

Development and Energy in Africa (DEA) Project

Tanzania Background Paper

1.0 Introduction

1.1 Purpose

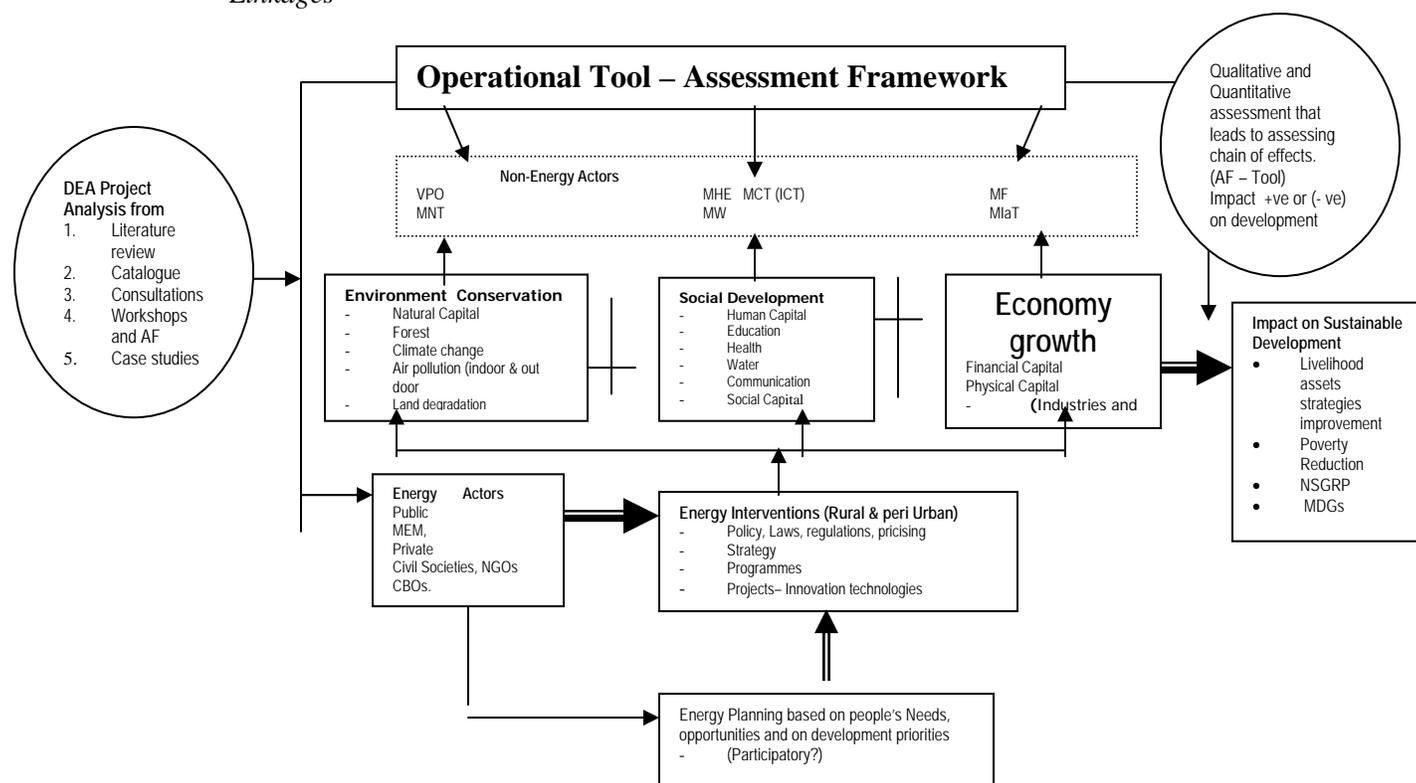
The purpose of this paper is to provide brief information on DEA project, profile of the implementing country centre and the country energy status. The paper discusses also in brief the energy policy of Tanzania, strategy development and some findings on the impacts of the energy programmes and projects implemented in the country.

1.2 The DEA project

The Development and Energy in Africa (DEA) is a project of the EC COOPENER programme, which started officially on 1st May 2005. The project is implemented and coordinated by the RISØ National Laboratory, Denmark and supported by the Energy Research Center of the Netherlands (ECN) and Six African NGO Centers from six participating countries: Botswana - EECG, Ghana - KITE, Mali - MFC, Senegal - ENDA, Tanzania - TaTEDO and Zambia - CEEZ.

