

The Role of Private Sector in Biomass Cogeneration Development in Tanzania

Tanzania's energy situation is characterized by low per capita consumption of commercial energy i.e.(petroleum, coal and electricity) and relatively large dependence on biomass fuels in form of firewood,charcoal and bio-waste. Biomass energy consumption accounts to about 92% of the total energyconsumption. Petroleum, coal and electricity account for the remaining 8%. Petroleum products that areall imported consume quite substantial amount of the country's foreign exchange. It is estimated that, 35-40% of export earnings is consumed on petroleum product imports.

Electricity contributes only 1% of the total energy consumption and serves only about 10-15% of thecountry's population. Furthermore, electricity power generation is about 70% dominated by the hydropower sources. The remaining 30% is by thermal plants that use imported petroleum based dieselfuels.

The supply of electricity in the country has been the mandate of the public utility–TANESCO (Tanzania Electrical Supply Company) that was established in 1964. TANESCO mandates have however since early 1990s been relaxed in order to respond to the country's economic reforms to all sectors including power. The economic reforms put emphasis to the private sector to attain a leading role in the development of the national economy. With regard to the power sector reform (PSR) it is an opportunity to the private sector to participate in expanding electrification.

This study draft report mainly presents the merits of the two forestry based cogeneration systems in the context of the objectives of the Power Sector Reforms in Tanzania. Accordingly the merits of the two cogen systems are evaluated in the context of expanded electrification, technical/financial performance and local participation.

The methodology used in the study has included literature review from annotated bibliography; field visits to the cogeneration plant localities and discussions with the respective owners. Consultative meetings with the private sector in agro-forestry businesses, the power utility, relevant policy makers in government and local communities. Literature review on biomass cogeneration development in the countries of Mauritius and Zimbabwe has provided valuable inputs to the study as well.

The report contains six chapters. The first chapter covers the background of the power sector in general and in particular the status of the electricity sub sector. The major observations/findings are:

- § The rate of electrification is far much higher in Urban areas than in rural areas
- § Large-scale power sources and IPPs are targeting large industrial energy markets such as the mining sector to the disadvantage of rural energy markets.
- § Biomass cogeneration systems that are located in rural areas and in isolated areas could become cost effective (IPPs) and consequently expand rural electrification.
- § The operations of biomass based cogeneration systems involve significant local population in employment terms. For example forestry based cogeneration employs more women and youth in rural areas particularly in tree planting operations
- § The national forestry policy is explicit in encouraging fuel wood plantations for energy uses and that forestry energy as a modern fuel in form of electricity will promote more value to forestry national planning and environment conservation.
- § Forestry based cogen systems notably TANWAT has vast experience in the technology and is the first IPP in Tanzania.

The second chapter covers the forestry sector. Major observations in the study include:

- § The availability of forestry resource base for cogeneration in state forest plantations that could generate some 12 GWh of firm power annually for expanded electrification in rural areas and improved payback on the forestry investment.
- § National Forestry Policy explicitly encourages local communities and the private sector participation in investing in cogeneration for sustainable livelihood.

The third chapter covers the "case study" of Saohill. Besides describing the technical details of the plant, other major observations are:

- § Power generation by diesel gensets is the most expensive.
- § There is enough fuel for an increase of the current capacity of 1.0 MW to 2.5 MW. This could suffice the power demands in Mufindi district and eliminate load shedding.
- § The disposal methods of the unused wood residue are both expensive and environmentally hazardous.
- § Unit energy production cost starts to compete with grid energy costs of US\$ 0.09 per kWh at plant utilisation of 40-50%. At high utilisation, the unit cost drops to about 0.0525 US\$.
- § Thermal energy is used in the drying of timber that consequently eliminates the use of chemicals that are not environmentally sound.
- § High potential for local participation e.g. in equity sharing in forest based cogeneration as a source of power in rural electrification.

The fourth chapter covers the case study of TANWAT, which is the first IPP in Tanzania. Other major findings include:

- § There is valuable technical information in the combustion of different wood species (wattle, eucalyptus, pinus) – an important factor in the overall sustainability of raw material supplies in the locality.
- § There is enough fuel for an increase in capacity from 2.5 – 4.0 MW generation to meet a substantial power demand in Njombe district.
- § Power generation by diesel fuel is most expensive and that TANESCO has the policy to reduce the use of diesel plants.
- § TANWAT plant utilisation ought to be above 90% in order to compete with the grid power.
- § Thermal energy is used in wattle factory where tannin is extracted.
- § In the context of the power sector reform, the issues of expanded electrification and improved technical and financial performance are remarkably demonstrated.
- § The workers have accumulated valuable skills and experiences over the years as an IPP.

The fifth chapter discusses the role of private sector in biomass cogeneration in Tanzania. The discussion is based on the Saohill and TANWAT case studies and in the context of power sector reform. Salient issues as a result of the discussion include:

- § The availability of local technical capacity in cogeneration technology
- § The availability of facilitative sectoral policies and legislation
- § The availability of local financial sources to develop small capacity cogen plants.

With regard to the challenges of the power sector reform, the discussion highlights the merit of the case studies in addressing the power reform challenges.

The last sixth chapter covers conclusions and recommendations. In summary, the conclusions include:

- § The private sector is on the lead demonstrating the viability of the biomass cogeneration as stand alone grid systems expanding rural electrification in Tanzania.
- § Biomass cogeneration is a strategic technology to save foreign currency, improve environmental quality, ensures power security and is potential for equitable local participation.

In summary the recommendations include the urge for:

- § Government support in the establishment of agro-forestry efficiency policy in order to make use of biomass cogeneration system as source of electric power.
- § Government support for local participation in share ownership structures that will ensure equity among electric power users both in rural and urban areas.
- § Networking and research
- § Financial institutions relaxing lending conditions for increased development in biomass cogeneration