rectification of unbalanced gender impact from inferior energy services, (iv) development of a clear financial regime for the sector, and (v) balancing revenue generation and costs of service.

Rural Energy Act 2005. This act established the Rural Energy Board (REB), Rural Energy Fund (REF), and Rural Energy Agency (REA). It is responsible for promoting improved access to modern energy services in the rural areas of mainland Tanzania and, through the REF, providing grants to TANESCO for rural grid distribution investments and to developers of rural energy projects.

Electricity Act 2008. This act established a general framework for the powers of the Ministry of Energy and Minerals (MEM) and EWURA. It defined key parameters for EWURA with regard to tariff-setting criteria and procedures, criteria for awarding provisional and permanent licenses, monitoring and enforcement activities, requirements for ministerial plans and strategies for rural electrification, dispute resolution procedures, and a process for determining possible future reorganisation of the electricity sector.

Public Private Partnership Act No. 18 of 2010. This act set forth the responsibilities and obligations of the parties, penalties, remedies, financial management and control requirements, public-party available assistance, and dispute resolution. It established PPP coordination units within the Tanzania Investment Centre and Ministry of Finance.

Policies and legislation influencing biomass energy. These include Guidelines for Sustainable Harvesting and Trade in Forest Produce, 2007; New Royalty Rates for Forest Products, 2007; Community-Based Forest Management Guidelines, April 2007; Joint Forest Management Guidelines, April 2007; Charcoal Regulations, 2006; Forest Act, 2002; Subsidiary Legislation to the Forest Act, 2002; National Forest Programme, 2001; National Forest Policy, March 1998; and Biofuels Guidelines, 2010.

Environmental and land policy and legislation influencing renewable energy development. These include Environmental Management Act, 2004; National Land Policy, Ministry of Lands and Human Settlements Development, 1997; and National Environmental Policy, 1997.

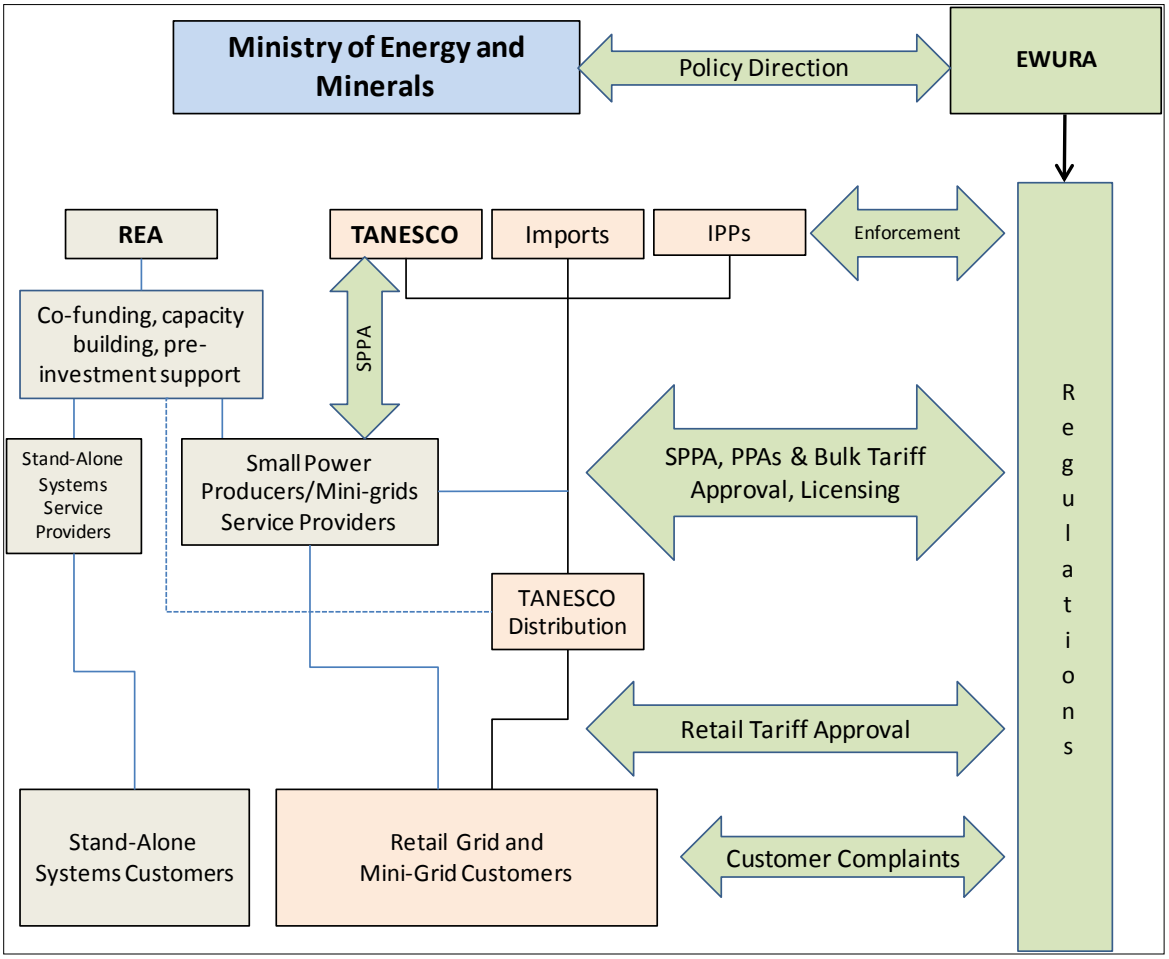
Several specific outcomes resulting from these policies and legislation, described below, are having a profound, positive impact on renewable energy development.

- **Establishment of the Rural Energy Agency and associated Rural Energy Fund**. The REA is the lead agency responsible for rural electrification, as well as supporting development of renewable energy to supply rural communities. The REF, with budgetary support from the Government of Tanzania and contributions from a surcharge on grid electricity sales, as well as the development partners, co-finances rural and renewable energy electrification schemes implemented by TANESCO and the private sector, NGOs and communities. In addition, the REA is the implementing agency for a number of donor-financed projects. It is also preparing the Rural Electrification Investment Prospectus, which, for the first time, takes a least-cost planning approach to rural electrification that integrates grid and off-grid options, along with renewable energy sources.
- **EWURA's promulgation and application of the Small Power Producers Programme**. This is a system of regulations, standardised contracts, and avoided cost–based non-negotiable tariffs pertaining to private small (under 10 MW) renewable-energy power projects to supply the TANESCO grid and enable these entities to supply electricity directly to isolated rural communities. The Standardised Power Purchase Agreements (SPPAs), Small Power Producer (SPP) tariff methodology and tariffs, interconnection guidelines, and SPP implementation rules issued by EWURA enable private entities to invest in renewable power projects for both grid-connected projects and isolated grids. As a result, 11 SPPAs have already been concluded with TANESCO, thus paving the way for the further development of rural and small renewable-energy generation projects. The SPP tariffs are updated annually, based on TANESCO's avoided cost, so they do not negatively impact TANESCO's financial situation.
- **Development of the Medium Term Strategic Plan (2012–16) and Power Sector Master Plan**. These plans reinforce the commitment to collaborate with and encourage the private sector to participate in the development of the energy sector, using various renewable and fossil-fuel sources to ensure national energy security. Key interventions under the Medium Term Strategic Plan include (i) increasing power generation, (ii) developing alternative and renewable energy sources, and (iii) promoting energy efficiency and conservation.

2.8 INSTITUTIONAL FRAMEWORK

Tanzania's energy sector comprises various stakeholders, including national institutions, private-sector operators, and NGOs (Figure 9).

FIGURE 9 INSTITUTIONAL FRAMEWORK AND MARKET STRUCTURE OF THE ELECTRICITY SECTOR



2.8.1 NATIONAL INSTITUTIONS

Ministry of Energy and Minerals. The MEM is mandated to develop energy and mineral resources and manage the sector. It is responsible for the formulation and articulation of policies to create an enabling environment for stakeholders. Promoting renewable energy is part of its mandate. The MEM plays an essential policy guidance role, complementing the other major players (i.e., the REA, TANESCO, EWURA, private companies, NGOs, and financiers).

Rural Energy Agency. The REA is an autonomous body under the MEM that became operational in October 2007. Its principal responsibilities are to (i) promote, stimulate, facilitate, and improve modern energy access in rural areas of mainland Tanzania to support economic and social development; (ii) promote rational and efficient production and use of energy and facilitate the identification and development of improved energy projects and activities in rural areas; (iii) finance eligible rural energy projects through the REF; (iv) prepare and review application procedures, guidelines, selection criteria, standards, and terms and conditions for the allocation of grants; (v) build capacity and provide technical assistance to project developers and rural communities; and (vi) facilitate the preparation of bid documents for rural energy projects.

Tanzania Electric Supply Company. TANESCO, a public company, is the country's principal electricity generator, transmitter, and distributor. Currently, it provides nearly 60 percent of the

effective generating capacity of the national grid, and is responsible for transmission and distribution, serving customers on the main grid and in 20 isolated grids.

Energy and Water Utilities Regulatory Authority. EWURA is an autonomous, multisectoral regulatory authority established by the Energy and Water Utilities Regulatory Authority Act. It is responsible for the technical and economic regulation of Tanzania's electricity, petroleum, natural gas, and water sectors.

Universities and Research and Training Institutions. Various universities and research and training institutions focus on building human capacity for the energy sector. These include the University of Dar es Salaam, Dar es Salaam Institute of Technology, Mbeya Institute of Science and Technology, Arusha Technical College, and Vocational Education Training Authority (VETA).

2.8.2 Private-Sector and Nongovernmental Organisations

Supported by the government's commitment to create and maintain an enabling business environment, Tanzania's dynamic private sector is active in renewable energy development. The private sector has become a key contributor to economic growth in numerous sectors (e.g., tourism, mining, energy, building and construction, transport and communication, agriculture, manufacturing, and finance).

Independent Power Producers and Emergency Power Producers. Currently, six IPPs and EPPs (Symbion-Ubungo, IPTL, Symbion Arusha, Songas, Aggreko, and Symbion Dodoma) are operating in the country, contributing approximately 40 percent of the national grid's effective generating capacity. Several other private power companies are in the process of developing large-scale hydro, solar, wind, and geothermal projects.

Small Power Producers. Various private companies are engaged in small renewable power development under the SPPA to sell power to TANESCO and/or sell directly to retail customers. Many of these firms are already working in rural areas in such enterprises as tea, sugar, sisal, and tannin, amongst others. Currently three SPPs are selling power to the grid and an additional eight SPPAs have been signed with TANESCO.

Nongovernmental Organisations. Various NGOs promote access to sustainable and renewable energy. For example, the Tanzanian Renewable Energy Association brings together stakeholders in the renewable energy sector to promote renewable options. The Tanzania Traditional Energy Development and Environment Organisation (TaTEDO) has been promoting access to sustainable energy since the early 1990s. Other NGOs include the Tanzania Engineering and Manufacturing Design Organisation, WODSTA (efficient stoves promotion), Solar Innovations of Tanzania, AMKA Trust, and CARE-Tanzania.[22]

Though not specifically classified as renewable energy organisations, a number of faith-based organisations utilise renewable energy to meet the rural energy needs of their communities.

Other Renewable Energy Providers. Many renewable energy equipment and service providers engage in the retail sale of such products as solar home systems (SHSs) and offer design, installation, and repair services.[23]

[22] A complete list is provided in the TAREA directory (http://tarea-tz.org/index.php/membership/general-infomration).
[23] The TAREA directory offers a complete list.

2.8.3 FINANCIERS

Tanzania's financial system includes a banking sector with more than 20 commercial banks, which, with support from the development partners, are looking increasingly at opportunities to finance renewable energy and energy efficiency projects. With the advent of the Small Power Programme, the World Bank established a US$23 million credit line under TEDAP, providing long-term liquidity to local commercial banks for re-financing of small renewable energy projects. The first two renewable energy mini-grid projects have been financed through this credit line. The REA also provides performance-based grants to buy down mini-grid connection costs. Public-sector financing of TANESCO is direct from the government, the REA, and multilateral and bilateral lenders and donors. TANESCO also borrows from commercial banks for working capital. IPPs, EPPs, and SPPs bring their own financing, both equity and debt, some of which is sourced externally.

Equity funds are still rare in Tanzania, although some regional equity funds are looking into investment opportunities under the SPP program. Carbon finance is also rare in Tanzania; there is only one registered Clean Development Mechanism (CDM) project and two projects under validation. The REA is trying to overcome this constraint through development of a CDM Program of Activities for small renewable energy projects, through which the agency would advance expected carbon revenues to SPPs to use for equity financing (Box 6). However, opportunities to widen the use of CDM instruments are presently limited due to the low price of CERs (presently less that €0.50 per ton of CO_2 certified emissions reduction).

2.8.4 STAKEHOLDER FEEDBACK ON RENEWABLE ENERGY DEVELOPMENT

Key stakeholders consulted during the preparation stage of the SREP-Tanzania Investment Plan (IP) offered many important suggestions regarding priorities to be addressed, types of activities to be undertaken, and policy and regulatory directives to be followed. Private-sector consultations were held in January 2013. Geothermal-sector stakeholders' feedback was obtained during the Geothermal Legal and Regulatory Framework Workshop hosted by the MEM, AfDB, and DFID in March 2013. SREP IP consultations were held with a broader group of stakeholders, including the private sector, NGOs, financiers, and other government agencies during the SREP Joint Mission in March 2013. Further feedback was received during the comment period in April 2013, when the IP was posted on the MEM website.

The feedback received provided clarity on the renewable energy strategy and the role of the private sector, streamlining processes for project development, renewable energy tariff setting, and covering payment risks by TANESCO and other off-takers. It also stressed the need to improve credibility and comprehensiveness, as well as access to renewable resource data and finance on affordable terms.

Stakeholders noted the importance of a roadmap for geothermal development and the need for a legal and regulatory framework; the Mining Act, which currently governs the award of licenses for geothermal resource development is not completely suitable. Stakeholders also emphasised the urgent need for increasing the human capacity needed for geothermal sector governance and resource development. They recommended that a more effective arrangement would be having the MEM's Energy Department, rather than its Minerals Department, assume responsibility for geothermal development.

The stakeholders also acknowledged the need to strengthen the institutional capacities of the MEM and the REA in order to handle the increased workload expected during SREP implementation, which

can only succeed if a broad group of stakeholders is effectively engaged. The MEM agreed to appoint an SREP Advisory Committee representing the key public, private, and NGO stakeholder groups. The stakeholders noted the need to integrate the monitoring and evaluation (M&E) systems of the national energy sector with the SREP M&E requirements. Finally, they noted the vital need for knowledge generation and lessons sharing amongst stakeholder groups in order for sustainable, transformative changes to occur (Annex III).

2.9 Donor Support and Coordination

Tanzania has received significant energy-sector support from its development partners, whose harmonized assistance is aligned with national priorities and strategies. Tanzania has a well-coordinated working group of development partners involved in the energy sector, chaired by SIDA. The group meets regularly to discuss key sector issues and challenges, as well as development partners' approaches and interventions to address them.

Donors' multi-year energy-sector commitment through 2016–17 totals about TZS 1.5 trillion (US$1 billion), of which approximately $350 million is for renewable energy (Section 6.6).[24] In addition to technology-specific assistance, sector-wide support is provided. For example, the United Nations Development Programme (UNDP) is helping Tanzania to analyse financing gaps to achieve the three interlinked objectives of the Sustainable Energy for All initiative, which are to provide, by 2030, (i) universal access to modern energy services, (ii) a doubling of the global rate of improvement in energy efficiency, and (iii) a doubling of the share of renewable energy in the global energy mix.

Additional development partner support for renewable energy and electrification includes the Norwegian Agency for Development Cooperation (NORAD) and the Swedish International Development Cooperation Agency (SIDA), who are expected to provide significant funding to the Rural Energy Fund (REF), and the French Development Agency (AFD), which is establishing a €20 million credit line for renewable and rural energy. In addition, the UK Department for International Development (DFID) has a £30 million regional soft loan facility that can finance renewable energy investments. JICA and KfW are also providing support to renewable energy, particularly for geothermal development. The DFID is preparing a regional mini-grid facility expected to be available for Tanzania, and the U.S. Agency for International Development (USAID) and KfW are also contemplating support to mini grids. Furthermore, the European Union (EU) has supported five mini grids in Tanzania and is considering funds for scaling up these interventions.

[24] According to the latest PSMP, the required financing through 2017 is about US$10 billion. In addition, the draft Rural Electrification Investment Prospectus estimates the required financing through 2022 at US$3.5 billion; however, the delineation of costs between government and development partners has not yet been defined. Thus, current development-partner support is about 7–10 percent of the required investments in generation and T&D identified in the PSMP and Rural Electrification Prospectus.

3 RENEWABLE ENERGY SECTOR CONTEXT

3.1 RENEWABLE ENERGY POTENTIAL AND DEVELOPMENT STATUS

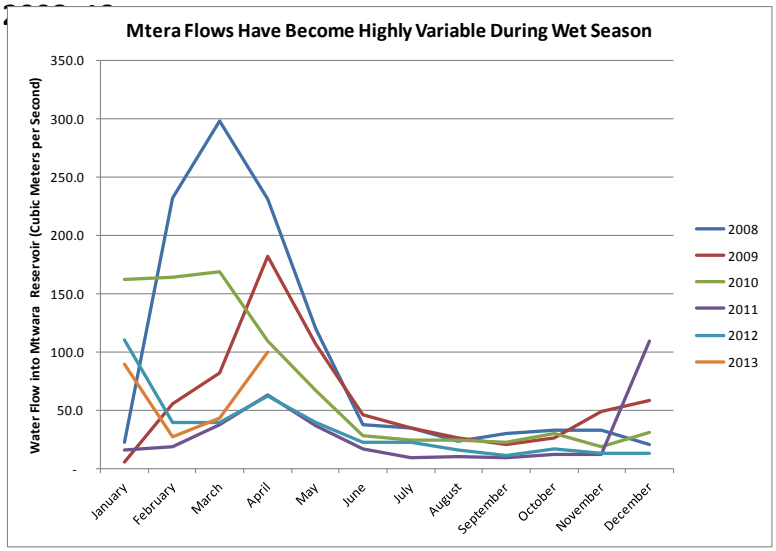
As previously mentioned, Tanzania is blessed with abundant, high-quality renewable resources, which are largely untapped. Currently, the country's total generation capacity from renewable energy, excluding large hydro, is about 4.9 percent; this includes captive generation in sugar, tannin and sisal factories, solar, and small hydro plants. By 2015, the government expects this share of the electricity mix to increase to 14 percent,[25] meaning that total generation capacity from renewable energy, including large hydro, would total about 40 percent.

3.1.1 LARGE HYDROPOWER

Historically, hydropower has been the mainstay of Tanzania's national electricity system. Hydro sources consist mainly of a few large dams and smaller plants. Total installed capacity is 562 MW. But in recent years, intermittent river flows resulting from droughts have decreased hydro's reliability as a power source (Figure 10). Rainfall has fallen off overall, whilst the frequency of below-average rainfall has risen. Meteorologists have observed an intensified severity of extreme weather events, including dry and wet spells, making predicting seasonal weather patterns increasingly challenging.[26]

Another key challenge facing hydropower development in Tanzania is the regional mismatch between hydro sites and major demand centres. Hydro generation facilities are located primarily in the southwest, whilst major demand centres are in the north, northwest, and east. In order to realise the full potential of hydropower, the weak transmission system must be strengthened.

FIGURE 10 VARIATIONS IN THE MTERA RESERVOIR RIVER FLOW,



But because of the high installed capacity, large hydro could play a significant role in Tanzania's future energy development. It could provide an excellent backup to other renewables and store large quantities of intermittently generated electricity from solar and wind. For energy security, it could provide peaking power and generate large amounts of power, at least during the rainy season.[27]

[25] MEM, Medium Term Strategic Plan (2012–16), December 2011. Achieving the target will require adding about 300 MW of new renewable energy capacity before 2016.
[26] Saiguran Loisulie, "Vulnerability of the Tanzanian Hydropower Production to Extreme Weather Events," Sokoine University of Agriculture, Faculty of Science, Department of Physical Sciences, Morogoro.
[27] North and east Tanzania experience two distinct wet periods: the "short" rains in October–December and the "long" rains in March–May. The south, west, and central regions experience one wet season, which continues from October through April or May (UNDP Country Profile 2008).

Furthermore, the country has additional large-hydro capacity that it intends to develop. Some of this capacity is located in areas currently set aside for wildlife conservation, as part of a national park. Estimates of potential added capacity range up to 4,000 MW, but the long-term reliability of the water flows is not clearly established. The Power System Master Plan (PSMP) includes 16 projects with a combined capacity of 3,000 MW.

The World Bank, with DFID co-funding, is carrying out the Tanzania Hydropower Vulnerability Assessment. Expected to be completed in June 2013, the study is evaluating recent hydrology trends and the potential impact of both climate change and non-climate change factors, such as watershed management.

With co-incident peak demand expected to reach 7,600 MW by 2035, an important power-planning issue is whether over-dependence on large hydro could once again lead to supply volatility. With the proposed capacity additions, large hydro is expected to exceed 30 percent of generation capacity after 2025 (Figure 6),[28] thus risking a repeat of drought-related supply disruptions. Adding other renewable energy sources to the generation mix could mitigate this risk.

3.1.2 SMALL HYDROPOWER

The assessed potential of small hydropower resources up to 10 MW is 480 MW. The installed grid-connected, small-hydro projects contribute only about 15 MW. Most of the developed small-hydro projects are owned by private entities and are not connected to the national electricity grid. Five sites in the 300–8,000 kW range are owned by TANESCO. More than 16 are owned by faith-based groups,[29] with a 15–800 kW range in capacity and an aggregate capacity of 2 MW.

Of the 11 projects for which Small Power Purchase Agreements (SPPAs) have been signed, four are mini-hydro projects, with a combined capacity of 20.5 MW, whilst the others are biomass powered. Examples include Mwenga, a 4 MW hydro plant that supplies power to nearby rural villages, with the excess sold to TANESCO and AHEPO, a 1 MW privately-owned small hydro project in Mbinga, currently under construction, that will supply power to TANESCO's isolated grid and directly to communities. In addition, TANESCO has signed Letters of Intent for six small hydro projects with a combined capacity of 29.9 MW (Table 3). Several small hydro projects are also being developed as isolated mini grids. For example, a 300 kW Mawengi hydropower plant supplies electricity to an isolated community through its own mini grid.

Currently, the MEM is conducting small-hydro feasibility studies in eight regions: Morogoro, Iringa, Njombe, Mbeya, Ruvuma, Rukwa, Katavi, and Kagera. GVEP International, in partnership with the REA, is supporting the development of six hydro mini grids, with a total capacity of 7.4–8.8 MW. The EU is financing the Yovi Hydro Power project and Sustainable Community-Based Hydro Power Supply, whilst the United Nations Industrial Development Organization (UNIDO) is co-funding the development of six mini grids based on mini/micro hydropower. The REA has awarded some 20 TEDAP matching grants to private-sector developers for small hydro pre-investment studies. In addition, the Energy Sector Management Assistance Programme (ESMAP) has approved funding for renewable-energy resource mapping, starting with small hydropower, including two-year hydrology measurements.

[28] MEM, "Power Systems Master Plan Update," November 2012.
[29] GTZ, "Tanzania`s Small-Hydro Energy Market: Target Market Analysis," December 2009.

TABLE 3 SPP PROJECTS WITH SIGNED SPPA OR LOI

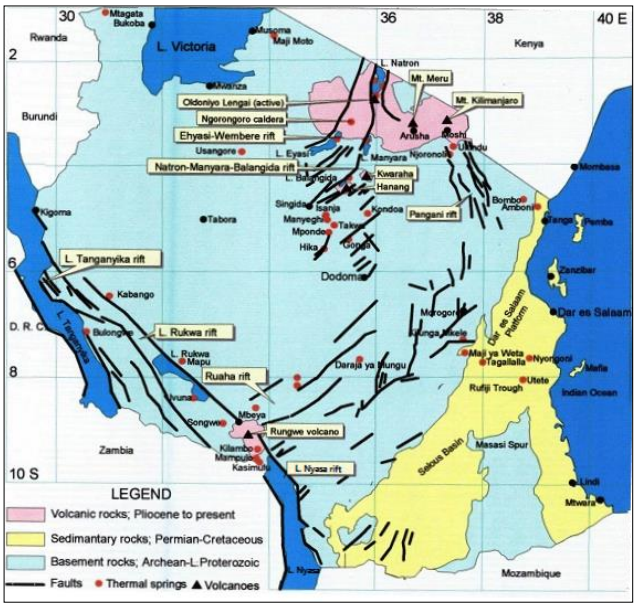
SPP name	Technology	Export capacity (MW)	Grid connection	SPP/LOI date	Commission date
SPPA signed					
TANWATT	Biomass	1.5	Main	17 Sept. 09	15 June 10
TPC, Moshi	Biomass	9.0	Main	6 Oct. 09	13 Sept. 10
Mwenga, Mufindi	Hydro	4.0	Main	19 Jan. 10	21 Sept. 12
Ngombeni, Mafia Island	Biomass	1.5	Isolated	19 Jan. 10	March 13
Sao Hill, Mufindi	Biomass	6.0	Main	26 Feb. 10	June 14
Symbion-KMRI, Tunduru	Biomass	0.3	Isolated	17 July 12	July 14
Symbion-Kigoma	Biomass	3.3	Isolated	31 Dec. 12	March 14
St. Agnes Chipole, Songea	Hydro	7.5	Isolated	11 Jan. 13	July 14
NextGen Solawazi, Kigoma	Solar	2.0	Isolated	16 Jan. 13	April 13
EA Power, Tukuyu	Hydro	10.0	Main	March 13	-
AHEPO, Mbinga	Hydro	1.0	Isolated	March 13	-
Total SPPA		**46.1**			
LOI signed					
Mapembasi, Njombe	Hydro	10.0	Main	25 June 10	-
Kikuletwa II, Kilimanjaro	Hydro	7.0	Main	28 Oct. 11	-
Darakuta, Manyara	Hydro	0.9	Main	10 Jan. 12	-
Mofajus, Mpanda	Hydro	1.2	Isolated	27 April 12	-
Tangulf, Natakuta	Hydro	10.0	Main	16 Nov. 12	-
Windpower, Mpanda	Solar	1.0	Isolated	21 Nov. 12	-
Go On Tosa, Iringa	Hydro	0.8	Main	Lease from TANESCO	-
Total LOI		**30.9**			

Source: TANESCO March 2013.

3.1.3 GEOTHERMAL ENERGY

Tanzania has significant geothermal potential that is not yet fully quantified. Estimations using analogue methods indicate a potential exceeding 650 MW, with most prospects located in the East African Rift System. Most geothermal prospects have been identified by their on-surface manifestation, mainly hot springs. Surface assessments started in 1976 and, to date, more than 50 sites have been identified (Figure 11). These are grouped into three main prospect zones: northeastern (Kilimanjaro, Arusha and Mara regions), southwestern (Rukwa and Mbeya regions), and eastern coastal belt, which is associated with rifting and magmatic intrusions (Rufiji Basin). Only the southwestern zone has undergone detailed surface exploration studies. In 2006 and 2010, the MEM, in collaboration with the Geological Survey of Tanzania (GST), the German Federal Institute for Geosciences and Natural Resources (BGR), and TANESCO, carried

FIGURE 11 DISTRIBUTION OF GEOTHERMAL PROSPECTS



Source: MEM.

out surface exploration and conducted detailed studies in the Ngozi-Songwe prospect in the Mbeya region. The geo-thermometers showed that the reservoir temperature exceeds 200° C.

Recognising the potential of geothermal resources and their contribution to energy diversification, the government formed a National Task Force on Geothermal Development, whose main task is to advise the government on national geothermal resource development. The government intends to prepare a Renewable Energy Policy and Geothermal Energy Act in order to expedite and scale up geothermal development in the country.

The development partners have also shown interest in supporting this sector. DFID and JICA have expressed interest in supporting preparation of the Geothermal Development Roadmap. JICA is also supporting satellite-based geothermal resource characterisation to identify promising fields and undertake pre-feasibility assessments to determine whether exploratory drilling should occur at selected sites. The German government, through the BGR, is supporting capacity building and resource characterisation. KfW could also potentially contribute to financing geothermal development in Tanzania through the Geothermal Risk Mitigation Facility (GRMF), which supports early drilling in the Rift Valley countries, both for private and public developers. In addition, Tanzania is a partner in the ARGeo project to support geothermal development in the Rift Valley countries. Tanzania could also benefit from the ICEIDA/NDF Geothermal Exploration Project, which provides funding for Rift Valley countries to expand on reconnaissance and geothermal exploration, training, and technical assistance to set up an appropriate legal and regulatory framework. Finally, Geothermal Power Tanzania, Ltd. (GPTL), a company partly owned by the Tanzanian National Development Corporation, has begun shallow well drilling in Mbaka.

3.1.4 WIND

Several areas of Tanzania are known to have promising wind resources. In areas where assessments have been conducted to date, only Kititimo (Singida) and Makambako (Iringa) have been identified as having adequate wind speeds for grid-scale electricity generation. At Kititimo, wind speeds average 9.9 miles per second and 8.9 miles per second at Makambako, at a height of 30 m.

The MEM, in collaboration with TANESCO, is conducting wind resource assessments in Mkumbara (Tanga), Karatu (Manyara), Gomvu (Dar es Salaam), Litembe (Mtwara), Makambako (Iringa), Mgagao (Kilimanjaro), and Kititimo (Singida). The REA is supporting wind measurements at Mafia Island (Coast region). MEM and TANESCO will be conducting wind resource assessments in Usevya (Mpanda).

To date, four companies have expressed interest in investing in wind energy, namely Geo-Wind Tanzania, Ltd. and Wind East Africa in Singida and Sino Tan Renewable Energy, Ltd. and Wind Energy Tanzania, Ltd. at Makambako in Iringa. These companies are considering investments in wind farms in the 50–100 MW range.

3.1.5 SOLAR

Tanzania has high levels of solar energy, ranging between 2,800 and 3,500 hours of sunshine per year, and a global radiation of 4–7 kWh per m^2 per day.[30] Solar resources are especially good in the central region of the country. Thus, solar energy as a viable alternative to conventional energy sources is a

[30] European Commission, Joint Research Centre, Photovoltaic Geographical Information System, Interactive Maps (http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?map=africa).

natural fit for Tanzania if efficiently harnessed and utilised. Both solar PV and solar thermal technologies are under development in the country.

Off-Grid Solar Photovoltaics

To date, about 6 MWp (megawatt peak) of solar PV electricity has been installed countrywide for various applications in schools, hospitals, health centres, police posts, small telecommunications enterprises, and households, as well as for street lighting. More than half of this capacity is utilised by households in peri-urban and rural areas. The government is implementing awareness-raising and demonstration campaigns on the use of solar systems for domestic and industrial use, as well as supporting direct installation in institutions. To make solar PV more attractive, the government has removed the value added tax (VAT) and import tax for main solar components (panels, batteries, inverters, and regulators), which has allowed end-users to get PV systems at a more affordable price.

- The government, through the REA, and various donors have supported a number of solar PV programmes that target off-grid areas where the cost of lighting from solar is less than from a diesel generator or kerosene. Sustainable Solar Market Packages (SSMPs) provide off-grid solar electricity for public facilities and households. The SSMP under way in the Rukwa region will benefit 80 villages, and new SSMP packages are being prepared for five additional regions (eight districts) under TEDAP (Box 3). The SSMP approach, with MCC financing, has also been applied in Kigoma for 25 villages. In addition, with European Union support, 15,000 SHSs are being financed through association members in the Lake Victoria region, with micro-financing from Standbic Bank and the REA subsidy.

- The REA's Lighting Rural Tanzania competitive grant programme (financed under AFREA and TEDAP) supports private enterprises in developing new business models to supply affordable energy in rural areas. The first competition, financed by AFREA, had more than 25,000 household beneficiaries. The second competition, financed under TEDAP, centres on developing innovative business models for rural schools. Specific efforts encourage women developers and programmes that support women's energy needs. The REA also provides technical support and training for PV system design, installation, maintenance, and repair through Vocational Education Training Centres in rural areas.

BOX 3 SUSTAINABLE SOLAR MARKET PACKAGE

The Sustainable Solar Market Package (SSMP) is a contracting mechanism that bundles the supply, installation and maintenance of photovoltaic (PV) systems for public facilities, such as schools and clinics, with requirements and incentives for commercial sale to households, businesses, and other nongovernmental customers in a defined geographical area.

Funding for the public and community-services facilities is provided by the government or other donors, whilst a performance-based grant is used to help households defray the cost of solar home systems (SHS). Customers may obtain a loan from a partner microfinance institution, use pay-as-you-go technology to tie usage to payment, or pay cash for the balance of the SHS payment.

The SSMP approach attempts to address key challenges of past solar PV programs in Tanzania, particularly the high costs of systems sold in rural areas, sustainability, and affordability.

- High Costs. Installation and transaction costs are reduced by bundling a larger number of PV systems in the same geographic area. Bundling of public facilities with private market increases the attractiveness of the packages, resulting in more competitive tenders.
- Sustainability. Public-system sustainability is reinforced through standardising hardware supported by a five-year maintenance contract. The contractor's physical presence in the target area over the five-year period enables provision of after-sales services for the private market.
- Affordability. Apart from the performance grants provided by the REA, contractors are required to implement additional measures to improve affordability, such as providing microfinance or deploying pay-as-you-go systems.

The REA has implemented the first set of SSMPs in the Rukwa region, Sumbawanga district. MCC has adopted the model for its project in Kigoma. Lessons learned from these two interventions have been integrated into the new tender, which REA is currently launching for eight additional districts with TEDAP and SIDA funding (Annex IV). The SREP will allow for additional fine-tuning and scaling up of this promising model.

- Business development services are also provided to solar companies in 16 regions under SIDA and UNDP programmes. These include technical and marketing training for solar retailers, technicians, and vocational school instructors; marketing, awareness-raising, and networking amongst solar industry stakeholders; and policy and institutional support for implementing national quality-control standards. In addition, there is an active private-sector market and NGOs are engaged in providing PV systems for both social services and households. For example, the NGO Oikos East Afric is installing solar PV systems in all primary and secondary schools in Oldonyo Sambu and Ngarenanyuki wards in Arumeru district to promote the use of renewable energy sources.