The DEA project is a two and half years project (30 months) which aims to develop an operational assessment framework for identifying and quantifying how energy interventions and projects can contribute to sustainable development, including achieving the Millennium Development Goals (MDGs). Fig. 1 tries to indicate the expected operational assessment tool within the complex linkages between energy and sustainable development.

Fig 1: Proposed Assessment Framework within the Energy and Sustainable Development Linkages



Source : Sawe 2005

1.3 TaTEDO as DEA Implementing partner in Tanzania.

TaTEDO is the DEA project implementing partner in Tanzania, TaTEDO is a sustainable energy development national NGO based in Dar es Salaam, Tanzania with more than 14 years actively involved in sustainable energy development projects and programmes in the rural and urban areas.

1.3.1 Vision

TaTEDO's vision is communities with better access to modern sustainable energy services for poverty reduction, economic growth and social development while conserving the environment.

1.3.2 Mission

The mission of TaTEDO is to develop and promote greater uptake and rational use of Sustainable Energy Technologies (SETs) and environmentally sound practices through provision of relevant information, knowledge and skills geared towards sustainable development of communities.

1.3.3 Goals

The goals of TaTEDO are:

- To improve quality of life of the poor majority in Tanzania by contributing to availability of improved and sustainable energy services, employment and income generating opportunities, which are essential for poverty reduction and sustainable.
- To reduce environmental degradation resulting from increased use of wood and fossil fuels,
- To contribute in reducing the country's dependence on imported energy (fuels and electricity).

1.3.4 Activities

To achieve her goals, TaTEDO undertakes the following activities:

- Promote the use of modern sustainable energy services for productive uses (industrial, agriculture and commerce etc), consumptive uses and for basic needs (households and communities) and institutional and social needs uses (education, health, water etc).
- Implement sustainable energy programmes and projects.
- Provide sustainable energy related consultancy services.
- Develop networking and partnership with local and international organisations,
- Manage and disseminate energy information to stakeholders.
- Undertake lobbying and advocacy to influence energy related policies, strategies regulations, legislations and pricing.
- Support sustainable energy enterprises development.
- Conduct energy related applied and adaptive research on technologies.

1.3.5 Organization Strength and Capacity

In order to facilitate effective implementation of her development programmes and achieve her goals, TaTEDO's policy is to continuously improve her capacity, through training, recruitment of competent staff, acquiring modern office equipment and facilities and promoting partnership. Present organisation strength and capacity include:

- Thirty committed personnel of whom include 22 university graduates staff and 8-field extension and supporting staff;
- Supportive and reliable partners from local, national and international levels.
- Bi- annual Sustainable Energy and Environment Newsletter.
- Modern office and communication facilities: (computers, printers, internet, e-mail, fax, telephone);
- Partnership and networking with CBOs, NGOs, Government and private institutions from within and outside the country;
- Belong to Sustainable Energy Development Network (SEDN) and a founder member of TASEA as a national energy networks and the East Africa Energy Technology Development Network (EATDN).
- A library with a good collection of over 4000 documents on sustainable energy, environment, gender issues and related issues;
- Committed Board of Directors and Members;

Table 1: Some Energy Projects being implemented by TaTEDO and Partners

S.N	Project / Programmes Titles	Funding Sources	Project Duration
1.	Integrated Sustainable Energy Services for Poverty Reduction and Environment Conversation Programme (ISES – PRECP)	HIVOS – Netherlands NORAD – Norway TaTEDO	July 2003 – June 2006.
2.	African Rural Energy Enterprise Development (AREED) Programme	UNF, UNEP & SIDA	January – December 2007
3.	Enabling Access to Sustainable Energy Development (EASE)	DGIS, ETC - Netherlands	June 2004 – June 2008
4.	Bio fuels for transport study	GTZ	July – October 2005
5.	Biodiversity Conservation for Mountain Kilimanjaro Through Promotion of Improved Stone- made Firewood stoves	UNDP/GEF	October 2003 – Dec 2005.
6.	Development and Energy in Africa (DEA)	EC COOPENER Programme.	May 2005 – November 2007.
7.	Market Development of Solar Dryers and its products in Ukerewe District, Mwanza Region	UNDP /GEF	2005 – 2007
8	Construction of Improved Firewood stoves in 10 schools Kondo District	WFP	(June - December 2005)
9	Global Village Energy Partnership (GVEP)	UNDP	August 2005 – July 2006
10	Energy for Water, health and Education (ENABLE)	SEI, EU	August 2005 – July 2006
11.	Energy Professional Exchange Programme	Fredskopset - Norway	On-going

