THE EastAfrican
PUBLISHED WEEKLY BY THE NATION GROUP

February 23 – 29, 2004

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Goodbye Power Cuts, Welcome Cheap, Easy Renewable Energy

Frequent power cuts are, unfortunately, one of the characteristics shared by almost all countries in the eastern and horn of Africa. The region's media are inundated with a growing chorus of complaints from households, commercial establishments, offices and industrial concerns. Recently, Kenya's Minister of Energy, Ochillo Ayacko, confirmed that the Kenya Power and Lighting Company (KPLC), the country's principal utility, is registering over 10,000 reported electricity interruptions every month (the total is likely to be higher if unreported interruptions are included).

In a move unprecedented for a senior Cabinet Minister known for his composure, Mr. Ayacko recently provided the mobile telephone number of the utility's managing director on national television, encouraging viewers to forward any power-cut complaints directly to KPLC's top man. This uncharacteristic sign of exasperation is shared by hundreds of thousands of consumers in households, offices, businesses and factories throughout the region who are facing almost daily electricity cuts. Losses arising from poor quality power supply range from the crippling of expensive electrical appliances such as refrigerators and TVs at household level to millions of dollars of damage in large-scale process industries such as steel, cement and tyre manufacturers.

A secure and affordable supply of electricity is crucial to economic development. Without a reliable supply of electricity, the export-oriented industrial development strategy that countries in the region are actively pursuing will not be feasible. The much-touted reform of the power sector, announced with great fanfare a decade or so ago in several countries in the region, has yet to deliver the promised reliable power supply.

The unplanned interruptions are often the result of either a shortfall in power generation capacity or simply inadequate and poorly maintained distribution and transmission infrastructure. What can be done to reduce power cuts and bring some sanity to this vital sector?

We would like to argue that there are new renewable energy technologies that can significantly increase power generation capacity in the region as well as reduce power cuts. But first, we need to understand the structure and key characteristics of the region's power sector. Power generation is heavily reliant on hydro, with close to 75 percent of the electricity coming from hydro generating units. The balance is provided by thermal (diesel) generating units, and new renewable energy sources.

Hydro power is largely at the mercy of rainfall patterns. Without rain, rivers run dry and power dams simply run out of water. This is partly what happened in Kenya in 1992 when failed rains resulted in unprecedented power rationing during the months of April and May. In 1998, Kenya experienced a severe drought, which led to decreased water levels at the major hydro dams. This resulted in yet another extensive power rationing programme instituted in September 1999 that continued until 2001. Major industrial concerns were forced to operate at a fraction of their normal operating capacity, registering large losses that many have yet to fully recover from. In 1997, Tanzania experienced similar problems and Ethiopia has for the past two years continued to face serious power supply problems, partly linked to persistent drought.

According to the International Panel on Climate Change, an influential global scientific agency involving over 5,000 scientists from different parts of the world, climate change is likely to result in

more frequent drought periods. Consequently, the East Africa and Horn of Africa region countries that rely on hydro power are likely to face more frequent drought-related electricity crises. The hydro power problems are already being compounded by the increased siltation of major hydro dams – a result of soil erosion and deforestation in upstream sections of major rivers.
Although in strict technical terms, hydropower can be considered a renewable form of energy, environmentalists often exclude it from the new renewables category because of its negative environmental impacts such as flooding of ecological sensitive areas. Its growing unreliability arising from siltation and what could possibly be climate change-induced droughts further cast doubt on the characterization of large-scale hydro as a true renewable source of energy.

One option that could be acceptable to the growing body of environmentalists in the region is the inter-connection of the region to existing under-utilized hydro power plants of the Southern African region - Mozambique and Zambia have plenty of surplus power for export. An even more ambitious option is an inter-connection with the massive Inga dam of the Democratic Republic of Congo. A third option could be the expansion of existing hydro power installations (that have proven limited impact on the environment and are not prone to drought-related adverse impact) to sell electricity to the region. The ecological rationale underlying the above three options is simply that the installations are in place and any negative environmental impact has already taken place – figuratively and literally “water under the bridge.” The experience of the Bujagali hydro power development project, however, demonstrates that this rationale does not pass muster with the increasingly effective local and international environmental community. In addition, the high investment cost of long-distance transmission lines presents a challenge that is yet to be overcome by the region’s cash-strapped Governments.

A number of energy analysts have called for increased use of thermal power stations that use fossil fuels such as diesel, gas or even coal. The adverse environmental impact, high cost of some fossil fuels such as diesel as well as the negative experience that both Kenya and Tanzania have had with high-cost fossil fuel independent power producers (IPPs) has diminished the attraction of the thermal fossil fuel route.