Grid-Connected Solar Photovoltaics

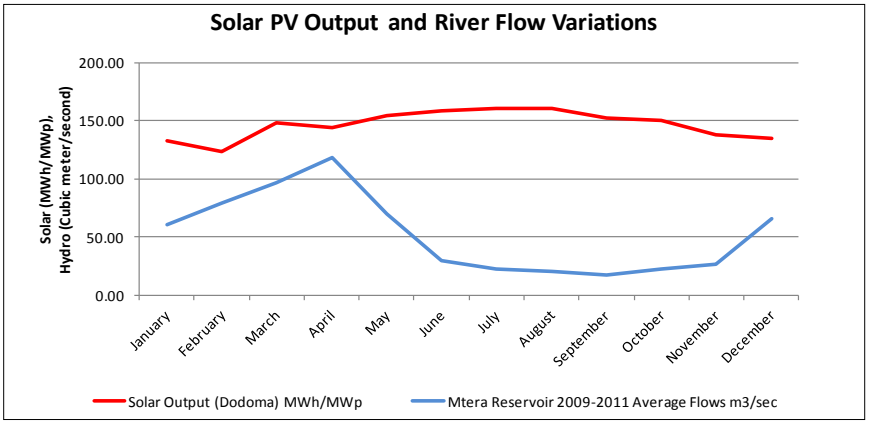
In central Tanzania, a MWp of solar PV generates about 1,800 MWh per year (net of losses), and will require about 1 hectare of land. Theoretically, the total estimated 2025 electricity demand of 27,000 GWh could be met by solar PV fields of about 15,000 hectares or about 0.02 percent of Tanzania's land mass. That is, the theoretical potential of solar is unlimited. However, for purposes of system stability, solar is usually restricted to less than 20–30 percent of daytime peak demand. On the basis of a 20 percent constraint, the potential for grid-tied solar in 2025 could be about 800 MW.[31] Given that

[31] According to the PSMP, in 2025, coincident peak demand will be 4,700 MW, with noon peak about 85 percent of nighttime peak demand (R. Vernstrom, "Long Run Marginal Cost of Service Tariff Study," Final Report to TANESCO, May 2010).

large-scale, grid-tied solar PV installations are being undertaken in some countries for under US$1,750 per kWp, its prospects in Tanzania should be excellent.

The Power System Master Plan (PSMP) envisages 120 MWp of solar in the power expansion plan by 2016. Several private firms have expressed interest in investing in 50–100 MWp of solar PV. NextGen Solawazi has signed a SPPA with TANESCO to supply electricity from 2 MWp of PV to an isolated grid. TANESCO has also signed a Letter of Intent (LOI) for a 1 MWp isolated grid-tied PV project.

FIGURE 12 VALUE OF COMBINED USE OF SOLAR AND HYDRO



Source: SREP Task Force.

As high rainfall and solar radiation are usually negatively correlated (e.g., during the rainy season, solar radiation levels are typically low), there is high value in using solar and hydro in combination. This is illustrated in Figure 12, which shows the average 2009–11 river flows into the Mtera Reservoir and solar PV output at Dodoma. Using the existing reservoir capacity as low-cost electricity storage can make the solar output dispatchable, thus adding capacity value to a power source considered intermittent.

Solar Thermal

Solar thermal energy has been used for generations in Tanzania for drying crops, wood, and salt. Currently, solar dryers are used in the agricultural sector to dry cereals and other farm products, including coffee, pyrethrum, and mangos. The Sokoine University of Agriculture, University of Dar es Salaam and TaTEDO have been at the forefront of promoting solar dryers. These institutions are also promoting solar thermal for cooking in parallel with solar drying.

Solar water heating systems in Tanzania are used mainly by households and various types of institutions (e.g., hotels, hospitals, health centres, and dispensaries). Despite the potential of solar thermal and the demand for low-temperature water for both domestic and commercial applications, the uptake level is low. Lack of awareness, inability to mobilise financing, relatively lower priority given to such investments (i.e., water heating may not be a major cost relative to others) are some of reasons attributed to the little use of solar hot water heating.

3.1.6 BIOMASS

Biomass is Tanzania's single largest energy source. According to REA estimates, agricultural, livestock, and forestry residues amount to about 15 million tons per year (MTPY). A portion of that amount may be available for use in power generation. This includes sugar bagasse (1.5 million

MTPY), sisal (0.2 MTPY), coffee husk (0.1 MTPY), rice husk (0.2 MTPY), municipal solid waste (4.7 MTPY), and forest residue (1.1 MTPY), with the balance from other crop waste and livestock. Further supplies can be obtained through sustainably harvested fuelwood from fast-growing tree plantations. For example, a 50 MW biomass power plant could obtain all its fuelwood needs from a 10,000 hectare plantation.

BOX 4 BIOGAS: AN UNRECOGNISED RESOURCE

Today, Tanzania's entire national electricity supply could be met if just 1 percent of its land area were used to grow maize or sorghum efficiently at commercial scale and the crop waste used to generate biogas (the grain itself being used as food). Also, two-fifths of the country's current charcoal consumption could be provided from the use of anaerobic-digester solid waste. All of the current charcoal consumption could be provided if the most efficient charcoal stoves were used. For comparison, Germany has twice the population of Tanzania and half the land, but has installed a biogas capacity of 2,900 MW (2010 figure). This is supplied with feedstock from an area equivalent to about 1 percent of Tanzania's land area.

However, biogas also has potential drawbacks. Crop residues have low biodegradability and biogas yield and a long digestion time due to the high content of lignocellulose in crop straw. Feedstock is difficult to handle owing to its features of intertwining, difficulty in loading in and discharge, low bulking density, inflation in water, and non-uniformity. Potential solutions include pretreatment to improve biodegradability, optimizing the digester to adapt to the special material properties and meeting the biological requirements, and optimizing operational parameters to achieve the best performance. Year-round production may not be possible if feedstock availability is seasonal with only one crop harvested annually since storing low-density crop waste over many months is unviable.

There is considerable unrealised scope for crop wastes supplying a larger portion of the nation's energy supply, using commercially proven anaerobic-digestion technology. Crop waste can make a good feedstock for biogas, either for electricity use or domestic lighting and cooking. At an industrial scale, it can be used for both anaerobic digestion for gas or electricity, and the residues from that process make excellent charcoal briquettes (Box 4). Also noteworthy is that biogas can provide dispatchable electricity; gas storage over a daily cycle is both simple and cheap, and gas engines can follow loads effectively. This makes biogas an excellent complement to either wind or solar power, although it is rarely used as such.

The biomass supply sector is a major employer in Tanzania. An estimated 1 million people in the informal sector are engaged in charcoal preparation and supply. Because of the weak enforcement of current regulations and lack of awareness of the need and tools to operate sustainably, much biomass from the forests is harvested unsustainably. The informal nature of the industry and the low incomes of charcoal makers hinder gaining access to the capital needed to improve charcoal production, develop sustainable wood sources, and reduce consumption by using more efficient devices. A 2010 World Bank report on the charcoal situation in Tanzania reports that some 100,000–125,000 hectares of annual forest loss are attributable to unsustainable charcoal production, and the Government of Tanzania is losing about US$100 million in annual revenue.[32] The report recommends various remedial actions to make biomass a sustainable resource that can offer rural communities—both women and men—productive livelihoods. Following this in-depth examination, Finland and Switzerland are supporting further investigations of the charcoal value chain.

[32] The World Bank, "Enabling Reforms: A Stakeholder Based Analysis of the Political Economy of Tanzania's Charcoal Sector and the Poverty and Social Impact of Proposed Reforms," June 2010.

Heat Applications

Much of the biomass is used for heat applications. These include cooking in the residential sector and process heating for agriculture and industry (Figure 4).

Power Production

Tanzanian industry using wood or agricultural feedstock (e.g., sugar, tannin, and sisal) has been generating its own power from waste biomass materials. It is estimated that about 58 MW of such generation is taking place.

Under the SPPA programme, two biomass power projects are supplying power to TANESCO: TPC, a major sugar producer with an SPPA for 9 MW of power,[33] and TANWATT, a tannin producer with an SPPA for 1.5 MW. In June 2013, a third SPPA for 1 MW, the Ngombeni project, is expected to be commissioned to supply power to TANESCO's isolated grid on Mafia Island. TANESCO has signed SPPAs for three additional biomass projects with a total capacity of 9.6 MW.

Development Partner Support

Various development partners are supporting biomass-sector development. The EU is supporting the preparation of a Biomass Energy Strategy. SIDA and NORAD are supporting institutional and legal frameworks for developing the bioenergy (biodiesel and ethanol) subsector. CAMARTEC is implementing a four-year countrywide biogas programme (2009–13), supported by the Netherlands government, which aims to construct 12,000 digesters of various sizes. The gas produced is used for household cooking and lighting and institutional electricity production. As of December 2012, the programme had constructed 4,000 digesters in 11 regions (Tanga, Dar es Salaam, Kilimanjaro, Arusha, Manyara, Morogoro, Pwani, Iringa, Mbeya, Singida, and Dodoma). The REA, under the TEDAP, is providing matching grants for development of several biomass mini and micro grids.

3.2 Barriers to Renewable Energy Development and Mitigation Measures

Transforming Tanzania's energy sector through the large-scale deployment of renewable energy faces numerous institutional, regulatory, and legal challenges, as well as knowledge and capacity constraints and economic and financial uncertainties (Table 4).

[33] Although only about 3MW are currently supplied.

TABLE 4 KEY BARRIERS TO RENEWABLE ENERGY DEVELOPMENT AND MITIGATION MEASURES

Barriers	Mitigation measure	Primary relevance
Institutional, Regulatory, and Legal		
Uncertainty about the future direction of power-generation investment planning; i.e., the PSMP baseline plan has a limited role for renewable energy (large hydro), reflecting inadequate data and unavailable power planning methods that could more effectively integrate a wide range of renewable energy options, especially distributed generation.	PSMP planners require access to more effective planning tools and better planning processes. Some progress in this regard is being made. For example, the Rural Electrification Investment Prospectus explicitly considers distributed renewable energy generation. Future revisions to the PSMP will improve its consideration of renewable energy.	All renewable energy.
Project developers face multiple risks in developing renewable energy projects in Tanzania, including off-taker risk (particularly TANESCO), currency risks (if PPA in TZS), and resource uncertainty.	Considerable progress has been made in reducing regulatory risks, especially for SPPs (under 10MW), but similar work is now needed for larger-scale renewables. TANESCO needs revitalisation to become financially sustainable, with a cost-reflective tariff. In the interim period, risk-mitigation mechanisms against TANESCO's default/late payment risk need to be developed. The government can invest in resource assessments (e.g., geothermal, wind, small hydro, and biomass) and make this information publically available.	All renewable energy.
Complex bureaucratic requirements linked to preparation and approval of renewable energy projects, resulting in lengthy time required to bring financial closure to smaller projects.	Investments in renewable energy are still relatively new in Tanzania. The policies, regulatory and administrative processes, and financial incentives are not yet tested. Administrative processes are quite lengthy and need to be mainstreamed. Further institutional capacity strengthening and streamlining of processes are required. The REA could play a facilitating role (e.g., becoming a one-stop shop for rural electrification projects). Also, more comprehensive transaction advisory services or funding are needed. More broadly, the government must address constraints facing IPPs, and is committed to doing so.	All renewable energy.
Lack of information and uncertainty about grid extension plans result in worries about grid encroachment and increase the risks borne by private companies in developing mini-grid projects.	The Rural Electrification Investment Prospectus will identify areas for grid extension and renewable-based, mini- and off-grid supply opportunities.	Mini grids and stand-alone off-grid renewable.

Barriers	Mitigation measure	Primary relevance
Biomass resource extraction from forests is virtually unregulated, which leads to unsustainable harvesting of fuelwood and charcoal. Current regulatory and enforcement environment and move to other energy sources have not proven effective. Also, there is little awareness of the need to operate sustainably.	Mitigation measures include improving revenue collection methods and providing funds and training to local governments to improve sector supervision, using fiscal incentives to support sustainable harvesting practices and strengthening capacities for monitoring and enforcement.[a]	Biomass.
Knowledge and Capacity		
Tanzania has limited expertise in undertaking feasibility studies, detailed design, and construction. It is difficult to find qualified staff willing to be posted in remote locations.	Building human and institutional capacity requires expanding specialised training, supporting local educational and sector institutions that deal with renewable energy, supporting partnerships with international firms through South-South and North-South exchanges, and developing implementation models that can deliver services more efficiently.	All renewable energy.
There is a lack of renewable resource information on needed quality and duration.	Resource assessment work should be expanded for geothermal and should cover biomass and solar resources (wind resource monitoring is ongoing). Hydro resource characterisation for mini grids should be expanded. Information should be easily accessible to developers.	All renewable energy.
Low-cost, small solar lighting products sold directly to customers may be of low quality, and customers may be unable to discriminate between well- and poorly-made products.	Building on the outcomes of the Lighting Africa Program can create public awareness of high-quality products and thus encourage their marketing and sale.[b]	Off grid.
Extraction enforcement is lacking in forests, which are easily accessible and provide low- or no-cost fuelwood supplies.	Alternatives to unsustainable wood extraction include better resource information, adoption of sustainable harvesting plans, community forestry, support of efficient charcoal production, and more effective wood pricing.	Biomass.
Consumers lack access to better and more affordable alternatives to charcoal and fuelwood.	Solutions include pilot testing and market development of more efficient charcoal production, briquetting, improved cookstoves, and biogas and other alternative fuels, working in partnership with the Global Alliance for Clean Cookstoves and others.	Biomass.

Barriers	Mitigation measure	Primary relevance
The pre-investment and transaction costs for renewable energy, including resource assessment and feasibility studies, are high.	The REA matching-grant support programmes should be expanded and adapted to the needs of a scaled-up program. The current project-by-project approach is time-intensive with high transaction costs; bundling services would mean delivery of better-quality services at lower cost—a key aim of SREP IP off-grid electrification. Cost-shared assistance should be provided, possibly converting it to equity/debt on successful financial closure.	All renewable energy, especially SPPs and mini grids.
Economic and Financial		
Renewable energy projects have a high capital cost. The technologies are capital intensive and the period for pre-investment, financial closure, and construction is of long duration. The types of financing and financing conditions available domestically are not well suited to the development of renewable energy projects.	By increasing access to long-term financing through commercial banks, the high capex can be spread over a longer period. Transaction advisory services can be expanded to assist local developers find equity partners. Thus, World Bank or similar credit line should be extended and scaled up. Partial risk guarantee instruments can be offered to cover off-taker, currency, and other commercial risks that foreign equity partners may require.	All renewable energy.
Revenues are uncertain. For projects that sell power to TANESCO, there is a risk of payment delay.	The government is engaging with its development partners and TANESCO to help resolve the current problem. The World Bank has approved the first tranche of a Policy Operation to help ease TANESCO's financial burden. This will facilitate repayment of overdue accounts. Both of the proposed SREP projects plan to establish risk guarantees to avoid TANESCO payment delays to the private sector.	Grid-connected IPPs and SPPs.
Rural residents spend a significant portion of their income on energy services, yet have limited ability to pay for electricity connections and consumption under traditional billing arrangements (i.e., end of the month or every three months).	Output-based grants can be used to buy down a portion of the capital cost of off-grid services. Credit and/or pay-as-you-go solutions can be offered so that households can spread out system payments over time, mirroring current spending on energy services, such as kerosene for lighting or battery-charging for mobile phones.	Mini grids and off grid.
The informal nature of the fuelwood/charcoal industry and low incomes make it difficult to gain access to capital needed to improve production, develop sustainable wood sources, and reduce consumption by using more efficient devices.	Microfinance organisations, coupled with technical assistance and technology transfer, can be used to provide financing.	Biomass.

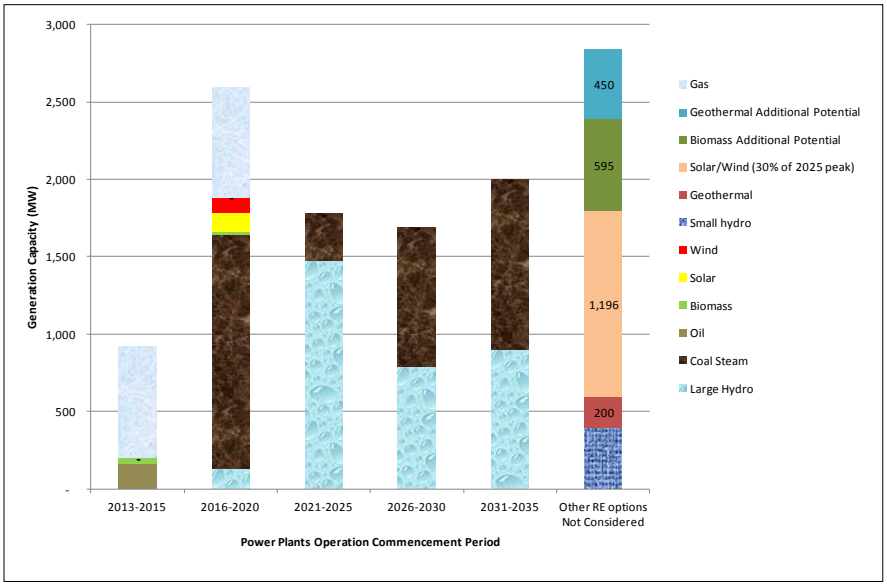
a. The World Bank, "Environmental Crisis or Sustainable Development Opportunity: Transforming the Charcoal Sector in Tanzania," Policy Note, March 2009.
b. Details on the Lighting Africa Program are available at http://www.lightingafrica.org.

Despite the many renewable energy projects and programmes being implemented or planned, Tanzania's renewable energy development is still in the nascent stages. More strategic and programmatic actions—which the SREP-Tanzania Investment Plan is well-positioned to deliver—are required.

4 Power Planning and Economic Viability of Renewable Energy

The PSMP 2012 Update expects Tanzania to require massive capacity additions to meet the electricity demand envisaged up to 2035. The Government of Tanzania estimates that about 9,000 MW of capacity will need to be added to meet demand and replace retired generation units in order to meet economic growth and access expansion targets. The majority of these additions are expected to be large hydropower and coal (35 and 41 percent, respectively), whilst oil and gas (21 percent) would supply power, particularly in the early years. Although the potential for other renewable energy is significant, only 3 percent is considered in the 2012 Update because the available resource information needed for renewable-energy investment decisions is still insufficient, there are few concrete project proposals, and existing planning methods are inadequate.

Figure 13 Proposed Capacity Additions and Renewable Options Not Yet Considered



Source: PSMP 2012 Update.

As suggested in Figure 13, much of the early capacity requirements are met by oil and gas generators since they require shorter lead times. In these early years, the PSMP expects other proposed renewable energy investments to occur. In later years, longer-gestation coal and large-hydro projects predominate. Nevertheless, Tanzania has significant renewable energy potential that could be considered in a least-cost expansion plan. This potential, shown in the last column of the figure, is merely indicative as there is insufficient information to more precisely estimate it.[34]

The government recognises the need to take more proactive and inclusive consideration of viable renewable energy options rather than wait for unsolicited project proposals from interested parties, as

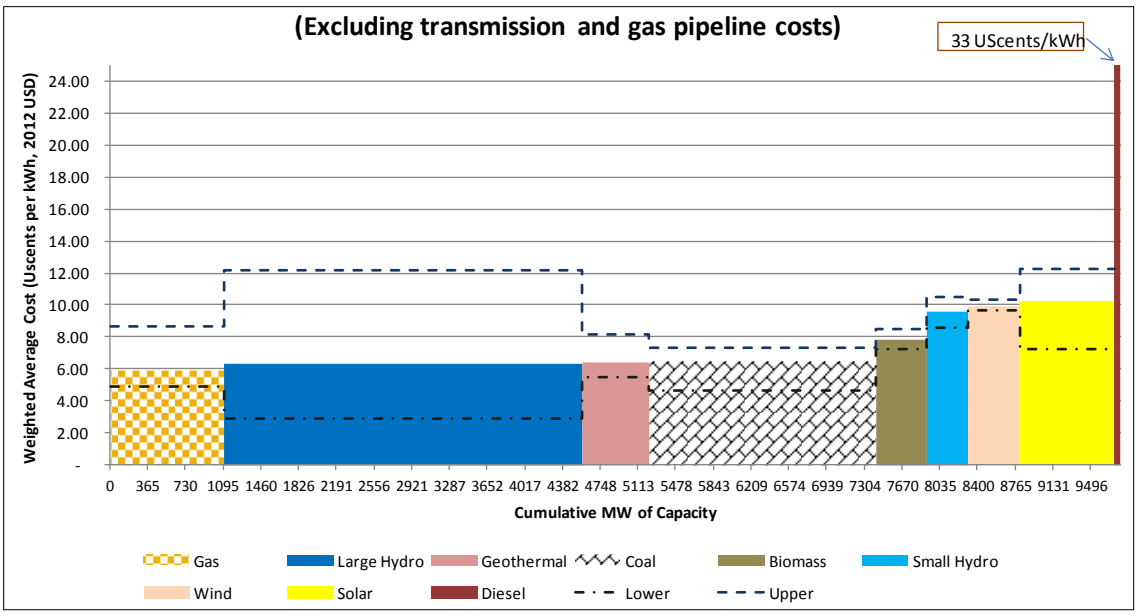
[34] The estimated potential for renewable energy is based on intermittent solar and wind accounting for no more than 30 percent of 2025 daytime peak demand for system stability reasons (an arbitrary assumption as the PSMP extends to 2035); theoretically, however, its potential is unlimited. Biomass generation is assumed to be derived from only half of available biomass waste. Purpose-grown biomass plantations could add to generation capacity. For example, a 10,000 hectare plantation could meet the fuelwood needs of a 50 MW biomass power plant. Small hydro and geothermal are based on estimates of resource potential.

is the current practice. The SPPA to encourage smaller renewable energy power projects (up to 10 MW per facility) is showing encouraging results. The EWURA is planning to develop streamlined procedures, a regulatory framework, model contracts, and tariff rules for larger grid-tied renewable energy projects (above 10 MW per project). SREP support can help in this process, especially for larger-scale and systematic project development.

4.1 Economic Cost Competitiveness of Grid-Connected Generation

The rationale for deploying renewable energy generation depends on its ability to provide cost-effective electricity that, when coupled with other sources, provides the needed supply diversity and security. Figure 14 shows a supply curve based on the economic levelized cost of electricity. The horizontal axis represents the cumulative capacity additions anticipated in the PSMP 2012 Update, plus renewable energy with potential in Tanzania. The vertical axis represents the weighted average levelized economic cost of electricity from each class of generation technologies. All renewable energy options have economic levelized costs of US¢12 or less per kWh, with geothermal (should the resource be proven) at about US¢ 6–8 per kWh. These cost estimates are indicative, based on the typical costs for each technology. Financial and economic costs will differ, depending on the cost and tenor of financing, taxes, duties, and subsidies. Transmission costs are excluded because they are site-specific and project locations cannot yet be identified. The attractiveness of generation sites, whether renewable energy or fossil energy–based, could be lessened if sites are located far from the grid or main load centres.

Figure 14 Grid-Connected Generation Supply Curve



Source: SREP Task Force calculations.

Figure 14 is based on available data from existing or planned projects in the PSMP, while estimates for renewable energy projects are based on current and projected future costs. The upper and lower bounds in levelized electricity cost are based on variances in the cost and performance of the technologies and fuels as reported in the PSMP and estimated for renewable energy technologies. There is considerable variation as individual project costs vary; in the case of renewables, earlier projects will have a higher cost compared to later ones as cost reductions are expected. A detailed

schedule of plants and projects, together with their estimated costs and the derivation of the cost curve, is set out in Annex V.

Although the supply curve is relatively accurate in terms of current and projected costs, it does not fully reflect the potential contribution of renewables. The cost of natural gas and coal is based on current national costs with no escalation, although these costs are lower than international benchmarks. The solar resource has been constrained by the grid capacity to absorb it, though the resource itself is virtually unlimited. Biomass capacity does not include purpose-grown fuelwood plantations, and the true potential of geothermal and wind is still unconfirmed.

In terms of geothermal energy, if the resource is proven, it is competitive with gas-powered generation without the risks associated with future gas-price increases (or releasing domestic gas supplies for other high-value applications). Thus, any stations built will be substantially immune to future inflation. Its principal cost is associated with the risks of exploration. In terms of solar PV, costs have fallen sharply over the past few years and are expected to decline further to under US$1,000 per kWp in the near future. Wind is a somewhat more mature industry; thus its costs are not expected to decline dramatically in the future. However, better characterisation of the wind resource could result in lower costs than estimated here.

4.2 Diversity and Decentralisation

The benefit of renewable resources to Tanzania is not apparent from the raw costs of the various sources. The country is large, has a low population density, and main demand centres are located far from major gas and coal areas. This means that transmission costs and losses are high. Tanzania has also experienced the consequences of over-dependence on a single source of power. Clearly, there is value in highly diversified power sources with a wide geographical spread.[35] The addition of a significant component of renewable power to the national energy system will achieve both objectives.

4.3 Economic Cost Effectiveness of Off-Grid Renewables

The costs discussed thus far are for large-scale, grid-connected facilities; however, much of Tanzania lacks access to grid electricity supply. In late 2012, the Rural Electrification Investment Prospectus study estimated the population split by electrification options. Early results indicate that, if the 2025 goal of 50 percent electrification is to be achieved, about half of the rural population might be better served by mini grids and off-grid options (Figure 15).

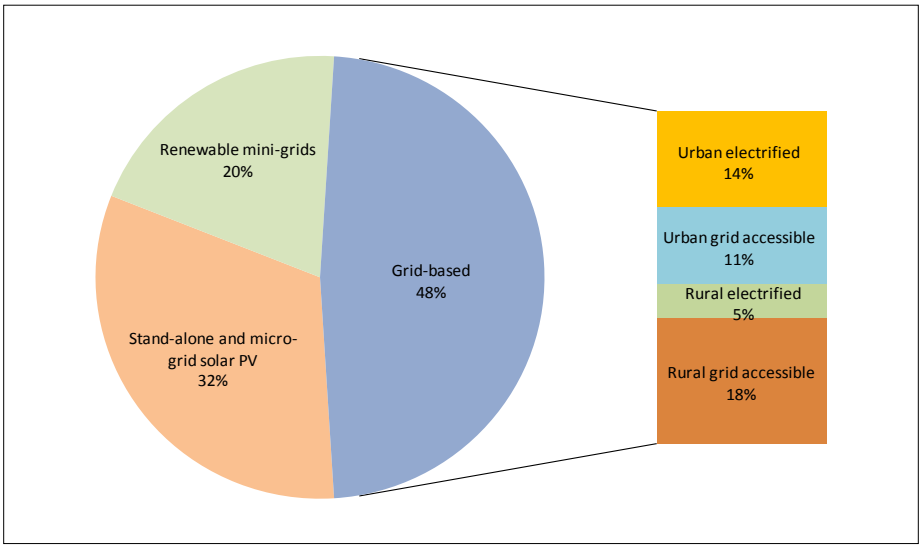
According to the screening, 20 percent of the population could benefit from mini grids. Given its relatively high fuel and operating costs, diesel is generally not the most economically viable option; in the future, most of these grids may have to rely on renewables, such as hydro, biomass (thermal or biogas), and solar (where diesel/solar hybrid systems may be more appropriate). An indicative comparison shows that the cost of electricity using renewable-energy mini grids can be lower on a levelized economic cost basis (Table 5) (Annex V).[36] These estimates are based on the current prevailing costs in Tanzania. It is expected that costs would decline as a larger market for off-grid

[35] On the other hand, development of some renewable energy sites that are distant from the grid could be constrained by high transmission costs.

[36] The financial cost will differ, depending on the financing terms and such factors as taxes, duties, and subsidies.

solutions develops, particularly for PV, which is experiencing a global price decline.[37] Site-specific analyses need to be conducted to determine the technology choice that offers the least cost of electricity for a given location.

FIGURE 15 POPULATION ELECTRIFICATION OPTIONS IN 2013



Source: Preliminary estimates, IED, Rural Electrification Master Plan, December 2012.

TABLE 5 ECONOMIC LEVELIZED COST OF ELECTRICITY IN MINI GRIDS FROM VARIOUS ENERGY SOURCES (BUSBAR COST)

Factor	Unit of measure	Isolated diesel generator	Small hydropower plant	Biomass power plant	Solar PV with battery	PV-battery diesel hybrid
Levelized electricity cost at generator	US$ per kWh	0.59	0.23	0.29	0.71	0.53

Source: SREP Task Force calculations.

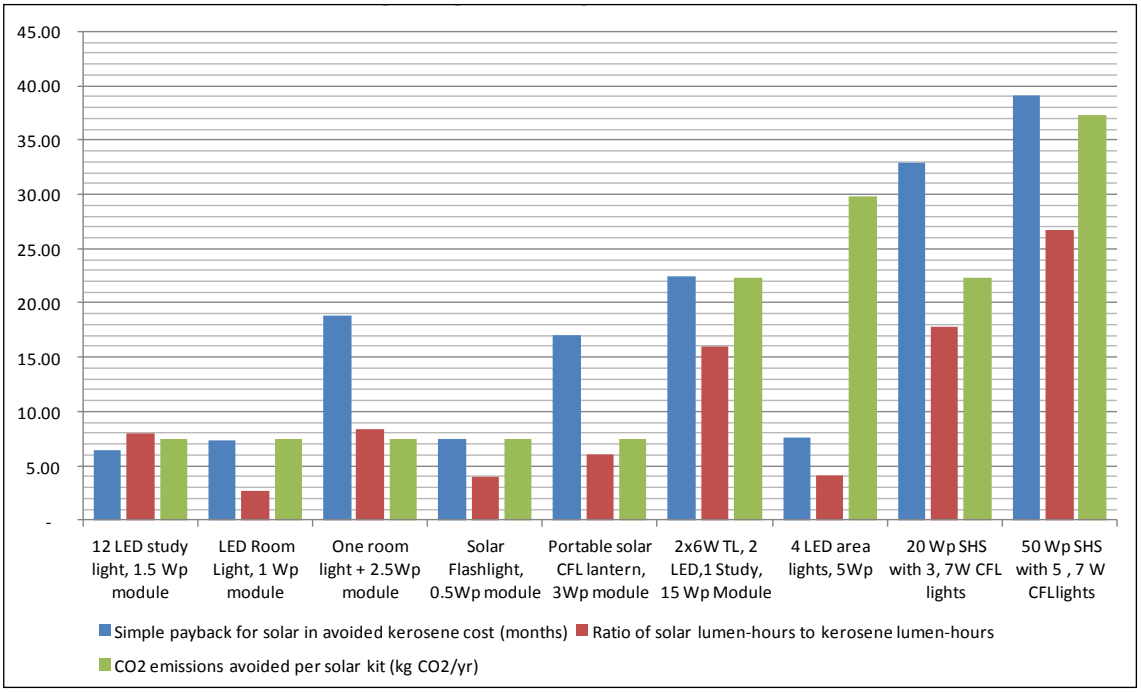
Mini grids face further challenges surrounding the economics of electricity distribution, billing, and payment collection. Thus, it is likely they will be developed mainly in areas with one or more anchor commercial clients and/or TANESCO, which can be the buyer/seller of bulk power in conjunction with the renewable-energy generation supplying the mini grid and thus justify the bulk of the generation investment. Distribution to households, generally low energy users, is likely to be marginally economic in many circumstances. Small villages with relatively high population densities for which mini grids are not viable could be served by village micro grids.[38]

[37] For example, the levelized cost of energy (LCOE) for solar PV-battery and PV-battery-diesel hybrid in Asia is reported at nearly half of Tanzania costs. With future PV installed costs of US$1,500 per kW, compared to $3,000 per kW, and a battery life extension of 10 years instead of 5, the levelized electricity economic cost from PV-battery and PV-battery-diesel hybrid could drop to $0.43 and $0.36 per kWh, respectively.

[38] Solar PV micro grids are under development in Tanzania.

About one-third of the population may need to use stand-alone or micro-grid technologies,[39] such as solar PV, if they are to benefit from electrification in the short-to-medium term. The primary determinant would be whether load densities in these dispersed communities are too low to justify a mini grid. Various solar PV options compare favourably with kerosene lighting in terms of payback period and the amount of lighting delivered (Figure 16) (Annex V). If the added value of PV systems for charging mobile phones and other uses otherwise requiring rechargeable or disposable batteries is taken into account, then the preference for solar PV solutions becomes self-evident. Tanzania has experience in such solutions with about 6 MWp of off-grid solar PV deployed.

FIGURE 16 COMPARING LIGHTING PERFORMANCE OF SOLAR PV TO KEROSENE FOR A RANGE OF SOLAR KITS



Source: SREP Task Force calculations.

For about half the rural population, renewable energy represents the future of electrification if the 2025 goal is to be achieved. In this way, remote rural communities can benefit from electricity services far sooner than if they were to wait for the arrival of national grid extension.

The Rural Electrification Investment Prospectus will define a least-cost investment plan for 2013–22, aimed at electrifying 1,200 development centres (about 6,000 localities) with the highest potential. Preliminary information suggests that at least 1,600 localities will require off-grid solutions, preferably mini grids. In addition, 5,500 localities will not be electrified even by 2022 and may therefore require pre-electrification solutions, such as SHSs and lanterns, or perhaps micro grids. The prospectus, expected to be ready by June 2013, will guide the SREP off-grid electrification investments.

[39] Micro grids consist of a small, low-voltage (e.g., 12–48V), centralised solar PV array with a battery to serve a small number of customers (e.g., 5–10) located in the immediate vicinity of the power plant. Pre-payment meters or other devices are used to simplify billing and collection.

5 PRIORITISATION OF STRATEGIC INVESTMENT AREAS

A participatory process involving many stakeholders under the leadership of the Government of Tanzania, represented by the Ministry of Energy and Minerals (MEM), with support of the Multilateral Development Banks (MDBs), helped to formulate the Scaling-Up Renewable Energy Programme (SREP-Tanzania) Investment Plan (IP). The process took into account preparatory work done by the SREP National Task Force on key barriers, bottlenecks, and opportunities; the conclusions of several technical consultations and various meetings with key stakeholders; as well as a consultative workshop held during the Joint Mission (Annex III).

The Government of Tanzania applied screening criteria in order to identify the renewable energy technologies and potential investments that correspond to national priorities to ensure that SREP investments focus strategically on areas where they will have maximum transformational impact. Table 6 provides the ranking scores for the technologies considered for SREP co-financing, while the criteria used to evaluate them are explained in Annex VI.