2.0 Tanzania Energy Status

2.1 Country Socio –economic context

Tanzania with a surface area of 945,087 Km², is located in East Africa bordering the Indian Ocean to the East, Mozambique, Malawi and Zambia to the South, Democratic Republic of Congo, Rwanda and Burundi to the west and Uganda and Kenya to the North. Tanzania has a population of about 35 million people with a growth rate of 2%. (2002 census)

Tanzania is still the poorest country in the world with annual GDP of USD10.7 billion in 2003 and a per capita income of USD 280. The GDP in real terms grew at 6.7 percent in 2004. The increase in growth rate was mainly attributed to debt relief, increase in agriculture products, tourism, minerals and communication.

Tanzania is rich in energy resources both renewable and non- renewable energy but is a least consumer of modern energy at about 70kgoe per capita. Annual per capita electricity consumption stands at 84 kwh and overall per capital annual energy consumption is about 700 kgoe. (MEM 2002)

Energy development in Tanzania clearly reflects the imbalances and inequalities that are part of the present urban and rural development in Tanzania. Energy policies have not fully taken into account the energy needs of the entire population. A great deal of attention is paid to investment and development of commercial energy sector i.e. infrastructure for electricity and petroleum fuels, mostly for urban few and industrial sector, virtually little efforts have been made in areas of biomass energy in particular for rural energy, which meets the energy needs of over 80 percent of the Tanzania population.

2.2 Energy Demand

National energy demand (consumption) is estimated at 22 million tones of oil equivalent (TOE) per annum or 0.7 toe per capita (MEM 2003). The quantitative distribution of the different energy carriers to the energy balance are: biomass fuels 90%, petroleum 8%, electricity 1.2 % and others less than 1% (includes coal and Renewable Energy sources).

2.2.1 Wood fuels

Average national wood fuel consumption per capita is around 1.0 to 1.5 cubic meter³ (m³) of solid wood. Main consumers of wood fuels include households both in rural and urban areas, small-scale industries and processing of agricultural crops mainly tobacco curing and tea drying. The estimated national annual wood fuel consumption is about 36 million m³, which is already over and above the estimated annual sustainable yield of 24 million m³ from the forest standing stock.

2.2.2 Electricity

The present total installed electricity capacity is about 950MW. Hydro contributes 59% and the rest is from thermal power plants. (MEM 2005)

The current forecasted demand of electricity is about 700MW, growing at around seven percent per annum. Only about 10 percent of the entire population of Tanzania has access to electricity, in urban areas electricity access is about 40% while in the rural areas only 2% of the population is connected. The high cost of electricity and its low reliability constitutes a major challenge to

electricity consumers (MEM 2004). The total number of TANESCO customers is approximately 525,000 with an estimated annual growth of 25,000 new connections per annum (MEM 2004).

2.2.3 Liquid Fuels (Petroleum)

Petroleum exploration efforts have been made in Tanzania but so far no oil has been found. Tanzania relies exclusively on imports of its oil heads whereby transport sector consumes 40% of all fuels imported. Presently only 70% of the demand for petroleum fuels is met. According to the World Bank, chronic fuel shortage in the interior of Tanzania cost some US\$ 100million annually in avoidable losses. Petroleum fuels consumption increased from 1.35 million metric tonnes in 2003 to 1.45 million metric tonnes (10.7million barrels) in 2004. Also the fuel bill increased from USD195.6million in 2002 to USD 402 million in 2005. The increase in importation of fuel and continuous rise in oil prices are heavy burden for the country. With the right policy, regulations and incentives, Tanzania has a potential of substituting a large percentage of this imported fuels with Biofuels i.e. ethanol and biodiesel that could be produced within the country.

