

Project Development Programme East Africa

Target Market Analysis

Tanzania's Solar Energy Market

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Federal Ministry
of Economics
and Technology

gtz

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List of Acronyms

a-Si	amorphous silicon
BBS	Battery-Based System
EPI WHO	Expanded Program on Immunizations, World Health Organization
HH	Households
ICT	Information Communication Technology
KARADEA	Solar Training Facility
MFI	Micro-finance Institutions
NGO	Non-Government Organisations
PEPFAR	President's Emergency Plan for AIDS Relief
PV	Photovoltaic
REA	Rural Electrification Agency
SACCO	Saving & Credit Cooperative Society
SHS	Solar Home Systems
SSMP	Sustainable Solar Market Packages
TANAPA	Tanzania National Parks
TANESCO	Tanzania Electric Supply Company Limited
TASEA	Tanzania Solar Energy Association
TAZARA	Tanzania-Zambia Railways Authority
TBS	Tanzanian Bureau of Standards
TEDAP	Tanzanian Energy Development and Access Project

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Summary

Tanzania has a minimum installed solar capacity estimation of 2.5 MWp. Annual sales in solar PV in 2008 were approximately 300 kWp. PV sales have been increasing at a sustained rate of over 15% per year for the last 5 years with a strong bias towards the urban market. The procurement for rural systems is set to increase, driven by a rural electrification programme.

Tanzania can boast relatively stable political and economic indicators within the region. Emerging solar PV off-grid has a potential market installation size of 35MW, largely formed of solar home systems. Opportunities in off-grid PV include the telecom, tourism, mining and small-scale commercial sector, partly driven by increasing costs of running diesel generators.

Distribution linkages are poorly established across Tanzania, partly due to the geographical size of the country. In the consumer SHS market there is a poorly developed and inconsistent offering across sales and installation, whilst the players in the larger institution market invest in overseas training but there remains a lack of recognised accreditation and guarantee of quality installation.

Government policy in general is supportive of solar power, especially in solar water heating and in solar PV in the rural areas, through the Rural Energy Agency and the World Bank backed program establishing road maps for development of solar PV procurement to service clustered markets. A solar feed-in tariff is not established yet, however there is consumer demand and regional changes in policy that may encourage Tanzanian policy. Marketplace standards are established for equipment and installations but without the clear capacity for enforcement

1 Status Quo of the Solar Energy Sector

1.1 Brief Solar Sector Overview

In Tanzania annual solar resources exceed 5 kWh/m²/day throughout the country. Insolation is generally higher and more consistent in the Lake Victoria basin and along the coast. In the elevated areas around Moshi and Arusha, and in Iringa and southwards, however, insolation is considerably reduced (i.e. below 4 kWh/m²/day) during the cloudy season between May and August.

A 2005 World Bank study estimated the total installed capacity (from installations made over the previous 5 years) to be at least 1.3MWp, and possibly twice that. Estimating installations of about 250 kWp/year since then, minimum installed capacity estimation in Tanzania is 2.5 MWp. Annual sales in solar PV in 2008 are likely to be over 300 kWp, and growing rapidly¹. Solar water heater sales are still below 500 units per year and mostly for institutions.

The solar energy sector benefits from Tanzania's political stability and steady economic growth (6.8-7.1% between 2006 and 2008). Revived agricultural export sectors (tea, coffee, cashew) is increasing rural spending power. At the same time, solar companies are beginning to overcome the major obstacle that is the large geographic size of the country, and the lack of sales and installation infrastructure in the interior. National and NGO projects are stimulating demand for institutional systems. Power instability is driving a market for battery back-up systems among major solar companies in Dar es Salaam and Arusha.

There are 3-5 major suppliers of solar equipment in Tanzania. Availability of PV modules, batteries, inverters, charge regulators and appliances is limited to major towns like Dar es Salaam, Mwanza and Arusha. Although the Sida/MEM PV project has been focusing on this, supply chains have yet to reach into rural areas and supply chain mark-ups are high because of a lack of competition. Many suppliers complain about reduced quality of equipment from Asia as demand increases.

Table 1: Key Tanzania PV Market Details

Key Tanzania PV Market Details	
Population (million, 2003)	40
Poverty (% of population below \$1/day, 2000)	57.8
Average GDP Growth 2006-2008	7.0%
Official Development Assistance as % of GDP (2003)	16.2%
Estimated Rural Off-grid Households (million)	5.1
Cell Phone Subscribers (2003) per 1000 pop	52
Cell phone coverage (as % of population)	25%
TV Ownership/HH	6%
Internet users/1000 cap (2005)	9

1.2 Major Market Segments

1.2.1 Solar Photovoltaic (PV)

The procurement-based institutional system market has historically been the most important installer of systems in the country, although the consumer-led Solar Home Systems (SHS) market is growing rapidly. The SHS market developed first in Kenya in the mid 80's, and rapidly expanded into Uganda

¹ Raw data from annual PV market study by Sida/MEM solar PV project. The study only considers 6 companies and not new entrants in the market.

and Tanzania in the 90's. Tanzania's market has followed a similar pattern to that of Kenya, but is still considerably smaller at about 300 kWp/annum with steady growth (>20% per year since 2000).