TABLE 6 RANKING OF SREP PRIORITY RENEWABLE-ENERGY TECHNOLOGIES

	Grid-connected				Off-grid		Thermal
Criteria	Geo-thermal	Solar or wind	Small hydro	Biomass power	Mini grid	Stand-alone solar	Biomass fuel
Aggregate scores							
SREP	26	21	19	21	27	24	25
National	10	7	8	8	10	9	9
Grand total	**36**	**28**	**27**	**29**	**37**	**33**	**34**

The three top priority areas that emerged to support national development priorities were geothermal power development, renewable energy for off-grid rural electrification, and alternative biomass supply options.

1. **Geothermal Power Development**. SREP resources would be used to reduce geothermal resource uncertainty, partly mitigate development risks, and improve sector governance and capacity to encourage the private sector to invest in and supply dependable and cost-competitive geothermal electricity. Such supplies can counter the increased unpredictability of hydropower output, release other energy sources that have high-value alternative uses, and reduce global and local environmental damage.
2. **Renewable Energy for Rural Electrification**. The SREP would catalyse the private sector in supplying renewable electricity in rural areas to contribute to the 2035 national goal of increasing electricity access to 75 percent of the population. The programme would focus on mini-grid, micro-grid, and stand-alone renewable-energy electricity supply (mainly solar PV systems) to more remote and dispersed communities, where the alternatives are high-cost diesel and expensive yet poor-quality service supplied by kerosene and disposable batteries.
3. **Alternative Biomass Supply Options**. Private sector–led initiatives would be supported to develop alternatives to traditionally supplied fuelwood and charcoal for cooking. Current practices are denuding forests at an alarming rate; causing local and global environmental damage; and creating household air pollution, which is especially damaging to the health of

women and their young children, who are likely to stay near their mothers in the household cooking environment.

BOX 5 BIOMASS ENERGY STRATEGY TANZANIA

The Biomass Energy Strategy Tanzania (BEST), an ongoing initiative to be funded by the European Union (EU), aims to identify the means of ensuring a more sustainable supply of biomass energy, raise the efficiency of biomass-energy production and utilisation, promote access to alternative energy sources where appropriate and affordable, and ensure an enabling institutional environment for strategy implementation. To achieve these objectives, the initiative will identify and work with institutional drivers for change and reform, recognising that past efforts to change biomass energy policies have met with limited success. The strategy is expected to be ready for implementation in June 2013.

The Government of Tanzania has decided that the SREP will focus on the first two priorities. If additional SREP resources are forthcoming, they will be used to implement the strategy to emerge from the Biomass Energy Strategy Tanzania (BEST) initiative now under development (Box 5).

6 SREP FOR TANZANIA: PROGRAMME DESCRIPTION

Based on the experience and insights from previous efforts to identify the potential of Tanzania's renewable energy sector and the screening of various renewable energy options, summarised in the previous chapters, the government decided on the structure of the Investment Plan (IP) to be co-financed by the Scaling-Up Renewable Energy Programme (SREP). This chapter presents the general architecture of the SREP-Tanzania, with its priority areas and investment projects, highlighting the roles and contributions of stakeholders and institutional arrangements for programme implementation. Annex I includes the project concepts for the two priority areas, detailing how the lead Multilateral Development Banks (MDBs), along with the SREP and other partners, will support the implementation of specific investments.

6.1 PROGRAMME OBJECTIVE

The objective of the SREP-Tanzania is to scale up the deployment of renewable energy to transform the country's energy sector, principally the electricity subsector, from one that is increasingly fossil-fuel dependent to one that uses a more balanced supply of diverse energy sources. Achieving this goal will help Tanzania move along a low-carbon development pathway, increase energy security, generate new economic opportunities, and widen access to energy services.

In accordance with SREP modalities, this goal will be achieved through an integrated approach that includes investments in renewable energies, particularly the infrastructure needed for their production and distribution; stakeholder capacity building; integration with dynamic public-private partnerships (PPPs); and provision of adequate technical-assistance services. In addition, the programme will support appropriate actions for consolidating or upgrading sector policy and strategic and regulatory frameworks, and will encourage the dissemination and use of renewable energies in the country.

This integrated programme approach assumes that transformational change is only made possible by improving energy market conditions and financing, as well as creating specific conditions for gaining the confidence of investors, whether small-, medium-, or large-scale enterprises, public or private entities, or national or international businesses. These conditions are indispensable for any replication and scaling up of public and private investments in renewable energy.

6.2 EXPECTED OUTCOMES

The main results expected from the SREP-Tanzania are as follows:

- Improved access and reliability of the electricity services used by Tanzania's rural and urban populations.
- Increased supply of electricity from renewable energies and scaling up innovative energy delivery solutions.
- Substantive and substantial private-sector participation in all aspects of renewable-energy project development and in investing and operating renewable energy projects.
- Increased gender-equitable access to renewable energy by rural and urban populations.
- Creation of jobs related to the adoption of renewable energy for women and men in the targeted areas.

- Improved enabling environment through optimization of the legal and regulatory framework and increased capacity of relevant government authorities to carry out negotiations with the private sector.
- Additional financial resources leveraged and appropriate financial instruments utilised for renewable energy projects.
- Reduce GHG emissions compared to the business-as-usual option.

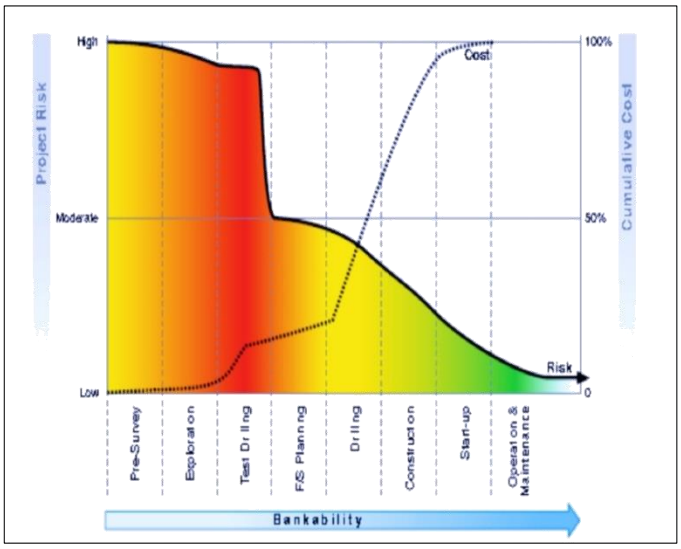
The two principal components for which SREP funding, along with other co-funding, will be utilised are described in the following two sections.

6.3 GEOTHERMAL DEVELOPMENT PROJECT

Like most renewables, geothermal involves high capital costs and relatively low operating costs. Thus, the cost of capital is the crucial determinant of the economics of most geothermal development projects. Fully exploring geothermal resources—the exploratory test-drilling phase—to convert them into proven reserves is an expensive and risky task, presenting a key barrier to private-sector investment. If the risk is borne fully by commercial developers and private investors, the result will be higher overall cost and cost of capital. Thus, they would seek higher tariffs than the nation could afford or exploration would happen more slowly or not at all.

Geothermal resource development occurs in stages, with each stage's success dependent on the outcomes of the previous one. First, a pre-survey is conducted to compile and review existing data to develop the exploration plan. Second, exploration uses geological, geophysical, and geochemical techniques and temperature gradient measurements. Based on initial results, exploratory test drilling and production well drilling follow. The next steps are steam field and power-plant and transmission-line construction. The final stages are start-up and commissioning and operations and maintenance. At any stage, particularly the early ones, there is a chance that the resource will not develop further commercially.

FIGURE 17 EXAMPLE OF GEOTHERMAL PROJECT RISK PROFILE



Source: ESMAP 2012.

Risks are highest up to the exploratory test-drilling phase, whose cost might account for 20–25 percent of total project costs.[40] Figure 17 provides an example of the evolution of risks and costs in geothermal power development. In Kenya, for example, the public sector has borne the risk of resource exploration and confirmation, as well as the required expertise and experience to better manage and mitigate all risks up to the steam-production phase. Once the resource is confirmed, the private sector is better positioned to develop it and supply electricity on more competitive terms.

[40] Energy Sector Management Assistance Programme (ESMAP), "Geothermal Handbook: Planning and Financing of Geothermal Power Generation," Technical Report No 002/12, June 2012.

Given its potential development risks and high investment costs, geothermal development must be undertaken strategically. Stakeholder consultation workshops held in March 2013 acknowledged that Tanzania's legal and regulatory framework must be improved first in order to facilitate geothermal development (Annex III). The challenge centres on the need to create specific geothermal legislation to replace existing mining legislation, which must be adapted in ways previously unforeseen to accommodate the nature of the resource. Human capacity inadequacies and institutional weaknesses must also be remedied.

6.3.1 SREP Funding Objective

The geothermal development project aims to catalyse the generation of about 100 MW,[41] developed mainly by the private sector, with public-sector support targeted to overcome the higher-risk phases of development, and thus make geothermal energy a reliable, low-cost, and significant contributor to Tanzania's electric power supply. For that to happen, SREP resources will first be deployed to establish an enabling environment for large-scale geothermal development through capacity building and risk mitigation. SREP co-financing for exploration through test drilling at several promising locations will be provided. It is usually more difficult and costly for the private sector to raise such funds where no precedent has been set for geothermal power projects. Risk mitigation and other forms of financing will also be provided for the power development phase. Beyond SREP funding, significant resources, both public- and private-sector, must be catalysed.

6.3.2 Priority Activities, Implementing Agency, and Outcome

During the first phase, SREP funding will be used to improve the legal and regulatory frameworks, improve power planning capacity, and strengthen institutional and human capacity. The government also plans to use SREP funding to partly mitigate the risks at the resource confirmation and power development stages. This will lower investor risk and the cost of capital, thus making geothermal resources more financially viable at any given tariff level. The proposed priority activities are as follows:

1. **Enabling environment for geothermal development.** This work comprises drafting policy, legislation, and associated regulations for geothermal development; supporting institutional development planning and establishment of relevant organisations and their staffing; capacity building, training, and knowledge and lessons sharing; analysing the economics of geothermal power development, which will provide additional information for including geothermal in the updated Power Sector Master Plan. Along with the SREP, various donors, including the Icelandic International Development Agency (ICEIDA), Nordic Development Fund (NDF), JICA, BGR, and DFID, have expressed interest in supporting this work. Development of the adequate enabling environment will be done in the context of broader sector reforms that aim at resolving TANESCO difficulties and facilitating private-sector investment.
2. **Geothermal resource assessment and feasibility studies.** These activities comprise satellite imaging and resource identification of high-potential sites supported by JICA to select from 3–5 fields for further in-depth investigation. Pre-feasibility studies based on conceptual models of the field will be undertaken, along with assessing suitability based on

[41] It is critical to understand that, based on the nature of geothermal power development, the project will be phased, and each phase's success will depend on the previous one. The project is expected to lead to the generation of about 100 MW; obviously, however, this will depend on the results of the exploration drilling phase.

environmental and social factors and project economics. For sites evaluated as promising,[42] an exploratory well-drilling programme will be prepared and, with SREP support, test well drilling will be undertaken by an expert firm contracted on a competitive basis. Where resources are confirmed, feasibility studies will be prepared.

3. **Power generation project development.** If and only if resources are confirmed, the SREP will support designing or complementing risk-mitigation instruments, as well as co-financing options offered to successful bidders.[43] Transaction advisory services will be offered to bid the promising sites to the private sector under PPP or Build-Own-Operate arrangements.

4. **Power project investment and operation.** In this second stage, SREP and MDB support will be sought to establish a risk mitigation facility to cover delayed payment risk of TANESCO. Long-term financing may also be offered, as needed. It is expected that most of the financing at this stage will come from private-sector investment and commercial banks; through a PPP, the private sector will co-invest in and operate the power project and sell power to TANESCO.

The lead national implementing agency will be the Ministry of Energy and Minerals (MEM), while the African Development Bank (AfDB) will be the lead MDB. The expected outcome of this process is a PPP project that has successfully developed, constructed, and commissioned the operation and maintenance of about 100 MW of geothermal power supplying about 700 GWh per year to the national grid (if resources warrant this at the exploration phase).

6.4 Renewable Energy for Rural Electrification Project

The vast majority of Tanzania's rural population—three-quarters of all residents in the country—are off-grid. To support equitable rural development and improve the rural economy and quality of life, the government has committed to an aggressive rural electrification programme. As previously mentioned, the PSMP 2012 Update anticipates 50 percent electricity coverage by 2025 and 75 percent by 2035. Rural electrification is more challenging than providing electricity to urban areas. It affects many more people; and because of low population densities and widely dispersed settlements, it comes at a high cost (whether grid or off-grid) even though rural people are least able to afford it.

Rural access to electricity will need to be accomplished using a combination of grid extension, mini and micro grids, and stand-alone PV systems. A preliminary investigation, which has mapped the population distribution in relation to the medium-voltage grid network and characterised it by density, has identified those groups best served by extension of the TANESCO grid, mini grids, and solar PV micro grids and stand-alone systems. The mini grids may be powered by a range of energy sources, such as small hydro, biomass, biogas, solar, wind, as well as hybrid systems.

The Rural Electrification Investment Prospectus shows that about 46 percent of rural residents live close to the grid, 20 percent far from it but in high-density population areas, and 33 percent far away in low-density settlements (Table 7). The prospectus will develop an investment plan for the least-cost grid electrification roll-out, and identify those load centres and geographic areas for which off-grid electrification is the least-cost option.

[42] It is anticipated that exploratory well drilling will be done for 2–3 sites, in accordance with the results of the identification phase.

[43] Additional support from donor supported facilities, such as the East Africa Geothermal Risk Mitigation Facility or Green Africa Power Facility, will be sought at this stage.

TABLE 7 RURAL COMMUNITY CHARACTERISTICS AND INDICATIVE ELECTRIFICATION OPTIONS: PRELIMINARY SCREENING

Characteristic	Population, 2012 (thousands)	Percent	Estimated number of households, 2012 (thousands)
TANESCO grid extension			
Up to 2 km from electrified settlement	10,217	23	2,085
Close to grid, low density	4,330	10	884
Close to grid, high density	6,050	14	1,235
Grid-connected subtotal	**20,597**	**46**	**4,204**
Mini grid			
Far from grid, medium density (125–250 residents/km^2)	4,737	11	967
Far from grid, high density (250–1,000 residents/km^2)	3,848	9	785
Very far from grid, very high density (> 1,000 residents/km^2)	522	1	107
Mini-grid subtotal	**9,108**	**20**	**1,859**
Stand-alone			
Far from grid, low density (< 125 residents/km^2)	14,902	33	3,041
Stand-alone subtotal	**14,902**	**33**	**3,041**
Total	**44,607**	**100**	**9,104**

Source: IED, Preliminary GEO-SIM mapping for the REA Rural Electrification Investment Prospectus, January 2013.
Note: Assumptions are that population growth rates remain at 2.9 percent per year, population distribution remains unchanged, and the average household size is 4.9 persons. Estimates are preliminary as the study is ongoing.

6.4.1 KEY CHALLENGES

SREP support will help to demonstrate that renewable energy for off-grid electrification is indeed a readily-scalable option. Without such demonstration effect, the risk is that, in the face of development priorities and political pressure to rapidly expand coverage, the government would be forced to choose second-best options, such as diesel generators or extending grids to non-viable areas, thereby increasing costs and transmission and distribution losses and possibly adding more fossil fuel–based power plants.

Mini Grids

The TEDAP project and SIDA capacity-building activities have already created a favourable environment that has spurred development of the first mini grids in Tanzania. The project has successfully demonstrated that private-sector driven, renewable-energy mini grids are viable electrification options. But the pace of mini-grid development is still too slow to achieve the scale-up intended by the SREP. Therefore, it is necessary to (i) continue expanding the existing TEDAP instruments that have proven successful, (ii) adapt those instruments not viewed as adequate for achieving the intended scale-up, and (iii) develop new instruments that can address the remaining market barriers.

The main challenges facing the rapid deployment of mini grids are as follows:

Inefficient and costly project preparation: Currently the costs and time associated with developing viable, scale-able mini-grid projects and business models is excessive, and will put at risk

achievement of Tanzania's 2025 goal. Developers of small projects rarely can afford the cost of employing the high-quality design services that are required, and there is insufficient data on renewable energy resources and demand side dynamics—much of which constitutes a public good and is thus most efficiently provided for the sector as a whole. The current TEDAP matching grant support helps developers to cover a part of their pre-investment costs, but does not address the critical capacity gaps of the consultants who often even lack capacity to fill in properly the matching grant applications. TEDAP-linked SIDA trust fund for capacity building has been effective in providing one-on-one support to the first entrepreneurs for key technical, business development and financial issues, but this support is too transaction intensive and impossible to accommodate a growing number of increasingly diverse set of mini- and micro-grid entrepreneurs. There is a need to establish a more comprehensive and nuanced technical support that would provide targeted services based on the entrepreneur profile and capacities while remaining flexible to accommodating evolving developers' challenges.

Off-take risk. Whilst regulations in Tanzania permit mini-grid service providers to supply electricity to retail customers with a cost-reflective tariff, retail tariff collection is perceived as risky, as the mini-grid model is relatively new and the rural-customer payment culture is still untested. The prevailing business model in Tanzania has been to diversify risk by supplying power to community anchor customers (where available), households, and TANESCO's main or isolated grids (if nearby). However, TANESCO's deteriorating financial situation is resulting in payment delays, which, in turn, are causing cash-flow problems for SPPs, putting the Tanzanian mini-grid model at risk.

Administrative problems. Neither the regulatory nor bureaucratic environment is optimised to make it easier for developers to secure all the rights and permits needed to develop a site. The result is that developments may be slowed or discouraged for non-technical or non-economic reasons. TEDAP and SIDA capacity building succeeded in streamlining and simplifying the regulatory process for small power projects under the EWURA, but developers are still struggling to obtain numerous other permits and approvals needed from various institutions (e.g., business registration, environmental clearances, water rights for small-hydro projects, and land titles). There is a need to work toward simplifying these processes, while, at the same time, providing developers advisory services to better understand how these clearances can be obtained.

Limited investment capital at a high cost. Typically, mini grids are developed and run by small companies whose cost of capital is higher than that of larger companies, including TANESCO. The mini-grids space, while growing quickly, remains nascent; and, as with most SMEs, lending institutions are cautious about providing capital to businesses without a strong operational track record. These factors limit the availability of capital and increase its cost, effectively putting technically and economically viable schemes beyond commercial reach. TEDAP has succeeded in motivating local commercial banks to start lending to the new renewable energy projects through establishing a credit line that provides long-term liquidity to commercial banks and by providing targeted training to the banks to develop capacities in evaluation of renewable energy projects. Access to capital, however, remains an unresolved issue. As the banks still consider renewable energy risky, loans are typically extended at high interest rates with high equity requirements with which developers struggle to comply. Equity investment funds are still rare in Tanzania.

Stand-Alone Solar PV Systems

Like mini-grid service providers, those who run stand-alone solar PV systems face the difficulties of payment collection from customers and access to financing. They also face several unique challenges. For example, the remote and dispersed nature of customers raises the cost of doing business. In

addition, assuring and supplying quality products is difficult (e.g., there may be competition from unscrupulous vendors who pass off poor-quality products at low prices). Furthermore, it is a challenge to retain trained staff in remote areas. As previously mentioned, various development partners are working with the REA and other government agencies to overcome these hurdles through capacity building, awareness-raising activities, innovative financing, and more suitable business models. For example, the Sustainable Solar Market Package (SSMP) model, supported by TEDAP, aims at overcoming some of these challenges through (i) bundling provision of larger institutional systems with marketing of smaller ones for households in the same geographic area, thereby exploiting economies of scale and reducing costs of service provision; (ii) linking the subsidy payment to products that comply with technical specifications and quality criteria, and (iii) providing incentives for the private sector to develop innovative credit/payment schemes that would make solar home systems (SHSs) more affordable for households. However, the model is relatively new, requiring continued monitoring, fine-tuning, and capacity building to achieve its full potential.

6.4.2 GOAL AND OBJECTIVES

The SREP Renewable Energy for Rural Electrification Project aims to (i) build an efficient and responsive development infrastructure for renewable energy-based rural electrification, and (ii) demonstrate its effectiveness by supporting a time-slice of private-sector investments in off-grid electricity enterprises. The target is to extend electricity service generated from renewable energy to some 400,000 households or approximately 2 million off-grid rural customers (assuming 4.9 persons per household) through mini and micro grids and SSMPs that benefit both women and men.

The project will offer transaction advisory services, financing, and risk mitigation for 25 renewable-energy mini grids and 50 micro grids to directly benefit an estimated 47,500 households and 10 SSMP projects to directly benefit an estimated 70,000 households. In addition, the project will provide transaction advisory services to prepare a pipeline of 250 mini grids and micro grids and another 30 SSMPs to benefit a total of 325,000 households (Table 8), for which the government will seek additional financing outside of the SREP.

It is expected that a range of renewable energy technologies will be used to meet electricity needs, depending on the renewable sources available in the particular locality and community characteristics. The options for mini grids include small hydro, solar, biomass, biogas, and wind. In certain locations, hybrid solutions (including the use of batteries and small amounts of diesel [e.g., to generate 10–15 percent of electricity]) may be appropriate in order to provide the required levels of availability at least cost. Micro grids and SSMP stand-alone systems will primarily use solar PV.

TABLE 8 RENEWABLE ENERGY FOR RURAL ELECTRIFICATION TARGETS

SREP off-grid targets			
Investment	**kW unit**	**Number**	**Total MW**
Mini grid	1,800	25	45.0
Micro grid	6	50	0.3
SSMP		10	
Public facilities	0.18	4,400	0.8
SHS	0.02	70,000	1.4
Total			**47.5**
Project beneficiaries			
Investment	**Number of projects**	**Households and other customers**	
Mini grid	25	37,500	
Micro grid	50	10,000	
SSMP	10	70,000	
Project pipeline			
Mini grid	50	75,000	
Micro grid	200	40,000	
SSMP	30	210,000	
Total	**280**	**442,500**	

Note: Number of household beneficiaries assumes a household size of 4.9 persons, based on the Rural Electrification Investment Prospectus. The prospectus goal for share of off-grid electrification is 12 percent. The typical facility size and number of beneficiaries are based on experiences from ongoing REA projects. The mini-grid renewable energy capacity (about 1,800 kW) is expected to serve about 1,500 customers, including households, enterprises, and public-service facilities within villages. Some facilities sell excess electricity to TANESCO. A micro grid may serve about 200 customers. The assumption for number of households and private customers per SSMP is 7,000, based on ongoing REA projects.

6.4.3 APPROACH

Leveraging private-sector investments is at the core of the Rural Energy for Rural Electrification (RERE) Project. Under the current regulatory regime, private and nongovernmental developers can and are encouraged to invest in off-grid energy solutions to supply electricity directly to retail customers, TANESCO, or both. This provision ensures that the government complements, rather than crowds out, the private-sector potential. Addressing barriers to investments through targeted support is expected to further leverage private-sector investment.

This approach is in line with the SREP's objectives, which seek to overcome economic and non-economic barriers that hinder the scale-up of private-sector investment in renewable energy markets. Greater investments in off-grid energy solutions are expected to create the momentum necessary for large-scale replication within and beyond Tanzania and offer lessons to other countries testing similar systems. This approach also ensures long-term economic viability by anchoring private-sector participation in the national energy development plan.

The RERE Project will build on the TEDAP project, as well as other relevant REA and donor initiatives developed in Tanzania (e.g., the AFREA-financed Lighting Rural Tanzania, SIDA-financed solar PV market development activities, and the European Union's support to mini grids). Based on the lessons learned from these activities (see Annex IV for the TEDAP project lessons), the REA is proposing a set of components that will (i) scale-up successful instruments, including a credit line and performance grants and (ii) develop new instruments to target the remaining barriers.

It is expected that scaling up existing instruments will be financed primarily by the proposed World Bank Group (WBG) and other donor co-financing, as both the credit line and performance grants are relatively well developed and tested and fit well into the WBG and donor energy-sector assistance plans. SREP funding will focus on addressing the remaining market barriers in order to act as a vehicle for market transformation. The SREP components (described in more detail in Annex I [RERE Project concept]) thus include the following:

Transaction Advisory Services. In the past, the delivery of transaction advisory services has been time consuming, constrained by limited human capacity and delays in obtaining services on a project-by-project basis. The SREP will overcome these problems by setting up a world-class Transaction Advisory Services Facility (TASF) to provide firm-level support for pre-feasibility and feasibility studies, regulatory compliance, technical design and evaluation, procurement, preparation of business plans and models, financial and economic modelling, market and risk assessments, and financial closure. The key ingredient for success will be committing to a large volume of business to attract highly reputable experts with a significant depth of expertise and providing high-quality public goods (e.g. market and resource data) in an efficient manner, such that all developers benefit equally and can focus their limited human and financial resources on operations.

The services will be designed in such a way that they close general market gaps and also respond to particular needs of various company types—ranging from small-scale local entrepreneurs and cooperatives, who often lack basic technical and business skills, to larger international companies, who bring technical skills but lack knowledge of local markets, sociocultural conditions, and regulatory processes. The TASF services will be competitively awarded to reputable service providers, and particular attention will be paid to leveraging local expertise to ensure that advisory services are rooted in local know-how and to promote longer-term development of local capacity.

This component will be implemented by the International Finance Corporation (IFC).

For SSMPs, the transaction advisory service component, managed by the REA, will focus on the design of 10 SSMPs to be directly financed by the RERE Project and 30 additional packages for scaled-up financing beyond the SREP.

Investments. The majority of investments in the RERE Project are expected to come from SREP co-financing provided by the WBG, expected to focus mainly on the credit line; the REA; development partners, expected to focus primarily on mini-grid performance grants; and the private sector and commercial banks. The SREP investment will be used mainly for testing new performance-based incentives for micro grids and co-financing SSMPs, which will bundle infrastructure for key public and community services (e.g., schools, clinics, and street lighting), with incentives for marketing SHSs to households and businesses in pre-identified off-grid areas.

Risk Mitigation. This is a new area previously not covered by TEDAP. The Project Preparation Grant (PPG) will be used to develop instruments covering the most detrimental risks, such as TANESCO's off-taker risk. For example, SREP funds could be used to establish a letter of credit, which could provide liquidity to project developers in the case of late payments. This letter of credit would ideally be backed up by a partial risk guarantee, potentially financed through WBG co-financing. In addition, the PPG will explore whether design of the new credit line should also include any risk mitigation factors; currently, the credit line is extended on commercial terms and does not include any guarantees or risk-sharing elements.

Capacity Building. The REA will be the main focus of the SREP's capacity-building component; however, other key stakeholders, including TANESCO, EWURA, and NEMC, will also be included. As the number of projects to be developed increases, capacity building is needed to expand the cadre of people with the necessary expertise. In addition, following successful experience under TEDAP and SIDA TF, the SREP will continue providing capacity building to local commercial banks to strengthen their comfort with lending to renewable energy projects. The SREP will also build on the World Bank/AFREA–supported Gender and Energy Program to implement the REA's Gender Mainstreaming Action Plan (Box 1). The REA will use these gender mainstreaming tools, checklists, and indicators developed under AFREA and will adapt them for SREP use throughout the project cycle. The knowledge and lessons that emerge during RERE Project implementation will be captured and disseminated both within and outside Tanzania.

Programme Management. The REA will have lead responsibility for programme management. As the scale and pace of development grow, the REA will need to increase its staff and streamline its operations and information systems in order to handle the increased volume of transactions and be client-responsive. M&E and reporting to national stakeholders, development partners, and SREP management will be undertaken as required.

Lead Implementing Agency and MDB. The REA will serve as the lead national implementing agency for the RERE Project (other than TASF mini-grid facility), while the WBG will serve as the lead MDB. The IFC will be the implementing agency for the TASF mini-grid activity.

6.5 PROGRAMME CO-BENEFITS

The direct impact of the SREP-Tanzania Investment Plan will be to engage the country in the large-scale development of renewable energy. The SREP will have a direct, positive impact on the living conditions of the Tanzanian people and the productivity of their economic activities, also ensuring a reduction in GHG emissions, which will contribute to improving climate resilience and adaptation of productive agricultural areas.

In a development paradigm in which social and environmental benefits are inextricably linked, the SREP-Tanzania will help to:

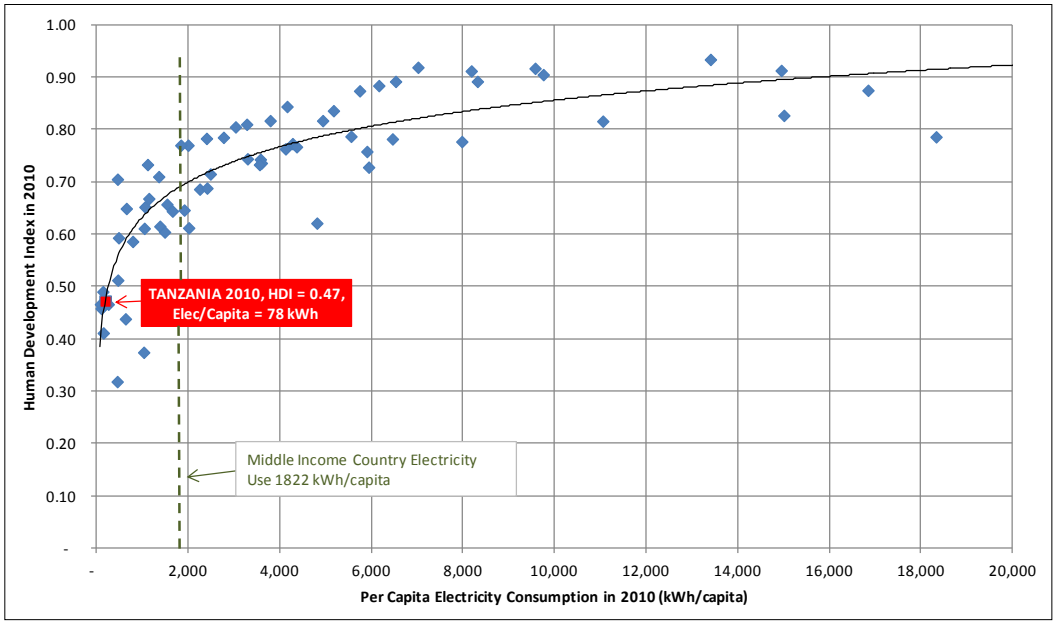
- Reduce the exploitation of non-renewable energy sources by increasing the share of renewable energy in the national energy mix;
- Reduce GHG emissions due to the use of fossil fuels;
- Maximise economic development opportunities, including the creation of new economic activities and jobs related to new technologies with private-sector participation;
- Improve rural people's quality of life through household and institutional access to electricity; and
- Improve gender equality.

Implementing these investments will yield significant benefits. Key among them are the following:

- Reduced dependence on fossil fuels and thus lower energy bills.
- Better availability of political, administrative, and regulatory information capable of attracting foreign investment.

- Reduced levels of poverty. Tanzania's National Development Vision 2025 and National Energy Policy of 2003 recognise the strong positive relationship between electricity use per capita and human development. Currently, the country ranks low in terms of both per capita electricity use and its Human Development Index (HDI) (Figure 18). In the quest to improve Tanzanians' living conditions and reach middle-income status by 2035, the government recognises improved access to and greater use of electricity as a key enabling condition. The SREP will support this effort in an environmentally sustainable way.

FIGURE 18 RELATIONSHIP BETWEEN HDI AND ELECTRICITY USE PER CAPITA, 2010



Sources: UNDP and World Bank databases.

- Greater private-sector participation. The SREP will strengthen the participation of private-sector operators in renewable energy production through (i) initiatives to build their technical and organisational capacity in the energy sector and (ii) better legal and regulatory arrangements that engage the private sector in a meaningful way.

- Improved socioeconomic status of women. The SREP initiatives will contribute to enhancing women's quality of life by reducing the time they allocate to household chores, improving their access to modern energy for income-generating activities, and increasing their access to modern forms of communication. In rural communities, the availability of electric lighting and other energy services can lead to better education, health, and public security, especially for women and children. Once a community has electricity, a wide range of income-generating activities opens up for women (e.g., ice-making and food-processing businesses, small retail shops, and restaurants).

6.6 ADDITIONAL DEVELOPMENT ACTIVITIES

Development activities supported by the development partners that can complement or supplement the SREP investments in geothermal development and renewable energy for rural electrification include the following:

Geothermal Development

- The British High Commission and the AfDB have supported a workshop on development of the legal and regulatory framework that would lead to preparation of the Geothermal Development Roadmap.
- The DFID has expressed interest in supporting the SREP Geothermal Development Project.
- JICA has confirmed that it is supporting satellite and ground-based geothermal resource screening in various potential areas throughout Tanzania. The agency has expressed interest in supporting the SREP Geothermal Development Project by conducting pre-feasibility studies of promising sites to identify areas suitable for exploratory drilling.
- Germany (BGR/KfW) is supporting capacity building and resource assessment in the geothermal sector.
- ICEIDA/NDF, USAID's Geothermal Partnership, and UNEP can provide additional capacity building for staff in charge of geothermal development.

Renewable Energy for Rural Electrification

- NORAD is funding preparation of the Rural Electrification Investment Prospectus, which will help guide the selection of communities and areas targeted for off-grid electrification. NORAD is also expected to provide the equivalent of about US$120 million in funding to the REA-managed Rural Energy Fund (REF). The first phase is expected to finance primarily grid extension. NORAD, however, has expressed interest in participating in co-funding the SREP mini-grid/off-grid component.
- The World Bank's TEDAP supports small power projects, including mini-grid and stand-alone electrification. It has helped to develop the regulatory framework for small renewable power, built capacity in renewable-energy project development and financing, demonstrated low-cost electrification methods, and supported investments in mini grids and stand-alone solar electrification. The project's closing date is March 2015.
- SIDA currently supports the REF, with most of its funding for grid extension. It expects to provide additional REF funding, and in that context, has expressed interest in supporting the SREP-Tanzania RERE Project. SIDA is also financing a World Bank-administered trust fund for energy access and regulation, providing technical assistance and capacity building to the REA and EWURA. This trust fund, among others, is providing support to EWURA for fine-tuning and enhancing the SPP regulatory framework.
- The Africa Renewable Energy Access Programme (AFREA) supports the REA in gender mainstreaming activities.
- Additional donors are considering supporting rural electrification. Amongst these, the DFID and the EU have expressed a potential interest in collaborating on the SREP framework once their funding commitments are confirmed.
- The EU, along with the Energy Sector Management Assistance Programme (ESMAP), is planning to fund renewable-resource mapping, covering solar, wind, mini hydro, and biomass. This information will be essential for developing off-grid renewable energy projects under the SREP-Tanzania.

