CHALMERS

Socio-technical-ecological evaluations of the potential to implement renewable energy sources in coastal areas of tropical developing countries

– an East African case study

Department of Energy and Environment
Division of Environmental System Analysis
CHALMERS UNIVERSITY OF TECHNOLOGY
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Planning trip STEEP-RES: Mozambique and Tanzania

Socio-technical-ecological evaluations of the potential to implement renewable energy sources in coastal areas of tropical developing countries

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TABLE OF CONTENTS

0 SHORT PROJECT BACKGROUND

The suggested project aims at evaluating the potential for a successful implementation of renewable energy sources in the coastal zone of tropical developing countries integrating results from different scientific disciplines (ecology, social science and technology) into a useful support for development policy. Its emphasis will be on remote areas where poor infrastructures raise the demand for independent electricity supplies. Moreover, the project intends to identify key-issues and socio-technical pathways for a future integration of suitable renewable energy sources in such areas.

The research will be based on analyses of the relationships between technical, ecological and social systems and focus on applying adequate technology in a socially and ecologically feasible way. The energy sources considered will be selected from local natural flowing resources, *i.e.* mainly tidal, stream, and wave energies.

With funding from Sida (SAREC Planning Grant) and Adlerbertska Forskningsstiftelsen, a planning study was carried out during October – November 2007, including the subsequent parts:

1) meetings with representatives from several concerned institutions in Mozambique and in Tanzania
2) field visit to remote rural areas in southern Tanzania where hydrographical and coast morphological features were documented
3) meetings with village representatives in remote rural southern Tanzania in order to collect information about living standards, energy demands and development intentions

Compiled results from the three parts are presented in this report and will constitute a baseline for the forthcoming application of Sida Project grant, to be handed in April 2008. When taking part of the results it is important to keep in mind that the suggested project does not intend to construct any actual power plants, or pilot plants, but to study the prerequisites and consequences, technical, natural as well as societal in order to evaluate if and how a future implementation of these recent technologies could be carried out in a feasible and sustainable way.

This report is written with a plain perspective and contains no abstract. As the proceedings of the study will be the basis for a research application in progress, conclusions will instead be developed within that context. However, it can be stated that the project received a noticeable support from official, academic and local stakeholders in both Mozambique and Tanzania. It has been made clear that project initiative in its current appearance is very welcome and that bilateral co operations will be straightforward to form.

Concerning the ocean energy resource and suitability of sites this planning study has been far to restricted to make any assessments; information received from the meetings and the short visit in field nevertheless implies that several areas may have potential for energy extraction.

1 FIRST PART – MEETINGS WITH REPRESENTATIVES FROM CONCERNED INSTITUTIONS

1.1 MOZAMBIQUE

During the visit in Maputo, Mozambique, meetings were arranged with the subsequent institutions and representatives:

Ministry of Energy: National Directorate of New and Renewable Energy
- António Saíde, National Director

Ministry of Science and Technology
- António José Leão, National Director

Ministry of Transport and Communication: National Institute of Hydrography and Navigation
- Humberto Raul Mutevuie, Head of the Hydrographic Department

Electricidade de Mocambique (EdM): Project and Electrification Directorate
- Abraão Rafael, Electrical Engineer
- Abel Chambuca, Electrical Engineer

Eduardo Mondlane University
- Boaventura Chongo Cuamba, Associate Professor, Faculty of Sciences – Department of Physics
- Carlos Lucas, Dr., Faculty of Engineering – Research and Extension
- Salomão Bandeira, Dr., Department of Biological Sciences

Embassy of Sweden
- Ana-Karin Municio, MSc. CEng., Programme Coordinator

1.1.1 Opinions on the suggested project and possible complications to notice

Generally the ideas around the suggested project were well received. Mr. António Saíde, National Director at the Ministry of Energy (National Directorate of New and Renewable Energy), clarified that the project was in line with the governmental goals. The project could fit the upcoming Master Plan of Energy; hence the Ministry would like to soon receive a summarized presentation of technical possibilities and requirements. In agreement, Dr. António Leão, National Director at the Ministry of Science and Technology, expressed the Ministry's interest and was positive to follow the further development of the project. . Both Ministries stressed the importance of a careful but rapid project development; beyond the important first steps there were no obstacles foreseen.