For East Africa and the Horn, two key renewable energy technologies that could improve the region’s power industry performance are biomass-based co-generation and geothermal.

Co-generation is the simultaneous production of electricity and process heat – a common practice in many agro-processing industries. Co-generation is widely practiced in sugar companies in the region as a way of meeting their power requirements. Other industries that practice co-generation include the paper and pulp, wood and rice processing industries. With modest investments and minor changes to their operations, agro-processing industries that already have co-generation facilities could generate additional power for sale to the national grid. Every country in the region has a number of major agro-processing concerns with substantial potential for exporting excess power to the national grid.

Conventional power engineers often deride co-generation as small-scale stuff that cannot meet large-scale demand for electricity. However, recent developments provide compelling evidence that this certainly is no longer the case. Mauritius has successfully demonstrated that co-generation can contribute to the power sector. A massive 40 per cent of the electricity in Mauritius is sourced from the country’s sugar industry co-generation plants. Over half of it (25 per cent) uses a renewable fuel – bagasse, a waste product that is often a nuisance to dispose of. In 1999, when Mauritius experienced a massive drought that led to a drop in hydro production, the shortfall was mitigated by increased electricity generation from sugarcane bagasse-based co-generation power plants (CEB, 1999). Recent estimates obtained by AFREPREN, a regional energy institute, with support from the Heinreich Boll Foundation and Sida, indicate that, in the short term and with very modest investments, well over 10 per cent of the region’s power demand could be met by the region’s sugar industry.

And the modest recent investments in the co-generation option are encouraging. In Uganda, the publicly owned electricity utility recently signed an agreement with a local sugar company for the supply of 7.5 MW to the national grid. In Kenya, during the power crisis of 2000, a local sugar company provided 2 MW to the national grid. Although the arrangement ended with resumption of normal water levels in the hydro dams, recent statements from the Kenya's Minister of Energy indicate growing interest in co-generation.

Other attractions of co-generation are its potential for providing a much-needed additional source of revenue for the region's beleaguered sugar industry – an important source of livelihood for millions of the region's inhabitants. A growing co-generation industry would also provide additional jobs and an important impetus to the region's embryonic small and medium-scale engineering industry. In the case of Kenya, the proposed co-generation plants are located at the extreme ends of the power grid and would assist in stabilizing the electricity grid system.

A second renewable energy resource that has attractive potential in the region is geothermal energy. With an estimated potential in Africa totaling 9,000 MW, geothermal energy is essentially the natural heat from the earth's interior stored in rocks and water within the earth's crust. Virtually all countries within the Rift Valley formation (ranging from Eritrea through Ethiopia, Djibouti and Kenya, all the way to Zambia and Malawi) have substantial geothermal energy potential. Kenya was the first country in Africa to exploit geothermal resources for electricity generation in a significant fashion. Geothermal installations provide 121 MW to the country's power system, accounting for around 10 per cent of installed electricity generation capacity. Ethiopia has a small pilot geothermal plant currently producing about 2 MW.

Although the development of geothermal energy is still in its early stage, there is growing interest in its exploitation as a result of its stellar performance in the recent past. During the drought of 1998-2000 that crippled Kenya's hydro power plants, geothermal came to the rescue with the country's two geothermal power plants at Olkaria offering continuous base-load power with almost 100 per cent availability, unaffected by the prevailing weather. Existing studies indicate that geothermal power could provide close to 2,000 MW of electricity – close to twice Kenya's existing power generation capacity. In Kenya's case, geothermal is also one of the lowest-cost sources of power supply, explaining its high profile in the Ministry of Energy's power development plan.

To return to our earlier question, how can co-generation and geothermal energy reduce the unrelenting power cuts? First, additional investment in co-generation and geothermal would provide additional capacity that would reduce power cuts arising from drought-induced electricity shortages. This is particularly true of Ethiopia, which until recently, was facing a major power generation deficit.

Second, the location of many of the proposed co-generation and geothermal plants are at the extreme ends of existing national power grids – their development would improve system stability which would, in turn, diminish power cuts.

Third, it is conceivable that the co-generation and geothermal investments could, in the long-term, lead to a decentralized power generation industry with many commercial and industrial establishments running their own independent co-generation units that meet their in-house power needs and sell surplus electricity to the grid.

Installations with in-house independent co-generation units would be able to continue working irrespective of the state of the local distribution/transmission infrastructure and the responsiveness of the utility's maintenance teams.

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