The coordination of these activities is carried out by the REA, the national agency in charge of planning and facilitating both grid and off-grid electrification. This coordination will be facilitated by the Rural Electrification Investment Prospectus, which the REA is developing with NORAD funding, and which is expected to be completed by July 2013. The prospectus will provide the least-cost path toward reaching the government's electrification targets, integrating grid and off-grid investments. In that context, the SREP would not only be coordinated with other off-grid programs but also with the REA's grid extension program.

There is a successful track record of donor cooperation supporting the REA. The World Bank, SIDA, and NORAD have established a close coordination mechanism. For example, they jointly monitor development of the Rural Electrification Investment Prospectus. World Bank is administering SIDA TF providing technical assistance and capacity building to the REA and EWURA, and there is a precedent of joint financing of REA programs (e.g., SSMPs).

Other development partner activities that complement or supplement both SREP investments including the following:

- The World Bank Board approved the IDA-financed, US$100 million Tanzania First Power and Gas Development Policy Operation in March 2013. The first of the expected three tranches will primarily help TANESCO bridge its financial gap, reduce the cost of power supply, and promote private-sector participation in the power sector. To complement the World Bank development policy loan, the AfDB is considering supporting energy-sector reforms. By the time implementation of the SREP-funded projects gets under way, the financial health of TANESCO is expected to have improved.
- The EU is supporting development of the Biomass Energy Strategy Tanzania (BEST), designed to improve access to sustainable biomass supplies, including biomass resources for power development.
- NORAD is supporting capacity building in the operation and maintenance of hydropower plants.
- The World Bank, with funding from DFID, is carrying out a study aimed at estimating the impact of climate change on hydrology. NORAD is also cooperating with the MEM and TANESCO on the mapping of hydropower resources.A proposed AFD credit line for rural and renewable energy could co-finance investments in mini grids.
- Additional donors, including USAID and kFW, are considering financing rural and renewable energy; however, the scope and amounts are still to be confirmed. These activities will be coordinated with the SREP once details are known. Finally, the Millennium Challenge Corporation (MCC) has approved a second MCC compact for US$400–500 million, with specific investments to be agreed on with the government.

7 FINANCING PLAN

The total estimated budget for implementing the SREP-Tanzania Investment Plan is about US$719.3 million. In addition to the US$50 million in requested SREP financing, the programme is seeking contributions from the Multilateral Development Banks (MDBs), private sector, commercial banks, and other development partners. US$45 million is being requested from the African Development Bank (AfDB) to finance the Geothermal Development Project, while US$50 million is being requested from the World Bank Group (WBG) in support of the Renewable Energy for Rural Electrification (RERE) Project.

The ability to mobilise financing from the private sector and commercial banks is critical to the success of the SREP-Tanzania. Table 9 presents the indicative cost estimate, including the required financing and funding sources. Not shown is the investment financing needed for the additional geothermal power projects beyond the first 100 MW and the additional pipeline of mini grids and SSMP projects to be prepared under the RERE Project.

Co-financing is tentative and will be confirmed during the project preparation phase. It is the understanding of the Government of Tanzania that these requests are subject to confirmation by the management of the MDBs and development partners.

The financing modalities of the projects to be supported will likely include a combination of grant, concessional loans, and guarantees. The modalities will be determined during project preparation, in accordance with relevant SREP guidelines and MDB procedures. The financing instruments selected will ensure that, by lowering capital investment costs, the projects will be able to attract co-financing by private- and public-sector partners.

With the carbon-finance sector in flux and certified emission reduction (CER) credits at historically low values, the SREP-Tanzania had decided not to seek carbon financing for these projects beyond the Programmatic Clean Development Mechanism (CDM) facility for capitalizing carbon payments, which the REA is developing for presentation to the World Bank's Carbon Partnership Facility (Box 6). However, should CER prices improve, individual SPPs may also decide to seek carbon financing from a broader array of sources.

BOX 6 THE REA'S CDM PROGRAM OF ACTIVITIES

The REA is developing a CDM program of activities (PoA), which is expected to generate carbon revenues for participating project developers. Given the continued challenges for developers to meet high equity requirements from commercial lenders, the REA is planning to develop a revolving facility. Initially capitalized by a US$6.5 million grant from the ESME program financed by the Government of Russia, the facility would advance a portion of expected carbon revenues to the project developer at the time of financial closure and would be later replenished from the carbon market.

The REA is in discussions with the World Bank's Carbon Partnership Facility to set up such a scheme, but the ERPA has not yet been negotiated. The scheme would be fully consistent with and complementary to the RERE Project by providing much needed equity finance to project developers while RERE investments would focus on broader enabling conditions, including transaction advisory services and capacity building, risk mitigation, and a long-term re-financing facility for commercial banks and performance-based connection grants. Including the REA's carbon finance programme is not likely to change the financing plan; rather, it would accelerate project developers' ability to mobilize the equity financing. But given current prices of GHG emission reductions, the contribution of carbon finance to overall project costs would be relatively small.

TABLE 9 SREP INDICATIVE FINANCING PLAN

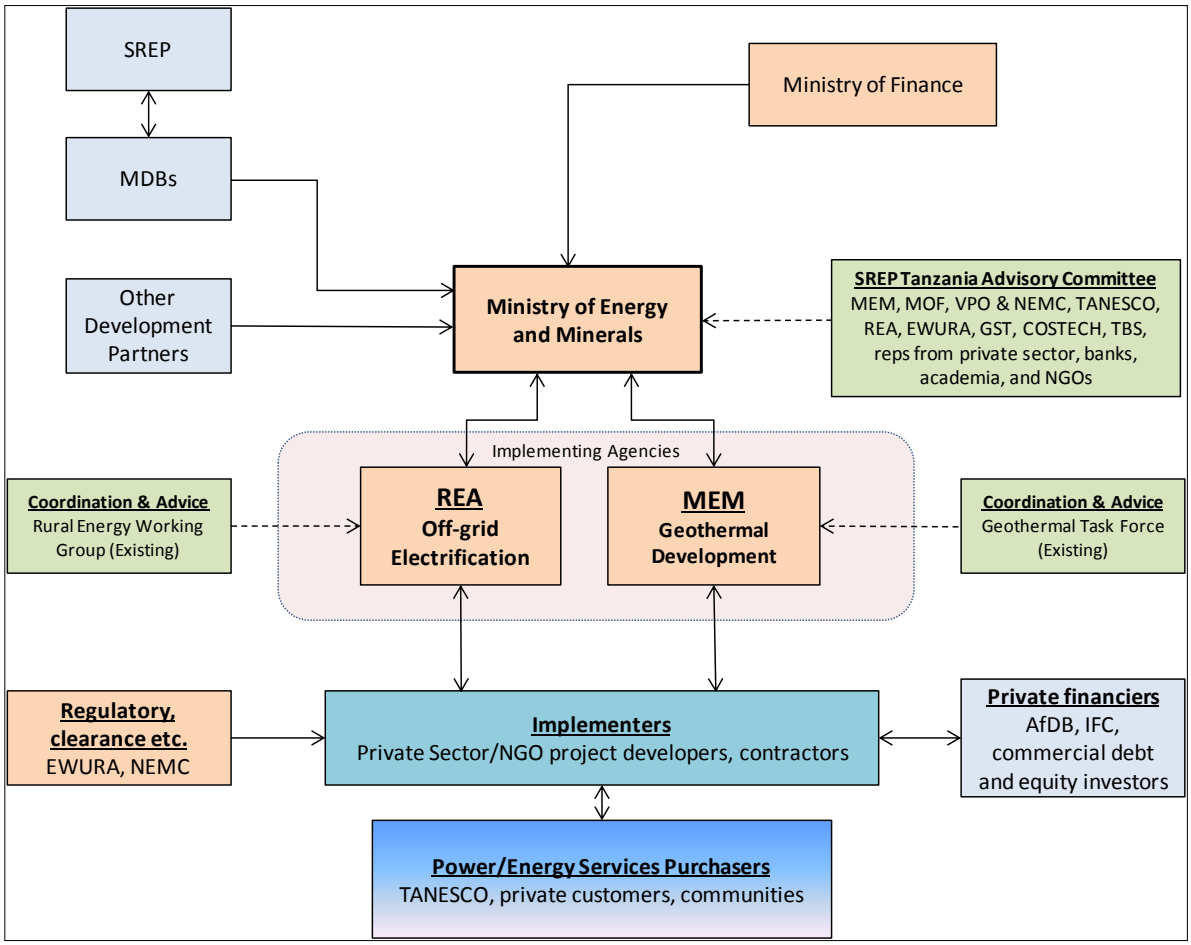
Thousands of US dollars

SREP Project	SREP	Government of Tanzania	World Bank Group	AfDB	Private Sector	Commercial Banks	Other Development Partners	Total
Geothermal Development								
Project Preparation Grant	700	-	-	-	-	-	-	700
Geothermal Strategy, Legislation, and Capacity Development	2,300	1,500	-	-	-	-	2,300	6,100
Geothermal Resource Confirmation and Feasibility Studies of Promising Sites	20,000	-	-	-	-	-	3,000	23,000
Power Generation Project Development and Transaction Advisory Services	2,000	-	-	-	-	-	-	2,000
Investments in 100 MW Production Wells, Steam Field, and Power Plant Projects	-	-	-	15,000	142,500	317,500	-	475,000
Risk Mitigation Facility	-	-	-	30,000	-	-	-	30,000
Subtotal: Geothermal Development	**25,000**	**1,500**	**-**	**45,000**	**142,500**	**317,500**	**5,300**	**536,800**
Renewable Energy for Rural Electrification								
Project Preparation Grant	1,000	-	-	-	-	-	-	1,000
Mini- and Micro-Grid Component								
Transaction Advisory Services	4,750	-	-	-	500	-	-	5,250
Capacity Building	1,000	-	-	-	-	-	-	1,000
Programme Management	500	200	-	-	-	-	-	700
Investment in Mini and Micro Grids	1,750	-	46,000	-	26,975	26,033	32,743	133,500
Risk Mitigation Facility	7,000	-	3,500	-	-	-	-	10,500
Subtotal: Mini- and Micro-Grid Component	**15,000**	**200**	**49,500**	**-**	**27,475**	**26,033**	**32,743**	**150,950**
Stand-Alone Electrification Component								
Transaction Advisory Services	1,500	-	500	-	-	-	-	2,000
Programme Management	500	200	-	-	-	-	-	700
Investments in Stand-Alone Solar for Public and Private Consumers	7,000	2,000	-	-	3,000	2,000	13,800	27,800
Subtotal: Stand-Alone Electrification Component	**9,000**	**2,200**	**500**	**-**	**3,000**	**2,000**	**13,800**	**30,500**
Subtotal: Renewable Energy for Rural Electrification	**25,000**	**2,400**	**50,000**	**-**	**30,475**	**28,033**	**46,543**	**182,450**
Grand Total: SREP	**50,000**	**3,900**	**50,000**	**45,000**	**172,975**	**345,533**	**51,843**	**719,250**
SREP Leverage	**13:1**							

8 INSTITUTIONAL FRAMEWORK FOR IMPLEMENTATION

The Ministry of Energy and Minerals (MEM) will serve as the lead government agency and counterpart for oversight of SREP implementation. The Government of Tanzania will utilise other existing ministries and institutions, which will be suitably strengthened to implement the programme. In this way, the institutional capacities that are built will extend beyond the life of the programme (Figure 19).

FIGURE 19 INSTITUTIONAL ARRANGEMENTS FOR SREP IMPLEMENTATION



The MEM's Permanent Secretary will appoint the SREP Programme Coordinator to manage the overall programme and an Advisory Committee to provide guidance. Committee members are drawn from the following key public- and private-sector institutions: MEM; Ministry of Finance; Vice President Office, Environment-Designated National Authority; Rural Energy Agency; Tanzania Electric Supply Company; Energy and Water Utilities Regulatory Authority (EWURA); Geological Survey of Tanzania; Tanzania Commission for Science and Technology (COSTECH); National Environmental Management Council (NEMC); Tanzania Bureau of Standards (TBS); Civil Society Foundation; University of Dar es Salaam, Geology Department; Tanzania Traditional Energy Development Organisation; Tanzania Renewable Energy Agency (REA); Confederation of Tanzania Industries; Tanzania Private Sector Foundation; and Tanzania Bankers Association.

The MEM will have lead responsibility for implementing the Geothermal Development Project, while the REA will be in charge of implementing the Renewable Energy for Rural Electrification (RERE)

Project, except the mini-grid Transaction Advisory Services Facility (TASF) activity, which will be implemented by the IFC. The MEM and the REA will prepare operating plans and budgets; undertake procurement and financial management; recruit and supervise consultants and contractors; undertake communications and outreach; and guide capacity building, including knowledge management; and report on progress. The ministry will benefit from the advice of the Geothermal Task Force, and will call for guidance from a group of international experts (e.g., from the U.S., New Zealand, and Iceland) to be formed during the project preparation phase. The REA's performance in implementing SREP activities will be overseen by the REA Board. In addition, the agency will call on the existing Rural Energy Working Group for advice and to facilitate inter-agency cooperation.

The private sector will play a critical role in both SREP Projects, as follows:

- *Geothermal Development*. SREP financing will facilitate private-sector entry by putting in place the appropriate policy and legal and regulatory framework and by financing higher-risk phases of implementation (e.g., test drilling). It is expected that the private sector will enter at the Independent Power Producer (IPP) development phase to provide the technical know-how and financing for development of geothermal power.
- *Renewable Energy for Rural Electrification*. The purpose of the project is to support private sector–driven rural electrification approaches, focusing on renewable-energy mini grids and stand-alone PV systems. The mini grids and micro grids are expected to be operated by private-sector operators, including business-oriented NGOs and cooperatives, which are expected to invest equity in these projects and seek commercial loans from financial institutions. Institutions that already operate renewable energy generators for own use and now seek to sell the power to retail customers will also be considered. The SSMPs will also be contracted to private companies, which will be expected to electrify public facilities and commercially market solar home systems (SHSs) in their designated areas. Implementation of the TASF would also be competitively awarded to a private-sector service provider.
- The EWURA will fulfil its traditional responsibilities as regulator. TANESCO will purchase power from privately developed and operated, small-renewables projects under the SPPA programme and, where required, will supply bulk power to the mini grids interconnected with its network when mini-grid generation is in deficit. Larger geothermal projects will follow existing IPP approaches.

The lead implementing MDBs for the SREP, as previously mentioned, are the African Development Bank (AfDB) (Geothermal Development Project) and the World Bank Group (RERE Project). Within the RERE Project, the International Finance Corporation (IFC) will lead implementation of the TASF for the mini- and micro-grid components.

The World Bank has conducted procurement and financial management reviews of the MEM and REA as part of ongoing projects and has found them suitable. The AfDB will shortly undertake the same for the MEM to ensure that financial management and procurement procedures are in compliance with AfDB requirements; if need be, some capacity-building activities for procurement and financial management will be undertaken, with support from AfDB field-office specialists in Dar es Salaam. The Government of Tanzania will engage, as needed, with the MDBs to review capacities in cases where personnel or institutional structures have changed. In addition, partnership agreements will be established between the MEM and the stakeholders involved in project implementation. These agreements will help to verify performance of the intervening parties and their compliance with

respective obligations. The agreements will also help to establish annual planning of activities to be conducted, depending on the structures, budgets, and procurement plans.

9 ENVIRONMENTAL AND SOCIAL ASPECTS

The two lead implementing entities—the MEM and the REA—have undertaken numerous lending and technical assistance projects with the World Bank and the AfDB. As such, they have policies and procedures in place to ensure compliance with the Government of Tanzania, the World Bank, and AfDB social and environmental safeguards. In addition, IFC Performance Standards and its policies on social and environmental sustainability will be appropriately applied. Specific arrangements are as follows:

Environmental and Social Management Framework (ESMF). Since specific locations of investments will be determined during project design, an Environmental and Social Management Framework will be prepared that defines the environmental and social (E&S) planning, review, and clearing processes that follow national and MDB guidelines.

Resettlement Policy Framework (RPF). This framework will establish the modalities for conducting resettlement action plans (RAPs) and outline components that must be integrated, such as legal frameworks, eligibility criteria, methodology for asset valuations, and mechanisms for stakeholder consultations.

The REA has developed a ESMF and RPF for implementing the Tanzania Energy Development and Access Project (TEDAP), including a simplified guide for project developers. The agency's performance has been satisfactory. It is expected that this framework, updated to reflect lessons learned under the TEDAP, can be applied to the SREP Renewable Energy for Rural Electrification (RERE) Project.

Environmental and Social Assessments. For each SREP component to be undertaken, separate, comprehensive E&S assessments must be conducted. These must include detailed studies aimed at uncovering the particular E&S impacts of each subproject. The studies include an Environmental and Social Impact Assessment (ESIA), an Environmental and Social Management Plan (ESMP), and a full or abbreviated RAP.[44] Adequate stakeholder consultations must be undertaken and guide the development of the E&S studies. Additional specialised E&S management plans and/or initiatives may be required to better address the impacts associated with a given subproject. Preparation of detailed E&S studies must adhere to Tanzanian laws and regulations, as well as the E&S policies, guidelines, and standards of the MDBs.

Responsibilities. Subproject operators are responsible for compliance with national law and regulations and the E&S policies, guidelines, and standards of the MDBs. These operators are also responsible for preparing the required detailed E&S studies (e.g., ESIA, ESMP, and RAP), obtaining clearances, implementing all required mitigation and monitoring measures, providing adequate budgets to sustain these activities, and complying with any directives issued by the relevant parties.

The detailed E&S studies must be submitted to both the NEMC and the MDBs for review and approval. NEMC approval is based on Tanzanian laws and regulations, while that of the MDBs is based on their respective E&S policies, guidelines, and standards. The NEMC will be responsible for the review and clearance of ESIAs and ESMPs for subprojects. It provides a one-stop clearance process by involving all other key governmental agencies in the approval process.

[44] The type of RAP will depend on the number of persons affected by resettlement effects experienced as a result of the project.

The MEM and the REA have overall responsibility for implementing the ESMPs, RPFs, and any specialised E&S management plans and/or initiatives developed for the subprojects.

The EWURA is the licensing authority; as such, it will not issue licenses to operators until the NEMC or other relevant authorities issue E&S clearances.

Stakeholder Consultations. The ESMF contains detailed checklists and generic mitigation measures to ensure that potential impacts are addressed in E&S assessments and subproject management plans. In preparing the required detailed E&S studies (e.g., ESIA, ESMP, and RAP), the subproject operators must adhere to the requirements for ensuring that participatory stakeholder consultations are captured in the E&S policies, guidelines, and standards of the MDBs. Project-affected people and other critical stakeholders must be informed and consulted about the nature, timing, and scope of the relevant project impacts and mitigation measures. Participatory approaches must be utilised in organizing and conducting the consultations. Gender considerations must also be factored in (Table 10).

Capacity Building. The TEDAP project and SIDA Trust Fund for access expansion and regulation have carried out numerous workshops and other capacity-building activities for key stakeholders, including the REA, NEMC, district officers, and project developers. It is expected that these improved capacities will facilitate the implementation of safeguards instruments under the SREP. Similar capacity-building activities will be carried out under the SREP.

TABLE 10 SUMMARY OF ANTICIPATED ENVIRONMENTAL AND SOCIAL IMPACTS

Project type	Major E&S concerns
General	Influx of foreign workers or workers from other localities. Resettlement of people. Construction of roads, well pads, and power plants, resulting in the reshaping of topography.
Geothermal Drilling	Soil compaction and damage to vegetation due to equipment. Deposition of waste soil and drilling mud. Air pollution resulting from gas emissions and smoke exhaust from generators, compressors, and vehicles. Adverse effect of steam and spray during well testing on local vegetation, including the scalding of trees and grass. Deleterious effect of dust carried by winds across exposed surfaces.
Waste Sugar Conversion	Waste disposal, pollution control, and safety.
Biomass Energy	Air emissions and loss of soil fertility and organic matter.
Biomass Plantations	Loss of natural habitats and indigenous species, displacement of food or other crops, and introduction of invasive species.
Wind Power	Aesthetics, noise pollution, and bird fatalities.
Mini-Hydro Power	Loss of natural habitat and water-flow disruption and diversion.
Decentralised Solar	Recycling of batteries and parts.

HIV/AIDS and Collaboration with Public Health Sector and Department of Public Works. An influx of workers from other localities raises concerns of social conflict and the risk of spreading HIV/AIDS and other STDs. The project will establish procedures for reporting grievances and lay out mechanisms for conflict management and resolution. In the area of HIV/AIDS, public-awareness and

education campaigns will be undertaken with relevant local health authorities. During construction and operation, the project will ensure adequate training in public safety hazards and adherence to warning signs and strict workplace rules. Prior to commencing work, a compliance monitoring plan will be established.

Environment, Health, and Safety Management System. Subproject operators will design, construct, and operate the project and implement an environment, health, and safety (EHS) management system.

Public Disclosure. Subproject implementation will require communication and consultation with both the Tanzanian stakeholders impacted directly and indirectly by the subproject and other stakeholders within and beyond the project zone of influence. Disclosure of the detailed E&S studies (i.e., ESIA, ESMP, and RAP) must be done in compliance with the public-disclosure requirements of the AfDB and the World Bank Group. Relevant documentation will be made available on the websites of the Government of Tanzania and the MDBs and through additional means.

10 MONITORING AND EVALUATION AND KNOWLEDGE MANAGEMENT

This chapter describes the areas in which the key tools of monitoring and evaluation (M&E) and knowledge management will be strengthened as part of implementing the SREP-Tanzania Investment Plan (IP).

10.1 STRENGTHENING MONITORING AND EVALUATION

The SREP Tanzania will define and implement a M&E system aimed at collecting, analysing, processing, and communicating key information related to programme activities, as well as results, impacts, and lessons learned. To the extent possible, the SREP M&E system will be integrated into the national energy sector's M&E system, whilst helping to remove major bottlenecks through capacity-building activities. The SREP M&E system will also be harmonised with the M&E systems of the proposed investment projects to ensure that data from projects feed into the programmatic M&E system.

During SREP IP preparation, a quick AfDB assessment concluded that the existing sector-wide M&E system lacked the human and technical capacity for handling M&E activities within the Ministry of Energy and Minerals (MEM). The AfDB specialist recommended that the sector-wide M&E framework currently being developed (i) include SREP indicators to facilitate reporting, (ii) improve indicators related to renewable energy, and (iii) put a data collection system in place to obtain baseline information.

Thus, to strengthen the MEM M&E team, the officer in charge of monitoring and reporting on SREP progress at the programmatic level will be expected to perform the following tasks:

- Develop an efficient data collection system and ensure regular data collection;
- Operate the SREP M&E system and fill in the logical framework indicators;
- Recommend ways to improve programme implementation and its transformational impact;
- Determine the potential for Tanzania's further development of renewable energy and the required investments; and
- Document the social, economic, and environmental impacts of project investments and programme activities.

10.2 RESULTS FRAMEWORK

Table 11 summarises the proposed SREP M&E results framework, which is in line with expected outcomes and results. More broadly, the programme's development outcomes are expected to encompass many dimensions beyond those required for monitoring under the SREP guidelines. Amongst others, these include improved reliability of electricity; economic savings to the nation and financial savings to consumers from lower-cost electricity; high-value jobs created in new energy subsectors; less volatile electricity supply and more predictable prices; and an improved enabling environment resulting from the positive experiences of the SREP interventions, which will create the conditions for transformative change in how energy is supplied to the nation.

TABLE 11 SREP RESULTS FRAMEWORK

Result	Indicators	Baseline	Targets by 2020	Means of Verification
SREP Transformative Impacts				
Support low-carbon development pathways by reducing energy poverty and/or increasing energy security.	National measure of energy poverty. Note: This is affected by other far more dominant factors than the SREP, including gas policy and the effectiveness of its implementation.	MEPI[a] = 0.84 Electricity used in 2010: 78 kWh per capita.	MEPI[a] =___ Electricity used (MEM electricity demand forecasts): 350 kWh per capita.	Country-based reporting using household survey data.
	Electricity output from renewables in GWh per year.	370 GWh per year.[b]	~ 2000 GWh per year.	TANESCO and MEM (Energy Development Section).
	Increased annual public and private investments ($) in targeted subsector(s) per country.	0	US$1,000[c] million beyond the baseline.	National M&E system and PSMP implementation monitoring.
SREP Programme Outcomes				
Increased supply of renewable energy.	Increased annual electricity output (GWh) as a result of SREP interventions.	Geothermal electricity output: 0 GWh. Off-grid: 8 GWh per year.[d]	Geothermal electricity output: 700 GWh per year.[e] Off-grid: 178.6 GWh per year.[f]	SREP Projects' M&E systems.
Increased access to modern energy services.	Increased number of women and men and businesses and community services benefitting from improved access to electricity as a result of SREP interventions.	0	Renewable Energy for Rural Electrification Project: ~ 2.2 million.[g] Geothermal Development Project: ~ 7 million.[h]	SREP Projects' M&E systems.
New and additional resources for renewable energy projects.	Leverage factor: US$ financing from other sources compared to SREP funding.	0	Other financing to SREP financing: 13:1.	SREP Projects' M&E systems.
Avoided GHG emissions	Avoided GHG emissions (tons CO_2e per GWh) as a result of SREP interventions.	0	697 345 tons CO_2e per year once SREP projects are operational.[i]	SREP Projects' M&E systems

a. MEPI = Multidimensional Energy Poverty Index.

b. From grid, captive, mini-grid and stand-alone renewable-energy plants (18 MW small hydro, 54 MW biomass, and 6 MW solar).

c. The US$ 1 billion comprises renewable energy investments co-financed by SREP consisting of 100 MW geothermal, 45 MW renewable-energy mini grids, 2.2 MW solar PV, as well as renewable energy investments (excluding large hydro), included in the PSMP.

d. From 6 MWp solar, plus about 27 MW of isolated small-hydro and biomass (mainly sugar bagasse) power plants.

e. 700 GWh from geothermal is the output from 100 MW of geothermal power plants.

f. 178.6 GWh per year is the estimated production from 45 MW of renewable-energy mini grids powered by mini hydro and biomass primarily, as well as 2.2 MW stand-alone solar PV.

g. Electricity access due to SREP-funded physical investments, plus a pipeline prepared by SREP's transaction advisory facility expected to be financed from additional sources.

h. Based on electricity output of 700 GWh per year, assuming PSMP-projected 2020 electricity use of 100 kWh per capita. The number of potential beneficiaries is provided for information purposes as it is understood that about 7 million Tanzanians will only benefit from additional power generation once the geothermal power plant is built and connected to the grid.

i. According to Document SREP/SC.8/4 on the SREP Revised Results Framework, a proxy-based method (emission equivalent based on diesel-generated electricity: 793.7 tons CO_2e per GWh) has been used to measure the co-benefit of avoided GHG emissions.

10.3 Strengthening Knowledge Management and Lessons Sharing

The SREP Task Force identified areas for strengthening knowledge management and information and lessons sharing (ILS). The sections below describe the complementary programme- and project-level activities targeted for SREP implementation.

10.3.1 Programme Level

Raising awareness amongst national and local stakeholders about Tanzania's energy-sector challenges and opportunities for developing the potential of renewable energy is a key element of the SREP-Tanzania IP. The efficient management of knowledge is needed to measure the outputs obtained and share what has been learned with stakeholders at all levels (national and local, other pilot countries, and other countries in the subregion).

To strengthen the Tanzanian government's knowledge management and ILS capacity, the SREP will provide funding support for a dedicated expert to be assigned to the MEM SREP coordination office and the two lead implementing agencies. This expert will work to expand knowledge on renewable energy in Tanzania and ensure that the government benefits from all the needed knowledge resources to implement activities efficiently. The expert will perform the following tasks:

- Support the development and maintenance of an efficient, national-level energy-information system;
- Promote efficient knowledge management and exchange of best practices between projects and with other African countries;
- Ensure a favourable environment for the rapid expansion of renewable energy by promoting a cross-cutting approach aimed at building the capacity of all stakeholders;
- Raise the SREP profile in order to raise additional funds and foster large-scale replication of activities countrywide and in the subregion;
- Communicate SREP results by disseminating outputs at all levels (local, regional, national and international), especially through online posting of knowledge management products;
- Support the management of renewable energy knowledge (i.e., approaches, methods, and lessons) acquired by the SREP;
- Ensure linkage with the Climate Investment Funds (CIF) Administrative Unit and draft regular programme implementation reports intended for the SREP subcommittee;
- Conduct targeted studies, organise consultation workshops, and develop and support dialogue to achieve more efficient project implementation;
- Regularly monitor progress in other SREP countries and share operational management experience; and
- Organise information and exchange sessions with other countries in the subregion to disseminate best practices and the SREP's programme-based approach (e.g., geothermal with Kenya).

Because knowledge management is closely linked to monitoring and reporting on programme results and outcomes, the ILS and M&E experts should work closely together.

10.3.2 PROJECT LEVEL

Knowledge-management and capacity-building activities will also be developed at the project level (Annex I). Specific capacity-building activities will be linked to the renewable-energy technology and business model, which will help in linking proposed investments with the development of local expertise. For example, the Geothermal Development Project will require capacity building in the fields of science (geology, borehole geophysics, and geo-chemistry), engineering (reservoir and drilling), law (contract management and PPPs), and environmental due diligence. Cross-learning could be organised with the Kenyan team under the umbrella of SREP lessons sharing. For the Renewable Energy for Rural Electrification (RERE) Project, capacity building will cover strengthening project design and development, E&S impact assessment and management, project finance, renewable-energy due diligence of commercial banks, and providing state-of-the-art information on developments in renewable energy appropriate to off-grid electrification.

The ILS component will help to draw lessons from the new business models and innovative activities to be adopted in the SREP-supported pilot projects so that similar models and activities can be replicated in other regions of Tanzania and/or other countries. Lessons from project implementation should cover such aspects as assessing the key factors that contributed to success or failure, quantifying some of the co-benefits of renewable-energy development, and identifying areas of the project implementation phase that could be improved.

11 RISK ASSESSMENT

The overall implementation risk of the SREP-Tanzania Investment Plan (IP) is assessed as **Moderate.** Table 12 presents the main identified risks and mitigation measures used to ensure successful implementation of the programme. Appropriate corrective and supportive measures will be put in place during the formulation and implementation of the IP in light of the lessons that will have been drawn from the activities. Guidance from members of the SREP Steering Committee will be actively and regularly sought to ensure that good practices are always adopted.

TABLE 12 MAIN RISKS AND PROPOSED MITIGATION MEASURES

Risk type	Description	Mitigation measure	Residual risk
Technical	• Solar PV and other renewable-energy, mini-grid technologies and geothermal-generation technology may not work as intended.	• Transaction advisory services by experienced and knowledgeable personnel will help to ensure that the technologies selected are appropriate for Tanzanian conditions and the designs suited to site conditions. • The REA provides cost-shared grants to assist developers obtain project design and feasibility assessment support. This practice will continue, but more comprehensively and efficiently. The REA will offer training to national consultants to improve their capabilities. • Detailed feasibility studies and mini-grid and off-grid projects currently under way will provide additional site-specific information and valuable lessons learned for fine-tuning designs. • Geothermal technologies are mature, with decades of experience worldwide. There is rich experience in the region (i.e., Kenya), which Tanzania can easily access.	Moderate
	• Geothermal resources are uncertain. • River/stream flow data quality and adequacy are uncertain. • Hydrology affected by climate change. • Biomass fuel availability can become limited and prices rise after investments are made.	• Geothermal project support is mainly to identify and fully characterise the resource. Expanding the number of locations to be investigated enhances the probability of success. The first undertaking is thorough geo-scientific investigations prior to drilling to mitigate the risk of failure during the high-cost drilling phase. Geothermal exploration remains risky, but less so with SREP support; the geothermal component will be developed in phases, with each phase dependent on the satisfactory outcome of the preceding one (e.g., exploratory drilling will be conducted only after geo-scientific investigations confirm promising potential. • ESMAP resource mapping funds have been obtained for Tanzania to carry out thorough resource measurements for small hydropower and biomass, following an initial assessment of these resources carried out under the European Union–supported IREP project. The resulting resource assessment data will be publically available and is expected to facilitate private-sector investment in small hydropower and biomass projects/mini grids. Additional assessments (such as wind and solar) are also expected to be carried out once additional resources can be mobilised. • Long-term hydropower vulnerability is currently assessed by the DFID-financed, World Bank–managed study, Tanzania Hydropower Vulnerability Assessment. • Other renewable energy resources, stream flow at hydro sites, and biomass fuel availability are reconfirmed during feasibility studies. • Risk of price rise in biomass fuel will be mitigated by project developers having long-term supply contracts for a portion of their fuel needs, as well as directly controlling access to a portion of requirements through their own fuelwood plantations. • TASF will assist developers to assess and mitigate the resource availability risk.	High for geothermal Moderate for hydro and biomass

Risk type	Description	Mitigation measure	Residual risk
	• Maintenance and operation failures.	• Trained managers and operators will be required at all facilities. In off-grid projects, long-term maintenance contracts will be required. Training of technicians will be expanded.	Low
Financial	• Mini-grid and solar off-grid customers have limited ability to pay or will not pay.	• Willingness-to-pay and market studies are undertaken as part of the feasibility assessment phase to evaluate ability to pay. Performance-based grants are provided to increase affordability. Pay-as-you-go metering or microfinance is used to increase affordability. The initial experience in SPP mini grids and micro grids is positive, showing that rural customers are willing to pay for reliable electricity, particularly if they can control their expenses, such as through pre-paid meters.	Moderate
	• TANESCO delays paying for electricity supplied.	• The Government of Tanzania, along with the MDBs and development partners, is keenly aware of this temporary difficulty and is working closely with TANESCO to overcome its problems through improving its liquidity position, pre-conditioned on performance improvements. • Based on the COSS, the EWURA expects to move to a cost-reflective tariff so that, over the next 3–4 years, TANESCO is ensured of being in a stronger financial position. • Both Geothermal and RERE projects plan to establish off-taker risk mitigation facilities.	Moderate to High
	• Lenders have little experience appraising such projects.	• Continue to provide training to commercial banks as due diligence of renewable energy projects.	Low
	•Project developers have limited financial management capability.	• Transaction advisory services and capacity building are provided to overcome these risks.	Moderate
	• The Tanzanian Shilling will depreciate.	• Investors already take into account some degree of currency depreciation risk. The SREP-Tanzania will consider offering guarantees to cover such risks, based on expert advice from the MOFEA and the MDBs.	Moderate
	• Government failed to secure anticipated funding for the proposed projects.	• Co-financing from the MDBs is about to be secured, and other partners and the private sector have already shown interest in co-financing. If the necessary co-financing resources are not secured during the project preparation phase, the projects could be phased, with the first phase benefitting from the secured funding and the second one for scaling up once additional funding is secured.	Moderate

Risk type	Description	Mitigation measure	Residual risk
Institutional	• Limited human capacity for project development and implementation.	• Project development and implementation capabilities will be strengthened.	Low
	• Regulatory and contractual mechanisms are not adhered to or are delayed.	• The EWURA has been an effective regulator in implementing the SPP programme and is embarking on establishing a regulatory regime to facilitate larger renewable-energy power projects. It has issued implementation guidelines for small renewable-energy power projects and is developing retail tariff-setting rules for mini-grid operators. It effectively enforces regulations.	Low to Moderate
	• Clearance and approval are delayed.	• There have been delays in obtaining environmental and other clearances for renewable projects; The MEM and the REA will work with NEMC to remove bottlenecks.	Moderate to High
	• Power-planning capacity gives inadequate consideration to renewable energy development.	• The SREP will support the MEM, TANESCO, and the REA in improving planning processes to incorporate generation from renewable energy, both intermittent and dispatchable technologies. New expansion planning tools will be introduced and capacities of power planners will be strengthened. The REA has already embarked on this process by explicitly including mini grids and stand-alone power systems in preparing the Rural Electrification Master Plan.	Low
Environmental	• Projects have unacceptable environmental impacts.	• All projects must comply with environmental assessments as part of NEMC oversight and clearance procedures. • NEMC requirements, including ESMF, have already been reviewed and accepted by the MDBs in similar projects. Additional requirements pertaining to geothermal exploration will be developed as needed and cleared with the MDBs prior to using MDB or SREP financing for any activity. • NEMC will monitor according to Tanzania's legislation and MDB requirements.	Low

Risk type	Description	Mitigation measure	Residual risk
Social	• Projects have unacceptable social impacts.	• Intensive stakeholder consultations were carried out during SREP preparation and will continue when projects are implemented. • Specific project-level, social-safeguards assessment will be undertaken according to the ESMF, and compensation or other mitigation actions will be taken in accordance with the framework and Government of Tanzania and MDB guidelines. • By providing affordable electricity to more people, the programme will promote greater economic growth and equity, including targeted investment activities in rural areas. A focus on productive energy uses and employment creation is incorporated into the programme design and will target vulnerable groups (women and youth). Design of financial mechanisms under the SREP will take affordability and willingness to pay into account, supported by information, education, and communication campaigns.	Low
	• There could be negative consequences to foreign and outside workers coming into areas for geothermal or mini-grid development.	• The guidelines and procedures that must be followed under the ESMF and close monitoring and supervision by the NEMC, MEM, and REA, as well as MDB specialist staff, will help to ensure that this is minimised and that appropriate and timely corrective actions are taken, as needed.	Low

12 RESPONSIVENESS TO SREP CRITERIA

Tanzania has experienced first-hand the damage that climate change can cause, and its government is committed to taking responsible mitigating actions to reduce the impacts. The SREP offers a unique opportunity to begin the process of transforming the country's energy sector, and the government accepts the responsibility and associated challenges.

