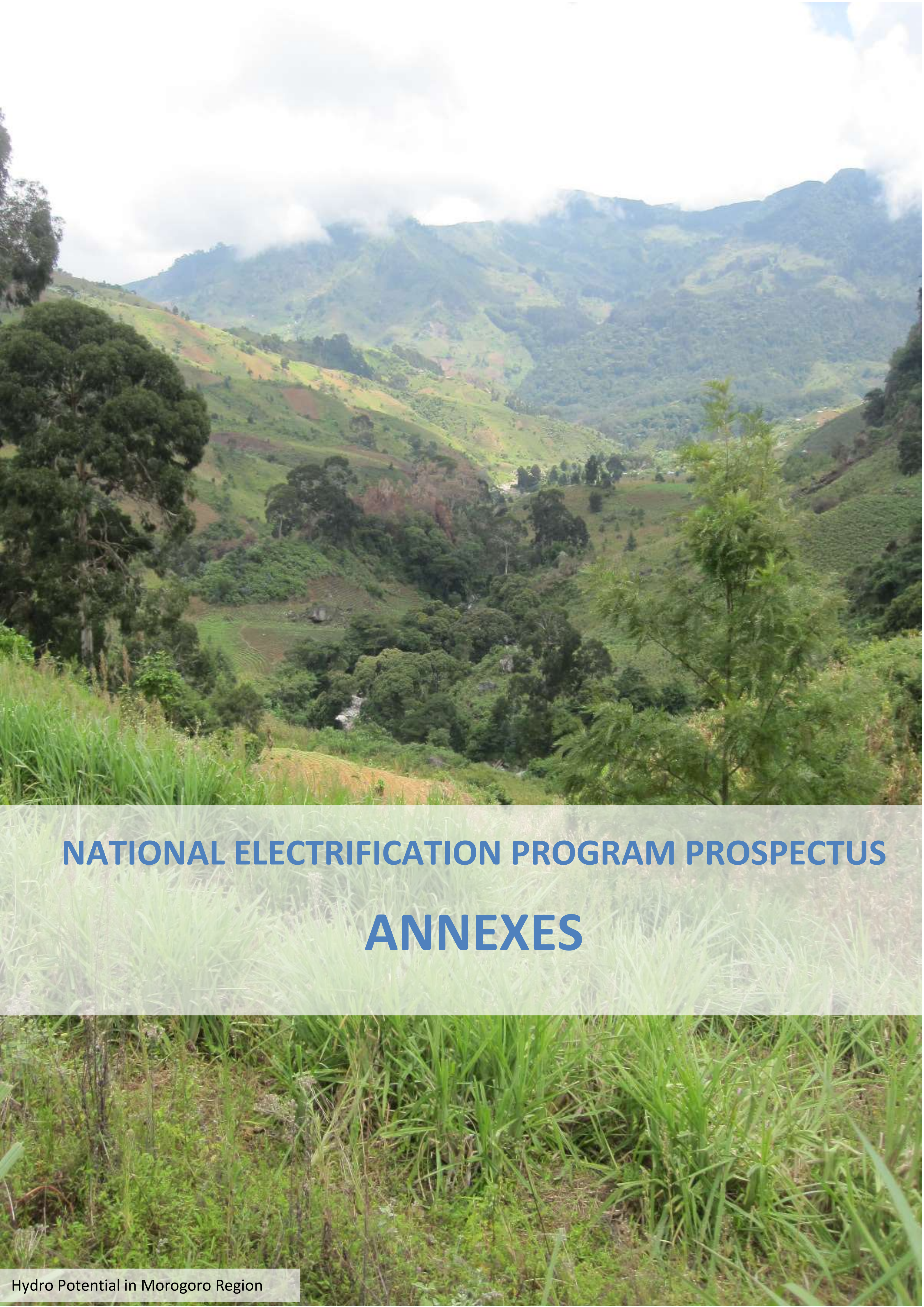
NATIONAL ELECTRIFICATION PROGRAM PROSPECTUS

ANNEXES



Hydro Potential in Morogoro Region

ANNEX 1: Status of Electrification

1.1 Definitions of Electrification

Estimating the status of electrification in Tanzania is not only difficult because of data problems but also because there is no consensus on how to define electrification.

In the most widely used definition worldwide, the status of electrification is measured by the **electrification ratio (a.k.a access ratio)**, defined as follows:

$$\frac{\textbf{Number of electrified households*}}{\textbf{Total number of households}}$$

**Electrified means "connected to a grid or with an own source of electricity generation"*

Other definitions focus on the **access to services which electricity may provide**[1]. In these definitions, households which are connected to a grid or have their own source of supply belong, of course, to households which have access to electricity services. But that may also apply to non-electrified households as the following examples demonstrate: (1) a shop offering internet access in a nearby town; (2) an electrified clinic in a small town which provide access to the town's people and nearby areas on the services offered by the clinic; (3) a neighbour who is connected to the grid may offer his non-connected neighbours to charge their mobile phones at his home. While work is still ongoing on how to exactly define access to electricity services, it is obvious that the access values will be higher than the electrification ratio.