2.3 Main Energy Consumption Sectors

Mixes of energy sources are normally used by different sectors depending on availability and affordability. These are illustrated in table 2 below:

Table2: Sectoral Energy Consumption summary

S.N.	Sector Category	Percentage of Total Energy	Percentage of commercial Energy
1.	Households	80	14
2.	Industry	9	27
3.	Transport	6	50
4.	Agriculture	4	4
5.	Commerce and Others	1	5
	Total	100	100

Source: MEM

2.4 Energy Supply

Tanzania has abundant and diverse indigenous energy resources but so far poorly developed. Their sources include: wood fuel and other biomass-fuels, hydropower, natural gas, coal, uranium, wind, geothermal and solar, (MEM 2003). Current supply situation from the different energy sources are highlighted as follows:

2.4.1 Biomass Energy

Tanzania has about 35 million hectares of forests; which is 38% of total land areas (MNRT, 1998) of which 13 million ha are gazetted (protected) forest reserves and remaining 62% are forests on public land in village areas that are under enormous pressure from human activities including harvest for energy. Forest and trees in farmland contribute to wood fuel supply. Experience has shown that, supply potential of wood fuel is declining rapidly in the country causing scarcity of energy to low-income families and environmental degradation in areas where harvesting of wood fuel exceeds the growing stock potential (VPO 1997, MNRT 1998a).

There are few biomass based – co generation plants in Tanzania. These include sugar processing mills (about 32.3 MW) and the wattle (tanning) processing plant (2.5 MW). It is also reported

that Sao Hill Sawmill has waste to electricity generation plant with capacity of 1.025 MW (MEM 2005).

Recent studies show that more than 6,000 domestic size biogas plants have been built countrywide between 1984 to 2004 for domestic and commercial application. There are initial efforts to promote biofuels i.e. ethanol and biodiesel production in the country for transport.

2.4.2 Hydropower

Hydropower potential is estimated at 4700 MW. The current total installed generating power capacity is about 950MW with 561 MW being hydro – based (Table 3) Tanzania also import electricity from Uganda (8 MW) and Zambia (5MW)

Table 3: Existing hydropower plants in Tanzania

Hydropower Plants	Installed Capacity (MW)	Effective Capacity (MW)
Kidatu	204	204
Kihansi	190	180
Mtera	80	80
New Pangani Falls	68	66
Hale	21	17
Nyumba ya Mungu	8	8
TOTAL	561	555

Source: MEM 2004

TANESCO's thermal generating plants in the country has a net effective capacity of 475 MW. Thermal plants include: Ubungo gas turbines, Ubungo diesel plant, Independent Power Tanzania Ltd. (IPTL) plants, isolated remote diesel plants, Kiwira Coal Mine Company Limited (*table 4*).

Table 4. A summary of thermal Power Plants.

PLANT	INSTALLED CAPACITY (MW)	EFFECTIVE
Grid connected		
Songas	192.000	112.5
TANESCO	85.700	35.3
IPP (IPTL)	100.000	100.0
Sub Total - Grid	377.700	305.3
Isolated		
Diesel	55.500	25.3
Coal	6.000	2.0
Bagasse (Sugar Plant)	32.300	24.2
Wood Biomass	3.525	3.5
Sub total - Isolated	97.325	55.0
Total Thermal	475.025	360.3

Source: MEM 2004

2.4.3 Natural Gas

Natural gas deposits in Tanzania are found at Songo Songo in Lindi Region and Mnazi Bay in Mtwara Region. The reserves are estimated to be around 30 and 15 billion cubic meters

respectively. A gas pipeline with a distance of 232 km from Songo Songo to Dar es Salaam has been constructed and is supplying natural gas for power generation in Dar es Salaam (MEM 2004). Already 192 MW of electricity are being generated using natural gas.

2.4.4 Coal

Tanzania coal reserves are estimated at about 1,200 million tones of which 304 million tones are proven. Main coal plants include: Kiwira, Machuchuma, and Katewaka. The available coal is bituminous with an average ash content of about 25 percent and calorific value of about 28MJ/Kg. Some coal from Kiwira is used for generation of electricity of about 6 MW also it is used in industries such as cement and textile (MEM 2004). Efforts are underway to utilize Mchuchuma - Katewaka coal for generation of up to 400 MW of electricity under the Mtwara corridor development initiative.

2.4.5 Renewable Energy resources.

Tanzania lies between 1° and 11° South of the Equator with long sunshine hours. The average daily insolation is about 4.5 – 6.5 Kwhm² through the year.