The initiatives proposed under the SREP-Tanzania are in the national interest and target two of the country's priority goals. The first is to invest in power generation options that bring diversity and reliability and do so at the lowest economic cost. Geothermal is such a technology once the resource is proven, and the SREP provides the means to prove the resource. The second priority goal is to rapidly increase people's access to electricity services in a manner that is environmentally friendly, avoids the high cost and risk of relying heavily on diesel generation, utilises available resources located near the population to be served, reduces overstretching TANESCO's capacity, and does so at least cost. Given the dispersed nature of many rural communities, renewable energy–based power supplies that deliver electricity services through mini grids and stand-alone systems offer the solution.

Both SREP projects—Geothermal Power Development and Renewable Energy for Rural Electrification—are responsive to the SREP criteria (Table 13).

TABLE 13 SUMMARY OF PROJECTS' RESPONSIVENESS TO SREP CRITERIA

Criteria	Geothermal Power Development	Renewable Energy for Rural Electrification
Increased installed capacity from renewable energy sources.	Tanzania aims to triple its generation capacity by 2020. SREP-funded investments could result in adding 100 MW of geothermal power and creating the conditions for fully exploiting its potential.	It will result directly in investments of more than 40 MW of renewable energy capacity. It will build the capacity and project pipeline that will lead to achieving the national off-grid electrification goal.
Increased access to energy through renewable energy sources.	About 700 GWh of electricity per year—the average electricity consumption of 7 million Tanzanians in 2020—will support productive uses and meet community and household needs.	It will provide electricity access to about 2.2 million residents in more remote communities, and will supply more than 178.6 GWh of electricity per year.
Low emissions development.	Geothermal electricity produces negligible CO_2 emissions and will offset or defer fossil fuel–generated electricity.	Renewable-energy mini grids and solar PVs emit no CO_2; mini grids that use backup diesel for about 10 percent of generation emit relatively small amounts.
Affordability and competitiveness of renewable sources.	Supply curve analysis shows that, once the resource is confirmed, geothermal power generation is competitive with gas, large-hydro, and coal on an economic basis.	The economic cost of supply for mini grids is significantly less than for diesel generation. The economic avoided cost of lighting is significantly less for SHSs than for kerosene. But given rural consumers' limited ability to pay and that lower-income consumers must be reached to deepen access to half of the rural population, subsidies will be needed.

Criteria	Geothermal Power Development	Renewable Energy for Rural Electrification
Productive use of energy.	Geothermal is base-load power supply and will enhance supply reliability and availability and thus meet crucial requirements of the economy's industrial and productive sectors.	Mini grids directly support electricity supply to industry and commercial enterprises. Stand-alone systems support productive energy use, directly by enabling cottage industries and small retail ventures to increase their productivity and indirectly from the benefits that accrue from children's improved education due to better lighting and access to communication, improved health, and enhanced security.
Economic, social, and environmental development impact.	Access to electricity generally brings socioeconomic development to a community; geothermal power does so with positive environmental impacts. It allows the offset fossil fuels (e.g., gas and coal) to be used for higher-value applications, such as feedstock.	Displacement of diesel and kerosene reduces local pollution and risk of fire from open-wick lamps. Greater economic opportunity results from electricity access. Local communities can retain money in the community that previously would have been used to purchase fuel.
Economic and financial viability.	Geothermal power is economically competitive with other base-load sources (once the resource is confirmed). Financial viability depends on how well commercial and development risks are managed. As Kenya's experience shows, geothermal can be a financially attractive power source, not subject to fuel-price increases.	Renewable energy sources are least cost compared to fossil-fuel alternatives, and projects have high and robust economic rates of return. Financial rates of return are satisfactory, though some grant support for initial investment is needed due to rural residents' lower ability to pay, especially since 50 percent access must be reached.
Leveraging of additional resources.	SREP funding will leverage significant private-sector and donor funding—well above the 4:1 required SREP leverage.	Infrastructure is needed to rapidly scale up investments to achieve the national electrification goal. SREP resources also leverage investment financing from other sources (leveraged 5.5:1).
Gender equity.	Women will share equally in the benefits that access to electricity brings. In addition, there are opportunities for utilization of by-product heat and condensate that will support industrial and agricultural activities (e.g. horticulture) that can be developed and run by women.	Women and children are direct and significant beneficiaries as they will gain access to cleaner energy services in homes that offer far superior services, improved access to essential health and educational services, greater economic opportunities, and lower costs of accessing better energy services. The REA has tools developed under the AFREA gender program for integrating gender considerations into project preparation, implementation, and monitoring and evaluation.
Co-benefits of renewable energy scale-up.	The SREP will help to create an entirely new industrial and energy sector, thereby diversifying the economy, creating new high-value employment opportunities that may have spin-off benefits in other sectors.	Scaled-up renewable energy reduces local air pollution, avoids risk of fire from fuel spillage, and protects watersheds to ensure hydrologic conditions are maintained and improved. Supplying fuel for biomass power projects supports sustainable forestry. Increased use of agricultural residues for power generation improves the local environment and economy and reduces stress on forest resources.

ANNEXES

ANNEX I: SREP INVESTMENT BRIEFS

Project Concept 1. GEOTHERMAL POWER DEVELOPMENT

PROBLEM STATEMENT

The Tanzanian economy has been growing at a steady pace for more than a decade, and the government is keen to remove barriers to development. The energy sector has a pivotal role to play in the country's economic and social progress, but electricity supply shortages in recent years have presented a serious bottleneck. Demand for electricity is increasing rapidly owing mainly to accelerated productive investments and the government's commitment to achieve 75 percent electrification by 2035, more than 55 percent higher than today's level of just 18.4 percent.

The nation's dependence on large hydroelectric power plants has increased its vulnerability to unpredictable weather patterns and extended periods of drought. As a result, extensive load shedding has occurred, hindering both industrial productivity and social development. In turn, the government has turned to expensive emergency power sources to alleviate the shortages. Thus, it is now looking to diversify and expand its generation capacity with clean energy sources, as articulated in Vision 2025, the national development plan. Geothermal energy can form an important part of the country's energy mix. The government has expressed interest in developing this sector, whose potential is estimated at more than 650 MW. But development of the resource requires overcoming key barriers, as described below:

Lack of a geothermal development roadmap and appropriate legal and regulatory framework. Currently, there is no systematic plan in place for developing the geothermal resource. A strategy is required that covers both resource development and subsequent power development. The mining laws now applied to the geothermal sector are inadequate, and a resource pricing policy is needed. In addition, institutional and human capacities require strengthening.

High cost of exploration and uncertainty. There is little private-sector interest in exploration due to its high cost and uncertain results. Exploration up to test well drilling utilises 20–25 percent of project costs, with high risk that a potential site might not yield the expected resources.

Limited financial resources. To date, scant public resources have been directed to geothermal energy. The government must determine how best to allocate limited financial resources for development of the geothermal resource, along with power development, which requires significant investment.

Financial credibility of the power purchaser. The credit and liquidity risk of TANESCO, the state utility, affects the developer's ability to raise financing and recover costs to generate a return on investment. There is an ongoing dialogue between the Tanzanian government and its development partners to resolve this issue, which affects the power sector more broadly.

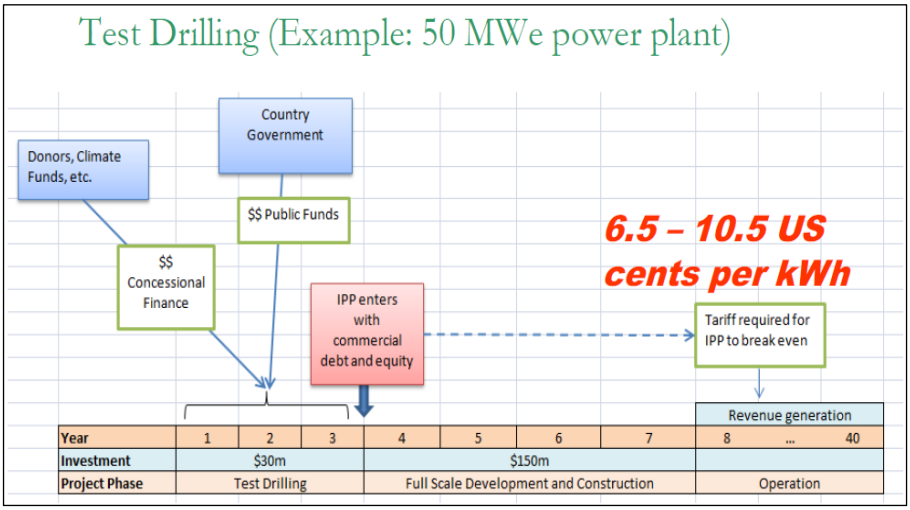
DEVELOPMENT APPROACHES

Two business models could be used to develop geothermal energy (Figure I.A). In Model 1, the exploration phase (up to test well drilling) is conducted by the public sector, supported by government resources or concessional financing. This reduces the risk and investment level of the private sector, which can enter in phase 4 to develop the full-scale production well drilling and power project. This approach can result in lower electricity cost from the geothermal plant since the public sector can attract lower-cost financing than can the private sector for this higher-risk phase of

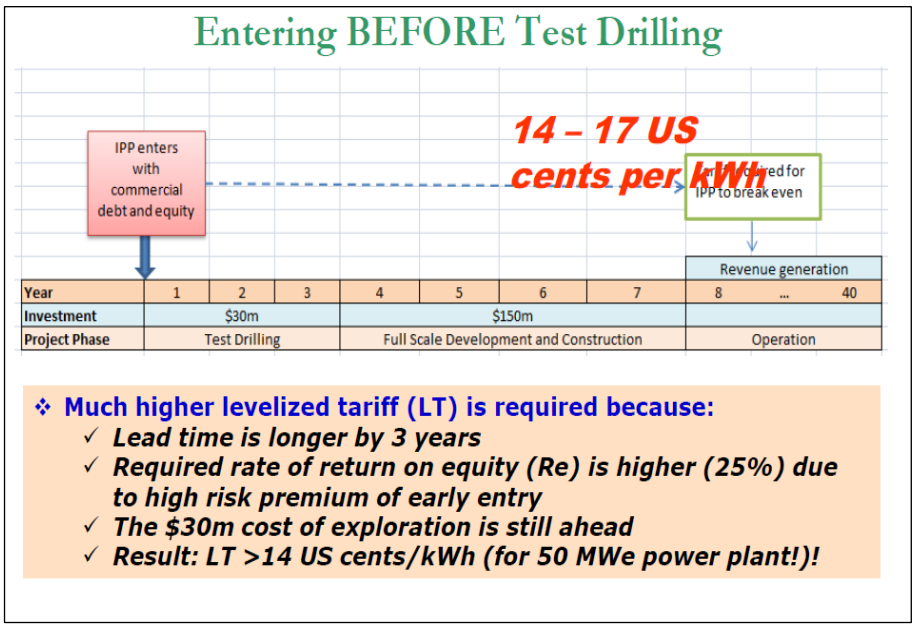
development. Cost is also lowered if the public sector considers resource confirmation as a sunk cost and does not recover the development cost from the private developer. However, there is a risk that public-sector implementation may take longer. In Model 2, the private sector enters in phase 1 and bears all the costs of exploration and production of geothermal electricity. The resulting cost of electricity is higher since private-sector investors will demand a higher return on investment, given the higher risks, and the resource confirmation costs must be recovered. The proposed SREP project is adopting the Model 1 approach.

FIGURE I.A EXAMPLES OF TWO GEOTHERMAL DEVELOPMENT MODELS

MODEL 1



MODEL 2



Source: Geothermal Development Corporation, Kenya.
Note: The numbers represent financial costs and returns in Kenya and might not apply universally.

PROJECT OBJECTIVE

The project aims to catalyse the generation of about 100 MW,[45] developed by the private sector, with public-sector support targeted to overcome the higher-risk phases of development, and thus make geothermal energy a reliable, low-cost, and significant contributor to Tanzania's electric power supply.

The project will achieve this objective by: (i) creating the enabling environment and strengthening institutional and human resource capacities, (ii) reducing development risks by financing resource exploration and confirmation, and (iii) providing transaction advisory services to ensure that sites with proven resources are competitively awarded. Once the resource is confirmed and power development projects are awarded, the SREP and other financing partners will contribute to power development by (iv) providing risk mitigation and/or other forms of co-financing for the power development phase. SREP funding will be used to catalyse from both public and private sectors the significantly greater financial resources that are required.

Four sub-components will support the development of Tanzania's geothermal sector, as follows:

Enabling Environment for Geothermal Development

Such donors as BGR/KfW, ICEIDA/NDF, JICA, and DFID have expressed interest in supporting activity 1 alongside the SREP. The budget provides details of the division of financing between the SREP and other donors under this section.

- Policy framework regarding roles and responsibilities for resource development and allocation of licenses; ownership of exploration knowledge; business models for exploratory and power development phases; risk mitigation and other incentives; power purchase tariff policy; and roles for government, donors, and the private sector.
- Legislation and regulations and tariff formulation to implement policy. Along with the SREP, various donors, including the Icelandic International Development Agency (ICEIDA), Nordic Development Fund (NDF), JICA, BGR, and DFID, have expressed interest in supporting this work.
- Institutional development plan and establishment of relevant organisations and their staffing.
- Capacity building, training, and knowledge and lessons sharing.

[45] It is critical to understand that, based on the nature of geothermal power development, the project will be phased, and each phase's success will depend on the previous one. The project is expected to lead to the generation of about 100 MW; obviously, however, this will depend on the results of the exploration drilling phase.

2. Geothermal Resource Confirmation and Feasibility Assessment

JICA has expressed interest in conducting an initial analysis of the geothermal sites in Tanzania up to the pre-feasibility stage. The SREP will conduct further investigations to confirm the resource, including test drilling, and prepare the feasibility analysis.

- JICA is supporting satellite imaging and resource identification of high potential sites. It will take into consideration existing resource information and complementary developments being undertaken by others and selection of 3–5 fields for further investigation. Prospective sites may include Ngozi-Songwe (Mbeya), Kisaki (Morogoro Region), Luhoi (Pwani Region), Lake Natron (Arusha Region), Majimoto (Mara Region) and Lake Manyara (Manyara Region). To reduce the concentration of resource risk, the sites have a wide geographic spread and cover promising geothermal reservoirs suitable for power generation.
- Surface-level explorations will be conducted for a few sites to supplement existing work and expand the preliminary resource assessment.
- A pre-feasibility report will be prepared based on a conceptual-level model of field, conceptual engineering design, power/energy output, environmental suitability, and project economic/financial viability.
- For promising sites (2–3 sites, according to results of the previous phase), an exploratory well-drilling programme will be prepared to confirm the reservoir's existence, exact location, and potential.
- Test drilling will be undertaken.
- Feasibility studies will be prepared.

3. Power Generation Project Development

SREP financing will support transaction advisory services to prepare project documentation for bidding the project out to the private sector for power development. Specific steps are as follows:

- Develop co-financing and risk mitigation options offered to successful bidders.
- Develop the project development strategy (most likely a PPP).
- Prepare legal and other contractual documentation.
- Provide transaction advisory services to bid award project(s) to the private sector or on a PPP basis.
- Offer co-financing or risk mitigation for power project development, as needed.
- Estimate the costs related to grid connection and ensure mobilization of necessary financing by the government and development partners.

4. Power Project Investment and Operation

The private sector will invest in the power project, operate it on a Build-Own-Operate or PPP basis, and sell power to TANESCO. The AfDB will provide a risk-mitigation instrument to cover the payment risk of the utility to the private sector at the IPP stage.

IMPLEMENTATION READINESS

The Tanzanian geothermal sector is in its infancy, with the government having taken the initiative to set up a task force for geothermal development. Surface-level explorations have been undertaken in

several fields, and exploratory well drilling at one site has started. Eight personnel have been trained by the ARGeo in Iceland. A new satellite imaging study of the geothermal potential is to be conducted within the year, with support from JICA. This work will help identify specific areas to be explored more intensively under this project. The outcomes of the March 2013 Workshop on Geothermal Laws and Regulations, which advised the government on setting up a geothermal development roadmap, guided the preparation of this project concept.

RATIONALE FOR SREP FUNDING

Geothermal energy development requires substantial investment during initial exploration, which is the highest-risk phase of the project. Given the uncertain outcome, the private sector is reluctant to invest. If it does decide to invest in the exploratory phase, it will require higher revenues and thus a high tariff to cover the risk. This would make an otherwise economically attractive power source that offers generation diversity and reliable and dispatchable power commercially unviable. Thus, SREP support is of critical value.

SREP support is also needed to create the enabling legal and regulatory environment and build and strengthen institutional and human-resource capacity, which are essential requirements for geothermal becoming a major source of power supply. Having the legal and regulatory framework in place will be key to attracting private-sector investors for the production phase.

SREP funding will clearly catalyse additional financing from the AfDB, other development partners, and the private sector, who previously have hesitated to invest in geothermal development considering the aforementioned bottlenecks. SREP funding will be best used in coordination with other partners' financing to reach common objectives in developing geothermal power in Tanzania.

The proposed project is fully responsive to the SREP Investment Evaluation Criteria (Table 13).

RESULTS INDICATORS

The main results indicators, to be further elaborated on during project preparation, will comprise the following:

- A dedicated policy, legal, and regulatory framework in place to enable private investment in geothermal power generation.
- The appropriate institutional setup in place, with clear responsibilities and adequate capacities.
- Resource confirmation undertaken for multiple sites.
- Increased human and technical capacities, with a core group of experts leading geothermal development in the country.
- About 100 MW of additional electricity generation resulting from the project, depending on resource confirmation.

FINANCING PLAN

The total estimated project cost, including both phases, is about US$537 million, of which US$25 million is sought from the SREP, and $45 million from the African Development Bank. The Government of Tanzania, private sector, commercial banks, and other development partners will also contribute to the project (Table I.A). The utilization of SREP/AfDB geothermal-sector funding will be on a staggered basis. After development of a dedicated policy and legal framework and capacity building, SREP/AfDB financing will be directed to exploration of 2–3 sites. Following success of these activities, financing for further site development can be utilised. The project will be undertaken in two stages, with power development contingent on successfully confirming the geothermal resource.

TABLE I.A INDICATIVE FINANCING PLAN FOR GEOTHERMAL POWER DEVELOPMENT

Thousands of US dollars

Geothermal Power Development Project	SREP	Gov't. of Tanzania	AfDB	Private Sector	Commercial Banks	Other Development Partners	Total
Target Generation Capacity: 100 MW							
Project Preparation Grant	**700**	**-**	**-**	**-**	**-**	**-**	**700**
Geothermal Strategy, Legislation, and Capacity Development	**2,300**	**1,500**	**-**	**-**	**-**	**2,300**	**6,100**
Geothermal strategy, legislation, and regulations	-	500	-	-	-	2,300	2,800
Organisation establishment, institutional development, and program management	700	1,000	-	-	-	-	1,700
Capacity building, training, and knowledge and lessons sharing	1,600	-	-	-	-	-	1,600
Geothermal Resource Confirmation and Feasibility Studies of Promising Sites	**20,000**	**-**	**-**	**-**	**-**	**3,000**	**23,000**
Satellite and surface exploration and pre-feasibility studies	-	-	-	-	-	3,000	3,000
Test-drilling program design, test-drilling and feasibility studies	20,000	-	-	-	-	-	20,000
Power Generation Project Development and Transaction Advisory Services	**2,000**	**-**	**-**	**-**	**-**	**-**	**2,000**
Investments in 100 MW Production Wells, Steam Field, and Power Plant Projects	**-**	**-**	**15,000**	**142,500**	**317,500**	**-**	**475,000**
Risk Mitigation Facility	-	-	**30,000**	-	-	-	**30,000**
Total Cost:	**25,000**	**1,500**	**45,000**	**142,500**	**317,500**	**5,300**	**536,800**
SREP Leverage	**18.5**						

LEAD IMPLEMENTING AGENCIES

The MEM is the implementing agency on behalf of the Government of Tanzania, while the AfDB will serve as the lead MDB.

PROJECT PREPARATION TIMETABLE

The estimated timetable for submitting the project appraisal document to the SREP subcommittee is the third quarter of 2014 and to the AfDB board the fourth quarter of 2014.

PROJECT PREPARATION GRANT

The Government of Tanzania is requesting a preparatory grant of USD 700,000 to prepare this project (see chart below).

SREP INVESTMENT PROGRAMME **Project Preparation Grant Request**			
1. **Country/Region**:	Tanzania	2. **CIF Project ID#**:	(Trustee will assign ID)
3. **Project Title:**	Geothermal Power Development		
4. **Tentative SREP Funding Request (in USD million total) for Project[a] at the time of Investment Plan submission (concept stage):**	Grant: $25 million	Loan:	
5. **Preparation Grant Request (in USD):**	700,000 USD	MDB: AfDB	
6. **National Project Focal Point**:	Edward Leonard Ishengoma, Assistant Commissioner, Renewable Energy, Ministry of Energy and Minerals		
7. **National Implementing Agency (project/programme):**	Ministry of Energy and Minerals, Government of Tanzania		
8. **MDB SREP Focal Point and Project/Programme Task Team Leader (TTL)**:	Headquarters-CIF Focal Point: Mafalda Duarte	TTL: Solomon Asfaw, Principal Power Engineer	

Description of activities covered by the preparation grant:

The grant will cover activities related to the preparation of the Geothermal Power Development Project:

- Contribute to the development of geothermal energy strategy regarding roles and responsibilities for resource development; ownership of exploration knowledge; business models for exploratory and power development phases; risk mitigation and other incentives; power purchase tariff policy; and roles of government and developers.
- Contribute to the development of legislation and regulations and tariff formulation to implement the strategy.
- Plan to develop and establish the adequate institutional framework with relevant organisations and their staffing.
- Assess existing capacities, establish gaps, and prepare a capacity-building programme for strengthening national capacities for geothermal development.
- Activities related to the elaboration of the project M&E system (baseline study for reference data, establishment of indicators, format for data collections, reporting system, write-up of the manual, etc.).
- Consultations with local stakeholders to inform them and ensure appropriate preparation of the project.
- Geothermal Power Development Project preparation, including detailed design of project, environmental and social impact studies, technical design of resource exploration work programme and its costing, project economic and financial viability, co-financing funds mobilization/confirmation.

9. **Outputs: Policy Framework**

Deliverable	**Timeline**
(a) Project Appraisal Document to be submitted to SREP Subcommittee and AfDB Board	Q3/Q4 2014
(b) Strategy, Legal and Regulatory Frameworks for Geothermal	Q2 2014
(c) Plan for institutional framework and operational geothermal unit	Q2 2014

(d) Capacity-building programme for geothermal development	Q2 2014
(e) M&E documentation	Q1 2014

10. **Budget (indicative):**

Expenditures[b]	**Amount (USD) –** estimates
Consultants/technical assistance	USD 450,000
Equipment	USD 50,000
Workshops/seminars/trainings	USD 70,000
Travel/transportation	USD 50,000
Others (admin costs/operational costs)	USD 50,000
Contingencies (max. 10%)	USD 30,000
Total cost	**USD 700,000**
Other contributions:	
• Government	USD 50,000 (staff time, etc.)
• MDB (AfDB)	USD 30,000 (staff time, etc.)
• Private sector	
• Others (please specify)	

11. **Timeframe** (tentative)

Submission of pre-appraisal document for SREP Subcommittee Approval: Q3 2014
Expected Board/MDB Management[c] approval date: Q4 2014

12. **Other partners involved in project design and implementation**[d]:

Following consultations with various stakeholders and partners, it is expected that the Project will be supported by several bilateral partners. JICA has shown interest in conducting satellite imagery of the country's geothermal resources, which will feed well into the work supported by SREP funding. BGR is interested in conducting surface studies for 3 sites, which can be further developed via SREP financing of feasibility stage. The Government is considering submitting a formal request to ICEIDA/NDF to support some surface studies. DFID may be involved in the early stages to support the enabling environment, while UNEP may provide additional support for capacity building. Government could also tap into the GRMF for early drilling.

13. **If applicable, explanation for why the grant is MDB executed:**

AfDB will perform an evaluation of MEM's fiduciary and procurement capacities in the coming weeks. It will then be decided whether the grant is executed by MEM or by the AfDB.

14. **Implementation Arrangements** (including procurement of goods and services)**:**

AfDB will perform an evaluation of MEM's fiduciary and procurement capacities in the coming weeks. Pending approval from AfDB, the fiduciary and procurement function will be implemented by MEM, whose capacities will be strengthened in the spirit of the programmatic approach. The funds will be channeled by the AfDB, which has a field office with Procurement and FM staff in Tanzania. Procurement of goods and services will be done according AfDB rules (or national procedures, if validated by AfDB) under the guidance of local expert staff. The stakeholders involved in grant implementation will establish memoranda of understanding with MEM, allowing for implementation, budget, and procurement planning.

a. Including the preparation grant request.

b. These expenditure categories may be adjusted during project preparation according to emerging needs.

c. In some cases, activities will not require approval of the MDB Board.

d. Other local, national, and international partners expected to be involved in project design and implementation.

MDB Request for Payment for
Project Implementation Services (MPIS)

<table>
<tr><th colspan="5">SCALING UP RENEWABLE ENERGY PROGRAM IN LOW-INCOME COUNTRIES
MDB Request for Payment of Implementation Services Costs</th></tr>
<tr><td>1. Country/Region:</td><td>Tanzania/Africa</td><td colspan="2">2. CIF Project ID#:</td><td>(Trustee will assign ID)</td></tr>
<tr><td>3. Project Title:</td><td colspan="4">Geothermal Power Development</td></tr>
<tr><td>4. Request for project funding (USDmill.):</td><td colspan="2">At time of country program submission (tentative): USD 25million</td><td colspan="2">At time of project approval:</td></tr>
<tr><td rowspan="2">5. Estimated costs for MDB project implementation services (USDmill.):</td><td colspan="2" rowspan="2">Initial estimate - at time of Country program submission:

USD 0.450million

Final estimate - at time of project approval:</td><td colspan="2">MDB: AfDB</td></tr>
<tr><td colspan="2">Date: May 2013</td></tr>
<tr><td>6. Request for payment of MDB Implementation Services Costs (USD.mill.):</td><td colspan="2">X First tranche:

☐ Second tranche:</td><td colspan="2">USD 0.250 million

USD 0.200 million</td></tr>
<tr><td>7. Project/program financing category:</td><td colspan="4">a - Investment financing - additional to ongoing MDB project ☐
b- Investment financing - blended with proposed MDB project X
c - Investment financing - stand-alone ☐
d - Capacity building - stand alone ☐</td></tr>
<tr><td>8. Expected project duration (no. of years):</td><td colspan="4">Five years</td></tr>
<tr><td>9. Explanation of final estimate of MDB costs for implementation services:</td><td colspan="4">If final estimate in 5 above exceeds the relevant benchmark range, explain the exceptional circumstances and reasons:</td></tr>
<tr><td colspan="5">10. Justification for proposed stand-alone financing in cases of above 6 c or d:</td></tr>
</table>

Project Concept 2. RENEWABLE ENERGY FOR RURAL ELECTRIFICATION

PROBLEM STATEMENT

The Government of Tanzania is committed to accelerating the rate of national electrification, expecting to reach half the population by 2025, further increasing to at least 75 percent by 2035. Currently, just 18.4 percent of the total population and less than 7 percent of rural residents have access to electricity. The vastness of the country, coupled with low population densities in most regions, makes grid network extension an enormously challenging and expensive way to electrify rural communities. Also, diesel-generated electricity, whose costs are high and rising, is no longer a cost-effective electricity supply option.

Because various renewable-energy technologies can provide lower-cost electricity using locally available resources, renewable energy–powered mini- and micro-grids have a potential to become the preferred choice for electrification where grid electricity is unavailable. Renewable sources include small hydro, biomass, solar, solar/wind hybrids, as well as stand-alone solar photovoltaic (PV) systems. The REA has established incentives for mini-grid projects, with the first few already in operation. Micro grids (e.g., centralised solar PV with battery serving a small community through a low-voltage line) are also being piloted.

The pace of development of these projects, however, needs to increase considerably to achieve the government's ambitious electrification targets. The Rural Electrification Investment Prospectus, being developed by the REA with NORAD support, shows that about 46 percent of unelectrified rural residents live close to the grid, 20 percent far from it but in high-density population areas, and 33 percent far away in low-density settlements. Rural access to electricity will therefore need to be accomplished using a combination of grid extension, mini and micro grids, and stand-alone PV systems.

CURRENT EFFORTS

The off-grid electrification development in Tanzania is supported primarily through the World Bank and GEF-financed Tanzania Energy Development and Access Expansion Project (TEDAP), which provides US$47.5 million in financing for the REA to support small renewable power projects in rural areas. TEDAP has set up various instruments to support private-sector developers (including NGOs and communities) to develop small renewable energy projects, including:

- Simplified regulatory framework, including Small Power Purchase Agreements (SPPAs) and tariffs, administered by the Energy and Water Utilities Regulatory Agency (EWURA);
- Credit line channelled through local commercial banks, providing long-term liquidity for renewable energy projects;
- Performance grants to buy down costs of connections for mini-grids (per connection) and solar home systems (SHSs) (per Wp);
- Matching grants for pre-investment support;
- Sustainable Solar Market Packages (SSMPs), which are competitively awarded to private-sector contractors to install and maintain PV systems for public facilities and commercially market SHSs to households and businesses in a defined geographic area; and
- Capacity building to key governmental and private stakeholders through theTEDAP-associated SIDA trust fund.

As a result, a pipeline of small power projects (under 10 MW) comprising a total of about 130 MW has been identified. TANESCO signed SPPAs with 11 developers to supply 46 MW of power and Letters of Intent (which precede SPPAs) with another 6 developers for 31 MW of power. However, only four SPPs are in operation and two are under construction.

The European Union has also financed renewable-energy mini grids, but the support has been provided primarily through grant funding, often resulting in high costs per connection. Faith-based organizations have also financed several mini grids and micro grids, primarily through grant funding. Some private-sector micro grids have been developed without any government/donor support, but the pace of their roll-out has been slow because of difficulties with accessing finance. TEDAP is currently the only comprehensive support mechanism aligning public-sector support with mobilisation of private-sector investments and commercial bank lending.

The objective of the SREP program would be to build on TEDAP achievements and accelerate the pace of off-grid electrification by concentrating on the remaining barriers, including: (i) reducing the time and transaction costs of off-grid electrification project development; (ii) making credible information available on renewable resources and community characteristics; (iii) increasing access to long-term financing at reasonable rates, such as through expanding and fine-tuning the credit line facility; (iv) increasing affordability of electricity services by reducing project costs, improving delivery efficiencies, and using performance-based grants to reduce upfront costs; (v) mitigating risks to private investors (especially the off-taker risks); and (vi) increasing human capacity for the implementation of the scaled-up program.

PROJECT OBJECTIVE

The SREP Renewable Energy for Rural Electrification (RERE) Project aims to (i) build an efficient and responsive development infrastructure for renewable energy-based rural electrification, and (ii) demonstrate its effectiveness by supporting a time-slice of private-sector investments in off-grid electricity enterprises.

The project encompasses three renewable energy electrification schemes:

- Mini grids of several hundred kilowatts and up to 10 MW serving a group of villages, as well as larger commercial customers. Some may be connected to the TANESCO main or isolated grid, but operated by the private sector, selling excess power to TANESCO under SPPAs.

- Micro grids powered by a small, centralised PV array and battery bank, biomass gasifier, biogas, or other renewable technology, supplying electricity through a low-voltage grid to a few households and other customers at the village level.