Though encouraging, the initial growth of the PV market is still a long way from reaching its potential. Key market segments for the solar PV market include non-electrified rural households (of successful farmers or rural teachers), schools, health facilities, rural small businesses and non-commercial establishments, like churches, mosques or community centres. There are a number of undeveloped markets such as telecom and tourism (see section 2.2).

Demand from NGO/missions, and a number of Government projects keep a number of companies busy. PV SHS in Tanzania are mostly purchased by high-end consumers (prosperous farmers, urban-based consumers with families in rural areas), whilst rural incomes in Tanzania still lag behind neighbouring Kenya. Tourism and telecom are still largely undeveloped markets.

Table 2: The main market segments of the existing Tanzania solar PV market²

Solar PV Technology	Estimated installed capacity	Estimated kWp installed/year (2008)	Degree of Competition
Off-grid HH electrification & small scale commercial	1 MWp	>200 kW	Medium
Off-grid community systems (including institutional and pumping systems)	0.3 MWp	>100 kW	Medium
Tourism	>50 kWp	N/A	Emergent

Off-grid household and small-scale business electrification

Since 2000, PV sales have been growing at a rate of over 35% per year, and a-Si modules are an important part of the market. Overall estimated PV sales have grown from over 60 kWp per year in 2003, to over 100kWp in 2005, to 200 kWp per year in 2006 to well over 300 kWp in 2008. Recent market growth has been driven to a large extent by expansion of new, dynamic solar PV dealers and technicians into more regions.

In Tanzania (as in other east African countries), the PV market is closely integrated with the Battery-Based System (BBS) market (where owners charge their SLI batteries from grid-based charging stations. The BBS market relies on demand for lighting, cell phones, televisions and music systems.

The most common appliances used in SHS are:

- Televisions (though 12 VDC TVs are common, colour TVs with small inverters are popular in Tanzania).
- Radio/music systems
- Lights (mostly fluorescent lamps)
- Cell phones

The PV consumer system market has followed Kenya's growth pattern, starting with a number of dedicated companies that dealt exclusively with PV and moving towards a more over-the-counter, smaller system component-based market (Few rural people can afford to purchase a full system all at once). Today the consumer portion of Tanzania's SHS market is increasingly competitive and still maturing as new players enter. It increasingly suffers from quality issues in components and installation.

² Estimate from Sida/MEM Solar Project. Detailed survey was not possible within time constraints.

As in other east African countries, a significant percentage of small PV systems are used for small-scale commercial uses. These include cell phone charging, barber shop, lighting of bars and kiosks and powering of music systems to attract customers or for rural functions (church, wedding, disco).

Off-Grid Community Systems

With over 20% of Tanzania's population off-grid, many rural institutions consider PV as a primary source of power. This market includes Government, NGO and private sector. Historically, donors and missionary groups have dominated this market, often sourcing equipment from outside the country because of high local prices and lack of capacity of local companies to reach and service remote areas.

Specifically, these procurement-based projects have included:

- EPI WHO vaccine refrigerator systems (most of these programs have ended, but there is continual support for the health sector)
- Clinic systems (funded by missions, bilateral aid groups).
- Schools. (Solar Aid, a British charity, is working with the Government to provide funding)
- Tanzania National Park procurements (purchase a number of solar PV systems for remote quarters and stations).
- Refugee programs

The Catholic Diocese and the Evangelical Lutheran Church of Tanzania have both been active in promotion and use of renewable energy.

The Rural Energy Agency is positioning itself to be a major procurement agent and subsidy agent for solar PV in various districts (see Section 3 for further information).

Predominant operator models

The Tanzania PV market is still in a development stage with an emerging distribution network and solar home systems rapidly becoming the most important segment of the market. Distribution linkages between international sellers, local wholesalers and retailers and installers are only recently being established. More critically, linkage between national level wholesalers and local level retailers are not well established, meaning that there are many mark-ups along the chain that greatly increase end-consumer prices.

The geographical distance between players is a major barrier to the development of the market. To help overcome this, a number of smaller players and more retail dealers are entering the market in small towns. Approximately 15% of equipment comes over the border unofficially from Kenya.

Of the major distributors, only limited relationships have developed with international suppliers, such as with a large Kenyan PV/battery company. To a great degree, companies purchase in small lots and are opportunistic, buying where they can get good deals.

Key market features include the following:

- Dar es Salaam, Arusha and Mwanza are the primary sales hubs. 9-10 **established importers** represent international PV companies and sell their products to their selected distributors around the country. One of these is a battery company that sells Kenyan modified SLI batteries for household systems. At least 3 of these companies are subsidiaries of Kenyan companies
- As occurs in Kenya, a few **opportunistic importers** import PV modules and low cost components, as and when they can afford, from changing suppliers and distribute them to retailers of electric goods.

- There is no local battery production so all batteries are imported by sea or overland from Kenya and South Africa.
- Scores of **retail agents** (usually electric goods or hardware stores) represent importers and sell to regional markets that they develop on behalf of the wholesaler.

1.2.2 Solar Water Heating (SWH)

Solar water heating is an undeveloped market opportunity in Tanzania. Though solar water heaters have been sold in the country for twenty years, most units come directly from overseas or from a handful of local suppliers, three of which are subsidiaries of Kenya companies. In 2008, it is estimated that less than 500 units were installed in Tanzania by local companies on the local market. An unknown number was installed by direct procurement from other countries as part of development/investment projects, so this may make the actual market two or three times the indicated size.