Two representatives from Electricidade de Mocambique (EdM) were met; Mr. Abel Chambuca and Mr. Abraão Rafael, both electrical engineers and project leaders on rural electrification. The suggested project was expressed to be of important advantage to local people living beyond the reach of EdM grid extension. Such independent electricity supplies could benefit not only the people but also the Government. The lack of good infrastructure and competence for maintenance, the restricted potential of poor households to pay, and the possible complains from environmentalists, were suggested as the most potential problems. It was also stressed that the installed power (kW) should not be too small.

From the Eduardo Mondlane University, Department of Physics, Professor Boaventura Cuamba was met. It was articulated that the suggested project is very welcome from the University point of view, because it is in line with the governmental policy and could lead to extraordinary results if it proceeds. No obvious obstacles were predicted, but the importance to inventory all parts of interests was expressed.

Dr Carlos Lucas, at the Faculty of Engineering, at the same university, shared his experiences from research on renewable energy resources and pointed out the importance of combining different sources, of which the bio-based will be of great importance for long time, and to pay attention to costs.

At the Swedish embassy a meeting was held with Programme Coordinator Ana-Karin Municio. Concerning the suggested project it was seen to be in agreement with Sida's aim of rural electrification.

It was also notified that Sida in major has to follow the aim of the Mozambique Government which currently focuses on large scale power projects, such as rehabilitation of hydro power, making support for small projects more difficult.

1.1.2 Electricity situation

From the meetings it was clear that the electrification in rural areas of Mozambique is very low (Bandeira, Rafael, Cuamba, Chambuca). A total of 8% of the national population have access to electricity, this mainly in the cities (Rafael, Cuamba). Around 80-90% of the population live in rural areas where the access to electricity is much lower (Cuamba). The northern parts of the country generally have less access to electricity than southern parts (Rafael). The governmental aim is to rapidly improve the situation, which to a major part is planned through development of the national electricity grid (Rafael). Although, it is acknowledged that extension of the grid cannot reach all regions within a foreseeable future (Chambuca). This, together with the aim of getting out of expensive diesel dependence (Rafael) and the for Mozambique obvious setbacks expected from global warming (Cuamba), has motivated a national strategy for use of renewable energy sources (Saíde & Leão). Small-scale renewable energy could more easily be spread around the country, reaching remote areas far from the grid and conventional large-scale power plants (Chambuca).

Despite a pronounced governmental interest in complementary small-scale renewable energy sources (Saíde & Leão, Cuamba), the state owned EdM is mostly concerned with conventional power sources (Chambuca). Consequently, it was told from the Embassy of Sweden that since the Government invests in large scale power projects, also Sida has to focus on the large-scale approach (Municio).

Today, the most considered small-scale renewable sources are biomass, bio diesel production, small-scale hydro and photovoltaic (solar PV) (Rafael, Cuamba). The governmental organization FUNAI has a major role in the implementation of renewable energy (Chambuca, Municio). Unfortunately, no meeting was arranged with their represents during the visit in Maputo.

In order to keep a nationwide fair possibility of energy use (where it is supplied) EdM maintain the same price of electricity for all domestic costumers, a policy made possible by subsidies for remote regions. The price is today 8,5 US cent per kWh (Rafael). Mischievously, the beneficial cost-effectiveness in the use of large hydro power makes the production costs of electricity so low that problems arise where private energy companies supply regions with energy from other more expensive sources (e.g. natural gas) (Rafael). This challenging phenomenon is named “the Cahora Bassa-effect”.

The average energy use in Mozambique was told to be 200 kWh per month for urban costumers and less for rural costumers (Rafael). From EdM it is estimated that 75 kW would support 200 – 400 households, that a rural village need about 350 kW installed power, and that a typified industry would need 250 kW (Chambuca). The installation costs of a larger hydro power plant is about 2500 US$ per kW (Rafael). However, from the Ministry of Energy (National Directorate of New and Renewable Energy) it was emphasised that even an installation of 10 kW could be of important benefits in a small village (Saíde & Leão).