- SSMPs, supplying electricity services to essential public-service and community facilities (e.g., schools and health clinics), plus sale to private customers in a group of contiguous villages using stand-alone solar PV systems.

The RERE project will build on the TEDAP, as well as on other relevant REA and donor initiatives developed in Tanzania (e.g. AFREA-financed Lighting Rural Tanzania, SIDA-financed solar PV market development activities, and the European Union's support to mini grids). Based on the lessons learned from these activities (see Annex IV for TEDAP project lessons), the REA is proposing a set of components that will (i) scale up successful instruments, such as a credit line and performance grants and (ii) develop new instruments that would target remaining barriers.

1. Transaction Advisory Services.

The SREP project will set up a world-class Transaction Advisory Services Facility (TASF) that will provide firm-level support, including pre-feasibility and feasibility studies, regulatory compliance support, technical design and evaluation, procurement support, business-plan and business-model preparation, financial and economic modelling, market and risk assessments, and financial closure support. All services will be extended on a cost-sharing basis with the project developers Where possible, services will be bundled to leverage economies of scale. A key ingredient for success will be committing to a large volume of business to attract highly reputable experts with significant depth of expertise and providing high-quality public goods (e.g. market and resource data) in an efficient manner such that all developers benefit equally and can focus their limited human and financial resources on operations.

The services will be designed in such a way that they close general market gaps and also respond to particular needs of various company types—from small-scale local entrepreneurs and cooperatives, who often lack basic technical and business skills, to larger international companies, who bring technical skills but lack knowledge of local markets, sociocultural conditions and regulatory processes. The TASF services will be competitively awarded to reputable service providers, and particular attention will be paid to leveraging local expertise in order to ensure that advisory services are rooted in local know-how and to promote longer-term development of local capacities. TASF design will benefit from the lessons from the technical assistance programs supporting the mini-grid development to date, including TEDAP's matching grants, SIDA's capacity-building project with the REA, and the World Bank–executed SIDA Trust Fund, providing technical support to the REA, EWURA and other stakeholders, including project developers. The facility will coordinate closely with all existing and planned facilities of similar kind, and will primarily focus on delivering those

services that are not covered by other programs. The TASF for mini grids will be implemented by the IFC.

For Sustainable Solar Market Packages (SSMPs), the transaction advisory service component (managed by the REA) will focus on the design of 10 SSMPs to be directly financed by the RERE project and 30 additional packages for scaled-up financing beyond the SREP.

2. Co-financing Investments.

Mini- and micro-grid developers will make equity investments and obtain grant co-financing from the REA and debt financing from commercial banks. The commercial banks will utilise their own resources and access credit lines established under the SREP, as well as other credit lines (i.e., those set up by TEDAP, the AFD, and other Development Partners).

The SREP investment will primarily be used for testing new performance-based incentives for micro grids and for co-financing of SSMPs, which will bundle infrastructure for key public and community services (schools, clinics, street lighting), with incentives for marketing of SHSs to households and businesses in pre-identified off-grid areas.

The majority of investments for the RERE project are expected to come from SREP co-financing, including that of the World Bank Group (expected to focus primarily on the credit line), the REA, development partners (expected to focus primarily on mini-grid performance grants), and the private sector and commercial banks. The expected ratio between the credit line and performance grants is about 3:1.

The current TEDAP credit line provides local currency re-financing for Tanzanian commercial banks that provide long-term loans (up to 15 years) to renewable energy projects. Re-financing is provided on market terms but with longer maturity that would otherwise be available on the Tanzanian market. Refinancing is available to any local commercial bank complying with the prudential requirements of the Tanzanian central bank. It is expected that similar design will be applied under the SREP; the possibility to link the credit line with a guarantee (see below) will also be explored.

The current performance grant provides subsidies tied to the rural connections for mini grids and SHSs to make electricity connections more affordable for rural households and businesses. It is expected that performance grants will continue under the SREP. The exact amount for mini grids, micro grids, and stand-alone systems will be confirmed during project preparation.

The SSMP is a contracting mechanism that bundles the supply, installation, and maintenance of photovoltaic (PV) systems for public facilities, such as schools and clinics, with requirements and incentives for commercial sale to households, businesses, and other nongovernmental customers in a defined geographical area.

3. Risk Mitigation.

The project will offer appropriate mitigation instruments to help share in the risks and permit private investors to attract lower-cost investment funds. This is a new area previously not covered by TEDAP. The Project Preparation Grant (PPG) would be used to develop instruments covering the

most detrimental risks, such as the TANESCO's off-taker risk (e.g., SREP funds could be used to establish a letter of credit, which could provide a liquidity to project developers in the case of late payments). This letter of credit would ideally be backed up by a partial risk guarantee, potentially financed through World Bank Group co-financing. In addition, the PPG will explore whether design of the new credit line should include any risk mitigation factors; currently, the credit line is extended on commercial terms and does not include any guarantees or risk-sharing elements.

4. Capacity Building.

The following three areas are targeted for capacity building:

- *Human resource development*. The capacity of human resources will be strengthened in the public, private, and financial sectors. Given that the private sector would primarily benefit from the TASF component, the focus of the SREP's capacity-building component would primarily be the REA, but other key stakeholders, such as TANESCO, EWURA, and NEMC, would also be included. As the number of projects to be developed increases, capacity building is needed to expand the cadre of people with the necessary expertise. In addition, following successful experience under TEDAP, the SREP would continue providing capacity building to local commercial banks to strengthen their comfort with lending to renewable energy projects.
- *Gender mainstreaming*. The SREP will build on the World Bank/AFREA–supported Gender and Energy Program to implement the REA's Gender Mainstreaming Action Plan (Box 1). The REA will use these gender mainstreaming tools, checklists, and indicators developed under AFREA and will adapt them for the SREP to utilise throughout the project cycle, from project identification and evaluation to M&U, to ensure that both men and women benefit from the new investments in mini grids and off-grid activities.
- *Knowledge management and lessons sharing*. Significant new knowledge and emerging lessons during project implementation will be captured and disseminated within and outside of Tanzania.

5. Programme Management.

The project will strengthen the REA's capacity to oversee project implementation and enable it to handle larger volumes of transactions and be more client-responsive by streamlining its operations and information systems. Monitoring and evaluation (M&E) and reporting will also be undertaken.

IMPLEMENTATION READINESS

The REA, which has been mandated to lead national rural electrification efforts, is the lead agency for project implementation. With assistance from the 2007 World Bank and GEF–supported Tanzania Energy Development and Access Project (TEDAP), the REA has begun to pilot off-grid delivery methods.[46] Thus, the foundation for scaling up investments and capacity building for renewable off-grid electrification has been laid. The REA also has experience implementing World Bank projects, including fiduciary and safeguards aspects.

The regulator, EWURA, has issued regulations, guidelines, and tariffs governing electricity sales to TANESCO from small renewable-energy generators. Currently, it is in the process of reviewing and improving these regulations and drafting guidelines and tariff-setting rules for retail sales by private mini-grid operators. The Rural Electrification Prospectus study, being undertaken by the REA and scheduled for completion in June 2013, will delineate areas better suited to mini- and micro-grid and stand-alone electrification, thus allowing project development to focus on specific areas. The prospectus will identify grid extension projects for 2013 to 2022, as well as high-priority off-grid areas where the private sector will be especially encouraged to invest in and operate mini-, micro-, and stand-alone solar businesses, as well as those areas that would not be subject to official government electrification programs, which also could be a target for private-sector driven electrification.

RATIONALE FOR SREP FINANCING

In the absence of SREP resources, some renewable energy investments would still occur, albeit at a slower pace that would not satisfy the government's ambitious electrification needs.

SREP support will help to demonstrate that renewable energy for off-grid electrification is indeed a readily-scalable option. Without such demonstration effect, the risk is that in the face of development priorities and political pressure to rapidly expand coverage, the government would be forced to choose second-best options, such as diesel generators or extending grids to non-viable areas (thus increasing costs, incurring higher transmission and distribution losses, and possibly adding more fossil fuel–based power plants). Not only are these options detrimental to the global environment; the status quo would be harder to change at a later stage.

SREP resources will be used to catalyse and significantly leverage development partner and government funding for renewable-energy and off-grid electrification. The SREP directly builds on existing country activities and learning from previous experiences, concentrating on the removal of remaining barriers that are constraining further scale-up of renewable energy for rural electrification. The SREP's catalytic role is crucial to building the human capital and infrastructure needed to introduce new and more efficient approaches to attracting private-sector investment in off-grid electrification.

[46] To date, the projects supported by the REA and TEDAP include two small hydro mini grids serving isolated communities and a biomass-electric mini grid, which is under construction. Solar PV electrification using an area-based, SSMP approach is providing electricity service to community facilities and households in the Rukwa Region. The REA is cost-sharing the preparation of about 50 renewable-energy, mini-grid projects by private-sector developers and 10 stand-alone solar electrification projects.

The SREP's establishment of the TASF and the risk mitigation facility, expansion and fine-tuning of the existing financing instruments (credit line and performance grants), and continued capacity building of key stakeholders will establish a comprehensive support package for private-sector investments in rural renewable energy that will allow the government to meet its ambitious electrification targets in a sustainable manner.

The project meets all of the criteria needed to justify use of SREP resources (Table 13). It will use renewable energy to provide electricity services to a significant share of the target population. It will catalyse investments by the private sector in a market that would otherwise be unattractive to investors. CO_2 emissions are avoided, and in addition, local environmental conditions are improved and danger of fires from open-wick lamps is avoided. Women and children are specially benefitted. Where electricity is supplied to enterprises, productivity is improved. With household access to electricity, productivity is indirectly improved through higher educational attainment, better access to communication, and enhanced personal security. Other co-benefits include the protection of watersheds that must maintain the hydrologic conditions needed for small-hydro projects, support for sustainable forestry by supplying fuel for biomass power projects, and increased agricultural value added since agricultural residues can be sold for power generation.

RESULTS INDICATORS

The physical outcomes for the project are as follows:

- Renewable energy generation potential: 47 MW directly co-funded with SREP resources.
- Renewable energy investments catalysed: US$157 million from other sources for SREP co-funded investments, plus an additional $340 million for subprojects prepared with SREP support but not co-funded with SREP.
- Project beneficiaries: 400,000 households/enterprises (about 2.2 million households based on the REA Investment Prospectus assumption of 4.9 persons per household). Nearly 120,000 households directly benefitting from SREP co-funded investments and the balance from investments that follow from projects prepared with SREP support.
- Leverage of other funding to SREP funding: 6.3.

FINANCING PLAN

The total estimated project cost is about US$183 million, of which US$25 million is sought from the SREP, $50 million from the World Bank Group, and about $47 million from other development partners. Private-sector and commercial-bank financing is estimated at about $59 million. These are for activities directly co-funded by the SREP. In addition, the project will prepare a pipeline of other projects, whose investment financing is an additional $342 million.[47] These estimates are tentative, and will be firmed up during project preparation (Table I.B).

TABLE I.B INDICATIVE FINANCING PLAN FOR RENEWABLE ENERGY FOR RURAL ELECTRIFICATION

Thousands of US dollars

SREP Project	SREP	Gov't of Tanzania	World Bank Group	Other Development Partners	Private Sector	Commercial Banks	Total
Renewable Energy for Rural Electrification							
Project Preparation Grant	1,000	-	-	-	-	-	1,000
Mini- and Micro-Grid Component							
Transaction Advisory Services	4,750	-	-	-	500	-	5,250
Capacity Building	1,000	-	-	-	-	-	1,000
Programme Management	500	200	-	-	-	-	700
Investment in Mini and Micro Grids	1,750	-	46,000	32,743-	26,975	26,033	133,500
Risk Mitigation Facility	7,000	-	3,500	-	-	-	10,500
Subtotal: Mini- and Micro-Grid Component	**15,000**	**200**	**49,500**	**32,743**	**27,475**	**26,033**	**150,950**
Stand-Alone Electrification Component							
Transaction Advisory Services	1,500	-	500	-	-	-	2,000
Programme Management	500	200	-	-	-	-	700
Investments in Stand-Alone Solar PV							
Public Facilities	2,800	2,000	-	6,200	-	-	11,000
Households	4,200	-	-	7,600	3,000	2,000	16,800
Subtotal: Stand-Alone Electrification Component	**9,000**	**2,200**	**500**	**13,800-**	**3,000**	**2,000**	**30,500**
Total Cost (excluding Phase II)	**25,000**	**2,400**	**50,000**	**46,543-**	**30,475**	**28,033**	**182,450**
SREP leverage of other funding	**6.3**	**Excluding additional Phase II investment funds required for financing the mini grids and SSMP projects prepared using transaction advisory services.**					

[47] Assumptions:

Mini and Micro Grids: 25 mini grids, each of which serves 1,500 customers with a generation capacity of 1,800 kW; 50 micro grids with a generation capacity of 6kW. Transaction advisory services for preparing a total of 75 investments (25 mini grids and 50 micro grids). Grant contributions of US$500 per connection for mini grids and $100 per connection for micro grids from the MDBs or Development Partners; 35 percent equity from private developers, including the grants; commercial banks provide 35 percent of the debt, with the balance through a credit line set up by the MDBs and development partners (re-financing of 70% of the bank loan). Risk cover is for 3 months of revenue for sales to TANESCO covered by SREP, with an additional 6 months of coverage through co-financing (partial risk guarantee).

Stand-Alone Solar PV Systems: Investment in 10 SSMPs to benefit 70,000 households in 500 villages. Transaction advisory services for preparing 40 packages to benefit 2,000 villages and 280,000 households. Public facilities are wholly grant-funded; private sales have 20 percent down payment, plus a grant of $4 per Wp; private/household customers pay 20 percent net of grant, and commercial banks or pre-payment schemes finance 20 percent of the debt, with the balance of financing from a refinancing credit facility funded with SREP, World Bank, or development partners.

LEAD IMPLEMENTING AGENCIES

The project will be implemented by the World Bank as the lead MDB, with the IFC in a co-implementing role. The REA is the implementing agency on behalf of the Government of Tanzania. The IFC will implement the transaction advisory services component.

PROJECT PREPARATION TIMETABLE

It is expected that the project will be presented to the World Bank Board for approval after July 2014. Submission to the SREP Subcommittee for their no objection is expected about May 2014.

PROJECT PREPARATION GRANT

The Government of Tanzania is requesting a preparatory grant of USD 1 million to prepare the components of the project (see chart below).

SREP INVESTMENT PROGRAMME **Project Preparation Grant Request**			
15. **Country/Region**:	Tanzania	16. **CIF Project ID#**:	(Trustee will assign ID)
17. **Project Title:**	Renewable Energy for Rural Electrification Project		
18. **Tentative SREP Funding Request (in USD million total) for Project[a] at the time of Investment Plan submission (concept stage):**	Grant: $25 million	Loan:	
19. **Preparation Grant Request (in USD):**	800,000 USD for IBRD 200,000 USD for IFC	MDB: World Bank Group (IFC and IBRD)	
20. **National Project Focal Point**:	Edward Leonard Ishengoma, Assistant Commissioner, Renewable Energy, Ministry of Energy and Minerals		
21. **National Implementing Agency (project/programme):**	Rural Electrification Agency, Tanzania		
22. **MDB SREP Focal Point and Project/Programme Task Team Leader (TTL)**:	Headquarters-CIF Focal Point: Gevorg Sargsyan, World Bank Joyita Mukherjee, IFC	TTL: Dana Rysankova, Sr. Energy Specialist, Sub-Saharan Africa Region, World Bank Itotia Njagi, Sr.Operations Officer, Africa Region, IFC	

23. **Description of activities covered by the preparation grant:**

The grant will cover the following activities related to the preparation of the Renewable Energy for Rural Electrification Project:

1. Preparation of mini- and micro-grid investments, including the identification of potential project pipeline and fine-tuning of the existing financing instruments (credit line, performance grants) and design of risk-mitigation instruments, including incorporation of lessons learned from the existing mini-grid programme implemented by REA under the existing Tanzania Energy Development and Access Expansion Project (TEDAP): $200,000 for the World Bank to be implemented by the REA;

2. Preparation of the transaction advisory services facility (TASF), including the design, implementation plan, project-selection criteria, monitoring and evaluation framework, stakeholder consultations, and administrative structure: $200,000 for the IFC.

3. Preparation of 10 sustainable solar market packages (SSMPs), including the identification of sites, market surveys, design and preparation of bidding documents, including incorporation of lessons learned from the implementation of SSMP Phase I and II by REA under the existing Tanzania Energy Development and Access Expansion Project (TEDAP): $600,000 for the World Bank to be implemented by the REA.

24. **Outputs: Policy Framework**	
Deliverable	**Timeline**

(f) Identification /confirmation of the initial pipeline for mini grids and micro grids	Q3 2014
(g) Detailed design of financing and risk-mitigation instruments	Q1 2015
(h) Detailed design of the transaction advisory services facility	Q1 2014
(i) Identification of sites for Sustainable Solar Market Package (SSMP)	Q1 2014
(j) Market survey for SSMP sites	Q3 2014
(k) Bidding documents for SSMP sites	Q1 2015
25. **Budget (indicative):**	
Expenditures[b]	**Amount (USD),** estimates
Consultants	USD 1,000,000
Total Cost	**USD 1,000,000**
Other Contributions:	
• Government: REA	USD 50,000 (in kind staff support, organisation of stakeholder consultations)
• MDB	USD 30,000 (staff time, etc.)
• Private Sector	TBD
• Others (please specify – World Bank–administered SIDA TF for access expansion and regulation to be used for fine-tuning existing regulatory framework for small renewable energy projects, and capacity building to REA and EWURA for scale-up of renewable energy access	USD 500,000
26. **Timeframe** (tentative) For World Bank: SREP Subcommittee Approval: Q4 2014 Expected Board/MDB Management[c] approval date: Q1 2015	

27. **Other partners involved in project design and implementation**[d]:

Following consultations with various stakeholders and partners, it is expected that the project will be supported by several bilateral partners. Initially, the following Development Partners expressed interest in participating in the implementation of the SREP: SIDA, and NORAD. Close cooperation is also sought with DFID and the European Union. Additional discussions are ongoing with several other Development Partners for either direct participation in SREP or development of a coordinated approach supporting investments in renewable-energy mini grids and micro grids and stand-alone systems.

SIDA-funded trust fund for technical assistance to REA and EWURA (regulatory agency) will contribute to the development of SREP through financing a review and updating of the regulatory framework for small renewable power producers in Tanzania, and through the provision of capacity building to both REA and EWURA to prepare for the scale-up of renewable energy and access.

Under the TASF, the IFC will engage the private sector with an objective of mapping out the key bottlenecks (both technical and non-technical) in the development of commercial projects and design an appropriate facility to support private-sector end users.

28. **If applicable, explanation for why the grant is MDB executed:**

Not applicable for activities 1 and 3.

The IFC will implement activity 2 in close coordination and collaboration with REA and the World Bank. The expertise and comparative advantage that the IFC has in private-sector development, as well as its solid relationships with local companies and partners, places it in the best position to develop and implement the activities required to prepare the mini-grid transaction advisory services facility (TASF). The IFC has also been engaged in similar activities in the past in other countries and regions, and will leverage this expertise and knowledge in preparing and executing the programme at hand.

29. **Implementation Arrangements** (incl. procurement of goods and services)**:**

Activities 1 and 3 of the PPG for the Renewable Energy for Rural Electrification Project will be implemented by the Rural Electrification Agency (REA), which is the national government agency in charge of planning and implementing both grid and off-grid electrification projects.

REA is currently an implementing agency for World Bank's IDA and GEF-financed Tanzania Energy Development and Access Expansion (TEDAP) small power component. REA's implementation capacity, including for procurement and financial management, has been rated satisfactory. REA will be in charge of procurement and financial management of PPG.

Activity 2 will be implemented by IFC and it will work closely with the REA and the World Bank, as well as with IFC's private sector partners, other government agencies, and civil society organisations. In terms of procurement of goods and services, the World Bank Group procurement guidelines will be followed.

a. Including the preparation grant request.

b. These expenditure categories may be adjusted during project preparation, according to emerging needs.

c. In some cases, activities will not require MDB Board approval.

d. Other local, national, and international partners are expected to be involved in project design and implementation.

MDB Request for Payment for
Project Implementation Services (MPIS)

<table>
<tr><th colspan="4">SCALING UP RENEWABLE ENERGY PROGRAM IN LOW-INCOME COUNTRIES
MDB Request for Payment of Implementation Services Costs</th></tr>
<tr><td>1. Country/Region:</td><td>Tanzania/Africa</td><td>2. CIF Project ID#:</td><td>(Trustee will assign ID)</td></tr>
<tr><td>3. Project Title:</td><td colspan="3">Renewable Energy For Rural Electrification Project</td></tr>
<tr><td>4. Request for project funding (USDmill.):</td><td colspan="2">At time of country program submission (tentative):

USD 25.00 million</td><td>At time of project approval:</td></tr>
<tr><td rowspan="2">5. Estimated costs for MDB project implementation services (USDmill.):</td><td colspan="2" rowspan="2">Initial estimate - at time of Country program submission:

USD 0.428 million

Final estimate - at time of project approval:</td><td>MDB: World Bank</td></tr>
<tr><td>Date: May, 2013</td></tr>
<tr><td>6. Request for payment of MDB Implementation Services Costs (USD.mill.):</td><td colspan="2">X First tranche:

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<tr><td colspan="4">10. Justification for proposed stand-alone financing in cases of above 6 c or d:
Not applicable.</td></tr>
</table>

ANNEX II: ASSESSMENT OF COUNTRY'S ABSORPTIVE CAPACITY

OVERALL FISCAL OUTLOOK

Tanzania has had relatively high and stable economic growth over the past decade. Gross domestic product (GDP) growth has averaged about 7 percent since 2000, propelled mainly by growth in the mining, telecommunications, tourism, and construction sectors. The country has withstood recent international shocks; the 2009 global financial crisis affected the country only marginally. Higher gold prices have helped to sustain export earnings growth, thus countering the decline in tourism and agriculture.

In 2010–12, growth moderated to the mid-6 percent range, while inflation rose along with depreciation of the TZS and higher domestic interest rates. To reverse these negative trends, the Government of Tanzania has taken several effective measures. Though still high, inflation is decreasing; the fiscal deficit is declining, and most financial indicators, including the exchange rate and level of international reserves, are stabilizing. During the first half of 2012, the GDP growth rate returned to the 7 percent level in real terms.

Barring unexpected shocks, prospects are optimistic over the medium term. Economic growth is expected to remain in the 7 percent range, with inflation falling to the single digits. The fiscal deficit is expected to decline to about 4.5 percent. Tanzania is on track to become a major natural gas producer, leading to considerable foreign direct investment, increased export earnings, and more predictable fuel supplies for power generation.

RESOLVING THE POWER SECTOR CRISIS

The droughts experienced by Tanzania in 2010–12 resulted in a power crisis, with hydropower output reduced by as much as 75 percent of normal capacity. TANESCO, the state-owned utility, was forced to purchase expensive emergency power, which has led to the utility's current financial distress.

The energy sector's fragile financial situation can affect the success of the SREP. TANESCO has accumulated more than US$200 million in arrears and has delayed payments to several private power providers, including SPPs. However, the government is resolving these problems. It is seeking financial assistance from the MDBs and Development Partners, providing government subsidies, and requiring TANESCO's management to make efficiency improvements. EWURA has undertaken a cost of service study (COSS) to assess the implications of eventually moving to a cost-reflective tariff regime. TANESCO expects to shift from expensive emergency generation. SREP-supported renewable-energy generation will further diversify TANESCO's generation mix.

The first of three tranches of an IDA-financed US$100 million Tanzania–First Power and Gas Development Policy Operation was approved March 26, 2013. The programme's objectives are to (i) strengthen the country's ability to bridge the financial gap in its power sector, (ii) reduce the cost of power supply and promote private-sector participation in the power sector, and (iii) strengthen the policy and institutional framework for management of the country's natural gas resources. By the time SREP-funded projects begin implementation, it is expected that the financial health of TANESCO will have improved.

Despite some short-term risks due to the unstable and weak external environment and the power sector's financial difficulties, the overall macroeconomic trends and the Government of Tanzania's fiscal management provide sufficient confidence for the successful implementation of the SREP-Tanzania.

ABSORPTIVE CAPACITY AND SREP IMPLEMENTATION

The Government of Tanzania has a reasonably good track record of implementing projects through the Ministry of Energy and Minerals (MEM) and the Rural Energy Agency (REA). Currently, the REA is implementing the off-grid component of the TEDAP, and its implementing progress is satisfactory. This component was originally implemented by the MEM but was transferred to REA when it started its operations and was fully staffed in 2009.

The investment scale of these existing projects is comparable to the investments to be financed by the SREP-Tanzania, with the exception of the geothermal power project investment. The second phase of the latter project will be implemented by the private sector, and is comparable to some of the Independent Power Producers (IPPs) already operating in the country.

The Renewable Energy Division of the MEM will be responsible for implementing the Geothermal Development Project until an independent geothermal development division is established under the MEM, at which point lead responsibilities and staff currently responsible for geothermal development will be transferred. The MEM's geothermal staff, who are already working with the Geological Survey of Tanzania and foreign consultants to assess resources at several potential sites, have the required training and experience.

Since 2007, the REA has been developing and supporting mini-grid and stand-alone electrification projects, and its staff are well experienced in this work. Under the SREP-Tanzania, the staffing strengths will have to be increased as the work load will be higher. SIDA and NORAD are carrying out the REA's capacity assessment and will provide resources for strengthening the agency's capacity in the context of the scaled-up investment programme.

Operating guidelines currently in place are suitable for implementing the Renewable Energy for Rural Electrification Project. The REA has a strong technical and administrative staff, including special units for procurement and financial management. In addition, gender, M&E,communications, environmental and social specialists are already on board and environmental and resettlement frameworks are in use. The financial management and procurement functions, which have been appraised by the World Bank, have been found acceptable for World Bank–financed projects with REA and MEM.

In the coming weeks, the African Development Bank (AfDB) will undertake an evaluation of the MEM's financial management and procurement capacities. It will also assess the ministry's capacities for environmental and social safeguards, M&E, and communications, recommending upgrades as needed.

The SREP will help firm up relevant expertise at the MEM to handle the Geothermal Development Project. These facilities will be available for SREP-Tanzania implementation. As required, staffing will be increased to handle the increased work load. MEM staffing will be strengthened with

additional experts in geothermal policy and legislation, planning, resource exploration, training, and private-power development.

ANNEX III: STAKEHOLDER CONSULTATIONS

The SREP Tanzania Investment Plan is the product of a comprehensive participatory process involving many institutional, national, and international actors, led by the Government of Tanzania and represented by the Minister of Energy and Minerals, with the support from the multilateral development banks (MDBs). The main stages of the process are as follows:

(i) Holding multiple technical meetings during the Scoping Mission and Technical Mission with the development partners,' nongovernmental organisations (NGOs), and private sector (September 2012 and January 2013);

(ii) Holding one SREP consultative workshop during the joint mission, as well as a dedicated two-day workshop on defining the legal and regulatory framework for geothermal development (March 2013); and

(iii) Putting the draft Investment Plan on the Ministry of Energy and Minerals (MEM) website for two weeks to allow national stakeholders to review and comment on the proposed investments (April 2013).

The lists of stakeholders consulted during the joint missions are available in various Aide-Mémoire posted on the Climate Investment Funds (CIF) website (https://www.climateinvestmentfunds.org/ (cifnet/country/tanzania).

Private-Sector and Civil Society Organizations (CSOs) Feedback for Renewable Energy Development, September 2012 and January 2013

Private companies and CSOs working in the renewable-energy field who were consulted during preparation of the SREP Investment Plan offered the following suggestions:

- Specify a clear pathway for private-sector engagement in scaling up renewable energy. The private sector and its commercial bankers welcomed a longer-term strategy that outlines the role of the private sector and encouraged the Government of Tanzania to address this requirement in energy-development plans and policies.
- The small power producer (SPP) programme is encouraging renewable energy investments, but streamlining processes and removing bottlenecks are essential to speed up development and reduce transaction costs.
- The avoided cost-based tariff is a clear and transparent way to send price signals. However, it may lead to a lack of diversity in the types of renewable energy projects that are developed. EWURA could consider a "cost-neutral," technology-specific Feed-in-Tariff. It would offer a higher tariff for some technologies that are more expensive to develop or where there is limited experience and thus perceived as riskier. This higher tariff could be offset with lower tariffs for more mature and lower-cost renewable-energy technologies. Thus, there would be no net change in total cost of purchasing small-scale renewable energy from the SPPs.
- The current financial situation of TANESCO creates downstream financing issues for project developers as the ability of the off-taker to meet its payment obligations under a SPP is in

some doubt. Raising financing can be difficult or the cost of financing can be high. Access to long-term financing, guarantee instruments, or other mechanisms to offset this risk should be considered; and TANESCO must be placed on a sounder financial footing.

- Open access to data/information on renewable resources and credible information on renewable-energy technology cost/performance are important "public goods." The Government of Tanzania should facilitate their availability.
- As credible renewable-energy resource information is lacking, resource monitoring and mapping should be conducted to establish/confirm the potential of the various sources. In addition, continued capacity building, such as the REA-led programmes, should be continued for private companies, NGOs, and commercial banks. They can build technical expertise in renewable energy and improve skills in renewable-energy feasibility assessment, business management, financial structuring, economic and financial appraisal, and planning and project structuring.

SREP Consultative Workshop, March 20, 2013

In March 2013, the Government of Tanzania hosted a SREP consultative workshop that brought together some 60 participants from government agencies, the private sector, NGOs, and development partners. The government presented the proposed investments to national stakeholders and encouraged them to provide inputs and comments. Three working groups were organised to discuss aspects of the SREP Investment Plan in more detail.

The stakeholders concurred with the priorities selected for seeking SREP support. They also noted that biomass energy is a major sector that deserves SREP support and urged the Government of Tanzania to seek additional financial support from SREP and other sources to implement the strategy emerging from the Biomass Energy Strategy Tanzania (BEST).

Several private developers and commercial banks noted the risks of delayed payments by TANESCO, and the resulting dampening of interest to invest in renewable-energy projects that sell power to TANESCO. Success of SREP-Tanzania is contingent on increasing investor confidence.

The SREP investment screening criteria need to add an important criterion: "local participation in renewable-energy development and investment". The MDBs agreed to inform the CIF Administrative Unit about this recommendation.

Group on Geothermal Development Project

Several potential activities to be undertaken with SREP support were discussed with the stakeholders. The participants endorsed the proposed activities for geothermal development in Tanzania to be supported by the SREP, MDBs/donors, and the private sector. In particular, the following points were made:

- *Institutional Champion for Geothermal Development*. Presently, responsibilities for geothermal development are scattered across a number of agencies, including the MEM Mining Department, MEM Energy Department, GST, TANESCO, and the private sector. It was suggested that a Geothermal Division be formed under the MEM Energy Department and given lead responsibility for guiding geothermal development. The responsibilities would

encompass policy development, planning, licensing geothermal fields for exploration, and awarding sites for power-project development. The private sector should have lead responsibility for power development. New legislation to support geothermal development should include this organisational change.

- *Geothermal Strategy, Roadmap, and Capacity Development*. Various donors, including KfW/BGR, ICEIDA/NDF, JICA, UNEP, and DFID, expressed interest in supporting this activity alongside SREP. During the preparation phase of the SREP-funded project, cooperation will be increased to facilitate synergies and avoid unnecessary overlap.
- *Geothermal Resource Confirmation and Feasibility Assessment***.** JICA expressed interest in conducting initial analysis of the geothermal sites in Tanzania up to the pre-feasibility stage. SREP will conduct further feasibility analysis to confirm the resource.
- *Success Rate of Resource Development.* Stakeholders agreed that parallel investigation of a number of sites not "geothermally" related prior to exploratory drilling is important to increasing the chance of success in discovering fields with good geothermal prospects. It was recommended that exploratory drilling focus on about three unrelated instead of only one.
- *Power-Generation Project Development***.** SREP financing will provide financial assistance for transactional advisory services, along with AfDB funding for transmission lines. Geothermal experts pointed out that the SREP IP cost estimate for production well drilling and power generation investment, US$4,000 per kW, may be too low since geothermal fluid temperatures are expected to be in the 220 C° range (unlike in Kenya, where it is 350 C° range). A more appropriate cost estimate would be about $4,500–5,000 per kW.
- *Power-Project Investment and Operation***.** The stakeholders agreed that the proposed SREP and AfDB risk-mitigation instrument to cover the risk of delayed electricity payment is needed to encourage private-sector participation in independent power producer (IPP) development and offer electricity tariffs at competitive rates. Access to long-term financing is also required. If the private sector had to absorb all of these risks and raise its own long-term financing, the cost of capital would be so high as to make an otherwise economically viable source of power commercially non-viable.

Group on Renewable Energy for Rural Electrification Project

Participants included government representatives (TANESCO, REA, EWURA, and others), private-sector developers, commercial banks, CSOs, academia, and Development Partners. The participants strongly endorsed the proposed scale-up of small renewable-energy projects and off-grid electrification from SREP and the associated expected co-financing from the MDBs/donors. The participants noted that the SREP project must address key existing financial, institutional, and informational barriers, as follows:

- *Financial*. These barriers include the limited financing options, coupled with the prevailing off-taker risk, which is currently delayed payment from TANESCO to the SPPs, with a payment delay of up to 5 months. As SPPs are generally smaller companies with loan repayment obligations, the current financial situation at TANESCO is critical. New SPPs are experiencing difficulties reaching financial closure as commercial banks are hesitating to

provide long-term financing due to the "TANESCO risk." Additionally, many developers with strong technical skills may possess modest entrepreneurial experience, especially in designing attractive project or corporate finance structures. This situation calls for enhancing the capacity of project developers to access finance and that of local financial institutions to support renewable energy.

- *Regulatory and Institutional*. These barriers include complex and unclear processes for land-use decisions; water rights, namely poor catchment management and water-use conflicts; environmental regulations, including the role of the designated national authority in supporting the CDM process and EIA licensing; physical infrastructure planning; public-private partnerships (PPPs); taxation regimes; and business licensing.

  Experience shows that the issuance of water and land licenses can take up to 2.5 years, while EIA licensing may take up to 1.5 years, which is longer than in other countries. Also, import duties related to renewable energy are not clearly defined and clearances are often delayed. Another critical issue is what happens when the national grid is extended to areas served by the mini grid since the mini-grid SPPA would no longer be applicable and the lower-tariff, main-grid SPPA would be in force.