The Government of Tanzania favours an access definition since the electrification target is expressed as access to modern electricity service. An operational definition which allows measuring access is still outstanding.

1.2 Electrification Ratios in Recent Years

TANESCO's statistics show the number of registered customers by tariff category. However, the number of registered household customers is not shown. Estimating the figure requires assumptions regarding the number of customers of each tariff category that would be classified as households.

Figure A1.1 displays TANESCO's total registered customers between 2001 and 2013. The figure also shows the estimated number of registered household customers since 2008. The estimates assume that all D1 customers and 85% of the T1 customers were households[2].

[1] For a thorough discussion of the various issues associated with the definition and measurement of access see the report prepared by the World Bank/ESMAP, WHO, IEA, and the Global Alliance for Clean Cookstoves: "Sustainable Energy for All, Consultation on Global Tracking Framework, Proposed Methodology for Global Tracking of Energy Access", November 2012.

[2] The statistics evaluated by the consultant only provide the number of D1 and T1 customers since 2008. It is for this reason that the number of registered household customers is only shown from 2008 onward.

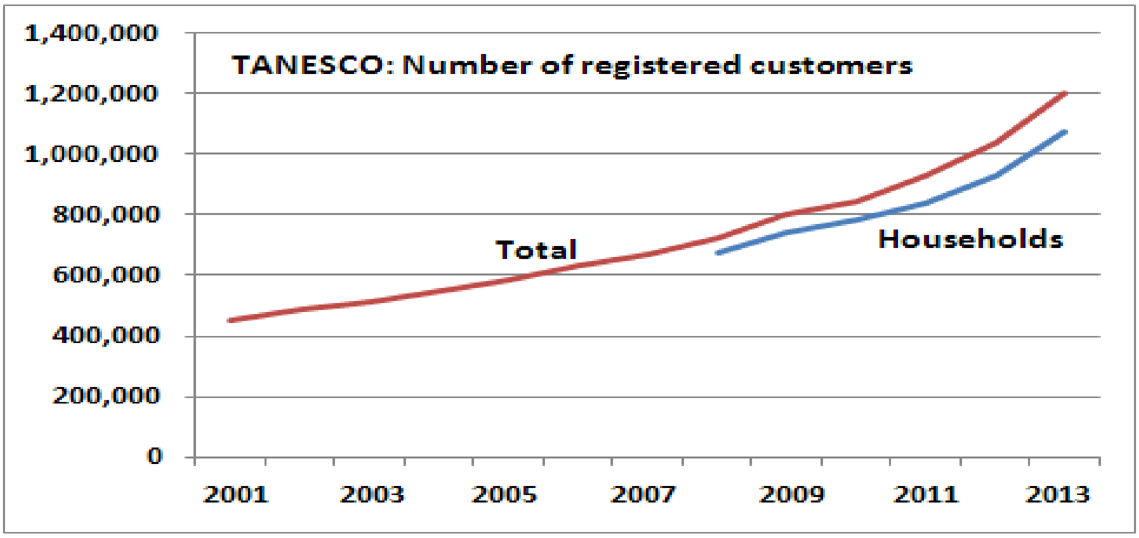


Figure A1.1: Development of TANESCO's registered customers in the period 2001 – 2013

At the end of 2013, the total number of registered customers reached about 1.2 million and the number of registered household customers about 1.07 million. A sharp increase in the numbers have been seen in recent years where more than 100,000 new customers (households and others) were connected in 2012 and 2013 saw another record with more than 160,000 customers. The Government's policy to advance electrification and the significant reduction of the connection fees in early 2013 are the main reasons behind the sharp increase. For single-phase customers with prepayment meters, the connection fees were, for example, lowered from US$ 241 to US$ 111 in rural areas and to US$ 201 in urban areas. The fees apply if the customers are within 30 meters of the distribution line.

The number of registered household customers underestimates the real number of household customers supplied by TANESCO. A survey conducted by IED in 2012 found that one household meter supplied an average of 1.25 households[3]. The results of the Baseline Survey conducted by REA in 2011 also indicate that more households are supplied by TANESCO than officially recorded.

Estimating the electrification ratio requires taking into account households which are supplied by other electricity suppliers than TANESCO. These suppliers comprise of:

- Communities, NGOs or religious institutions which operate a diesel generator or, in few cases, a mini-hydro plant and have set up a small grid to supply some households and other entities.
- Companies which produce the electricity needed for their business themselves and also supply some households in the surroundings, typically households of their employees.
- Households equipped with solar-home systems.
- Households equipped with a small diesel generator.

[3] The consultant sees the main reason for this phenomenon in that TANESCO's definition of a household differs from the definition used in demographic statistics. A family may ask TANESCO to install one meter. The family is then one household customer in TANESCO's statistics. The family may, however, comprise grand-parents or the families of sons or daughters who (still) live with the parents. A demographic survey would in that case count more than one family.

Only anecdotal data are available on the number of customers served by the other suppliers. The Baseline Survey which was conducted in 2011 in rural areas found, for example, that about 1% of households in rural areas had a diesel generator and about 1.5% had a solar-home system.