Companies visited during the course of this research mentioned increasing interest in solar water heaters (hundreds of enquiries, tens of sales/month), particularly from the institutional and hotel sectors, but the numbers are still not at the levels seen in Kenya or Uganda. The household market is largely undeveloped, at least in part because hot water is not a priority need among middle class households in humid Dar es Salaam.

With constantly increasing electricity prices, the market for conversions to solar water heaters is likely to increase in the next 5 years; however, as yet there is no Government policy to promote the units.

1.3 Local capacities

1.3.1 Solar PV Human Capacity

In terms of capacity, the Tanzanian market can be divided into two general categories, the consumer SHS market and the larger system institutional market. Although most companies participate in both markets, the capabilities of each market are different, and the capacity needs of the sectors are also distinct.

Consumer Solar Home System (SHS) market

Since the solar home system market operates largely along the same retail chains as consumer goods such as TV's, music system and, increasingly, cell phones, equipment importers are not the ultimate installers of SHS, rather it is the retailers that manage this work. The capacity of consumers to buy entire systems and pay for installation services are constrained, therefore, the market for installers is also constrained. For example, many system retailers focus first on making an equipment sale (and consequent margins) and afterward on finding installers. Although this is not the case with all sellers, it is certainly an important part of market development.

Retailers often have a group of independent installers attached to them who can be called upon to complete an installation once a sale is made. The Sida/MEM PV Project has focused on training installers attached to these retailers and maintains lists of retailers and installers in the various regions.

Retailers often lack capacity to design and market SHS. Support to develop these skills often comes from solar companies or projects. However, intense competition for sales means that dealers who make unsound claims about capabilities of equipment frequently mislead consumers.

For the size of the market, there is a sufficient pool of experienced small system solar technicians in Tanzania who can handle the installation of SHS.

Institutional and large system market

Companies that install and design large systems generally train their own staff or send their staff abroad for this training. Among the major companies participating in this market there is sufficient capacity to meet current modest demands. For systems below 3-5 kWp, the leading companies are able to complete jobs to high standards.

However, there is no accepted accreditation system or hand-over procedure to ensure that systems are properly installed (as there is with grid systems). Consumer agencies are often at the mercy of suppliers when systems are installed.

Development of the large system market is constrained by a lack of capacity to design and install large systems, and a lack of faith among potential customers, in solar companies to complete and execute large systems.

Training Programs

In general solar technicians that serve the smaller SHS market often do not often have formal PV training or accreditation so most training is on-the-job. As well, many of the sales people and sales engineers do not have sufficient training.

A variety of training initiatives have been instituted in Tanzania, primarily for solar home systems, though there still is a lack of accreditation or organized programs. The training initiatives include the following:

- Sida/MEM PV Project. Working with experts from the University of Dar es Salaam and TASEA, the project has completed dozens of SHS installation training courses in districts around the country and compiled a database of trained technicians. These courses are done in conjunction with vocational schools.
- KARADEA Solar Training Facility (Karagwe district, Kagera region) managed regular solar training courses up until 2004.
- Solar Now trained dealers throughout the country to design and market SHS through short one-day courses

2 Market potentials

2.1 Overall sector outlook

The overall outlook for the solar sector in Tanzania is extremely good, for a number of reasons:

- Tanzania is the most politically stable East African country with a liberalized economy that has seen steady economic growth over the past 10 years.
- Much of the country is off-grid. The country's large geographic size combined with the limited reach and capacity of the grid ensure that off-grid solutions will be the only plausible source of power.
- As elaborated below, a number of economically active sectors are located off-grid and will purchase PV systems provided that they are convinced they work. These include the telecom, tourism, mining and small-scale commercial sector. As well, households and small

businesses in agricultural areas (cashew, tea, coffee, cotton, sisal and sugar) have cash and will pay for PV systems to electrify their homes and premises.

- PV sales have been growing at a sustained rate of over 15% per year for the last 5 years.
- Off-grid, the costs of running generators sky-rocketed in 2008. PV and battery back-ups are increasingly viewed as viable alternatives to gen-sets.
- Planned Rural Energy Agency rural electrification programs are making procurements for solar PV systems. These procurements will increase steadily over the next 5 years.
- It is only a matter of time before grid connect opportunities become a reality. Cost is not the only factor in middle class and business consumer interest, energy independence, capability to survive power cuts, "green" marketing and a desire to be "modern" all play a role.

PV Solar

The table below presents an indicative matrix of the potential for PV systems in Tanzania. These are further discussed in the sections below.

Table 3: Tanzania's Off-Grid PV Potential Markets

PV Category	Min Potential Market Size	Sales/Year 2009-2012	Existing Penetration
Solar home systems	29 MW	200-300 kWp	1-2 MW
Off-grid Schools	N/A	>60 kWp	N/A
Clinics	N/A	>100 kWp	N/A
NGO power	N/A	>50 kWp	N/A
Small-scale commercial	>>2 MW	???	N/A
Telecom	>1 MW	???	Negligible
Tourism	>3 MW	???	NA
Total	>>35 MW	>400 kWp	

Solar Home Systems (SHS)

The off-grid SHS market has traditionally been the obvious choice for development of products. For serious PV traders in Tanzania, it cannot be ignored. First, it is growing at a rapid rate. Secondly, it is large, as can be seen in the table below. Thirdly, for qualifying companies, the Government will be offering \$2/Wp per sold system for systems below 100 Wp.