1.1.3 Suggested local energy use

When asked which local activities that would benefit the most through access to electricity from a possible implementation of small-scale tidal or wave energy there was a noteworthy agreement; fridge and freezers could improve the commerce for local fishermen (Bandeira, Cuamba, Chambuca, Saíde & Leão) and education system could develop, e.g. schools open during dark hours for adults (Bandeira, Rafael, Chambuca, Saíde & Leão). It was further implied that small-scale business activities would develop around a common electricity supply (Rafael, Saíde & Leão). With a limited energy source, it was generally agreed that the electricity in the first place should be used by common or production related interests, sooner than domestic use.

It was also mentioned that energy could be utilized by rural hospitals, mobile operators or hotels.

1.1.4 Important environmental and social issues

A general consensus from the meetings was that it is crucial to contact, and to some level involve, all stakeholders – from local population and village regolos (traditional chiefs) to environmental NGO:s

and authorities. The importance to address possible environmental impacts and have a dialogue with environmentalists was highlighted (Rafael, Chambuca). This, as rural population is highly dependent on the preservation of local ecological goods.

Concerning social issues it was pointed out that an immediate local access to the energy is important (Bandeira), along with local involvement (Cuamba, Chambuca) and education of the (often inexperienced) hazards of electricity (Bandeira). As another important concern it was emphasised that the gender perspective must be included, with women demands and voice as a certain part (Engvall).

A possible consequence of a successful project is that people from surrounding areas demands the same development, or may migrate to the village (Cuamba).

1.1.5 Resource assessment

The information on renewable energy resources in Mozambique is very sparse and there has been no mapping of waves or tide from an energy extraction perspective (Cuamba, Saíde & Leão). A future mapping of these resources, along with other natural resources, are wished by the Government, although it is expensive (Saíde & Leão). Some resource mapping on land are conducted by the University (Cuamba) and the National Institute of Hydrography and Navigation who perform sea bottom mapping (but focus on commercial ports) (Mutevuie). Navigation charts from the 1980:s are available, showing sea bottom features and depth covering most of the coast line. Tidal range is well understood from data collection in the port cities along the coast, still there are little or no data available concerning tidal currents or wave exposure.

Dr. Salomão Bandeira from the Department of Biological Sciences explained how the natural geography of Mozambique's coast is dived into three different zones:

A) The Northern zone with rocky bottoms, reef, lagoons (like southern Tanzania) and a tidal range of 3-4 m;
B) The Zambezi zone with rivers, estuaries, giant mudflats, frequent flooding (caused by cyclones) and a tidal range of up to 7 m;
C) The Southern zone with a steep and exposed coastline, large sand dunes and a tidal range of 3-4 m.

This description was supported by Humberto Mutevuie, executive at the National Institute of Hydrography and Navigation, who explained that soft bottoms (sand and mud) are found south of Angoche while rocky bottoms are more present northward from there. In the southern and northern parts of the country tidal range is 3-4 m, while up to 7 m in the central part. Waves are generally larger in the south.

1.2 TANZANIA

During the visit in Dar Es Salaam, Tanzania, meetings were arranged with the subsequent institutions and representatives:

Ministry of Energy and Minerals

- Ngosi Mwihava, Assistant Commissioner, Renewable Energy
- Mwakahesya Lutengano, Assistant Commissioner, Energy Development
- H.A. Mbise, Principal Engineer, Renewable Energy & Energy Efficiency
- Justina Uisso, Senior Research Officer Energy
- and their colleagues

University of Dar es Salaam

- Cuthbert Kimambo, Dr., College of Engineering and Technology
- Burton Mwamila, Professor
- Marcellina Chijoriga, Dr., Dean, Faculty of Commerce and Management
- Alfonse Dubi, Dr. Ing., Research Fellow, Institute of Marine Sciences (IMS)
- Narriman Jiddawi, M.Sc., Research Fellow, Institute of Marine Sciences (IMS)
- Mats Björk, Associate Professor, Bilateral Programme, Institute of Marine Sciences (IMS)