Based on the assumptions listed in Box 1, **the overall electrification ratio is estimated at 15.3% in 2011, 16.3% in 2012 and 17.7% at the end of 2013.** The break-down by urban and rural areas for 2013 produces electrification ratios of 45.1% for urban areas and 5.7% for rural areas.

Box 1: Assumptions made to estimate the electrification ratios

a) All of TANESCO's D1 customers are household customers and so are 85% of the T1 customers.

b) All of TANESCO's customers in Dar Es Salaam and 80% of its customers in other regions are urban customers. Rural customers are 20% of the customers in the regions other than Dar Es Salaam.

c) A meter installed at a household customer by TANESCO supplies on average 1.25 households.

d) At the end of 2013, 3% (5%) of households in rural (urban) areas which are not supplied by TANESCO either had a diesel generator, a solar-home system or were supplied by communities, NGOs, religious institutions or companies.

e) At the end of 2013, there were 2.8 million urban households in Tanzania and 6.3 million rural households. The numbers assume that the average household size was 4.9 persons.

ANNEX 2: List of electrification projects and associated activities which have been funded by donors

The following list is not exhaustive, neither as regards to the donors nor as regards to the projects funded by the listed donors. The list is mainly based on information obtained during discussions with donors. That information has been supplemented by information found in reviewed documents.

- **NORAD** finances the present study and provides some budget support to renewable energy projects, rural electrification and regional interconnection programmes.

- **SIDA** provided grants for the electrification of Urambo, the electrification of Serengeti and the studies for the 220-kV Makambako line (initially 132 kV) and associated electrification projects. Estimated amount: about 10 million US$. In addition, the World Bank-administered SIDA Trust Fund, which financed technical assistance and capacity-building activities for the REA, EWURA, and other key government and private-sector stakeholders.

- **EU:** Under the Rural Energy Program of the 10th EDF, the EU made 10 million Euros of grant financing available for three small hydro projects, a biogas project and a PV project. The EU Energy Facility co-financed almost 50% of the investment cost of the Mwenga Hydro Project in the form of a grant (3.6 million Euros) and financed the IREP studies by a grant (about 0.75 million Euros over two years). Under the SAGCOT Program, the EU financed rural electrification projects in the Kilombero and Ulanga Districts (Morogoro Region).

- A **Japanese Grant** financed transmission and distribution systems in 2010. The estimated amount is about 23 million US$.

- **AfDB** is financing rural electrification in the North of Tanzania (Mwanza, Shinyanga, Geita) and the rehabilitation of substations in Arusha and Dar es Salaam. The total budget is about 45 million US$.

- The **World Bank** finances the TEDAP Project (credit, 160 million US$, 2007 - 2015) which mainly focuses on improving power supply in the three main growth centers of Dar Es Salaam, Arusha and Kilimanjaro. **GEF** contributes 6.5 million US$ grant to the TEDAP and the **AFREA Trust Fund** a 1 million US$ grant for the component “Lighting Rural Tanzania”.

- **MCC** provided grant funding for the rehabilitation and extension of distribution systems in 7 regions: Tanga, Dodoma, Morogoro, Iringa, Mwanza, Kigoma and Mbeya. A 4.7 million US$ grant funded a PV project in the Kigoma region which comprised the installation of 208 kW of PV systems at 45 schools, 10 health centers, and 120 dispensaries as well as several local municipal buildings and businesses.

- **USAID** started supporting the electricity sector in 2013. A USAID-financed advisor is presently assisting REA.

- **AfD** started in mid 2013 a credit-line facility similar to the one provided under the TEDAP Project. A description of the credit line provided by TEDAP is given below.

- **UNIDO/GEF** finances technical assistance and mapping of micro hydropower (MHP) resources (1.8 million US$), capacity building of stakeholders in developing MHP based mini-grids (1.2 million US$), assistance in the development of viable business models for rural MHP mini grid (0.8 million US$), and subsidies for the investment costs of micro hydro plants (6.2 million US$).

- **GiZ** has financed capacity building projects and studies.

ANNEX 3: On the economics of grid extension versus off-grid electrification

3.1 Grid extension

Figure A3.1 shows the order of magnitude of the levelized economic cost of the grid extension programs.

Production and transmission costs have been taken from the Cost of Service Study (EWURA 2012) and the discussion paper on cost reflective electricity tariffs (EWURA 2012). LEC for bulk generation: 8.6 US cents/kWh. LEC for transmission: 2.2 US cents/kWh. Bulk generation costs are based on a mix of gas-fired generation, hydropower and coal-fired generation. At present, generation costs are much higher due to the highly expensive diesel emergency programme. Distribution costs are the low-cost network design costs determined as part of the Prospectus.

