

# Electrification of Sub-Saharan Africa

A. B. Sebitosi, Student Member, IEEE  
University of Cape Town, South Africa

P. Pillay, Senior Member, IEEE  
Clarkson University, Potsdam, NY, USA

R. Ramakumar, Fellow, IEEE  
Oklahoma State University  
Stillwater, OK USA

**Summary**  
**Prepared for the Panel Session Entitled**  
***Electrification and Development of Remote Areas***  
**IEEE-PES General Meeting**  
**Denver, Colorado, USA**  
**June 6-12, 2004**

Rural electrification has over the decades been the subject of numerous authors and the theme at countless forums. The grim reality of rural electrification or rather the lack thereof, in the third world and particularly in sub-Saharan Africa, implies that a lasting solution is still elusive. The reason for the prevalence of chronic problems is largely due the fact that their root causes have not yet been identified or effectively tackled when the identification was made.

This panel presentation will discuss the range of economic and political issues that constitute major obstacles to the realization of sustainable rural electrification. Many similarities exist between diverse cultures and across generations and many lessons and experiences can be shared.

## POLICY ISSUES

In many developing world rural communities poverty is largely due to failure by society to productively deploy human resources. However, as communities, people also look up to leadership for competent guidance. A rarely recognized fact, by leadership, is that apart from working to survive most humans derive their purpose to live from meaningful and satisfying activity. In practice, however, rural people are apparently not often regarded as contributors to development but just liabilities to national budgets. Economists generally classify human resources as simply, management, skilled and unskilled. Rural folks are naturally lumped into the latter category. It seems to be accepted that they know nothing; meaning that it is neither possible nor desirable for them to make any contribution.

The advantages of consumer participation for sustainable development are well documented and often rehearsed like a song at international forums and in publications. In practice however the concept is largely ignored or frowned upon for a

variety of reasons and even when, occasionally, tried the needs of the consumers are presumed and their roles prescribed.

## ISSUES OF SOCIAL EQUITY AND ENVIRONMENT

Current economic models perennially cite social equity and environmental issues as beneficial to society but continue to term them as 'intangibles' and resist assigning them any quantifiable values. In reality the denial of basic services to people results in real economic losses. It has in fact been argued that rather than being the consequence of poverty, wide spread deficit of energy services in sub-Saharan Africa may be the cause. Thus the most expensive unit of energy is actually the missed one.

There is however some ray of hope, as the World Bank group has been working and collaborating with countries, academics, researchers, aid agencies and NGOs to build and test various techniques and tools that evaluate these so-called intangible factors. Additionally the United Nations Forum Convention for Climatic Change (UNFCCC) has devised some ingenious financial mechanisms to reward countries with well-defined programs that are sensitive to the environment. Without some kind of concerted effort such words as equity and sustainability along with UN proclamations like 'the Declaration of the Rights of the Child' and 'Agenda 21' will remain consigned to the catalogue of slogans.

## IMPACT OF RURAL ADMINISTRATION AND POLITICS

The quality of local administration has an obvious direct impact on rural development. Often, administrators are either unable to identify with the community priorities (due the absence of representative forums) or, as it is politically construed, simply act as central government agents with an agenda to ensure that little or no development goes on in districts considered politically hostile to the incumbent regime. In fact, it has been observed that, "many African leaders do everything possible to undermine entrepreneurs!" Impoverishment has been used as a political tool in post-colonial Africa.

At the community level, infrastructure and services like electrification are often, erroneously, treated as commodities. In this regard electrification becomes an end rather than a means. In African politics it doubles as the proverbial 'carrot and stick': rewarding politically friendly communities and denied to communities that are perceived to be politically hostile.

Such scenarios sharply contrast with the infancy days of rural electrification in the USA, for example, where a cooperative movement for rural electrification sprang up across the country in the 1930's with full Federal Government support and funding through the Rural Electrification Authority, (REA). Initially established by President Franklin D. Roosevelt's executive order, REA was subsequently enacted by congress through the Rural Electrification Act in 1936. The bill authorized the REA to avail loans to the cooperatives and encouraged them to actively participate in their own rural network operations. In addition to making funds available, REA provided massive logistical support to rural communities by routinely dispatching personnel to educate consumers about electricity and its uses. They also published (and still do) magazines, like Rural Lines and Rural Electrification News as well as documentary films. Other consumer services included technical, managerial, legal and accounting matters. They even used to liaise with manufacturers to design equipment that they deemed more suited for rural applications.

#### ROLE OF RESEARCHERS AND PLANNERS

At the Science Forum of the 2002 World Summit on Sustainable Development there was consensus that a communication gap exists between the scientific research community and the public. This issue has been frequently decried as a major development barrier due to a perceived sense of aloofness by the largely urban-based researchers about rural issues. For example, one often reads from technical publications such lamentations as "rural communities have failed to fully realize the advantages of electrification!" There is also a cynical standard norm in research papers and presentations to cite illness or deaths in the rural areas as the apparently accepted justification for the slightest improvement in living conditions. If surely, a good standard of living were to be universally recognized as the purpose of all humankind's endeavors then focus would be on those developments that have names like health, education, shelter, environment, infotainment and civil order. These would require to be sustained by viable commerce and agriculture, which would in turn require functional infrastructure that would include electrification among others.