TaTEDO (Tanzania Traditional Energy Development and Environment Organisation)

- Samson Glory, Senior Programme Manager
- Senior Information Officer

Embassy of Sweden

- Anne-Lie Engvall, First Secretary, Programme Officer Infrastructure
- Maria Teresa Bejarano, First Secretary, Higher Education and Research

1.2.1 Opinions on the suggested project and possible complications to notice

In similar to the meetings in Mozambique there was found a generally positive attitude concerning the suggested project in Tanzania. An interest in the suggested project was declared from the Ministry of Energy and Minerals. The Ministry informed that tidal energy has not been considered so far; that still it may be of potential and that the initiative sounds exciting. It was further agreed that the main challenges probably will be societal – in terms of affordability. It was argued that if the technology can be found to be cost-effective there are no evident obstacles as the source is CO_2 neutral. The Ministry underlined the importance of a fast development of the project, with a soon introduction of a pilot plant to assess the capacity. Finally, the Ministry exemplified the actuality of research on the subject by announcing that at the moment they are asked by an Israeli company to invest in a proposed large-scale wave power installation offshore Zanzibar.

At the University of Dar Es Salaam, Dr. Cuthbert Kimambo (College of Engineering and Technology) informed that he support the project outlines and that the department may find it suitable to incorporate the issues in future research programmes. Further, it was implied that many sites along the Tanzanian coast and offshore islands probably have good potentials. Professor Burton Mwamila emphasised that research on the use of renewable energy is very important in Tanzania, and that the faculty has an interest of taking part in the suggested project. As the faculty concerning energy issues work in close cooperation with their colleagues in Mozambique it would be beneficial to include both countries.

At the Faculty of Commerce and Management, Faculty Dean Marcellina Chijoriga declared that the suggested perspective of rural development through renewable energy is a good initiative. Chijoriga further underscored that the project has to be carried out as a mix of technical, environmental and business sciences. Three principles were recommended to keep in mind: Access, Affordability, and Sustainability. Also, it was stressed that only proven technology should be exported to developing countries.

Dr. Alfonse Dubi, Research Fellow Narriman Jiddawi and Professor Mats Björk were met at the Institute of Marine Sciences (IMS) on Zanzibar. Dr. Dubi presented his previous work on measurements of the tidal power resource, showing indications of a resource potential along the Tanzanian coast. Mrs Jiddawi explained that the suggested project is very positive as there are both

local and political demands for optimistic research on development solutions. It was also mentioned that in order to gain local support it is important to let local villagers be assured that they will not be expelled by the energy extraction. Prof. Björk declared a positive opinion on the suggested project, emphasising the importance of a multi-sciences approach – and the importance of a critical environmental perspective concerning the technical systems.

As representative of the rural development organisation TaTEDO, Senior Programme Manager Samson Glory explained that there may be a potential for tidal power, and consequently the suggested project, along the coast and particularly at the islands of Pemba and Mafia. It was argued that tidal power in a future perspective may suit as power source in TaTEDO's proven multi-functional energy systems for remote villages (see below). To encourage involved people it was recommended that a pilot plant should be installed as soon as possible.

At the Embassy of Sweden in Dar Es Salaam, a meeting was arranged with Anne-Lie Engvall and Maria Teresa Bejarano. It was explained that Sida support projects and policies aiming for increased access to energy in rural areas, and the building of institutions around this issue. It was advised to include or take note of opinions from several divisions of the Sida organisation during the development of the suggested project. It was also told that Sida favour the use of proven technologies and that there is often a problematic shortage of "maintenance thinking" concerning technologies (which was as well confirmed by Kimambo).