Renewable energy technologies currently in use in Tanzania include: photovoltaic (PV) equipment, solar thermal, wind pumps and biogas. Quantatively, contribution of new and renewable sources of energy (NRSE) in Tanzania is estimated to amount to about 1.2 MW that is mainly used in telecommunication system (ECON 2004) and households. In order to increase the use of renewable energy technologies, the country has since 2005, removed all taxes on imported solar and wind equipment etc. Wind energy resource assessment studies have been undertaken which have indicated some potential for electricity generation with mean wind speed of above 6 m/s in some areas of the country.

3.0 Energy Policy and Implementation

The Tanzania energy policy (2003) emphasizes the need to focus on market mechanism as means to reach the energy policy objectives and achieve an efficient energy sector with a balance between national and commercial interests. On this basis, petroleum importation and markets have been privatized. Independent Power Producer are now operating with a proposal to privatize the power utility. Specifically the policy statement on rural energy include the need to: -

- Support research and development of rural energy sector.
- Promote application of alternative energy sources other than fuel wood and charcoal in order to reduce deforestation, indoor health hazards and time spent by rural women in search of firewood.
- Promote entrepreneurship and private initiative in the production and marketing of products and services for rural and renewable energy.
- Ensure continued electrification of rural economic centers and make electricity accessible and affordable to low income customers.
- Facilitate increased availability of modern energy services, including from grid and non-grid electrification to rural areas.
- Establish norms, codes of practice and guidelines for cost effective rural energy supplies.

These are promising policy statements, there are already on going and planned efforts to implement the energy policy i.e.

- MEM institutional Capacity strengthening project.
- Establishment of the Rural Energy Agency project (REA) and Rural Energy Funds (REF).

- Feasibility study for preparing Rural Electrification Master Plan.
- Implementation of the GVEP
- Solar PV market development project and
- Others.

Despite the efforts to get energy policy implemented, the development of deliberate strategy for policy implementation has not yet taken place. However the emerging energy strategy and directions include:

- Promoting affordable and reliable energy supplies countrywide.
- Reforming the market for energy services and establish adequate framework to facilitate investment, service expansion, efficient pricing mechanism and other financial incentives.
- Enhancing development and utilization of indigenous and renewable energy resources and technologies.
- Taking account of environmental concerns in all energy activities
- Promoting energy efficiency.
- Increasing energy education and building gender balanced capacity in energy planning, implementation and monitoring.

The policy intensions and a clear strategy when formulated will have to be supported by the necessary laws, acts and enforceable regulations, which are still not in place. This should be followed by programmes and projects for implementing the policy. The programmes and projects should see to it that adequate capacity to implement the policy is developed, coordination is improved and mechanism for monitoring the implementation of the energy policy is in place.

4.0 Energy, Millennium Development Goals and Poverty Reduction Strategy Paper

The Millennium Development Goals (MDGs) adopted in September 2000 at the UN summit provides, key set of time bound and measurable goals and targets for combating poverty, hunger, illiteracy, gender inequality, diseases, and environmental degradation. While there is no MDG explicitly on energy, access to modern energy services is essential for achieving all the eight MDGs. This was recognized at WSSD in 2002. Tanzania is committed to the Millennium Development Goals and has revised her strategy on poverty reduction (PRSP) to a new National Strategy for Growth and Reduction of Poverty (NSGRP). The NSGRP stipulates measures to undertake in order to address problems of poverty, hunger, diseases, illiteracy, environmental degradation and discrimination against women. The NSGRP promotes the contribution of sectors in three clusters which include:- economic growth and reduction of income poverty, improvement of quality of life and social well-being and good governance and thus cross – sectoral linkages.

The energy in the NSGRP is stipulated as critical for attainments of the NSGRP targets. Energy is necessary for productive activities in industries SME agriculture, transport and provision of social services such as education, health, water supply, etc.

Studies and assessment have indicated that energy is an engine for growth and poverty reduction; as such it should be given high priority and reflected in policies, programmes, and development partnership both at the national and international levels.