Morris Cooke, head of the REA wrote in 1935, "the promise of continued drudgery and the absence of modern comforts have helped drive from the farm to the city those who were most needed in the farm- the young people." The stark reality of these sentiments while having virtually disappeared in Morris' world is here with us (in Africa) like the dawn.

The most inefficient way to use electricity is by applying it for a purpose that could more efficiently be performed by a different form of energy or fuel. In fact, economists refer to opportunity cost, which is defined as 'the benefit foregone by using a resource for a purpose instead of its best possible

alternative. What is needed is energization in contrast to conventional electrification. A true energy efficient system should ensure, first and foremost, optimum performance of the process or ultimate function for which the energy is delivered as a unit lost in the final process results in several units wasted from the generator. Most often this ultimate function is a social human requirement. The character and goodwill of the consumer community is therefore critical to the efficient and sustainable operation of a system. The initial question then that one must answer is what the social requirements are. Then what the available energy options are.

The enlisting of local communities as stakeholders of economic ventures in their neighborhoods has, in fact, been shown to be not just politically moral but very cost effective. The Kenya Wild Life Services, for example, has found that the prevalence of elephant poaching is far less in areas where local councils have a share in the tourism revenue.

#### INERTIA TO CHANGE

Poor households in East London, South Africa, continued to use previous fuels such as kerosene even after electrification. Culture is cited as a major determinant in the choices of fuels and consequent lifestyles of the people. Culture seems to be depicted as an abstract, rigid and unchangeable given state. It is not evident that there was any participatory dialogue with the people or an attempt to compare relative fuel prices.

Additionally, certain traditional meals (like *injera*) are preferable when prepared with traditional fuels and this will transcend economic class barriers. In France, considerable energy savings have been identified in the cooking sector but these often involve changes in common cooking practices that may breach current cultural and behavioral norms and hence could encounter consumer resistance. Ironically, many of these households actually acquire the ultra-modern appliances but often end up with higher energy bills. For example, the microwave oven, that was originally meant to replace the traditional electric cooker, is more popular as a defroster for precooked food: food that has already had its energy allotment! This is before one considers the energy required to freeze it. So, evidently, these cultural tendencies have no specific ethnic tag and are much more universal than one ordinarily imagines. However, through a well-orchestrated campaign and participatory consumer engagement, consumer culture can indeed be re-shaped.

#### POST SCRIPT

The benefits of rural development to society cannot be overstated. The solution however cannot be simply, the massive undertaking of rural development programs by governments while the recipient communities are relegated to observer status. As seen from historical examples of

successful rural electrification, the communities were the primary driving agents. They did not achieve this on their own either. Instead, their own governments empowered them with the necessary logistical and material support that included finance as well technical, managerial, legal and commercial skills. This approach has an additional sustainability factor since communities' priorities remain the same while those of governments can change over time.

It is quite apparent that a dilemma may exist between the necessity to productively engage rural human resources as the primary agents of rural modernization and inherent human nature that seems to resist change. This can be manifested in either the disseminator or the recipient. In the case of the disseminator legislation and guidelines can be put in place. As for the recipient however, a different approach, termed "conscientization" of society may be appropriate. But the big challenge is "How does one conscientize society without appearing to impose an ideology?" One possibility is to start a process of "dialogical nature." True education starts from the premise, that peoples and nations are the true agents of their own education. The initiator or proposer must learn to balance his act of influencing while open to learning from the influenced.