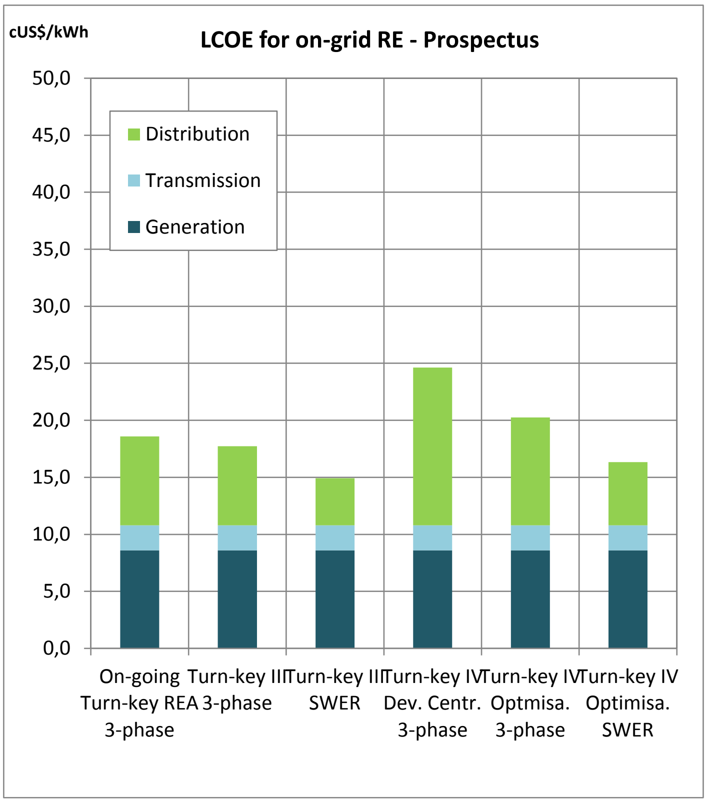


Figure A3.1: Levelized economic cost of turnkey programs

The grid extension by SWER technology that has the lowest LEC does not mean that this technology should be used everywhere. Using SWER is only recommended for areas where the demand for electricity is projected to be low over a long period and where in particular no large use of equipment is expected which normally requires 3-phase supply.

3.2 Off-grid supply with mini-hydro plants

Tanzania is endowed with a good hydro potential. Unfortunately the climate changes seem to seriously impact the availability of the resource and the larger dams have not been able to supply the expected power quantities during the late recurrent draughts. Most of the hydro resources are close to the densely populated areas of Tanzania Mainland. These resources can, on one hand, contribute to the national bulk supply through the national grid or can, on the other hand, constitute the basis for local power supply to clusters of rural localities until their connection to the national grid. 162 sites with a capacity of less than 10 MW each have been identified and are considered potential candidates to SPP (Small Power Producer) schemes under EWURA regulation.

Generally the quality of the hydrologic data is poor and outdated. It would be relevant to support the Ministry of Water Resources and the various basic agencies to develop an atlas on hydro resources. A hydropower resource assessment study is financed by ESMAP; the consultant in charge shall have the possibility to recommend additional measurement equipment for hydrological stations and TA if needed.

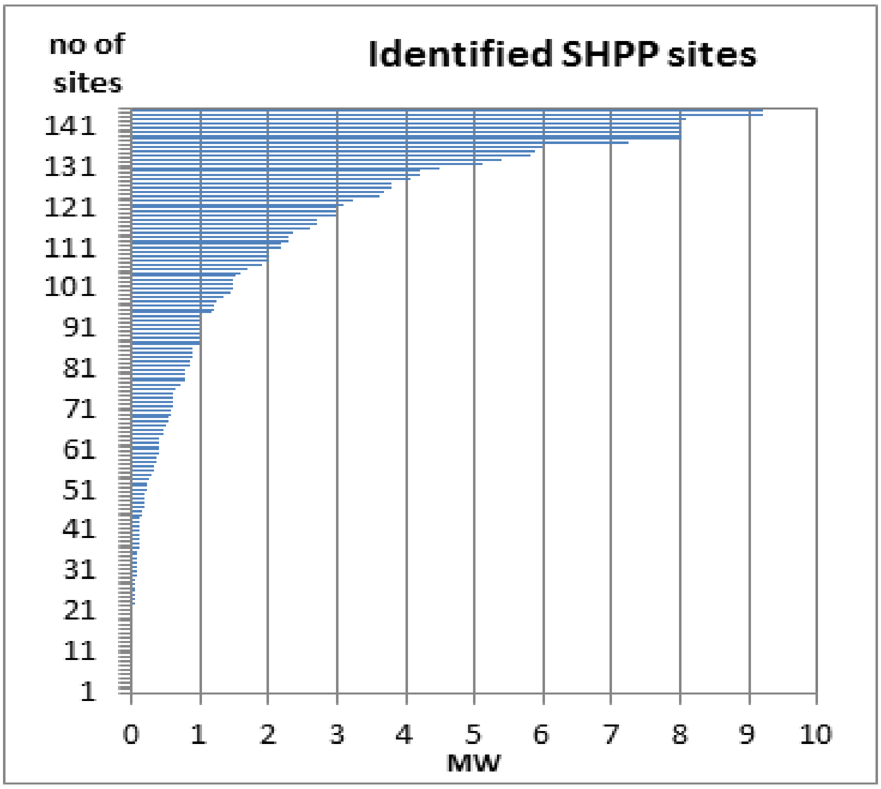


Figure A3.2: Distribution of Potential Hydro Sites (<10 MW) - GIS database

The cost of rural electrification based on hydro-power generation depends on many factors:

- The physical characteristics of the site.
- The capacity of the site and the demand in the cluster of settlements to be supplied.
- The length of the MW line connecting the hydropower plant to the cluster of settlements to be supplied.
- The minimum production capacity during the low water periods and the length of this period. Some sites will require installation of diesel power generation to complement hydropower production during low water periods.
- The distance to the main grid. The distance determines the feasibility of selling surplus production to the national grid under the FiT Scheme. Surplus production is the difference

between the production capacity and the demand in the cluster of settlements that would be supplied.