5.0 Impacts of energy programmes and projects

In the efforts to improve energy access in rural areas of Tanzania, there have been several projects and programmes implemented over the years. The programmes and projects have been initiated based on the needs, however, have been implemented on an ad-hoc basis, that is not based on a deliberate well spelt out strategies and regulations to address the energy problems of

the country. The projects initiated in the past have included; enhancing woodfuels supply thorough better management of forests and afforestation. Demand side management through promoting efficient woodfuels use and production technologies, promoting use of biomass energy substitutes such as biogas, coal, LPG and electricity. Rural electrification efforts.

As of today, by and large, while the past efforts have had some success they have failed to have significant impact on alleviating the rural energy problems. Wood fuels, depletion in many areas continues and areas of scarcity with commercialization of woodfuels are on the increase. Still more than 90 percent of the Tanzanian population has no access to electricity. More than 90 percent of the rural population depends on physical human energy for agriculture and transport activities.

The low performance on the efforts to improve rural energy situation has been due to the following barriers:

- Approaches to rural energy planning and implementation have not addressed the real needs, priorities and cause in the cultural and social –economic settings of which rural energy problems are merely one of them.
- Inadequate past commitment from the Government and development partners. Lack of clear policy, strategy, low priority in terms of financial resources allocation to rural energy development efforts.
- Financial limitations; lack of rural energy financing mechanism, unwillingness of private sector to invest in rural energy business due to low affordability of the rural population.
- Technical constraints:- low quality inefficient energy technologies are dominating energy use and production in rural areas. Limited human resources and facilities.
- Policy and institutional limitations inadequate policies, laws, regulations, and institutional frameworks are a major barrier.
- Poor private sector participation due to limited rural energy information and data poor markets and infrastructure development in rural areas.

6.0 Conclusions and Recommendations

The great challenge for provision of modern energy services is found in rural areas. Rural development should be the overall priority in meeting the energy access challenge, with a focus on increasing investments from donors, government, and private sector. The policy should support development and promotion of decentralized energy systems using conventional and renewable energy resources available in the country. Greater efforts should be made to promote local energy entrepreneurs, establishing effective financial mechanism and adapting policies and regulatory systems to meet new challenges and incorporate lessons from field practices to expand the level of energy services to support sustainable development particularly in rural areas.

Tanzania is rich in energy resources, however, due to lack of financial resources, for the foreseeable future woodfuels and human physical power will continue to be the source of energy in most rural areas of Tanzania. To bring about rural development, it is important that long term efforts are scaled up to facilitate access to modern energy services in rural areas. Rural areas of Tanzania need to use more modern energy services if poverty is to be made history. Presently energy consumption is too low with most of the energy being used for cooking, more energy is required to increase and improve production of value added goods and services in rural areas.

The production and use of modern energy in Tanzania is a problem of capital scarcity, not energy resources. It is more a question of whether or not adequate capital would be availed to develop the available energy resources.

With the present escalating fossil fuels prices, Tanzania and development partners, need to urgently avail the necessary capital to develop and produce own fuels from energy crops, if the current positive economic performance and growth is to be sustained.

The encouraging trend is that, for sometimes now, the political commitment to rural energy problems has been growing; there has been many initiatives and willingness at the international, national and local levels to support the rural energy cause. Despite this encouraging and supportive atmosphere, there has been proportionally very little actually happening on the ground in the rural areas to bring about the desired impacts. It is our strong recommendation that, time is now ripe for formulating and implementing effective policies, strategies and projects over longer periods of more than five to ten years to ensure greater access to modern energy which is essential for sustainable development in rural areas.

7.0 Reference cited

1. Vice President's Office, June 2005. National Strategy for Growth and Reduction of Poverty (NSGRP).
2. Ministry of Energy and Minerals, February 2003. The National Energy Policy,
3. BOT, December 2004 Monthly economic review, Dar es Salaam, Tanzania.
4. TaTEDO, May 2005. Research proposal document on enabling access to sustainable energy: productive uses of electricity and Biomass heat energy.
5. TaTEDO, May 2004. Integrated Sustainable Energy Services for Poverty Reduction and Environmental conservation programme document.
6. Ministry of Energy and Minerals, 2003. Review of Institutional arrangements for rural energy.
7. UNDP/TaTEDO, May 2004. Proceedings of the National Workshop on Developing Sustainable Rural Energy Strategies at District level, Lessons from the field.
8. Hifab and TaTEDO, 1999. Rural Energy Situation Study
9. UNDP/TaTEDO, 2001. Barriers for Solar PV market development, TaTEDO Dar es Salaam