Table 4: Tanzania's Solar Home Systems Markets

Type of System	% of Market	No. of Systems	Total kWp
No System	40%	2,011,378	-
Micro Systems (3Wp)	35%	1,759,956	3,520
One Light & Radio (10 Wp)	15%	754,267	7,543
2 light and radio system (20 Wp)	6%	276,564	5,531
4 light system or higher (40 Wp)	4%	175,996	8,800
Larger systems (inverter or hybrid)	1%	25,142	3,771
TOTAL MARKET	100%	5,003,303	29,165

Note that the cost of developing market networks in Tanzania is expensive, and this adds considerably to the marginal costs of sales. Therefore, even though the absolute turnover of the SHS market is large, the actual profit per sale is relatively low.

Small-Scale Commercial PV Systems

Income-generating businesses are increasingly popular targets because, unlike SHS, they raise revenue for rural people. Although PV does not provide electricity for high-energy applications, rural and off-grid consumers are adopting the technology for their needs, and markets are informally developing for business systems. This is potentially an active area for companies that develop full technology packages.

Table 5: Commercial Applications of PV Systems in Tanzania

Commercial Use	Notes	Prevalence
Battery charging for cell phones and small lanterns	Rapid growth of cell phone industry in Kenya, Tanzania and Uganda creates market niches for charging mobile phones. Entrepreneurs use PV and/or lead acid batteries to recharge mobile phones at a fee off-grid rural & peri-urban	Extremely common
Tea shop/Bar lighting and power for music, radio and TV/video	Many bars and tea shops in the region are powered by PV lighting systems. It is common practice for the shops to attract customers by having lights, radio, TV and video playing.	Common
Music sales	Off-grid village shops that sell cassettes and small music systems often power these systems with 12VDC batteries and PV systems.	Common
Barbers	Low power barber shears are commonly available in East Africa.	Common
Shop lighting	Kiosks that sell goods or engage in trades (tailoring) may use PV as a lighting source to enable them to attract customers and remain open a few more hours in the evening	Common

NGO/Mission/Church/Mosque Power

It is estimated that over 80 kWp of solar PV systems were purchased for use in rural areas in this market in 2008. This is a steady and growing source of revenue for the PV sector, and long term markets are in several megawatts. Accurate estimates of potential sales into this market are difficult to make, as there is little information about this sectors' energy expenditure. The following points are worth noting:

- PEPFAR, the US program to avail HIV/AIDS anti-retroviral to rural populations spends over US\$300M in Tanzania per year. They make considerable investments in rural health centre energy systems for laboratory and ICT equipment.
- Churches such as the Evangelical Lutheran Church of Tanzania and the Catholic Diocese make large investment in energy equipment for their missions
- Refugee support agencies regularly purchase PV systems
- The scores of development NGOs (Oxfam, Save the Children, Action Aid, World Wildlife Fund, etc) are continually making community investments in institutions and water supply systems.

Public Sector Procurements for Schools, Clinics and other Markets

Accurate assessments of public sector procurements are difficult to make, as these come and go with Government desires and donor support programs.

Government ministries are constantly making procurements for energy equipment in off-grid areas. These include the TANAPA (Tanzania National Parks), the Ministries of Health and Education and TAZARA (the Railroads).

Increasingly, the Rural Energy Agency will be making large procurements for district-focused Sustainable Solar Market Package activities. These procurements will typically be in the 100's of kWp for scores of health, education and Government institutions in remote regions. In order to be eligible to participate in these procurements, companies must be pre-qualified (see SSMP program in contacts section).

Obstacles / constraints

For small systems in the commercial market, the following are common obstacles:

- This sector is moving towards a “fast-moving-goods” and “over-the-counter” market. Lower priced lower quality goods have advantages where consumers are cash-constrained and dealers are especially interested in moving volume
- Customers tend to buy components, so it is hard to establish the full “SHS” unit
- In agriculture sectors, markets are extremely seasonal because of cash flow fluctuations
- Retailers and wholesalers are fickle and change relationships because of price
- REA subsidies are still not established. The process of getting subsidy cash from Government institutions is slow
- Retail and wholesale agents often have cash flow problems
- Few wholesale or retail agents are 100% dedicated to solar PV business

For the larger system market the following are common obstacles

- Procurements (especially with Government) often are won based on personal relationships with the customer. This is sometimes an area of moral hazard.
- Installation quality is often an issue. Installers often do not have proper tools.
- There is a lack of standards, codes of practice and availability of common safety equipment (fuses, circuit breakers, lightening protection devices, etc.)
- Specifications are often poor or non-existent for systems
- Consumers do not understand how to use the equipment, or add to load without consulting procurer
- After-service arrangements are often not fully considered

Recommendations for German RE enterprises

Companies should always be prepared to educate dealers, system designers and installers about their equipment.