1.2.2 Electricity situation

As well as in Mozambique, the electrification rate at the Tanzanian country side was explained to be very low; 1% have access in rural areas compared to 10% nationwide (Ministry, Glory). On the country side most household energy is harvested through firewood which may cause deforestation (Engvall & Bejarano) and depletion of mangrove forests (Jiddawi). Consequently, rural electrification has a very strong position in the governmental policy and has its own chapter in the developing plan (Ministry). The policy is to create a mix of public and governmental electrification projects, and to specifically get the private sector interested in rural electrification (Ministry). From the Ministry of Energy and Minerals it was stated that there is a strong link between rural electrification and renewable energy, the doors are open for all kind of sources (Ministry). Renewable energy is also a step away from oil import dependence (Jiddawi). So far, solar (PV) and wind power has been in focus (Ministry).

Unfortunately, the Tanzanian electricity grid is mainly adapted to large hydro power systems and there are technical hitches to connect other and smaller types of energy sources to the national grid (Kimambo, Engvall & Bejarano). At national level 60% of the electricity is supplied from hydro power while 40% come from other sources like natural gas and coal (Kimambo).

At small (village) scale, solar energy has been implemented showing good results (Jiddawi, Kimambo, Chijoriga). There have showed to be a willingness to pay; still only 20% of the rural population could afford the investment costs for solar systems (with credits allowed) according to a social assessment from Mwanza. Other possible renewable energy sources brought up are thermal power, small-scale hydro and wind (Mwamila). Over all, Tanzania has many good natural resources, but the scarce infrastructure and lack of affordability makes them difficult to extract (Chijoriga, Ministry). In remote areas several smaller diesel generators are sometimes used, but not often on community basis (Kimambo). It was pointed out that hydro power have the disadvantage of being sensitive to climate change, as water runoff may change. Another power source with some complications is the recently popular bio fuel (Mwamila, Engvall & Bejarano).

TaTEDO is an NGO working with small-scale and renewable energy on community basis, but also the public Tanesco work with renewables. It was notified that Tanzania has a good tradition in community based developing projects where local people often are willing to take part (Björk). Further it was stated that the electrification level is very uneven shared across the country, with a higher development in the Arusha region while lower in e.g. the southern regions (Glory). An estimate was that 90 kW power can serve 100 households, and probably more in poor regions (Glory).

1.2.3 Suggested local energy use

The suggested use of newly accessed energy (electricity) was less specified at the meetings in Tanzania compared to Mozambique, but the general opinion was that business activities could be

developed. It was further mentioned that prolonged hours of light could be used for education (Jiddawi), improve social life (Glory), and that fishermen could invest in freezers to improve the value of catch (Jiddawi). Overall, it was stated that electrification is a requirement for improved economy (Chijoriga).

During the subsequent visit in non-electrified villages in southern Tanzania, several electricity priorities where stated. The possibilities of machine tools, small-scale industries and cooling systems for fisheries were what first came to mind. Further, it was repeatedly mentioned that improved village security is an important advantage that would be achieved by outdoor village lights.

1.2.4 Important environmental and social issues

Even though few environmental impacts could be foreseeable at this stage, it was repeated that the environmental interests are strong and that it is crucial to research possible environmental impacts and to involve nature protection actors, including the Nature Board (NEMK) (Björk, Jiddawi, Chijoriga, Ministry). Concerning social aspects it was argued that the suggested project has to be viewed on a socio-technical basis (Mwamila). As in Mozambique, the need to inventory all concerned stake-holders and institutions was mentioned (Jiddawi, Mwamila). Further, social and religious aspects must be deeply assessed (Engvall & Bejarano).

1.2.5 Resource assessment

Like in most other countries, there has been no strategic mapping of the ocean power resources in Tanzania. For a deeper assessment of the potential mapping has to be accomplished (Kimambo). During the meetings, the offshore islands like Zanzibar, Pemba and Mafia, were generally thought of as having the best conditions (Glory, Kimambo, Dubi). Concerning wave power also Lake Victoria was mentioned.

Dr. Dubi suggested Mnasi bay and the Sound of Mafia as some among several interesting sites. The surface currents measured in the latter above is 1 m/s at neap tide and 3 m/s at spring tide. At Zanzibar the tidal range is 4.2 m, however tidal schemes are available from sites along the whole coastal region.