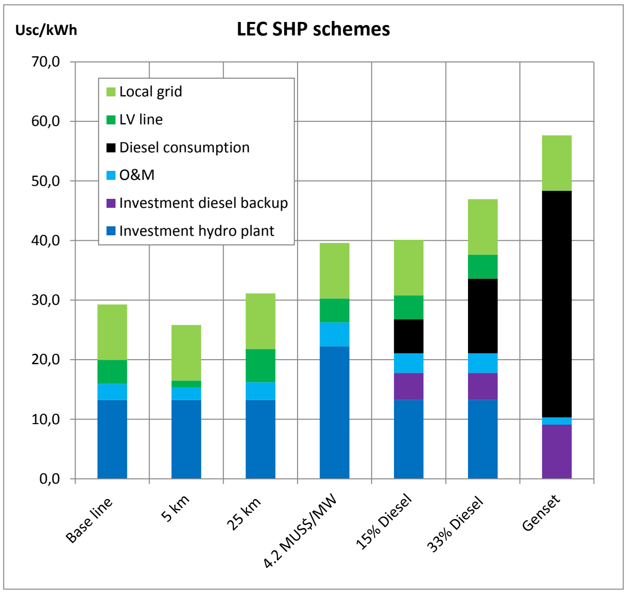


Figure A3.3: Levelized economic cost of isolated power supply

(Hydropower generation versus Diesel genset)

Figure A3.3 illustrates the levelized economic cost (LEC)[4] of a small hydro plant with investment cost of 2,500 US$/kW and 18 km of MV feeder line to the supplied settlements. Discount rate is 10%; economic diesel fuel cost is 0.7 US$/litre.

The same figure shows that the LECs of the hydro scenarios are lower than those of the diesel-only alternative.

The comparison with Figure A3.1 reveals that the LECs of the hydro scenarios are in most cases higher than the LECs of grid connection. The highest grid LEC shown in Figure A3.1 is about 25 US cents/kWh for development centres which would be electrified in Phase 3. These development centres are on average of about 40 km away from the grid.

3.3 Off-grid supply with biomass-fuelled gasifiers

Biomass residues such as sawdust and sawmills residues, rice husk and other agriculture by-products are available in large quantities and can be processed to produce electricity and thermal energy.

There are two major ways to use biomass for power generation:

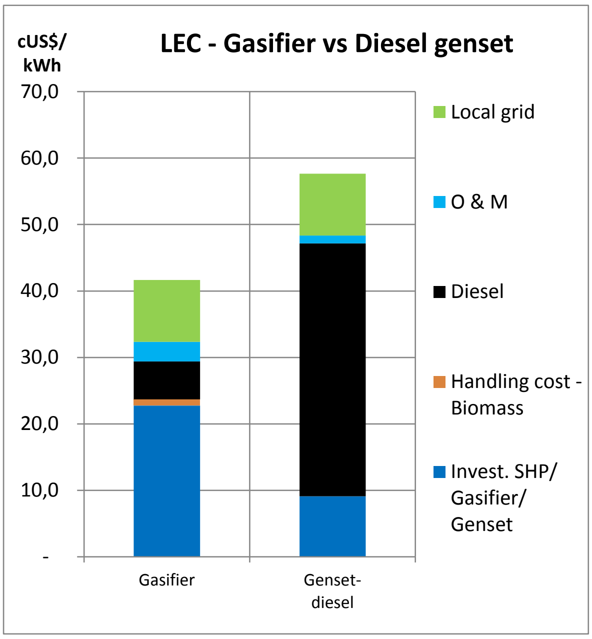
- Combustion: The biomass is burned in larger furnaces, heating medium to high pressure steam boilers. The steam is expanded in a steam turbine producing power. Depending on the local needs of thermal process energy, part of the steam can be tapped from the steam

[4] Discount rate 10%; economic diesel fuel cost 0.935 US$/litre, corresponding to a coat of 0.7 UU$/litre at Dar and 35% additional cost for transport and in rural areas. (Hydro production load capacity 50%, Demand load factor 35%, when necessary, diesel capacity up to 100% of demand peak load, increasing with the demand. In the simulation a locality of 5,000 inhabitants is supplied through a local grid, which cost estimates is identical to grid-connected localities). The economic live period for hydro equipment is sat to 35 years

turbine or from a back pressure turbine that processes steam applications (cogeneration). This technology is applied in Tanzania by wood and agro-industries, some of which sell excess power to TANESCO (Tanwat).