  Government agencies and regulators are already taking commendable steps toward addressing most of these issues; at the same time, more needs to be done, especially in demystifying the regulatory framework from the developers' perspective.

- *Informational*. These barriers include the lack of specialised skills and robust and consistent data on renewable-energy resources and demand-side dynamics. As an example, operators highlighted the difficulty in identifying a local partner and technical expertise (possible solution: consulting pool). Discussants noted the lack of information on electricity demand at the community level, emphasising the need to promote productive uses of electricity. Resource mapping and demand-side forecasting, including the promotion of energy-efficient appliances for mini grids, are needed to provide the pre-feasibility information required to design such projects.

The Government of Tanzania informed the participants that the proposed SREP activities seek to address these barriers at both the sector and firm level, which the discussants strongly welcomed.

Group on Institutional Framework, M&E, and Knowledge Management

The stakeholders discussed both existing needs and proposed additional activities to be considered under the SREP, as follows:

- *Institutional Framework*. The institutional framework must consider including other key ministries, such as the Ministry of Water and the Ministry of Natural Resources and Tourism. The framework must also consider key academic institutions that conduct renewable-energy trainings; an assessment of the renewable-energy curricula in these institutions could be proposed to help design training courses and offer diplomas that support renewable energy. The MEM must emphasize building its internal capacity, especially for the geothermal subsector. Institutions representing the SREP Task Force should be part of a National Advisory Committee to advise the MEM during SREP implementation.

- *Monitoring and Evaluation*. Strengthening of the existing sectorwide monitoring and evaluation (M&E) system is needed, including reinforcing human capacity for M&E within the MEM and REA,[48] which will facilitate design and implementation of the SREP M&E system. The SREP will support this activity as part of the Investment Plan. Discussants proposed appointing a SREP M&E focal point to facilitate sector-level coordination.

  The MEM should explore how it will integrate SREP indicators into the sectorwide M&E framework. A baseline assessment of data should be undertaken and used as a reference for M&E. Discussants noted that, though information may be scattered, it should be properly collected and reported. When baselines for SREP indicators are prepared, information should also be gathered from CSOs and the private sector.

- *Knowledge Management*. Shared learning and experience-sharing were underscored as key components required for creating an enabling environment for designing and implementing the proposed renewable-energy investments in Tanzania. The stakeholders expressed interest in learning from other companies in Tanzania that have implemented projects in the proposed areas. They also expressed interest in learning good practices from other countries that have already begun to implement the SREP (Kenya, Ethiopia, and Mali) to avoid repeating mistakes and to enhance replication of innovative ideas.

  Workshop discussants observed that various institutions have conducted many studies and research on renewable energy in Tanzania. But the results are stored on the shelves of institutions and are seldom disseminated to the appropriate stakeholders. Thus, existing knowledge is not used productively to inform effective implementation of renewable-energy efforts in the country. The inconsistency of renewable-energy statistics is a particularly challenging issue. Basing decisions on data that is scattered across institutions poses the risk of using wrong information, resulting in ineffective decisions. There is a need to agree on the baseline information used in the proposed investments.

Stakeholder Workshop on Geothermal Legal and Regulatory Framework, March 13-14, 2013

The Government of Tanzania hosted a Geothermal Legal and Regulatory Framework workshop, co-organised with the AfDB and the British High Commission, in the context of preparing the SREP. The objective was to identify existing gaps in the legal and regulatory framework and propose concrete actions that would constitute a clear roadmap for the government to put in place the appropriate geothermal-development framework.

Government officials, private developers, geothermal-resource survey specialists, development partners, lawyers, and CSO representatives held extensive discussions. They offered suggestions on how to reform and improve the legal and regulatory framework, the requirements for human and institutional capacity strengthening, and alternative institutional models in which the government creates the enabling environment and the private sector invests in developing the geothermal resource

[48] The existing sectorwide M&E unit, which is under the MEM Planning and Policy Department, has only one dedicated staff member; there is a need to develop the staff capacity of this unit and consider hiring additional staff.

and power generation. Amongst the key issues discussed were how to better manage the resource development risks and how PPP structures can be used. Guidance from the consultations included the following:

- *Legal and Regulatory Framework*. The government must explicitly include geothermal energy as a development priority in its updated Energy Policy and new Renewable Energy Policy. In addition, geothermal power must be included as a viable supply source whilst updating the Power System Master Plan. Furthermore, a geothermal development policy and geothermal act and associated regulations should be prepared to guide development of the sector and attract private investors.
- *Institutional Framework*. A geothermal division should be established within the MEM Department of Energy to ensure that geothermal development is well integrated with energy development and receives the necessary attention. Also, clear roles and responsibilities must be defined for public- and private-sector stakeholders involved in the various aspects of geothermal development (i.e., from resource exploration to power development). In addition, the geothermal division must be appropriately staffed with competent experts.
- *Capacity Building*: Tanzania's geothermal development capacity is weak, with only about 8 specialists trained to date. Realizing the country's geothermal energy potential requires strengthening of human capacity in both the public and private sectors. Expertise is especially needed in geothermal-resource development, planning, and power development; project finance and management; and social and environmental safeguards.

Comments Received on the Draft Investment Plan Posted on MEM Website

In order to facilitate review by national stakeholders, the Investment Plan was made available on the MEM website (http://www.mem.go.tz/) from 7 to 21 May, 2013. No comments were received.

ANNEX IV: LESSONS EMERGING FROM THE TANZANIA ENERGY DEVELOPMENT AND ACCESS PROJECT

PROJECT OVERVIEW

The World Bank–supported Tanzania Energy Development and Access Project (TEDAP), approved in 2007, aspires to improve the quality and efficiency of electricity service provision in Tanzania and establish a sustainable basis for expanding energy access. TEDAP is financed through a US$157.5 million IDA credit and a $6.5 million grant from the Global Environment Facility (GEF). It includes a $113.7 million grid extension component implemented by TANESCO and a $47.5 million IDA credit and GEF grant for its off-grid electrification component, implemented by the Rural Energy Agency (REA).

OFF-GRID COMPONENT

The objectives of the off-grid component of TEDAP are to (i) increase electricity access in rural and peri-urban areas, for households, enterprises, as well as health and education facilities; (ii) establish a functioning institutional framework for sustainable commercially-oriented, rural-electrification service delivery that can be scaled up; and (iii) exploit Tanzania's renewable energy potential.

The off-grid component comprises three sub-components, as follows:

- Small Power Producers. The SPP programme includes grid-connected renewable-generation projects and mini-grids[49]. Working with the Energy and Water Utilities Regulatory Authority (EWURA), and with assistance of SIDA trust fund[50], the programme has prepared a regulatory framework consisting of standardised contracts, avoided cost–based tariffs, regulatory rules and guidelines to support small renewable-energy projects (under 10 MW), implemented by the private sector, that sell power to TANESCO and may also serve communities in the vicinity of power plants using a mini grid owned and operated by the developer. In addition, this component has developed a comprehensive financing framework, which includes matching grants for pre-investment work, performance grants for mini-grid connections, and a credit line to commercial banks for re-financing of renewable energy loans (see below).
- Stand-Alone Renewable Energy Electrification (mainly using solar PV systems). The REA uses the Sustainable Solar Market Package (SSMP) model, which bundles institutional and household PV electrification services in a contiguous area to take advantage of economies of scale, product standardisation, and efficient delivery of repair and maintenance services. The SSMP approach attempts to address several challenges identified in the previous solar PV

[49] The mini-grids can be isolated mini-grids, or they can be connected to the main grid, but owned and operated by the private sector as an independent mini-grid. This type of SPPs sells excess power to TANESCO, using TANESCO as an anchor client.

[50] The World Bank is administering a trust fund financed by SIDA for energy access expansion and regulation in Tanzania that is providing technical assistance and capacity building to REA, EWURA and other stakeholders involved in the SPP and off-grid electrification program.

programs in Tanzania, in particular the high costs of systems sold in rural areas, their sustainability and affordability:

- Costs: Installation and transaction costs are reduced by bundling a larger number of PV systems in the same geographic area. Bundling of public facilities with private market increases the attractiveness of the packages, resulting in more competitive tenders.
- Sustainability: Sustainability of the public systems is reinforced through standardization of hardware supported by a the 5-year maintenance contract. The contractor's physical presence in the target area throughout these five years also enables provision of after-sale services for the private market.
- Affordability: Apart from the performance grants provided by REA, the contractors are required to implement additional measures to improve affordability, such as provision of micro-finance or deployment of pay-as-you-go systems.

The REA also uses the Cluster model to achieve market aggregation, working with local smallholder associations (e.g., coffee, cashew, and tea). It works with other donors to launch innovative business models to deliver off-grid lighting and energy services, such as through the AFREA[51]-financed Lighting Rural Tanzania competition, which supported innovative business models for delivering affordable lighting and micro-energy services in rural areas of Tanzania.

- Technical Assistance. This sub-component includes capacity building of off-grid electrification stakeholders (government, private-sector, NGOs, and users), pre-investment support, development of new business models, policy studies, and monitoring and evaluation. Additional stakeholder capacity building is provided through a SIDA-funded, World Bank-administered trust fund. In addition, several developers of renewable-energy, mini-grid projects supported by GVEP International are working in close cooperation with the REA.

TEDAP SUPPORT

TEDAP offers mini-grid developers matching grants of up to $100,000 to conduct pre-investment work leading up to financial closure. In addition, performance grants of $500 per connection, not to exceed 80 percent of project cost, are available to developers to offset the high costs of rural electrification and ensure that resulting tariffs are affordable to customers.

In 2010, a US$23 million credit line was added that provides local commercial banks long-term funding in local currency with which they can on-lend to small renewable-energy projects. The refinancing facility was established in response to the severe difficulties the private sector has faced in obtaining needed long-term financing to support off-grid electrification projects. The Tanzania Investment Bank, with REA oversight, administers the credit line, which is available to any Tanzanian commercial bank complying with the Bank of Tanzania's prudential regulations.

[51] AFREA stands for Africa Renewable Energy and Access Program. It is an ESMAP program for Africa, financing development of innovative solutions for scaling-up renewable energy and access in Africa. The first phase, which financed the Lighting Rural Tanzania competition, was funded by the Netherlands Ministry of Foreign Affairs.

Under the SSMP project, funding for the public and community-services facilities is provided by the government or other donors, whilst a performance-based grant is used to help households defray the cost of solar home systems (SHS). Customers may obtain a loan from a partner microfinance institution, use pay-as-you-go technology to tie usage to payment, or pay cash for the balance of the SHS payment. For both the SSMP and Cluster projects, household PV system developers receive grants of about $2.50 per Wp for systems under 30 Wp and $1.50 per Wp for larger ones.

Winners of the Lighting Rural Tanzania competition are awarded grants of up to $100,000.

To date, renewable energy–based electrification outcomes have included TANESCO signing Small Power Purchase Agreements (SPPAs) with 11 developers to supply 46 MW of power (currently, three projects are supplying about 10 MW to TANESCO) and TANESCO signing Letters of Intent (which precede SPPAs) with another 6 developers for 31 MW of power. The REA performance-based grant support to mini-grids, SSMPs and stand-alone electrification and the innovative Lighting Rural Tanzania project will benefit more than 100,000 households.

ACHIEVEMENTS TO DATE

The main achievements of the SPP programme are as follows:

- Regulations, standardised contracts, avoided cost–based feed-in tariffs, regulatory rules and interconnection and implementation guidelines for EWURA-issued SPP renewable energy. TEDAP and SIDA-supported preparation of rules and procedures is now under way for setting retail tariffs for private companies that sell directly to retail customers. The World Bank–administered SIDA trust fund supports REA and EWURA capacity building.
- REA processing of matching-grants applications for 60 projects. The agency has supported the pre-investment work of companies through awarding matching grants for about 20 SPP renewable-energy projects, with other 5 under evaluation. In addition, GVEP International supports the pre-investment work for 6 projects, while UNIDO supports 9 similar mini-grid projects.
- Performance grants. These have been awarded to 3 projects, with another 4 expected to be awarded within the next year. The pipeline of connections from these projects is 15,000.
- TANESCO has signed Small Power Purchase Agreements (SPPAs) with 11 developers for 46 MW. Three are already selling power to TANESCO, and 2 are under construction. Six of the projects use biomass, 4 rely on small hydro, and 1 uses solar PV. Six will sell power to TANESCO’s main grid and 5 to TANESCO’s isolated grids.
- TANESCO has signed 7 Letters of Intent, a precursor to signing the SPPA, with 319 MW of projects. Sit projects are small hydro and one is solar PV. Five will sell power to TANESCO’s main grid and 2 to TANESCO’s isolated grids.
- Training. Commercial bank staff members have received training in appraisal of mini-grid and small renewable power projects; while engineers, hydrologists, and other staff have been trained in preparing feasibility studies. TANESCO SPP unit has received extensive training related to SPP interconnection and other technical and administrative aspects of the SPP

program. In addition, low-cost electrification methods are under development, and wind-resource assessments are being conducted in 4 areas.

The main achievements of stand-alone electrification are as follows:

- SSMP implementation is underway in Sumbawanga District in Rukwa Region to benefit the population 80 villages with electricity services to schools, dormitories, dispensaries, health clinics, police posts and street lighting, expected also to benefit 8,000 households and other private customers.
- SSMP projects prepared for eight additional districts to benefit population in 455 villages through community services and electricity services for 70,000 households and private customers. REA is ready call for bids. In addition, the Millennium Challenge Corporation has financed an SSMP project in Kigoma Region to benefit the population in 25 villages.
- Cluster project was undertaken with cashew, coffee and tea associations, though only one is progressing. The EU is funding a similar cluster project in Lake Victoria region to benefit 15,000 households.
- Two rounds of Lighting Rural Tanzania competitions held with 10 awards made in the first round and 20 in the second round, with over 20,000 households benefiting from improved lighting.

EMERGING LESSONS

Key lessons that have emerged from the off-grid electrification component of TEDAP are as follows:

Renewable-Energy Mini Grids

- Strong private-sector interest is tempered by the need for essential pre-requisites: streamlined procedures and regulations to minimise transaction costs and time, transparent processes.
- Limited experience and capacity in undertaking feasibility studies and preparing projects for financing has resulted in the need to extend preparation time for over-committed staff members and consultants to reach the financial application stage. Thus, both capacity building and specialised expertise are critical.
- Soliciting private companies to submit proposals, proposal evaluation, and awarding matching grants are time-consuming processes. Bundling projects and awarding their preparation to larger, more capable entities for Transaction Advisory Services can reduce time and cost and improve outcomes. One example of the bundling concept is GVEP International's responsibility for 6 projects.
- Commercial bankers have little experience in lending to this sector. Training bank staff in performing due diligence is important. Whilst classroom training is useful, the real value added is providing experienced consultants to work with banks on evaluating actual projects. Although the banks started to lend to renewable energy projects under the credit line, they remain very risk averse.
- High equity requirements (about 40 percent) and limited access to long-term financing reduce project bankability. The TEDAP credit line, while important, does not eliminate the

constraint of high equity requirements. Although international private-equity funds have started to enter the Tanzanian off-grid electrification market, the high equity returns demanded and concerns over currency and off-taker risks have limited their investments.

- TANESCO's recent delayed payment of SPP and IPP invoices is of great concern to current and future investors. Early resolution of this problem through liquidity injections to TANESCO and/or using appropriate risk-mitigation instruments is essential to maintaining the viability of the SPP programme.

Stand-Alone Systems

- Preparing the SSMP bid packages is an expensive, time-consuming process involving considerable village and consumer survey work. Owing to the lengthy process, conditions in the project area may have changed by the time contractors begin work. The procurement process is complex due to the combination of goods, installation, and services. The preparation of the bidding documents should therefore start as early as possible in order to have enough time to implement the investments. Strong technical support is needed to minimize preparation time.
- Bundling supply and installation of larger PV systems with long-term maintenance contracts, plus sale of PV systems to private customers, can be an effective delivery model; however, finding interested companies with capabilities that span all functions is difficult, meaning that competition is limited. A good information campaign to bidders is essential to attract high quality bids. In the future, these functions may need to be split into (a) supply and installation of PV systems in public facilities, which can interest both international companies and domestic firms and (b) long-term maintenance and sales to private customers, for which domestic firms are far better suited.
- SSMP project implementation has taken longer than anticipated, requiring intensive time and personnel supervision. This situation has resulted, in part, from contractors not complying with requirements and the need for multiple verification visits to correct problems. Also, sites are located in remote areas, making accessibility time-consuming and expensive. Comprehensive technical support and adequate funds for verification are essential.
- Sale of small PV systems is difficult in these rural areas due to difficult logistics and limited ability to pay. Banks and microfinance institutions are reluctant to lend to these applications, which they consider consumer goods. Consideration should be given to using newly emerging, pay-as-you-go metered systems, such as Azuri and M-COPA, or smaller lower-cost Lighting Africa–qualified products that use efficient LED lights and offer additional mobile charging services.
- Cluster project implementation has been more difficult than anticipated. Owing to the inability to interest lenders, credit arrangements for sale of solar PV systems has been hard to arrange. As with the SSMP model, pay-as-you-go or lower-cost products may need to be considered.

The proposed SREP project concept, Renewable Energy for Rural Electrification, has taken these emerging lessons into consideration.

ANNEX V: TANZANIA ELECTRICITY GENERATION SUPPLY CURVES

Tanzania is endowed with vast and diverse energy sources, ranging from coal, gas, and large and small hydropower to geothermal, solar, wind, and biomass. Generation expansion planning studies have begun to examine the role that these options can play in supplying Tanzania with reliable least-cost electricity. The studies under way have identified specific projects and their optimal scheduling.[52] Based on this information and other data on renewable-energy options for which the preliminary resource potential has been identified, the economic levelized cost of electricity and supply curves were derived. Where country-specific information was lacking, data was obtained from other sources.[53]

An economic levelized cost of electricity was computed in constant 2012 U.S. dollars using an economic discount rate of 10 percent. Coal and gas prices were based on current Tanzanian prices of US$60 per ton and US$2.70 per thousand cubic feet (MCF), respectively, with no real cost increases over project lifetimes. These costs are below current international prices. As of December 2012, the export price for South African coal was US$89 per ton, the U.S. Henry Hub price of natural gas was US$3.60 per MCF, and diesel was assumed at US$0.85 per litre. Taxes, duties, and subsidies were excluded. Table V.C provides the data used and the results of the levelized cost calculations. The acceptable amount of intermittent wind and solar generation was set conservatively at 15 percent of 2025 coincident daytime peak for each resource (i.e., 85 percent of the daily peak). As Tanzania has large amounts of reservoir hydro, the value of intermittent generation is high since it can add capacity as water storage behind the dams.

Results of the levelized economic cost of generation, presented in Figure V.A, exclude transmission and gas pipeline costs, which will increase the supply cost of generation from sources located far from demand centres. Large hydro and natural gas have the lowest levelized electricity cost, though geothermal and coal are comparable. These generation costs are in the range of US¢ 4–8 per kWh. The levelized costs for biomass, wind, and solar are US¢ 6–12 per kWh, with diesel generation at more than US¢ 30 per kWh. Financial levelized electricity costs are expected to be higher than the economic costs as the return on equity, interest rates will be higher than the economic discount rate, and loan tenors significantly less than the economic life of the assets.

For clarity of presentation, a supply curve is presented for the aggregated sources of electricity generation rather than on a project-by-project basis. Figure V.B shows the supply curve for the weighted average generation costs, as well as the lower and upper bounds for each type of generation.

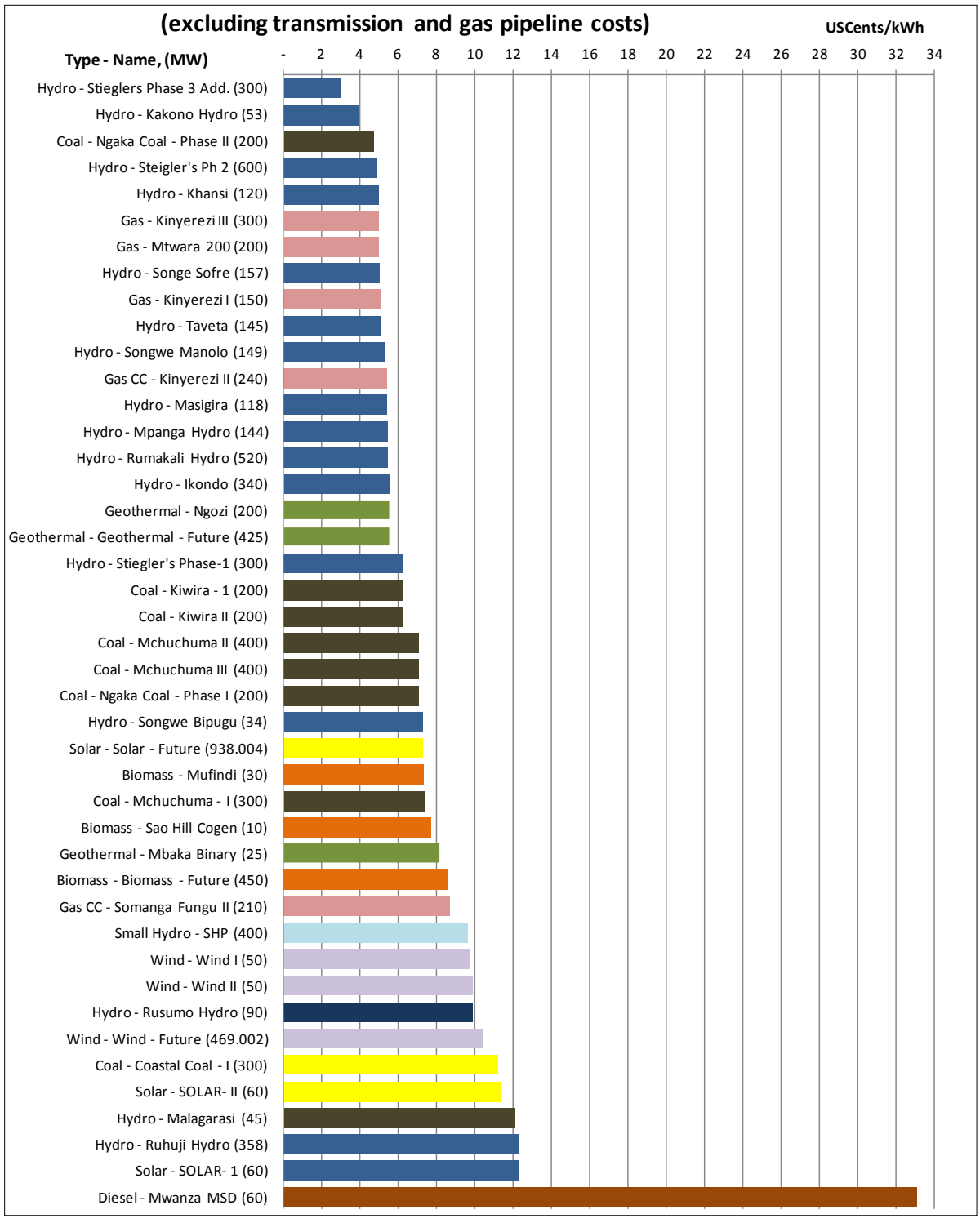
According to the Power System Master Plan (PSMP), dependence on large hydro will return to about 35 percent by 2035 (Figure V.C). Given the impact of weather variability, over-dependence on hydropower could exacerbate problems observed in the recent past, with Tanzania once again resorting to purchasing significant amounts of high-cost emergency generation to offset the shortfall in hydro generation. Increasing diversity through a variety of renewable energy sources can lower the

[52] Ministry of Energy and Minerals, "Power System Master Plan 2012 Update," Interim Executive Summary Report, November 2012.

[53] The World Bank, "Technical and Economic Assessment of Off-Grid, Mini-Grid and Grid Electrification Technologies," Energy Sector Management Assistance Program, September 2006.

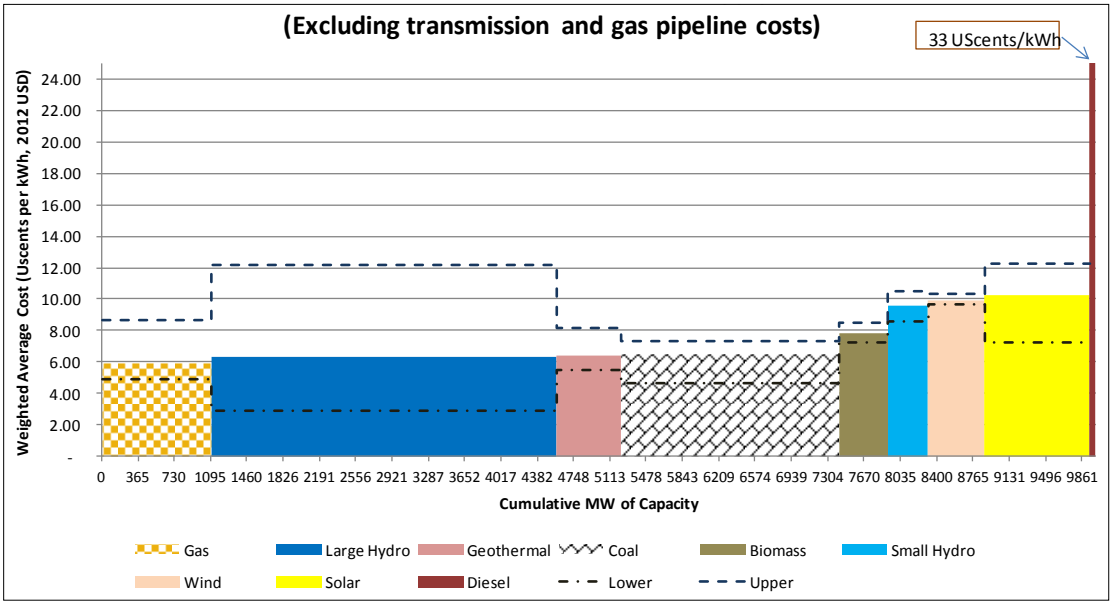
risk-adjusted levelized cost of electricity. Moreover, diversifying with renewables that have no recurring fuel cost component further reduces risk exposure to volatile fuel prices.

FIGURE V.A LEVELIZED ECONOMIC COST OF GENERATION



Source: SREP Task Force calculations.

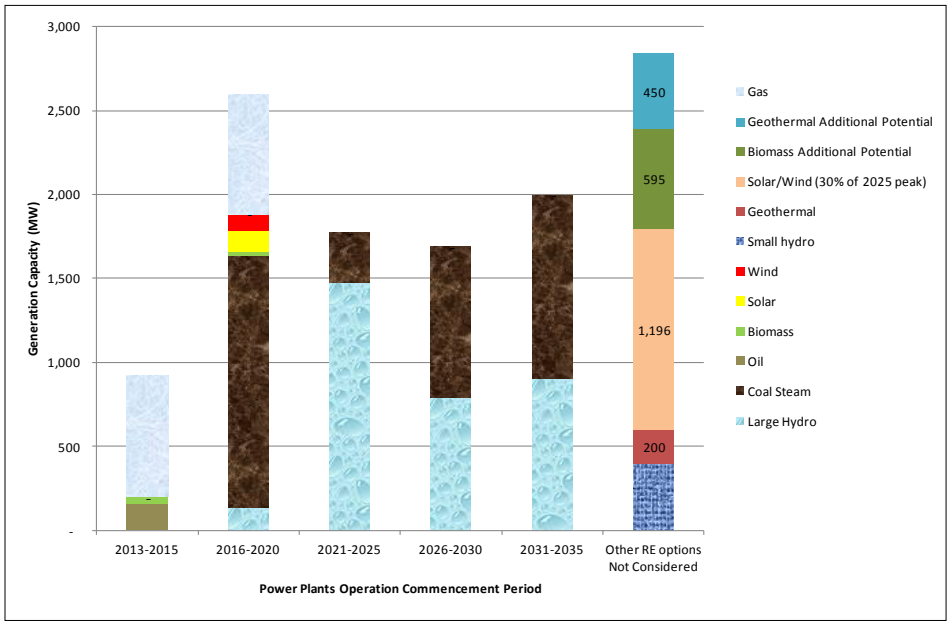
FIGURE V.B GRID-CONNECTED GENERATION SUPPLY CURVE



Source: SREP Task Force calculations.

Although most non-conventional renewable-energy sources (i.e., geothermal, biomass, wind, small hydro, and solar) are not included in the PSMP 2012 Update at any significant level, they could contribute about 3,000 MW (Figure V.C, far-right-column). This figure is indicative since a more extensive assessment is needed to confirm the resource potential. In the assessment, the combined contribution of solar and wind is contained to not more than 30 percent of the 2025 daytime coincident peak load. This estimate also excludes off-grid use of solar and wind.

FIGURE V.C CAPACITY ADDITIONS PROPOSED IN PSMP 2012 UPDATE AND OTHER RENEWABLE ENERGY OPTIONS NOT YET CONSIDERED



MINI-GRID ELECTRIFICATION OPTIONS

The mini-grid options analysis compared diesel generation with small hydro, biomass power, solar PV-battery, and solar PV-battery-diesel hybrids. Economic cost analysis was conducted based on the following assumptions:

- Diesel generator installed capital cost is US$500 per kW, diesel fuel and lube oil are $1.27 per litre, SFC is 0.4 litres per kWh, and diesel O&M is 20 percent of annual capital cost.
- Hydro installed capital cost is $3,000 per kW, and O&M is 5 percent of annual capital cost.
- Biomass installed capital cost is $2,500 per kW, O&M is 10 percent of annual capital cost, biomass fuel required is 1.4 tons per MWh at $30 per ton (at 30 percent moisture content).
- Solar installed capital cost is $3,000 per kW, plus $150 per kWh for battery; O&M is 1 percent of annual capital cost for solar and 5 percent for diesel in hybrids. The solar PV-only option has 3 days autonomy and a 75 percent maximum battery depth of discharge. The hybrid system has 1.2 days autonomy and derives 15 percent of its electricity from diesel.[54]
- Diesel generators have a 10-year life before major overhaul; the plant life for PV, small hydro, and biomass is 20 years, while battery life is 5 years.
- The economic discount rate is 10 percent.

Results of the analysis, summarised in Table V.A, show that renewable-energy mini grids, with the exception of PV-battery systems[55], can be least economic cost suppliers of electricity to a mini grid. However, site-specific conditions could change the results. For example, if demand varies seasonally, a renewable-energy system may have to be oversized to meet maximum seasonal demand. During the other months, when demand is lower, excess generation potential will be wasted and thus the cost of useful electricity delivered would be higher.

[54] These costs estimates are based on the current prevailing costs in Tanzania. It is expected that costs would fall as a larger market for off-grid solutions develops, particularly for PV which is also experiencing falling prices globally. For example, LCOE for solar PV with battery and PV-battery diesel hybrid in Asia is reported to be almost at half of Tanzania costs. With future PV installed costs of US$1,500 per kW (compared to $3,000 per kW assumed, and battery life extended to 10 years from the five years assumed, levelized electricity economic cost from PV-battery and PV-battery-diesel hybrid could drop to $0.43 and $0.36 per kWh, respectively.

[55] With the rapidly falling PV prices, it is expected that the PV-battery LCOE should drop to $0.43, making it competitive with diesel.

TABLE V.A ECONOMIC LEVELIZED COST OF MINI-GRID ELECTRICITY

Economic Levelized Cost of Electricity in Mini-grids from Various Energy Sources (Busbar Cost)						
	Units	Isolated Diesel Generator	Small Hydropower Plant	Biomass Power Plant	Solar PV with Battery	PV-Battery-Diesel Hybrid
Connections	Number	3,000	3,000	3,000	3,000	3,000
Total Demand	MWh/year	1,080	1,080	1,080	1,080	1,080
Peak demand	kW	450	450	450	450	450
Capacity	kW	500	500	500	740	629
Annual Fuel Required	liters diesel or biomass tons	432,000	-	1,512	-	64,800
Batttery	kWh	-	-	-	11,836	4,734
Capex	US$	250,000	1,500,000	1,250,000	3,994,521	2,846,438
Annnualized cost						
Capex	US$/year	40,686	176,189	146,825	728,995	438,262
O&M	US$/year	50,000	75,000	125,000	39,945	50,964
Fuel	US$/year	546,934	-	45,360	-	82,040
Total Annual Cost	US$/year	637,620	251,189	317,185	768,940	571,266
Levelized Electricity Cost at generator	US$/kWh	0.59	0.23	0.29	0.71	0.53

STAND-ALONE ELECTRIFICATION OPTIONS

The analysis of stand-alone electrification options compared lighting services provided by variously sized solar PV systems with kerosene lighting (Table V.B). Results show that solar CFL and LED lighting produce 3–27 times as much light as the kerosene lighting alternative. Simple payback in terms of months of avoided kerosene expenses are in the range of about 7–40 months. Clearly, the larger kits, such as solar home systems (SHSs), will require some form of financing or pre-payment metering solutions since most rural consumers could not afford the high upfront costs, despite the system's far superior service. The analysis did not consider other value-added services that PV systems typically offer, ranging from mobile phone charging (in smallest kits) to operating a radio or small TV (in larger kits).

One kerosene lamp is assumed to be replaced by one solar light despite the far superior light output from electric lighting. LED lighting kits are based on information from Lighting Africa (http://www.lightingafrica.org) and manufacturers. Larger SHS prices are based on an FOB cost of US$6 per Wp. Other assumptions for solar products are an exchange rate of 1,600 TZS to 1 US$, a per-container shipping cost of $3,000 (from Shanghai) and $1,500 (from Chennai), local transport cost of $1,000 per container, port clearing charge of $500 per container, and distribution margins of 50 high and 0 percent duties and taxes. Kerosene lighting performance is conservatively valued.[56] The kerosene fuel price is assumed at TSH 2,023 per liter, while kerosene lamp use is assumed at 3 hours per day with 0.025 litres consumed per hour.

[56] Based on data in Louineau et al., "Rural Lighting: A Guide for Development Workers," Intermediate Technology Publications, 1994.