For **small systems** in the commercial market the recommendations are:

- Seek to cluster large numbers of systems together
- Work with established networks of competent and honest traders
- Seek to utilize local finance partners
- Geographically target marketing efforts, especially in regions where there is income from coffee, tea, cashew, sugar or gold.
- Seek partnerships with players who have a good reach into rural market. (It may be useful to look beyond the small PV companies and to other companies that have successfully sold other products into rural areas).
- Work with the REA's subsidy program (see section 3.2)
- Do not focus on "rural poor" and procurement-based poverty alleviation PV projects only. There is a growing market for PV among economically active groups that can no longer afford to rely only on generators
- It is often useful to focus on components, not whole systems

For the **larger system** market the recommendations are:

- Work with a local agent that is capable of responding to tenders and has capacity to write proposals.
- Work with an agent that is well-connected with Government procurement agents and/or the NGO/mission sector. NGOs and church missions tend to be good customers if they are happy with the work done by a supplier
- Provide high quality equipment
- Make sure local agents complete installations to a high standard.

2.2 Undeveloped Solar Market Opportunities

All areas of opportunity are outlined and summarised in the following tables.

2.2.1 Tourism - Solar Hybrid PV Systems and Solar Water Heating

Tanzania has among the largest area of game reserves on the continent, and a huge population of wild animals. Hundreds of tourism facilities serve the increasing numbers of tourists that visit the country each year. Tourism accounted for about 12% of the GDP in 2006 and nearly 25% of total export earnings. The portion of GDP contribution rose to 17.2 per cent in 2007. In 2006, more than 625,000 tourists visited the country, up 5% from 2005. International tourism income increased from US\$ 823.5 million in 2005 to US\$ 862.0 million in 2006. The slowdown in current and recent global economic conditions has impacted the rate of growth in 2008.

Off-grid tourism is an emerging market field with a potential for several megawatts of off-grid installations. Like Kenya, there is a large potential to switch power sources for small and medium sites from primary dependence on diesel to PV and solar water heating. The sector has been slow to take up solar because of:

- A lack of knowledge about solar energy
- Low traditional prices of fuel
- A lack of sophisticated solutions from PV suppliers
- A lack of easy finance for solar energy systems
- A lack of technical capacity in the sector to convincingly supply quality services.

Virtually all off-grid tourism sites rely on generators for electrical requirements (lighting, pumping, refrigeration, communication, etc). Rising prices for fuel, theft, and a “greening” of expectations among tourists is driving off-grid facilities to reduce dependence on generator power. Some tented camps have installed hybrid solar PV systems, and other lodges are installing inverter-battery back-up systems so that they run equipment when generators are off.

Tourism companies are aware of the long-term economical and environmental benefits of renewable energy and interested in pursuing it, but specific awareness of the right technology and their appropriateness to particular applications is low. Tourism companies are extremely risk averse in investment strategies with new technologies, an approach that has been greatly exacerbated by high numbers of low-capacity unreliable companies that approach them.

The most likely segments of interest to German renewable energy companies are the hotel and lodge groups servicing the mainstream package tourism market and the high-end small-scale exclusive camps.

Table 6: Basic opportunities for hybrid system installations in 150 off-grid camps identified

Type of Opportunity	Estimated Unelectrified sites	Average Size	Basic Potential	Total Size of Market
		Wp	%	kWp
Tented Camp (10-20 tents)	50	1500	50%	375
Tented Camp (21-50 tents)	50	3000	50%	750
Small Lodge hybrid	30	20000	20%	1,200
Large Lodge hybrid/mini-grids	20	50000	10%	1,000
total	150			3,325

Table 7: Parameters of off-grid applications in tourism

Applied technology	<ul style="list-style-type: none"> Solar water heaters Stand-alone solar systems Hybrid PV-genset systems Solar electric fencing Solar ICT and telecommunications, Solar pathway lighting
Expected Financial Volume	<ul style="list-style-type: none"> Solar Water Heating: Immediate market potential is >\$50M. Solar PV: Currently this opportunity is in the pioneer stage. Minimum estimated current viable market is at least \$30 million, but considerable development activities will need to occur. Investment in Tanzanian tourism sector was over \$700M in 2007.
Competitiveness	Higher end of the market targeting higher paying customer (small and medium sized tented camps and lodges) likely to be more discerning in their choice of technologies, favouring quality and reliability. Solar water heating will have to compete with cheaper technologies from elsewhere in Europe, N. Africa and China.
Planning	1 + year time horizon 1-2 + year time horizon, but projects must compete with other unrelated (i.e. non energy) investment projects
Constraints	<ul style="list-style-type: none"> Financing of solar water heaters, and especially solar PV, presents difficulties because of high capital costs. Weak design and installation capacity of local systems integrators. Previous poor experiences with solar technologies. Poor maintenance and back-up capabilities
Recommendations for German	<ul style="list-style-type: none"> Much of existing market will require retrofit. Best considered during planned hotel rehabs/refurbishment projects.

companies	<ul style="list-style-type: none"> • Rapid uptake for good quality solar PV and hybrid systems is possible once a “bold mover” can demonstrate proof of concept – this is demonstrated by previous experience with battery-back up systems. • Financing solutions will be a key determinant, especially in high capital cost solar PV. Work with GTZ, trade finance organisations, export credit schemes etc to address risk factors & offer finance solutions • Penetrate the existing market by work with larger tourism groups that have international partners and/or presence • Market for new hotels and lodges will require marketing and engagement with design teams (project managers, architects, consulting engineers) – currently more inclined towards traditional forms of supplying energy • Professional systems integration, solutions offering strong technical back up & support • Complete PV system solutions / PV hybrid solutions • Centralised SWH systems either providing complete supply or as pre-heat to boilers
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2.2.2 Solar PV Hybrid Systems & Telecommunications