- Gasification: A gasifier produces gas (CO) from biomass. The gas is injected into a gas or dual-fuel motor which runs a generator. This technology is almost unknown in Africa, while 10,000 gasifiers are operating in South-East Asia. The size of the gasifiers ranges from 3 to 700 kW for wood gasifiers and from 40 to 400 kW for gasifiers using other biomass resources (rice husks, different shells). As a rule of thumb, 2 kg of rice husk or 1.35 kg of wood chips or saw dust is required to produce one kWh. For a local rural power demand ranging from 200 to 500 MWh per year, the available resource should be in the range of 400 to 1,000 tonnes of rice husk or 270 to 675 tonnes of dry wood residues.

The investment cost of gasifiers with dual-fuelled motor is about 2,250 USD/kW. About 15% of the total power production is generated from diesel fuel. Handling and storage of raw materials also has a cost. A cost of 5USD/tonne is applied for the handling of the biomass as it is expected that most of the biomass is available in the vicinity of the plants.



FigureA3.1: Levelized economic cost of isolated power supply

(Gasifier versus Diesel genset)

Excluding the costs of the local grid, the LEC[5] of gasifier supply is 32.6 US cents/kWh. That is significantly lower than the 48.3 US cents/kWh value of diesel generation. The gasifier has a relative short life time of 8 to 10 years. In areas with sufficient biomass resources, the gasifier can be considered as a viable alternative to diesel generation. This technology can develop the rural

[5] Calculated for an economic life time of 8 years, a unit investment cost of 2250 US/kW and an economic cost for rural diesel cost at 0.935 USD/l.

electricity market in an area prior to its connection to the national grid. As technology for power generation is to be sold to the grid, the production costs are too high compared to the proposed FiTs.

3.4 Off-grid supply with diesel-PV hybrid systems

For localities far from the national grid and in regions with no hydro and biomass resources, use of solar energy is an alternative to diesel generation. The conditions for using solar resources are good in many parts of the country. In Tanzania, PV systems produce between 1,300 to 1,700 kWh per year per kWp.

Two different concepts can be considered:

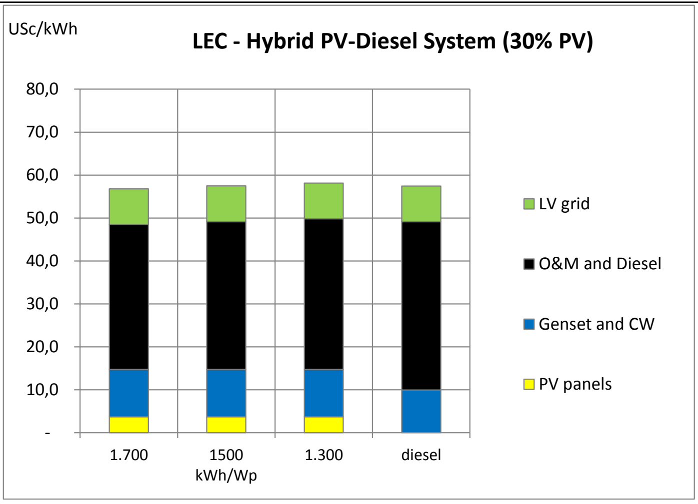
- Solar based power generation to cut the peak of diesel consumption of an existing or new diesel generation plant.

  The solar production shape from 8:00 to 16:00 has to contribute to load demand when the diesel motor is highly loaded (over 80%) to fully benefit the solar injection in the system. During the mid-day break the solar generation is generally peaking at a reduce load demand. Therefore limited energy storage can be considered enabling the full stop of the diesel generation during few hours. The present rule of thumb is that the size for the PV array should not exceed 25 to 30% of the peak demand and a battery storage equivalent to at least 4 hours of solar energy production that could be installed.

- Solar based power generation designed to cover most of the daily demand.

  In that case the PV array is designed to cover on average 80% of the total demand and a battery storage capacity corresponding to 70% of the average solar daily production to regulate the solar production during the day and provide sufficient energy during the night. The diesel generator will contribute to cover the late evening up to midnight peak demand as well as an additional charge of the battery to shutdown the diesel generation during the night. The simulation is carried out with a continuous upgrading of the solar capacity and battery storage to avoid unnecessary capital costs on poorly exploited equipment.

Applied research is presently developed to secure an efficient monitoring of hybrid PV-diesel system. Current experiences only show mitigated results. Generally, the technical reliability of the system is secured after a trial period and a fine tuning of the settings of the solar power injection. On the economic side, **the LEC for a hybrid-diesel system is just below the LEC of pure diesel alternatives.** Each time the economic cost of rural diesel is higher than the average it will increase the economic advantage to the hybrid system. Financially, the benefit of the hybrid system will depend on the financial conditions and the fiscal rules for diesel oil purchase. All measures aiming at reducing investment costs' impact (credit lines) of solar PV and batteries will have a positive effect on the financial supply costs that will be supported by the end-users.