TABLE V.B COST COMPARISON OF SOLAR PV LIGHTING KITS WITH KEROSENE LIGHTING

Indicative Cost comparision of solar lamps & kits compared to kerosene lighting	12 LED study light, 1.5 Wp module	LED Room Light, 1 Wp module	One room light + 2.5Wp module	Solar Flashlight, 0.5Wp module	Portable solar CFL lantern, 3Wp module	2x6W TL, 2 LED,1 Study, 15 Wp Module	4 LED area lights, 5Wp	20 Wp SHS with 3, 7W CFL lights	50 Wp SHS with 5 , 7 W CFLlights
Wp	1.5	1	2.5	0.5	3	15	5	20	50
Lumens	40	30	50	30	120	600	200	840	1400
Lumen-hours/day	480	160	500	240	360	2880	1000	3200	8000
Cost Analysis (in Tanzanian Shillings)									
Lamps & Solar Panel	16,800	20,000	54,400	20,000	50,133	200,000	88,000	294,400	592,000
Shipping	1,920	1,200	2,400	1,920	1,200	4,800	3,200	6,000	6,857
Port clearing cost	320	400	400	320	400	800	533	1,000	1,143
Taxes and Duties	-	-	-	-	-	-	-	-	-
Total Landed Cost	19,040	21,600	57,200	22,240	51,733	205,600	91,733	301,400	600,000
Local Transp/Handling	640	800	800	640	800	1,600	1,067	2,000	2,286
Distributor margins	9,840	11,200	29,000	11,440	26,267	103,600	46,400	151,700	301,143
Total estimated retail price (rounded)	29,500	33,600	87,000	34,300	78,800	310,800	139,200	455,100	903,400
Kerosene Alternative									
No. of kerosene lamps	1	1	1	1	1	3	4	3	5
Lumen-hours Kerosene	60	60	60	60	60	180	240	180	300
Liters/yr of Kerosene	27	27	27	27	27	82	110	82	137
Kerosene TSh/yr cost	55,380	55,380	55,380	55,380	55,380	166,139	221,519	166,139	276,898
Simple payback for solar in avoided kerosene cost (months)	6.39	7.28	18.85	7.43	17.07	22.45	7.54	32.87	39.15
Ratio of solar lumen-hours to kerosene lumen-hours	8.00	2.67	8.33	4.00	6.00	16.00	4.17	17.78	26.67
CO_2 emissions avoided per solar kit (kg CO_2/yr)	7.5	7.5	7.5	7.5	7.5	22.4	29.8	22.4	37.3
Solar kit retail cost ($/Wp)	12.29	21.00	21.75	42.88	16.42	12.95	17.40	14.22	11.29

TABLE V.C CHARACTERISTICS AND COSTS OF THE GENERATION PLANTS USED IN THE ANALYSIS

Plant	Type	MW	PLF	Life	Cost		Cost UScents/kwh			Total
					Capex $ million	$ million/ MW	Capex	O&M	Fuel	Uscents/ kWh
Mufindi	Biomass	30	80%	20	41.0	1.37	2.29	1.23	3.75	7.27
Sao Hill Cogen	Biomass	10	80%	20	16.0	1.60	2.68	1.23	3.75	7.66
Coastal Coal - I	Coal	300	74%	25	1,435.0	4.78	8.17	0.90	2.07	11.14
Kiwira - 1	Coal	200	80%	25	410.0	2.05	3.22	0.90	2.07	6.19
Kiwira II	Coal	200	80%	25	410.0	2.05	3.22	0.90	2.07	6.19
Mchuchuma - I	Coal	300	74%	25	769.0	2.56	4.38	0.90	2.07	7.35
Mchuchuma II	Coal	400	80%	25	1,025.3	2.56	4.03	0.90	2.07	7.00
Mchuchuma III	Coal	400	80%	25	1,025.3	2.56	4.03	0.90	2.07	7.00
Ngaka Coal - Phase I	Coal	200	74%	25	476.0	2.38	4.07	0.90	2.07	7.04
Ngaka Coal - Phase II	Coal	200	80%	25	214.0	1.07	1.68	0.90	2.07	4.65
Mwanza MSD	Diesel	60	74%	20	80.0	1.33	2.43	5.00	25.57	33.00
Kinyerezi I	Gas	150	74%	20	188.0	1.25	2.28	0.50	2.21	4.99
Kinyerezi II	Gas CC	240	80%	20	432.0	1.80	3.02	0.80	1.49	5.30
Kinyerezi III	Gas	300	74%	20	357.0	1.19	2.17	0.50	2.21	4.87
Mtwara 200	Gas	200	74%	20	241.0	1.21	2.20	0.50	2.21	4.90
Somanga Fungu II	Gas CC	210	37%	20	365.0	1.74	6.33	0.80	1.49	8.62
Kakono Hydro	Hydro	53	72%	30	99.3	1.87	3.14	0.75	-	3.89
Malagarasi	Hydro	45	50%	30	209.3	4.65	11.26	0.75	-	12.01
Mpanga Hydro	Hydro	144	50%	30	274.1	1.90	4.61	0.75	-	5.36
Ruhuji Hydro	Hydro	358	50%	30	1,688.7	4.72	11.42	0.75	-	12.17
Rumakali Hydro	Hydro	520	50%	30	994.1	1.91	4.63	0.75	-	5.38
Rusumo Hydro	Hydro	90	63%	30	423.6	4.71	9.11	0.75	-	9.86
Stiegler's Phase-1	Hydro	300	72%	30	962.0	3.21	5.37	0.75	-	6.12
SOLAR- 1	Solar	60	20%	30	120.0	1.75	10.60	0.50	-	11.10
SOLAR- II	Solar	60	20%	30	120.0	1.75	10.60	0.50	-	11.10
Wind I	Wind	50	34%	30	125.0	2.50	8.90	0.75	-	9.65
Wind II	Wind	50	30%	30	125.0	2.25	9.08	0.75	-	9.83
Stieglers Phase 3 Add.	Hydro	300	50%	30	280.9	0.94	2.27	0.60	-	2.87
Khansi	Hydro	120	50%	30	211.1	1.76	4.26	0.60	-	4.86
Steigler's Ph 2	Hydro	600	16%	30	342.7	0.57	4.25	0.60	-	4.85
Songwe Manolo	Hydro	149	50%	30	285.8	1.92	4.65	0.60	-	5.25
Songwe Bipugu	Hydro	34	50%	30	92.7	2.73	6.60	0.60	-	7.20
Masigira	Hydro	118	50%	30	229.5	1.95	4.71	0.60	-	5.31
Taveta	Hydro	145	49%	30	257.4	1.78	4.39	0.60	-	4.99
Songe Sofre	Hydro	157	50%	30	281.1	1.79	4.34	0.60	-	4.94
Ikondo	Hydro	340	50%	30	682.5	2.01	4.86	0.60	-	5.46
Solar - Other	Solar	938	20%	20	900.0	1.00	6.70	0.50	-	7.20
Wind - Other	Wind	469	28%	20	1,172.5	2.00	9.58	0.75	-	10.33
Ngozi	Geothermal	200	90%	30	600.0	3.00	4.04	1.48	-	5.51
Mbaka Binary	Geothermal	25	90%	30	112.5	4.50	6.05	2.09	-	8.15
Geothermal - Other	Geothermal	425	90%	30	1,275.0	3.00	4.04	1.48	-	5.51
Biomass - Other	Biomass	450	80%	20	945.0	2.10	3.52	1.23	3.75	8.50
SHP	Small Hydro	400	40%	30	1,000.0	2.50	7.57	1.99	-	9.56

ANNEX VI: RATIONALE FOR RANKING AND SELECTING PRIORITIES FOR SREP SUPPORT

Criteria	National Grid Power Supply				Off-Grid Electrification		Thermal
	Geothermal	Solar or Wind	Small Hydro	Biomass Power	Mini Grid	Stand-Alone Solar	Biomass Fuels
SREP Criteria							
Increased installed capacity from renewable energy	**High**. Potentially about 650 MW, with very high capacity utilisation.	**High**. Near unlimited potential constrained only by absorbable capacity due to intermittency.	**Moderate**. Potential estimated at under 500 MW.	**Moderate**. Potential estimated at under 500 MW.	**Moderate**. Capacity required relatively low in terms of MW (~250 MW).	**Low**. Large number of potential users, but small unit capacities (~100 MW)	**High**. Ninety percent of energy from biomass and much of it used for cooking.
Increased access to energy through renewable energy	**Moderate**. Helps access with dispatchable power.	**Moderate**. Helps access but supply intermittent.	**Low**. Helps access to lesser extent due to seasonality.	**Moderate**. Helps access with dispatchable power.	**High**. Directly increases access to millions in hard-to-reach areas.	**High**. Directly increases access to millions in hard-to-reach areas.	**High**. Improved access for millions of people.
Low emissions development	**High**. No global-warming emissions.	**High**. No global-warming emissions.	**High**. No global-warming emissions.	**Moderate**. Full emissions offset not available.	**High**. No global-warming emissions.	**High**. No global-warming emissions.	**Moderate**. Full emissions offset not available.
Affordability and competitiveness	**High**. If resource is confirmed, low-cost electricity. But commercial risks must be mitigated.	**Moderate**. Cost higher than geothermal. Commercial risks lower as less capital intensive.	**Moderate**. Cost higher than geothermal. Commercial risks lower as less capital intensive.	**Moderate**. Cost higher than geothermal. Commercial risks lower as less capital intensive.	**High**. Far less costly than diesel generation. Some subsidy needed for affordability.	**Moderate**. Less costly than diesel generation or use of kerosene and batteries. Subsidies needed for affordability.	**High**. Enhanced supplies and efficient use will lead to lower costs.
Productive use of energy	**High**. Base-load, reliable power supply helps improves productive uses.	**Moderate**. Intermittent power must be backed up to supply reliable power needed for productive uses.	**Moderate**. Seasonal intermittency must be backed up to supply reliable power needed for productive uses.	**High**. Base-load, reliable power supply helps improves productive uses.	**High**. Quality and quantity of power suitable for productive uses.	**Low**. Affordability usually limits power levels per user; suitable for households uses.	**Moderate**. Primarily used for cooking.

Criteria	National Grid Power Supply				Off-Grid Electrification		Thermal
	Geothermal	Solar or Wind	Small Hydro	Biomass Power	Mini Grid	Stand-Alone Solar	Biomass Fuels
Economic, social, and environmental impact	**High**. Supports regional economic development. No negative social consequences. Positive environmental impacts if well designed and located.	**Moderate**. Land requirements may conflict with other uses. Must be designed to meet environmental standards.	**Moderate**. May compete with other water uses. Must be designed to meet environmental standards.	**High**. Economic benefits high in local communities in supplying fuel. Fuel must be from sustainable sources.	**High**. High-value electricity brought to community sooner than possible by grid extension. Income generation potential supported by electricity supply.	**High**. High-value electricity brought to community sooner than possible by grid extension. Environmental impact of improper battery disposal must be managed.	**High.** Economic benefits to suppliers of fuel-efficient stoves. Significant indoor air quality improvement. Reduces unsustainable biomass supply.
Economic and financial viability	**High**. Lower-cost electricity and good financial returns if risks are mitigated.	**Moderate**. Low-mid electricity cost and good financial returns if risks are mitigated.	**Moderate**. Low-mid electricity cost and good financial returns if risks are mitigated.	**Low**. Low-mid electricity cost and good financial returns. Fuel supply/price risk must be mitigated.	**High**. Far less costly than diesel generation. Some subsidy needed for affordability.	**High**. Less costly than diesel generation or use of kerosene and batteries. Subsidies needed for affordability.	**Moderate**. Improved supplies may lead to lower costs. Cookstove affordability may require subsidy.
Leveraging of additional resources	**High**. Resource confirmation can lead to significant private investment.	**Moderate**. Whilst resource risk is lower, investment needed is less than for geothermal.	**Moderate**. Whilst resource risk is lower, investment needed is less than for geothermal.	**Moderate**. Whilst resource risk is lower, investment needed less than for geothermal.	**Moderate**. May require additional government support to interest private investors.	**Moderate**. Requires subsidy support. Low affordability limits sizes of systems customers will purchase.	**Low**. Supply-enhancement role for government. Low investment for fuel and cookstove supply. Low user affordability.
Gender equity	**Low**. Bulk grid electricity supplies do not target women.	**Low**. Bulk grid electricity supplies do not target women.	**Low**. Bulk grid electricity supplies do not target women.	**Low**. Bulk grid electricity supplies do not target women.	**Moderate**. Benefits women and children as households are predominant users.	**High**. Benefits women and children as households are target users.	**High**. Main beneficiaries are women as biomass is used mainly in households.

Criteria	National Grid Power Supply				Off-Grid Electrification		Thermal
	Geothermal	Solar or Wind	Small Hydro	Biomass Power	Mini Grid	Stand-Alone Solar	Biomass Fuels
Co-benefits of RE scale-up	**Moderate**. Offsets fossil-fuel use, releasing these fuels for higher-value uses. Increased high-value income opportunities.	**Moderate**. Offsets fossil-fuel use. Increased high-value employment and income opportunities.	**Moderate**. Offsets fossil-fuel use. Increased high-value employment and income opportunities.	**High**. Offsets fossil-fuel use. Creates opportunities for farmers through sale of agricultural waste; increases income opportunities for fuelwood suppliers.	**High**. Increased energy security to vulnerable and small communities and enhanced socioeconomic conditions. Avoided risk from kerosene fires.	**High**. Increased energy security and safety to households and enhanced socioeconomic conditions. Avoided risk from kerosene fires.	**High**. Increased energy security; enhanced socioeconomic conditions for households. Major co-benefits from sustainable forestry and reduced deforestation.
Additional National Criteria							
Contribution to national energy supply/electrification goals	**High**. Vital to ensuring availability of stable, year-round power supplies; not subject to weather and fuel-supply uncertainties.	**Moderate**. Augments supply, but intermittency must be managed.	**Moderate**. Augments supply, but seasonal intermittency must be managed.	**Moderate**. Augments supply, but fuel-supply organisation and management are difficult.	**High**. Important for meeting national electrification goal. Least-cost option for about 20 percent of population if they need to be reached within 10 years.	**High**. Important for meeting national electrification goal. Least-cost option for about 30 percent of population if they need to be reached within 10 years.	**Moderate**. The main reasons are related to the environment, public health, and deforestation, rather than energy per se.
Contribution to base load or essential daily needs	**High**. Directly contributes to base load.	**Low**. Intermittent power supply must be managed.	**Moderate**. Seasonally variable power and lower MW contribution.	**Moderate**. Lower MW contribution.	**Moderate**. Total MW contribution not high but does provide essential energy services.	**Moderate.** Total MW contribution not high but does provide essential energy services.	**High**. Vital energy services for cooking and industrial and agricultural heat supply.

Criteria	National Grid Power Supply				Off-Grid Electrification		Thermal
	Geothermal	Solar or Wind	Small Hydro	Biomass Power	Mini Grid	Stand-Alone Solar	Biomass Fuels
Government role complements, but does not crowd out, private sector	**High**. Removes resource risks and mitigates commercial risks; levels high private investments.	**High**. Creates the enabling environment and reduces commercial risks; incentivises private investments.	**Moderate**. Important to creating the enabling environment, but business prospects less than for geothermal, solar, or wind.	**Moderate**. Important to creating the enabling environment, but business prospects less than for geothermal, solar, or wind.	**Moderate**. Broad private-sector engagement difficult due to perceived risks, which take time to overcome. Significant grant assistance required.	**Moderate**. Broad private-sector engagement difficult due to perceived risks, which take time to overcome. Significant grant assistance required.	**High**. Creating enabling environment and enforcement will encourage credible fuel and technology suppliers to participate. Benefits small entrepreneurs.
Project implementation readiness	**Low**. Some initial exploratory work done, but more work needed to create an enabling environment and for resource confirmation.	**Low**. No enabling environment, resulting in ad hoc submissions of unsolicited proposals. Resource assessment at early stage. No development strategy.	**Moderate**. SPPA regulations and guidelines in place. But limited available long-term financing. Limited human capacity.	**Moderate**. SPPA regulations and guidelines in place. But limited available long-term financing. Limited human capacity. Resources are dispersed, and availability uncertain.	**High**. REA-led support to project identification and development, and capacity-building bearing fruit. Robust pipeline of projects becoming available. EWURA establishing regulations.	**Moderate**. REA has several SSMP projects benefiting some 450 communities (80,000 households). Many more projects needed. Other partners supporting financing and capacity building for commercial SHS sale.	**Low**. Early stages of problem definition and determination of solutions. Diverse stakeholders must engage in problem solving.

ANNEX VII: INDEPENDENT REVIEW

SREP TANZANIA INVESTMENT PLAN

Independent Reviewer Comments and Feedback from the Government of Tanzania and the MDBs

Independent reviewer: Mike Allen

Peer Review Comment	Response
GENERAL COMPLIANCE WITH SREP	
Catalyse increased investments in renewable energy	
The plan outlines how it is anticipated that SREP investments and programme support will help attract other public and private funding. This is explained in some detail. The leadership of existing government agencies is seen as establishing strategies that will provide public-funded examples in the geothermal and solar market segments and help aggregate the markets in the latter so that private investors have larger-scale opportunities to develop. The expectations around the geothermal strategy may require some tempering (see recommendations below).	Well noted.
Create an enabling environment	
The plan clearly acknowledges that a sound regulatory environment is essential if the clean energy markets in Tanzania are to grow. The plan looks to utilise SREP funds to address legislation and regulation around the geothermal market in particular. The proposal to assist with transactional services in the solar sector should offer additional encouragement for private-sector participation.	Well noted.
Increase energy access	
Access to electricity is a major issue as power is available to less than 20 percent of households. The plan reflects the reality of the enormous unmet demand for electricity; the SREP will help to address the issue, which is also a focus of wider investment strategies.	Well noted.
Build implementation capacity	
With leadership of the Ministry of Energy and Minerals (MEM) and the autonomous Rural Energy Agency (REA), Tanzania's institutional structure appears to offer a sound approach to the coordinated management of efforts to build clean energy resources in the country. Various references suggest recognition that added capacity will be required as new programmes are introduced, and the plan addresses how these may be met. Clearly, there are numerous donor/partner relationships; no doubt, their effective management is an ongoing challenge. The private sector (said to be strong and active) is seen as a key element of development, and various financial incentives to buy down risk are anticipated to encourage its expanded participation.	Well noted.

Improve the long-term economic viability of the renewable energy sector	
Tanzania's power system is complex, heavily dependent currently on diminishing hydro reserves. The introduction of renewables is following the path of many other nations; at this stage, the near-term commercial viability remains a challenge. During the call of 6th May, it was explained that efforts are under way to consider introducing feed-in-tariffs for all renewables. With this support, it would be hoped that growth going forward will still be largely market driven. Given the current immaturity of the renewables market, it is perhaps more realistic to accept that SREP support will help build the market, but its impact on the sector's long-term economic viability will be indirect and in the future, rather than perhaps immediately apparent as a result of the SREP investments.	Well noted.
Achieve transformative impact	
The targeted nature of the proposed SREP investments in the geothermal and solar market sectors is seen as a pragmatic approach. As noted above, the renewable-energy sector is relatively immature; thus, major market transformations through the SREP alone are unlikely; but a well-managed, focussed programme around geothermal and solar opportunities will add to the emerging strengths within the sector.	This is in line with SREP objectives, whereby the SREP will help to catalyse additional financing and quick-start a transformative process in the sector.
SPECIFIC COMMENTS ON INVESTMENT PLAN	
GEOTHERMAL POWER DEVELOPMENT	
General compliance	
Given the current status of geothermal knowledge and exploration in Tanzania, the plan proposes an approach that, from a macro point of view, appears reasonable. It takes into account the main aims under the SREP, as noted above.	Well noted.
Capacity to execute and technical assessment of proposed approach	
As the papers within the plan clearly acknowledge, geothermal development is not straightforward. The intention appears to be that support from a number of partners would be utilised across various stages.	This is correct.
Mention is made of a geothermal roadmap, but this is not explained in detail (a copy of this report was offered by Mr. Ishengoma during the call of 6th May). A note of caution is that care should be taken to ensure that resources are targeted. Roadmaps have become popular, but their shortcoming is that they can be technology driven; it is important to recognise from the outset that any significant power facility must integrate with TANESCO and meet its operational requirements at an acceptable cost. While there will be pressure to explore a range of fields, it is important that an initial filtering be undertaken to eliminate those that, for example, are particularly remote, small in scale, distant from transmission, have likely issues around land access and environmental restraints, and overall will be the most challenging for development. During the call of 6th May, it was stressed that the intention is to initially focus on only one or two fields.	The MEM is in the process of drafting the roadmap for geothermal development. The IP has been updated to include an overview of the roadmap at its present state. The approach for field identification and then selection for drilling is systematic. As the IP notes, with JICA assistance for satellite imagery analysis, highest priority fields will be identified, including such consideration factors as grid accessibility. SREP support will be used for the high-risk, but potentially high-reward, test-drilling phase for a few fields that have highest promise.

The proposed model where the public sector undertakes the preliminary higher-risk activities accurately reflects international experience; interestingly, in very few geothermal developments has the private sector carried this risk; where this has occurred, it has only been possible because the developer was a substantial corporation that could fund such activities off its own balance sheet.	Well noted.
Given the limited SREP investment anticipated, there would appear to be a risk that inadequate funds will be available to follow through to a power development unless there is a focus on only one or two preferred resources. It is unclear how the expenditure on surface exploration and pre-feasibility studies is expected to be split and across how many fields. Some additional detail on the assumptions around costs and budgets would help to clarify this issue.	Given Tanzania's lack of experience in geothermal development, the cost estimates have depended on those provided in the referenced ESMAP report, "Geothermal Handbook: Planning and Financing of Geothermal Power Generation," Technical Report No 002/12, June 2012, as well as guidance provided by consultants from BGR who have been conducting geo-scientific studies of the Tanzanian fields for a number of years. The estimated cost breakdown is given in the cost estimate (Annex I). Further detailing of costs will be done during project preparation, for which a PPG is being sought. The PPG will be used for, among others, preparation of the Geothermal Development Project, including detailed project design, environmental and social impact studies, technical design of resource exploration work programme and its costing, project economic and financial viability, and co-financing mobilization/confirmation.
In a virgin field it would be reasonable to expect that drilling of no less than 3–4 wells might be necessary before there was adequate evidence of an available resource. A comparison with experience in early Kenyan developments would tend to confirm this; the current approach in Kenya is built on long-term development and considerable experience around the nature of its resources. Care should also be taken in assuming that costs in Kenya are a reliable guide for what may be required for building a geothermal industry from scratch in Tanzania.	The MEM intends to draw on experiences in the region, particularly Kenya. It is recognised that geothermal resource temperatures in Tanzania are likely to be lower than in Kenya and therefore greater numbers of wells will need to be drilled to obtain the same energy output.
Impact	
With the reservations noted above, a focus on geothermal opportunities could provide the impetus needed to open up this market in Tanzania. Experience from other countries in the region supports the value and impact this could have on building a substantial base-load generation capacity. It is, however, a long-term process requiring firm management to put the policy and regulations in place and build an environment that will attract experienced private-sector partners.	We agree. The first task under the geothermal development component is to establish the enabling environment for geothermal development, as noted in the IP. This work comprises drafting policy, legislation, and regulations for geothermal development; supporting the institutional development plan; establishing and staffing relevant organizations; and capacity building, training, and knowledge and lessons sharing.

Use of investment, capturing and disseminating lessons learnt, and stakeholder engagement	
Again with the above-noted reservation about adequacy of overall project funding, the direction of SREP funds into geothermal has been well justified. Given the likelihood of numerous partners involved across the project, ranging from policy and regulation through exploration and possible power-plant construction, it will be important to maintain existing links with stakeholders and continue this engagement. To date, there appears to have been good stakeholder engagement and recommendations from meetings with them are reflected in the plan.	To-date, various donors, including KfW, ICEIDA, JICA, and DFID, have expressed interest in supporting this work, along with SREP. KfW has been supporting BGR to provide assistance in exploration. JICA is currently supporting remote sensing of geothermal resources, and DFID has fielded a team of geothermal experts. Discussions are ongoing with KfW regarding benefitting from the Geothermal Risk Mitigation Facility it set up at the African Union. The Government of Tanzania and the AfDB will have continued dialogue with other stakeholders during project preparation and implementation (see proposed institutional framework for the SREP-Tanzania IP implementation).
One approach that is successfully used by Ken Gen in Kenya is having a small external advisory board; current members are from the U.S., New Zealand, Guatemala, and Iceland, each of whom brings specialist knowledge and can also contribute experience across the spectrum of issues within any geothermal project. Such a group might be of value in helping focus efforts in Tanzania and could include those with regional experience from Kenya and Ethiopia.	This is excellent advice. The MEM will invite several geothermal experts from other countries to serve on an external advisory board to complement the existing Geothermal Task Force, which comprises of a number of relevant national agencies.
Social considerations	
Unlike solar developments, geothermal has more immediate application to grid-connected power supply; hence it contributes to national access to electricity rather than to local needs alone. In this way, its contribution to energy access enhances economic and social development.	Agree.
Attraction of additional investment	
It is understood that, at the current stage, there is limited geothermal funding from the MDBs and bilateral agencies. The stakeholder consultations suggest a potentially high level of interest from various donors to support specific aspects of development, which would be triggered by the SREP investment. It is assumed that significant private-sector participation can be attracted to the power-plant phase of the project. Clearly, this will depend on the success of the exploratory efforts undertaken with SREP and donor funds.	Agree. The development strategy as articulated in the IP focuses SREP and donor assistance at the phases up to resource confirmation. It is during the second phase, power development, that private-sector investment is anticipated, conditional on confirming the resource. Even in the second phase, a partial risk guarantee will be created to cover other risks (e.g., TANESCO payment delays).

Overall Summary	
The proposed Geothermal Power Development Project is an aggressive plan. If it succeeds in opening up the geothermal market in Tanzania, it could provide a valuable longer-term source of energy for the country. The plan has been prepared with considerable background research and thought, drawing on regional experience, particularly from Kenya. Some caution about the spread of efforts is recommended, given the relatively low budget and the limited national experience in the geothermal sector.	The detailing of the Geothermal Power Development Project during project preparation and the step-by-step implementation will be done cautiously, taking into account the risks and budget constraints. It will further mitigate risks by seeking advice from regional and international experts.
RENEWABLE ENERGY FOR RURAL ELECTRIFICATION PROJECT	
General compliance	
This project builds on what appears to be growing experience within Tanzania under programmes led by REA. Given the initiatives by EWURA and that these will provide the opportunity for stand-alone mini grids and interconnections with TANESCO, the moves to increase the activity in this sector fit well with the aims of the SREP. The potential to use solar generation to supplement and/or displace diesel generation provides a significant incentive. The programme outcomes, however, depend heavily on access to funds from the World Bank and other partners to finance installations.	The MEM recognises that renewable energy–based rural electrification programs are capital intensive compared to diesel-based supply; thus, considerable capital investment is required. The Government of Tanzania has received considerable support in rural electrification, including renewable energy–powered electrification, particularly from the World Bank and SIDA. The World Bank is in discussion with the Ministry of Finance about the new project pipeline, including SREP co-financing. SIDA is planning to scale up support to the REA; NORAD has also committed funds to REA. . The SREP donor co-financing thus includes funds expected to be provided to the REA for off-grid electrification, based on existing commitments of these two development partners and the World Bank, who all expressed interest in joining forces under the SREP. There are, however, additional donors considering support to mini grids (e.g., DFID is preparing a mini-grid initiative for East Africa. USAID is considering a mini-grid program for Tanzania). If these expectations materialize, even more significant scale-up could be possible. The law also requires that a REA-managed Rural Energy Fund receive funds from the rural electrification surcharge on electricity sales. The government is confident that funds will be forthcoming to support a program at the envisaged scale, especially as rural electrification will be guided by the Rural Electrification Master Plan currently under development, with support from NORAD. But, should funds be limiting, the pace of electrification can be slowed.

Capacity to execute and technical assessment of proposed approach	
A number of barriers have been recognised as hampering sector growth; these have been identified as "*reducing the time and transaction cost of off-grid electrification project development; making credible information on renewable resources and community characteristics available; increasing access to long-term financing at reasonable rates; increasing affordability of electricity services by reducing project costs; improving delivery efficiencies and using performance-based grants to reduce upfront costs; mitigating risks to private investors (payment risk, currency depreciation, renewable-energy resource uncertainty, etc.); assuring product quality and introducing best practices; increasing awareness of options; and increasing human capacity for project design, implementation, operation, and management.*" In themselves, these points suggest that some central issues need to be addressed; whether a single project can hope to resolve so many issues is a fair question. The approach that is being outlined does, however, have the provision of comprehensive transaction services as a key element and, working with the IFC, this would appear to be a realistic solution in the near-to-medium term.	A number of instruments already being deployed on a limited scale under the World Bank–assisted TEDAP are showing promise. These include providing access to long-term financing, providing grant assistance to reduce electricity-connection costs, and offering cost-shared assistance to developers to prepare projects and reach financial closure. These instruments were effective in delivering the first renewable-energy mini grids in Tanzania, but they are not sufficient to achieve the intended scale-up, as a number of barriers still remain. The Transaction Advisory Services Facility (TASF), developed and administered by the IFC support, will address the key information and capacity barriers. In parallel, a risk mitigation facility has been proposed to cover the off-taker risk, which has been identified as a cornerstone barrier.
Impact	
The plan outlines the use of funds to provide support to a broader programme funded by the World Bank and other donors, which is envisaged to provide solar electricity to some 400,000 households or businesses. This is based on obtaining a total of US$183 million (SREP, $25 million; World Bank, $50 million; other donors, $47 million, and private sector/commercial banks, $59 million). Securing these funds is obviously critical to the level of impact that will be achieved.	Agree. The REA and Government of Tanzania are actively soliciting the co-financing required. The expectations of co-financing are based on the existing donor plans to support the REA (see above).
Use of investment, capturing and disseminating lessons learnt, and stakeholder engagement	
It is understood that the plan draws on experience to date, as outlined above, and that funds from the SREP are to focus on resourcing support to overcome the challenges experienced. There has been strong stakeholder engagement in preparations to date. An excellent summary of lessons learnt, annexed in the plan, has helped to formulate the proposed approach; it will be valuable if the issues raised as concerns about past programmes can be regularly reviewed as the plan is implemented to ensure they are being addressed rather than inadvertently perpetuated.	Agree. The REA will engage with the Rural Energy Working Group, as well as Development Partners, to ensure that attention is focussed on removing recognised constraints.
Social considerations	
The opportunity to deliver solar electricity to an estimated 2.2 million people would be a considerable achievement. Clearly, it would offer well-recognised social benefits to those currently dependent on basic energy supplies and no access to electricity.	Agree.

Attraction of additional investment	
The proposed Renewable Energy for Rural Electrification Project is heavily dependent on access to investment from a number of groups. While it is understood that agreement for support from the World Bank is well advanced, the level of commitment from the other sources is less clear. It is argued that the provision of the transaction services will help overcome existing bottlenecks, but project implementation will only be achieved to the level that available funds allow.	Agree. Following consultations with various stakeholders and partners, it is expected that the project will be supported by several bilateral partners. Initially, SIDA and NORAD have expressed interest to participate in implementing the SREP: DFID is also interested to cooperate in the context of its East Africa mini-grid facility, which is under development. Additional discussions are ongoing with several other development partners for either direct participation in the SREP or development of a coordinated approach supporting investments in renewable-energy mini grids, micro grids, and stand-alone systems. The SIDA-funded trust fund for technical assistance to the REA and EWURA will contribute to the development of SREP by financing a review and updating the regulatory framework for small renewable power producers in Tanzania and providing capacity building to both the REA and EWURA to prepare for the scale-up of renewable energy and access. Under the TASF, the IFC will engage the private sector, with an objective of mapping out the key bottlenecks (both technical and non-technical) in the development of commercial projects and design an appropriate facility to support project developers. This is a crucial step to mobilising the required private-sector financing.
Overall Summary	
The Renewable Energy for Rural Electrification Project is clearly a key element for growth in the supply of electricity to areas outside those currently served by TANESCO. In addition, it should provide some opportunities for demonstrating the integration of new renewable generation into the TANESCO grid. The project is a complex mix of service provision and securing of financing from public- and private-sector sources; increasing the scale of activities and drawing all the elements of the project together, while addressing the issues that have been bottlenecks in the past, will require strong strategic planning and ongoing review to ensure that the ambitious growth targets can be met.	The Renewable Energy for Rural Electrification Project will be guided by the Rural Electrification Master Plan and Investment Prospectus, currently under preparation with NORAD assistance. This prospectus will delineate areas to be served by the TANESCO grid and those to be served by off-grid means. As the REA has the statutory responsibility for rural energy provision, it is responsible for ensuring that a well-coordinated program is developed and executed.

RECOMMENDATIONS	
The Investment Plan, as presented, is thorough and well prepared. It responds to the SREP criteria and draws on well-document past experience in proposing programme approaches.	Well noted.
One area apparent throughout is that Tanzania draws support from a wide array of donors; the work being proposed for SREP support will rely on funding and support from many of these partners. Although background comments on stakeholder meetings are provided, it could be useful to add comments within the plan that cover the following:	
• Experience with donor coordination; past examples of programmes where multiple donors have collaborated.	The IP notes that there is a strong and active Development Partner Energy Sector Coordination Group, currently led by SIDA in place. It meets regularly to exchange information and issues a regular report on what each donor is undertaking. Chapter 3, Renewable Energy Potential and Development Status, describes what support Tanzania is receiving in reach technology. There is already a precedent of very close coordination, including joint/parallel financing between the World Bank, SIDA and NORAD (for example, World Bank is administering a SIDA trust fund for REA and EWURA; SIDA is providing parallel financing for the REA's SSMP packages, NORAD is financing the Rural Electrification Prospectus, the work being supervised jointly with SIDA and the World Bank etc.). A new section in Chapter 2 has been added to the IP that summarizes the donor coordination process.
• More specific quantification of the anticipated sources of finance, and the current commitments/status of discussions/likely date of final agreement.	This is important and will be done during preparation of the proposed SREP-financed projects as detailed discussions and negotiations, beyond that already taking place between the GOT and Development Partners, are more appropriate when developing the detailed financing plan for the projects.
• Reference to risks that failure to secure anticipated funding would create included in the risk matrix; i.e., contingency plans for funding in place if anticipated sources are not secured.	A reference has been included.
These recommendations were discussed in some detail during the 6th May call, when it was clarified that, in addition to ongoing discussions with the Ministry of Finance on the likely requirements for added funding to support the SREP, donor commitments will be clarified as the IP moves into its preparation phase. It was acknowledged that this progress is needed before full engagement with donors can be effective. Others stressed that approaches to secure IDA funds in particular should be made as early as possible to ensure timing of receipt of funds matches project needs.	Once the SREP Subcommittee approves the IP, the MEM will begin discussions with the MOF regarding obtaining World Bank IDA funding commitments for the Renewable Energy for Rural Electrification Project. The firm commitment will, however, only be possible once the IDA17 allocation for Tanzania is known.