There is a major potential for solar PV to play a role in the telecom sector:

- The industry is one of the most rapidly growing sectors of the economy, valued at approximately 3% of the GDP. While helping drive growth, it offers a number of business opportunities in voice communication and internet services. Many of the business opportunities require minimal investments, enabling entry by low income players.
- Rapid expansion of the sector to off-grid areas. Both upstream infrastructure and downstream end-user sectors require significant use of off-grid energy technologies including generators and PV. There is enormous potential for the sector to modernize and switch to more efficient PV systems.
- Payers in the sector are willing to invest in energy infrastructure provided that new customers are brought into the market. Again, this includes both upstream infrastructure and downstream end-user sectors.
- New technologies are allowing off-grid consumers to access ICT and cell phones for lower and lower prices, leading to their expansion. These devices require power.

Tabelle 8: Parameters of off-grid applications in telecommunication

Opportunities	<ul style="list-style-type: none"> • Base stations • Wireless communication / internet • HF / VHF • Consumer / cell phone charging (this is a small business opportunity)
Expected Financial Volume	<p>Conversion of 50% of the 600 off-grid base stations to hybrid PV systems of 2.5kWp each would yield over \$6m of PV business. New installations in newly established stations could potentially be worth >\$2million/year.</p> <p>Niche opportunities could be worth as much as base station opportunities.</p>
Applied technology	<ul style="list-style-type: none"> • Solar / Wind and diesel hybrid systems • Battery back up systems for BTS powered by diesel gensets • Small PV systems for VSAT, phone charging and other applications
Competitiveness	<p>Telecommunications companies operate as large multinationals so much of the procurement and ordering decisions are made off-shore. Renewable energy systems, base station electronics and other technology is competitively sourced with competition from China and other countries.</p>

Planning Constraints	1-2 year (or longer) planning periods are common for telecom base station investments
	<ul style="list-style-type: none"> • High upfront costs of solar powered systems • local Government that resist switches to RE/solar; oil cartels/lobbies • Overcoming poor previous experiences with solar • Matching solar equipment to telecomm equipment is often difficult as telecomm companies change equipment frequently
Recommendations for German companies	<ul style="list-style-type: none"> • Approach telecom companies at high levels where decisions are made • Combine finance with technology packages • Do research on the type of equipment the prospective client is using • Be prepared to offer demonstration equipment to prospective customers • Be aware of the linkages between the various regional telecomm companies as it may help build business networks • Explore the various niche markets that solar PV can meet to serve off-grid ICT needs (including cell phone charging)

As of 2008, there were five active mobile phone companies: Zantel, Zain, Vodacom, Tanzania Telecommunication Company Ltd, and TTLC. Four additional companies are currently being licensed. The rate of estimated cell phone subscriptions gives an overall density of about 15% in 2007.

In off-grid areas, over 600 repeater stations use diesel as primary power sources. Over 100 new base stations are built per year. Companies increasingly see diesel as a recurring cost and diesel stocks are often stolen.

2.2.3 Solar PV Grid Connect

Consumer demand for grid-connect PV (in response to the need for demand-based solutions for load shedding) and development of grid-connect policy by other African states (including South Africa) will eventually cause the Tanzanian Government to enact grid connect policies. This may happen faster than expected³.

The attractions for grid connect solar PV are different in Tanzania than Germany. The German market relies on high feed-in tariffs to attract PV buyers. In Tanzania, there are several aspects that would attract a small, but perhaps important group of household and commercial grid connect customers:

- The high (and rising) price of electricity (>US\$ 0.18/kWh) makes PV increasingly attractive
- Frequent brown-outs make inverter-battery back-ups an intelligent investment for household and offices. Adding PV to these systems is simple and convenient.
- For middle class Africans, the prospect of producing one's own power and selling the extra back to the grid (through net metering, without monthly excess) would be attractive.
- Solar regimes are extremely strong and match demand from appliances such as air conditioners.

Table 9: Parameters of grid-connected applications

Opportunities	<ul style="list-style-type: none"> • Household • Commercial • BIPV • Solar Power Plants
Expected Financial Volume	Will not be a large market in the short run. But may be an interesting market for established PV players in the country.

³ South Africa, Namibia, and Uganda already have pilot grid connect systems and are exploring how grid connect legislation will be carried out.

Applied technology	<ul style="list-style-type: none"> • Solar electric systems with inverter and battery back-up technologies • Larger power plant types of systems
Competitiveness Constraints	<p>Since this is a largely unexplored field, there is little competition or commercial activity.</p> <ul style="list-style-type: none"> • High upfront costs of solar powered systems • Lack of experience in designing, planning and installing systems • Lack of agreements on tariffs or net-metering
Recommendations for German companies	<ul style="list-style-type: none"> • Make sure local partners have technical expertise on grid connect technology • Assist local partners to lobby for proper policy • Keep track of legislative developments

3 Solar-specific regulation and framework

3.1 Policies and regulations

In principle, Government policy support for solar energy in Tanzania has been strong. Government papers include solar energy and seek to increase its usage wherever possible. However, Government policy requires funding to achieve implementation and this relies primarily on donor support⁴.