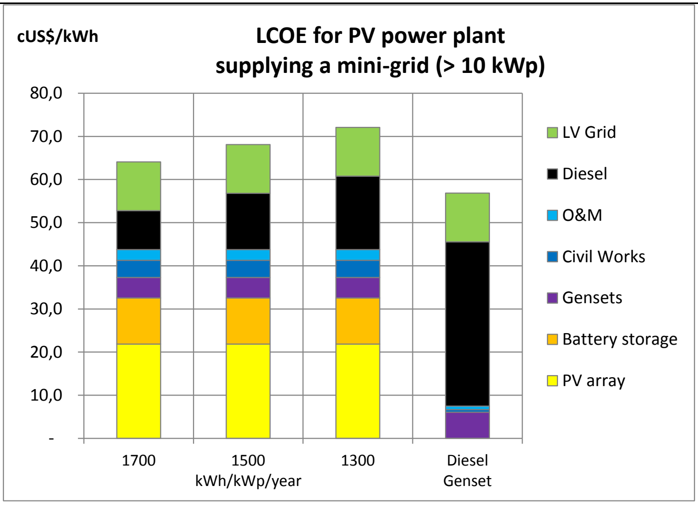


Figure A3.2: Levelized economic cost of isolated power supply

(Diesel-PV Hybrid System and Solar Minigrid[6])

In the case of a 80% solar powered mini-grid (green mini grid supplying in the simulation a settlement of 600 inhabitants) the LEC is in average 13% higher than the diesel power production cost for an average economic cost of 0.935 USD/l for rural diesel. However, in some remote areas the economic cost of diesel supply can be quite prohibitive due the long distances and the small amounts transported, with periods of disruption in the supply. **For a rural economic diesel cost higher than 1.18 USD/kWh, a 80% PV solar system will be relevant for some remote localities, supplying in priority the socio economic infrastructures.** It is not economically reasonable to try to totally offset the diesel production as the resulting cost for solar generation will almost be double of this for diesel generation.

[6] The assumptions used are the following:

- Investment cost for the PV array inclusive of the inverter: 3 US$/Wp
- Investment cost for battery storage capacity and inverter: 325 US$ per kWh stored on daily basis
- Investment cost for diesel generator: 450 US$/kW
- System losses from 15% for direct injection to 30% for larger storage capacity and two inverters
- The PV array life time is set to 20 years and this for the battery storage capacity to 8 years
- Diesel capacity as base-load is replaced and extended each 5 years.
- The diesel price is 0.935 US$/l

ANNEX 4: IPD Evaluation Grid and Demographic Projections

Table A4.1: Scoring system to calculate IPD values (Indicator for Potential Development)

COMPONENT	WEIGHT	SUBCOMPONENT	WEIGHT	INDICATOR	VALUE
HEALTH	1/3	Health infrastructures	1/1	Hospital	1
				Clinic	0.8
				Health Center	0.5
				Dispensary	0.3
				None	0
EDUCATION	1/3	Vocational training center	1/3	Existence of one vocational training center	1
				No structure	0
		Schools & colleges	2/3	University	1
				Secondary school	0.8
				College and institutions	0.5
				Primary school	0.2
				No structure	0
LOCAL ECONOMY	1/3	**Population** of the locality	5/15	More than 20 000 inhabitants	1
				From 10 001 up to 20 000 inhabitants	0.8
				From 2 000 up to 10 000 inhabitants	0.5
				Less than 2 000 inhabitants	0.2
		Prison, rehabilitation services, police…	3/15	0 km	1
				0-10km	0.8
				10-50km	0.5
				More than 50km	0
		Commerce (Distance to the closest Market)	3/15	0 km	1
				0-10km	0.5
				More than 10km	0
		Village Access (distance from the locality to the closest road)	2/15	0 km	1
				0-10km	0.5
				More than 10km	0
		Credit & saving points (distance to a closest bank)	2/15	0 km	1
				0-10km	0.75
				More than 10km	0

Table A4.2: Population by region in 2013 and 2022

Region	2013 Population	2022 Population	Region	2013 Population	2022 Population
Lindi	1,029,600	1,297,164	Kagera	2,360,899	2,974,429
Mtwara	1,488,210	1,874,953	Mara	1,772,573	2,233,214
Morogoro	2,372,814	2,989,440	Arusha	1,761,956	2,219,838
Dar Es Salaam	3,314,011	4,924,935	Kilimanjaro	1,808,281	2,278,202
Pwani	1,184,003	1,491,692	Mwanza	2,708,712	3,412,629
Tanga	2,170,287	2,734,282	Geita	1,798,762	2,266,209
Ruvuma	1,486,489	1,872,786	Shinyanga	1,562,896	1,969,048
Njombe	862,926	1,087,175	Singida	1,437,210	1,810,699
Iringa	1,096,430	1,381,361	Tabora	2,287,334	2,881,746
Mbeya	2,716,419	3,422,339	Manyara	1,361,010	1,714,697
Rukwa	958,672	1,207,803	Dodoma	2,208,711	2,782,692
Katavi	537,264	676,883	Simiyu	1,758,208	2,215,116
Kigoma	2,217,433	2,793,681	Total	**44,261,106**	**56,513,013**

Source: Projection of IED

ANNEX 5: Costs of the Urban and Rural Electrification Program

Table A5.1. Connection costs and connection fees of single-phase and 3-phase customers