1.3 SOUTH AFRICA, DURBAN

The trip also included the participation in the international conference *5'Th WIOMSA Scientific Symposium* (Western Indian Ocean Marine Sciences Association), held in Durban, where the project team got the opportunity to discuss the suggested project with a wide range of marine and coastal zone researchers. A spectrum of opinions, mostly with concerns regarding the marine environment was expressed. Especially Professor Ian Bryceson underlined the importance of thorough assessments of potential environmental impacts on fish spawning grounds and other marine ecosystem services of great importance for the livelihoods of the coastal population.

2 SECOND PART – FIELD VISIT: RURAL SOUTHERN TANZANIA

In order to get small information on the coastal morphology in the aspect of its possibilities for future energy extraction, a few sites were visited in rural areas of southern Tanzania, mainly in the Pande Pwani Pinsula and the area of Kilwa Masoko. The brief information where collected through vision impressions, sand and substrate features, and occasionally snorkelling. The study is only a very basic overview.

2.2 KISONGO VILLAGE

Field visit 2007-11-03

Photos taken from the village water front - aiming north (L), east (C) and south. The area was visited during low tide.

Access from village
Settlement reaches down to shore.

Topography (coastline within eyesight)
Short sand beach down to large inter tidal plateau of coral rock, probably reef beyond the plateau. Steep 5-10 m coral rock coastline towards north-east. Opposite the sound, to the west, the coast raise to higher hill terrain.

Vegetation (land)
Dense bush along the coast and mangrove stands in the inter tidal zone towards north. Distant hills contain bush and forest.

Bottom structure and vegetation
Inter tidal zone consist of flat but broken and heterogeneous unvegetated coral rock. Coarse sand at the beach.

Tide
Large and flat inter tidal zone, water line varies up to 100-200 m.

Conditions for technology: Perhaps suitable for tidal micro-impoundments, using natural wall structures.

2.2 LIMALIAO KUSINI VILLAGE

Field visit 2007-11-03

Photos taken from shore - aiming north (L), east (C) and south (R). Central picture show vegetated coral rubble island. The area was visited during low tide.

Photos taken from vegetated coral rubble island (C) - aiming north (L) and south (R).

Access from village

Footpath through dense grass- and bushland, approximately 1 km from village to beach.

Topography (coastline within eyesight)

Average coast line slope 5 m down to a sand beach (fine grain size) that reach low tide waterline after 30 m or more. A flat inter tidal zone stretches 400-500 m out to reef; depth about 0-1 to 3 meters during low tide. Solitary vegetated islands consists of coral rubble. Local fishermen say the coast is always windy.

Vegetation (land)

Dense grass and bush with (50%) palm tree stands. Few mangrove stands along the coast; local fishermen say mangrove is to be found in Mtombo, Manksani, Mbanda and Ng'anga.

Bottom structure and vegetation

Inter tidal zone consists of flat coral rock, dispersed with a thin layer of fine grain size sand. Inner parts are flat and unvegetated. Outer parts contain small rocks and coral heads and are lightly vegetated with macro algae and sparse seagrass.

Tide

According to local fishermen the spring tidal range is 2-4 meters and the waterline varies on the scale of 10-100 meters.

Conditions for technology: Possible sites for tidal impoundments up to 400 x 400 m on the tidal flat, no natural wall structures though. No obvious sites for high current velocities, but natural channels through reef fringe would possible create high currents.

2.3 KILWA MASOKO TOWN

Field visit 2007-11-03

Photos taken from coral stone rocks (hotel area) - aiming south (L) and west (C, R). The area was visited between low and high tide (flood).

Photos taken from sand beach (village) - aiming north (L and R).

Access from village
Settlement reaches down to shore.

Topography (coastline within eyesight)
Peninsula of coral rock 6-10 m above waterline, sand slope or steep rock down to water. The bay is probably around 10-20 m deep and seems to lack larger shallow or inter tidal areas. Beach towards the village (west) consists of fine grain sand; cliffs towards hotel area (north) consist of vertical coral rock.

Vegetation (land)
Dense bush with several baobab trees, vegetation all down to waterline.