3.1.1 Off-grid Solar PV

Duties have been removed from solar products (including modules, solar batteries, regulators and inverters). PV modules have had Value Added Tax removed in recent budgets.

The Tanzania Bureau of Standards (TBS) has developed minimum standards and installation guidelines for solar PV equipment and solar installations (these are largely adapted from international and East African documents). Systems installed for Government projects are required to follow these. As well, equipment imported into the country must, in theory, meet these standards.

However, TBS is not legally able to enforce its standards, so there have been problems with quality control of modules and components in the market. Private installations largely occur outside of any code or standards and there is no standard procedure for inspection of PV systems.

Public sector installations that occur under the REA program will be required to meet strict requirements. The Sustainable Solar Market Packages (SSMP) program has internal quality control mechanisms, largely based on similar World Bank projects in other countries (e.g. the Philippines) that must be met by any company winning a tender.

3.1.2 Solar PV grid connect

Tanzania does not allow small solar power systems to feed power into the grid at reasonable prices, and policy makers have yet to consider inclusion of the required grid connection clauses. However, the Tanzanian Government is open to the idea of grid connect, provided that there is not a need to pay the electricity seller (TANESCO will not be able to pay special solar PV installers feed-in rates).

Recommendations for German companies

- Rapid changes in solar feed-in tariffs are occurring in various parts of Africa (South Africa, Namibia, Uganda). It is useful for companies to establish relationships with the Government and lobby for positive grid-connect regulations.

⁴ The Rural Energy Agency is accessing millions of dollars of tax levies and donor support for solar PV programs.

- Some companies may want to demonstrate the value of grid connect (and net-metering) by conducting “pilot” demonstration projects.

3.1.3 Solar Water Heaters (SWH)

Government policy promotes solar water heaters, in general, as a method to reduce consumer electricity demand. There are no duties or VAT on solar water heater systems. However, as yet, no specific targets, legislation or standards have been developed to facilitate increased use of solar water heaters.

3.2 Applicable public sector support / financing mechanisms and sources

Rural Energy Agency (REA)

In the coming years, the Rural Energy Agency will be a major procurement agent and subsidy agent for solar PV in various districts. It has identified solar PV as a key strategy to meet the needs for rural electrification. Utilising in excess of US\$ 25M per year for rural electrification projects it is supporting two key solar PV rollout strategies:

Sustainable Solar Market Packages (SSMP)

SSMP is a program being rolled out in Tanzania to issue large-scale procurements of solar PV systems in rural districts. Its approach draws on lessons learned from previous programmes and projects and seeks to overcome transactions costs associated with doing business in remote areas, using the following key features:

- Bundling of wards/villages into commercially viable packages (SSMP packages) that are bid out on a competitive basis
- Each SSMP package comprises a base-load of community facilities (village halls, health facilities, schools, public light, water pumping)
- Innovative subsidies to develop the private market and to buy down the capital cost and improve affordability
- Strong focus on after-sales services and continued marketing (including contractual obligations and performance securities)

This program, supported by the Ministry of Energy / World Bank TEDAP project, is rolling out SSMP procurements (i.e. >\$6M) of institutional and SHS in bid packages that will be won by single companies working with local partners. Successful companies will be responsible for installing and servicing dozens of institutional systems in selected districts, and will also be set targets for installing solar home systems in the same region. The first tender package was offered in 2008 for Rukwa region, Sumbawanga District, and more will follow.

Actual development of the program has gone much more slowly than intended due to bureaucratic delays.

PV Clusters

Tanzania has a number of rural-based off-grid income-generating industry including agriculture, mining and telecommunications. These industries employ considerable numbers of off-grid rural people and, at the same time, are able to group large numbers of customers together for the purpose of buying PV systems.

REA has conducted a market assessment and consultations with a number of these companies. They have brought together 5 clustered markets in tea, coffee, cashew, gold and telecommunications, building a framework of implementable business-type projects. Five business plans have been

developed in consultation with community groups and Tanzanian companies. If successful, these projects are likely to lead to the installation of about 30,000 off-grid PV systems totalling over 1.5 MWp.

The business plans are “road maps” which require a considerable amount of effort to be implemented. The primary responsibility for implementation of these plans lies with the project sponsor that owns the business plan. In addition to its role in providing planning and monitoring assistance, the REA/MEM, through TEDAP, will supply limited support for the project in terms of grant subsidies on PV equipment and technical assistance and matching grants to prepare detailed design, planning and capacity-building activities to the project sponsor.

The business models being considered in order to achieve the necessary market aggregation and economies of scale enhance affordability and improve quality include:

- Offering employee purchase of PV systems with repayments made through salary deductions for pre-qualified PV systems from approved dealers who comply with product quality, service, spares provision and warranties.
- Offering out-growers the opportunity to purchase of PV systems with repayments made through deductions from payments to be made to out-growers for leaf tea, coffee beans and other raw materials sold to companies. The company may pre-finance the PV systems or guarantee/arrange for bank, MFI, SACCOS financing directly with the out-grower. As before eligible products are pre-qualified PV systems from approved dealers who comply with product quality, service, spares provision and warranties.
- As part of the companies' social responsibilities towards the communities, funding the provision of PV systems for schools, clinics and other community services and facilitating the access to households and private business to PV systems, such as supporting/encouraging MFIs to finance sales. This will follow the SSMP business model.
- Establishing PV power services to company retailers and outlets to help improve productivity and business/sales volumes. Examples include cellular phone kiosks, or soft drinks and other sales outlets.