	Consultant's Cost Estimate	Connection Fees	
		Urban Area	Rural Area
SINGLE-PHASE SUPPLY	**US$**	**US$**	**US$**
Overhead service-line, single-phase, 30 meters			
D1 and T1 with LUKU meter	350	201	111
Overhead , single-phase, 70 meters, 1 pole required			
D1 and T1 with LUKU meter	550	322	211
Overhead , single-phase, 120 meters, 2 poles required			
D1 and T1 with LUKU meter	800	435	284
THREE-PHASE SUPPLY			
Overhead service-line, 3-phase, 30 meters			
T1 with LUKU meter, 16 mm^2 cable	650	527	527
T1 with LUKU meter, 36 mm^2 cable			
Overhead , 3-phase, 70 meters, 1 pole required			
T1 with LUKU meter	850	1124	1124
Overhead , 3-phase, 120 meters, 2 poles required			
T1 with LUKU meter	1100	1628	1628

**TSh values converted into US$ at exchange rate of 1600 TSHS per US$*

Table A5.2: Costs of Urban Electrification Program (Million US$ at 2013 prices)

Year	Densificat.	Phase 1	Phase 2		Phase 3	Phase 4		Off-Grid	Total
	exist. grids	3-phase	3-phase	SWER	3-phase	3-phase	SWER		
		TURN-KEY II	TURN-KEY III		TURN-KEY IV				
	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$
2013	83.7	21.8	-	-	-	-	-	-	105.5
2014	101.5	36.8	-	-	-	-	-	-	138.4
2015	104.3	51.1	-	-	-	-	-	6.1	161.5
2016	107.0	3.7	18.8	-	-	-	-	5.7	135.2
2017	109.7	3.8	23.4	-	-	-	-	5.9	142.8
2018	112.5	3.8	27.1	-	-	-	-	6.1	149.5
2019	115.1	3.9	45.0	-	-	-	-	5.1	169.1
2020	117.8	3.9	4.9	-	6.0	6.9	-	0.4	139.9
2021	120.5	4.1	5.0	-	8.9	8.7	-	0.4	147.6
2022	123.1	4.1	5.1	-	9.5	12.4	-	0.4	154.5
Total	**1,095.2**	**136.9**	**129.3**	-	**24.4**	**28.1**	-	**30.1**	**1,443.9**

File: Financial Analysis, Sheet3 (BK33)

Table A5.3: Costs of Rural Electrification Program (Million US$ at 2013 prices)

Year	Densificat.	Phase 1	Phase 2		Phase 3	Phase 4		Off-Grid	Total
	exist. grids	3-phase	3-phase	SWER	3-phase	3-phase	SWER		
		TURN-KEY II	TURN-KEY III		TURN-KEY IV				
	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$	Mio. US$
2013	16.63	91.29	-	-	-	-	-	-	107.9
2014	24.63	154.03	-	-	-	-	-	-	178.7
2015	28.38	213.76	-	-	-	-	-	31.26	273.4
2016	32.43	16.89	79.34	21.86	-	-	-	29.12	179.6
2017	36.77	17.38	99.38	26.36	-	-	-	29.85	209.7
2018	41.44	17.39	114.72	30.34	-	-	-	30.95	234.8
2019	46.44	17.35	191.78	37.42	-	-	-	26.24	319.2
2020	51.79	16.73	22.67	6.20	24.79	29.23	6.93	2.42	160.8
2021	57.51	17.52	22.78	5.94	37.17	36.76	7.68	2.29	187.6
2022	63.63	17.69	22.96	5.65	38.67	52.63	8.39	2.09	211.7
Total	**399.6**	**580.0**	**553.6**	**133.8**	**100.6**	**118.6**	**23.0**	**154.2**	**2,063.5**

File: Financial Analysis, Sheet3 (BK52)

ANNEX 6: Morocco's Electrification Program

In 1995, the electrification ratio in Morocco's rural areas stood at 18%. The electrification program managed to increase the ratio to 95% at the end of 2008. Today (April 2014), almost 100% have been reached.

In total, 30,766 villages were electrified and more than 1.8 million end-users supplied with electricity. On average, about 140,000 customers were connected annually. The maximum annual number was 213,000.

Electrification focused on grid connection. Of the 30,766 villages, 27,048 (88%) were connected to the grid. Until the end of 2008, 36,865 km of MV lines, 95,435 km of BT lines and 1,292 MVA of transformer capacity was installed.

Only 3,718 villages were electrified by off-grid technologies: 2 villages received wind turbines, 63 villages were connected to small hydro plants and solar home systems were installed in 3,653 villages. Off-grid electrification was entirely done by ONE, the public utility. There was no private sector involvement as investor in off-grid electrification.

At the end of 2008, the total investment costs had reached 1.8 billion Euros. At today's prices, the average annual costs would be in the order of 230,000 US$.

The program was financed as follows:

Government (ONE)	**47%**
Communities	**11%**
End-user	**11%**
Donors	**47%**

Credit facilities were made available for communities and end-user.

Source: Presentation of the Moroccan Rural Electrification Program, Dakar, June 2009.