Bottom structure and vegetation
The inter tidal zone has not been investigated. Seagrass grow in large patches, pale blue water colour suggests vast areas of unvegetated sand bottoms. Local fishermen indicate proximity to coral reef.

Tide
According to local fishermen the high tide reaches up to the lowest houses during spring. No larger inter tidal zone, because of bottom slope. In the nearby (region) strait strong currents bring good deep sea fishing.

Conditions for technology: Possibly suitable for tidal micro-impoundments, using natural wall structures. Nearby strong currents may be suitable for tidal velocity devices.

2.4 SOMANGA VILLAGE

Field visit 2007-11-04

Photos taken from island shore - aiming north (L), east (C) and south (R). The area was visited during low tide.

Island houses (L) raised on poles to avoid high water levels. Vast mudflats and mangrove forest (R), viewed from main village.

Access from village
One part of the village built on a shallow island situated on the vast inter tidal mudflat.

Topography (coastline within eyesight)
Flat coast line, probably the outskirts of a river delta. Very large inter tidal zone, only submerged during spring flood.

Vegetation (land)
Sparse mangrove forest with open unvegetated plains.

Bottom structure and vegetation
Mudflats and probably channels.

Tide
Tidal range not specified.

Conditions for technology: Probably no suitable sites, high environmental values.

3 THIRD PART – MEETINGS WITH VILLAGE REPRESENTATIVES IN SOUTHERN TANZANIA

During the field trip to southern Tanzania and the Kilwa Masoko region meetings where arranged with village representatives in settlements found along the road between Somanga and the Pande Pwani Peninsula. In some cases the same persons gave information of several villages, as they had access to the village official demographical statistics. In these cases not all questions could be answered. The same questions were asked at all meetings, although, the meetings should not be reviewed as true interviews. The same interpreter (man, age of 25) translated the communication during all meetings. It is important to notice that these results are at very basic quality.

REGION	PANDE PWANI	PANDE PWANI	PANDE PWANI	PANDE PWANI	PANDE PWANI	PANDE PWANI
VILLAGE	**LIMALIAO KUSINI**	**LIMALIAO KASIKASI**	**KISONGO**	**RUSHURI**	**NAMNKONGORO**	**RUYAYA**
Date of visit / Beachfront visit	2007-11-03 Pictures 214-247 Beachfront visited	2007-11-03	2007-11-03 Beachfront visited	2007-11-03	2007-11-03	2007-11-03
Information source	Chairman and Vice Chairmen	Chairman and Vice Chairmen	Chairman and Chairmen from Limaliao	Chairman and Vice Chairmen from Limaliao	Chairman and Vice Chairmen from Limaliao	Villagers and Chairmen from Limaliao
Population (W/M)	5000 (65/35%)	4900 (65/35%)	5000 (65/35%)	3100 (65/35%)	2800 (65/35%)	2200 (65/35%)
Number of houses	500	500	600	400	500	400
Religion	Islamic 98-99%	Islamic 98-99%	Islamic 98-99%	Islamic 98-99%	Islamic 98-99%	Islamic 98-99%
Activities	Agriculture, Fishing	Agriculture, Fishing	Agriculture, Fishing	Agriculture, Fishing	Agriculture, Fishing	Agriculture, (Fishing)
Main products	Cashew nuts, banana, cassava - export within region	Cashew nuts, banana, cassava - export within region	Cashew nuts, banana, cassava - export within region	Cashew nuts, banana, cassava - export within region	Cashew nuts, banana, cassava - export within region	Cashew nuts, export within region
Distance to sea	3.5 km	3.5 km	0 km	0 km	1.5 km	4 km
Schools	In Pande Pwani area: 7 primary and 1secondary	In Pande Pwani area: 7 primary and 1secondary	In Pande Pwani area: 7 primary and 1secondary	In Pande Pwani area: 7 primary and 1secondary	In Pande Pwani area: 7 primary and 1secondary	In Pande Pwani area: 7 primary and 1secondary
Industries	No industries	No industries	No industries	No industries	No industries	No industries
Average income per day (W/M) (1000Tsh = 6 SEK)	1200 / 1500 Tsh per day	1200 / 1500 Tsh per day	1200 / 1500 Tsh per day	1200 / 1500 Tsh per day	1200 / 1500 Tsh per day	1200 / 1500 Tsh per day
Local conflicts	No conflicts	No conflicts	No conflicts	No conflicts	No conflicts	No conflicts
Fresh water supply	Single spring in a cave (Kisima Ng'arwe)	Single spring in a cave (Kisima Ng'arwe)	Ground water well, manual water pump			
Health	Cholera and water associated deceases	Cholera and water associated deceases				
Energy use	Firewood (collected in bush)	Firewood (collected in bush)	Firewood (collected in bush)	Firewood (collected in bush)	Firewood (collected in bush)	Firewood (collected in bush)
Access to electricity	No	No	No	No	No	No
Electricity source						
Electricity priorities	Small machines, cooling fish, small industry, security	Small machines, cooling fish, small industry, security	Small machines, cooling fish, small industry, security	Small machines, cooling fish, small industry, security	Small machines, cooling fish, small industry, security	Small machines, cooling fish, small industry, security
Other	Water is a major problem, Electricity very important	Water is a major problem, Electricity very important				