For more information about these projects under development, contact the REA.

4 Business partners and competitors

4.1 Overview of solar key market players

Table 10: Solar products importing companies in Tanzania


Importing Company	Company Description & Distributors	Company Strategy	Major Product	Equipment Sources	Contact	Address	Email	Telephone
Rex Investments	Sole owned company. Dar-based.	Supply of institutions and NGOs. Contracts with Government and institutional market, telecomm	Entire systems. X-Si only.	x-Si: SunTech, Steca, Studor, BAE batteries	Francis Kibhisa	PO Box 76478 Kisarwe St. Dar es Salaam	info@rexsolarenergy.com	+255 22 2180109, mob +255 713 607533
Chloride Exide	Subsidiary of Chloride Exide Kenya. Dar-based, outlet in Arusha. Numerous agents.	Develop the small-scale PV market. Supply a-Si modules, batteries, lamps, regulators and other components for small PV systems. PV is side business of battery business (<30%).	a-Si, x-Si, systems, regulators, lamps, batteries, inverters, SWH, battery back-ups	Import from Kenya. x-Si: BP, Suntech; a-Si: Free Energy Europe; Regulators: Phocos	Louis Nyamwaya	PO Box 12746 Dar es Salaam	cexidetz@afraonline.co.tz	+255 222182209 mob +255 755 86055
Umeme Jua	Company started as part of Dutch PSOM grant programme. Partially owned by FEE. Numerous agents.	Develop the small-scale PV market. Supply a-Si modules, lamps, regulators and other components for small PV systems. Uses one HP agent (Tunakopesha).	Modules (a-Si): Europe, Batteries: Far East, BOS: Indonesia	Free Energy Europe.		Nyerere Rd. Block D PO Box 26 Dar es Salaam	office@umemejua.com	+255 22 2866061
BP Solar	One of the oldest players works through BP network. One staff member.	Sells PV through established network for large jobs mostly. No marketing or outreach.	Modules (x-Si): Europe, India	BP Lines				
Sollatek	Exclusive agent of Sollatek Kenya.	Small scale PV market, institutional market.	Sollatek line of fridge guards, lamps, regulators & electronics. a-Si, regulators,	a-Si: Sollatek line of BOS.				

Swift Holdings	Arusha-based. Side business of safari-outfitter.	Supply into the tourism and consumer market	Buys from other companies			Arusha		
Zara Solar	Started in Mwanza. Expanded to Dar.	Retail			Parpia zarasolar@yahoo.com	Mwanza		255-754-299162
Davis & Shirliff	Subsidiary of D&S Kenya. Dar-based but opening up strategic agents.	Focus on the pumping market and high end PV systems.	Pumping equipment, SWH, full solar PV line	Sundaya, Shell, Grundfos.	Tony Mwangi	Gerezani Rd. PO Box 10725 Dar es Salaam	tmwangi@tzdayliff.com	+255 22 2112515
Ensol	Small company recently set up (2003)	Focused on farmers, institutions, largers jobs and packages.	x-Si mainly		Hamisi Mikate	PO Box 42227 BP Kimara Bahama mama Bild 1st Floor Dar es Salaam	ensolut@yahoo.com	+255 22 2420176 Mob +255 744 694413

4.2 Overview of major and/or most emblematic solar projects

Table 11: Solar projects in Tanzania

Name	Role in Sector	Activities	Procurements (Types of equipment /services)	Volume kWp or \$\$\$	Plans in Immediate Future
Tanzania Solar Energy Association (TASEA)	NGO promotes the use of solar energy in Tanzania and executes projects throughout the country	Maintains a website about the Tanzania solar energy sector and publishes a quarterly magazine.	Minimal	0	Currently under reorganization
Solar Now	Advocate, capacity building	Funded with Dutch support, organisation has worked closely with rural entrepreneurs to build up the market for solar home systems.	Minimal procurement	0	
Clinton Global Initiative	Advocate and sometime procurer	Seeks to scale up use of solar PV in the region	Has procured PV systems for health centres	\$>150k	Seeks partnerships to strategically scale up market
Solar Aid	Foundation, project implementor, advocate	Provides funding for solar projects. Installs on behalf of donors	Has installed >18 schools. Involved in procurement of micro systems	\$100's of thousands	
Government					
Ministry of Energy and Minerals.	Primarily a facilitating agency.	Administers Sida-MEM PV project			
Ministry of Education.			Occasional		
Ministry of Health			Occasional		
Rural Energy Agency (REA/REF).	Facilitates RE projects. Provides grants and subsidies				
Sida MEM Solar Energy Project	\$3.2M 5 year project working to build up PV sellers country-wide	Provides technical, business and sales support. It is managed by ESD, a UK consulting organisation.			
TAZARA	Railway runs between Dar es Salaam and Zambia.	It has hundreds of PV-powered signalling installation along its corridor.			



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