#### REFERENCES

- [1] Berne E., "Games People Play - The Psychology of Human Relations," Grove Press, Inc., New York, 1964.
- [2] Joan du Toit, "Energy conservation in the home: some international trends and the situation in South Africa." International Conference on Domestic Use of Electrical Energy, 1998, Cape Town, South Africa.
- [3] Jerome Weingart, "Enterprise models for rural services: Building a momentum for large-scale use of small scale new and renewable energy systems," Alternative Energy Development, Inc (AED). 2000 -2001 APEC Energy R&D and technology transfer seminar.
- [4] Trevor Datson, "Coke keeps on getting it right," Business Report, South Africa p6, 10<sup>th</sup> November 2002.
- [5] ANC (African National Congress). The Reconstruction and Development Programme: A policy framework. Johannesburg: Umanyano, 1994.
- [6] The Government of Uganda: Rural electrification Strategy and Plan covering the period 2001 to 2010. Ministry of Energy and Mineral Development, Feb 2001.
- [7] DME (Department of Minerals and Energy). White Paper on Energy Policy for South Africa. Pretoria: DME, 1998.
- [8] White Paper on Water Policy, Republic of South Africa, 30 April 1997.
- [9] S. Habtetsion and Z. Tsighe (eds), "Energy for Rural Development in Eritrea – Proceedings of a National Policy Seminar." Afrepren Occasional Paper No. 9.
- [10] M. Teferra (ed), "Energy for Rural Development in Ethiopia – Proceedings of a National Policy Seminar." Afrepren Occasional Paper No. 11.
- [11] M. Davis and T. Horvei, "Handbook for the economic analysis of energy projects." Development Bank of Southern Africa, 1995.
- [12] A. Moser, B. Leers, "Moral Theology: Dead Ends and Ways Forward," Burns & Oats/Search Press, 1990.
- [13] Dani W Nabudere, "Nepad needs a more introspective approach," The Sunday Independent, South Africa, pp 6, October 27, 2002.
- [14] D. I. Banks, "Rural Energy Service Delivery – A Public Private Partnership Approach." Domestic Use of Energy Conference 2003, Cape Town, RSA.
- [15] Renewable energy technologies as an option for a low-carbon energy future for developing countries: case examples from Eastern and Southern Africa," Stephen Karekezi, Director, African Energy Policy Research Network (AFREPREN).
- [16] Richard D. Dukea, Arne Jacobsonb, Daniel M. Kammenb, "Photovoltaic module quality in the Kenyan solar home systems market," Energy Policy 30 (2002) 477–499.
- [17] Moses Agumba, Bernard Osawa, " Kenya's PV Market," Solar Energy Network (SOLARNET) - Rose Av., Off Ngong Rd. - P.O Box 76406 Nairobi – Kenya
- [18] "Zimbabwe Rural Electrification Study," March 2000 Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
- [19] Albertyn Ndlovu, "The GEF PV Solar project in Zimbabwe - an appropriate yet ineffective RET dissemination approach?" Renewable Energy for Development, April 1998, Vol. 11, No. 1.
- [20] Yacob Mulugetta, Tinashe Nhete, Tim Jackson, "Photovoltaics in Zimbabwe: lessons from the GEF Solar project," Energy Policy 28 (2000) 1069-1080.
- [21] "A guide to the Climate Change convention and its Kyoto Protocol," Climate Change Secretariat. Bonn, 2002.
- [22] Joseph Winter, "Nigeria's powerful new governors," BBC News Online, Abuja 22 April, 2003.
- [23] Morris L. Cooke, "Electrifying the countryside," Survey Graphic, 1935. Survey Associates Inc.
- [24] [http://www.nreca.org/news/news\\_rel0311\\_10.html](http://www.nreca.org/news/news_rel0311_10.html)
- [25] Cecil Thom, "Rural Electrification Policy in South Africa, Some Recommendations," International Conference on Domestic Use of Electrical Energy, 1999, Cape Town, South Africa.
- [26] The Tennessee Valley Authority. <http://newdeal.feri.org/tva>
- [27] Ramakumar R., Abouzahr I., Ashenayi K., "A Knowledge-based approach to the Design of Integrated Renewable Energy Systems," IEEE Transactions on Energy Conversion, Vol. 7, No. 4 pp. 648-659, December 1992.
- [28] Barbara Adair, "Magical Mali" Sunday Life pp 6-8, The Sunday Independent, South Africa, 20 Oct 2002.
- [29] "The Biafra Civil War, 1967-1970" Vanguard Daily (Lagos), 1 March 2001
- [30] Leslie Bank, "Basic energy needs and multiple fuel use: Some reflections on energy policy and social theory," Domestic use of energy conference 1999, South Africa.
- [31] Courter J. W. "Aladdin: The magic name in lamps," Wallace-Homestead Book Co. 1978.
- [32] Bereket Kebede, "Modern Energy Use and urban Poor in Ethiopia," Africa Energy Research Network, Newsletter No. 34, May 2002.
- [33] J. F.K. Akinbami , M.O. Ilori , T.O. Oyeibisi, I.O. Akinwumi , O. Adeoti, "Biogas energy use in Nigeria: current status, future prospects and policy implications," Renewable and Sustainable Energy Reviews 5 (2001) 97–112.
- [34] Gaurav Srivastava, "Psychological Resistance to biogas generated from human excreta," Final Paper - 11.479 May 13, 2002.
- [35] Benoît Lebot, "Energy efficiency for electrical appliances in the building sector: opportunities and benefits," International Conference on Domestic Use of electric Energy 1998, Cape Town South Africa
- [36] Alix Clark, Barry Bredenkamp, "The efficient lighting initiative: Bringing about a light revolution in South Africa," Domestic use of energy conference 1999, South Africa.
- [37] B Kloot, "Deep rural defined: energization viewed from the grass roots," International conference on domestic use of energy 1998. Cape town RSA.
- [38] G. Rosselli, C. Laing, "Sustainable energy upliftment solution for rural communities," International conference on domestic use of energy 1998. Cape Town , RSA.