REGION	KILWA	KILWA	KILWA	KILWA	MOHORO	MOHORO
VILLAGE	**KILWA KIWINJI** (Magengeni + Mgongeni)	**NANGURUKURO**	**MPARA**	**KILWA MASOKO** (Masoko town + Mnasi moja)	**SOMANGA**	**KINJUMBI**
Date of visit / Beachfront visit	2007-11-04	2007-11-04	2007-11-04	2007-11-04 Beachfront visited	2007-11-04 Beachfront visited	2007-11-04
Information source	Chairman	Chairman from Kilwa Kiwinji	Chairman from Kilwa Kiwinji	Chairman from Kilwa Kiwinji	Vice Chairman	Vice Chairman from Somanga
Population (W/M)	7446 + 4500 (60/40%)	2000 (60/40%)	1500 (60/40%)	4200 + 3800 (60/40%)	6690 (60/40%)	4000 (60/40%)
Number of houses	3000 + 2000	1000	700	3000 + 2900	1236	820
Religion	Islamic 98%	Islamic	Islamic	Islamic	Islamic 80%, Christian 20%	
Activities	Fishing (Agriculture)	Agriculture	Fishing (Agriculture)	Fishing (90%), Agriculture, Business	Fishing, Agriculture, (Business)	Agriculture (Business)
Main products	Fish export to Dar Es Salaam					
Distance to sea	0 km	15 km	2 km	0 km	0 km	
Schools	2 primary and 1 secondary				1 primary in village and 1 secondary in common	
Industries	2 small mills, cold room for fish			Fish industry, Wood industry		
Average income per day (W/M) (1000Tsh = 6 SEK)	1500 / 3000 Tsh per day	1000 / 1000 Tsh per day	1000 / 1000 Tsh per day	1500 / 3000 Tsh per day	2000 / 3500 Tsh per day	1300 / 2000 Tsh per day
Local conflicts	No conflicts, friendly and safe		No conflicts, friendly and safe	No conflicts, friendly and safe		
Fresh water supply	Ground water well, pumps does not work				Mechanical water pump, still problem with water in village	Ground water well, manual pump
Health	Some cholera during rainy season, HIV				HIV c:a 4%, cholera has been treated recently	HIV c:a 4%, cholera has been treated recently
Energy use						
Access to electricity	Yes, 40-60% of households are connected		Grid line passing thrue village, but NO ONE connection	Yes, 80% of households are connected	No, but those that can afford buy an own generator	No
Electricity source	Diesel generator in Kilwa Masoko (95 Tsh/kWh)			Diesel generator (95 Tsh/kWh)		
Electricity priorities	Cooking, lights, freezing fish				Freezing fish, small mechanics industry related to main road, agricultural machines	
Other	Water is a problem	Very poor village	Very poor village			