

Electricity Supply Industry Arrangements and Policies on Rural Electrification

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Abstract—Present estimates put the number of people without access to electricity at just over a quarter of the World population, approximately 1.6 Billion people with most of them residing in rural areas of developing countries. The International Energy Agency (IEA) estimates suggest that even by the year 2030, there will still be 1.4 Billion people without electricity unless there are dramatic changes in electrification policies. Policy changes are needed to enable governments to reduce poverty. In recent years arrangements for electrification have been affected by deregulation of electricity industries in developing countries. The IEEE Task Force on sustainable Energy Systems for Developing Countries was established to initially undertake a critical review of experiences worldwide of the impact of deregulation and resulting electricity arrangements on sustainable electrification in developing countries and to propose options and approaches for sustainable electrification. This paper presents a progress report and initial findings of the Task Force.

Index Terms— Sustainable rural electrification, electricity industry restructuring

I. INTRODUCTION

CURRENT estimates indicate that over a quarter of the World's population— approximately 1.6 Billion people, have no access to electricity [1]. Most of them live in rural areas of developing countries. Even by 2030 there will still be some 1.4 billion people without electricity unless there are dramatic changes in electrification [1]. Electricity plays a critical role in poverty eradication. It has the potential to improve the standard of living, opportunities and the lives of rural folk. The challenge of cost effective and sustainable delivery of electricity to rural communities is non-trivial in the deregulated electricity supply industries. This, among other factors, is due to the growing calls from funding agencies for the private sector to be involved in rural electrification. However, being profit driven, questions arise as to whether the private sector can thrive and deliver the desired outcomes given the relative poverty of communities served, and high cost of rural electrification. Up until now, sustainable

electrification of developing communities has been an issue of minor interest within communities of the Institute of Electrical and Electronics Engineers (IEEE), particularly the Power and Energy Society (PES) despite the obvious importance of this topic.

The primary aim of the IEEE Task Force on Sustainable Energy Systems for Developing Communities is to help amend the situation described above by bringing the issues and concerns to the fore, and provide recommendations to address the issues. The initial focus of the Task Force is on the implications of different power system arrangements and policies on rural electrification.

The scope of work and tasks under the purview of the Task Force can be summarised as follows:

- *Task 1 - Critical review of Rural Electrification (RE) experiences in identified case study countries*

This task will identify sample countries that will form the base cases for detailed study. The aim will be to cover major regions and countries in transition. The regions of focus are Africa, Latin America and the Caribbean, and Asia.

Methodology – The method of gathering information and data will be through literature search and stakeholder surveys in selected countries. This will require development of a suitable questionnaire for information collection. Where feasible, interviews with key policymakers will be encouraged.

- *Task 2 - Comparative analysis of country reports from Task 1*

This task is primarily a desk study of reports gathered from Task 1. It may involve further literature review and further conversations with stakeholders. The task will aim to formulate a coherent and consistent framework for assessing the impact of deregulation on electrification.

- *Task 3 – Development of options and approaches to electrification in deregulated environments*

This will be the final task and its aim will be to propose options and approaches to electrification within deregulated environments. The development of these options and approaches will involve a process of brainstorming and analysis of outputs of Task 2.

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II. PROGRESS THUS FAR

Questionnaires have been distributed to all Task Force Members. So far three questionnaires have been returned from Peru, South Africa and The Netherlands. More responses are expected and will be expedited from other countries in due time, in particular from the developing countries represented on the Task Force.

The results will be summarised in 4 sections consistent with the structure of the questionnaire a copy of which is provided in the Appendix. Section 1 titled “Basic statistics on access to electricity” is intended to provide a context on the electrification discussion in the country.

Section 2 is titled “Structure of the electricity industry and arrangements for rural electrification” with Section 3 focusing on the situation in those countries that have “Restructured Electricity Supply industries”. The last section (Section 4) is aimed at collecting information on “System reliability, power quality and customer satisfaction” in the respondent’s country.

While progress on data collection has been slow, there is little doubt about the interest in this subject. Some of the reasons for the apparent reluctance to provide data might be due to perceived sensitivity of the information. In some cases the information might be lacking or not readily available. More personal contacts may be required to encourage responses and to reassure potential respondents regarding intended use of the data.

III. CONCLUSION AND WAY AHEAD

There is no doubt that as long as more than a quarter of the world population in developing countries remains without access to electricity, rural electrification will remain a key focus of Governments in developing countries. It can be argued that it should also be of interest to Governments in developed countries, given their commitment to poverty reduction within the framework of millennium development goals [2], [3] as well as the shared consequences of unsustainable development especially from the environmental perspective. It is therefore important that sustainable forms of electrification are found and good practices shared. This Task Force aims to make a contribution to the collective effort of finding sustainable solutions for rural electrification not only from a technical perspective but also from a socio-economic perspective.

It is intended to expand the remit of the Task Force by transforming it into an IEEE Working Group. This will allow some attention to be paid to economic/technical and social issues as well.

IV. ACKNOWLEDGMENT

The authors are grateful for the contribution of Task Force Members from PERU, South Africa and Netherlands to this work.

V. REFERENCES

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[2] UN Millennium Development Goals 2000 [Accessed: September 2005]; Available from: <http://www.un.org/millenniumgoals/>.

[3] United Nations. The energy challenge for achieving the Millennium Development Goals. 2005 [Accessed: July 2008]; Available from: <http://esa.un.org/un-energy/pdf/UN-ENRG%20paper.pdf>.

VI. BIOGRAPHY

Dr. Joseph Mutale Joseph Mutale (M’96) is a Senior Lecturer at the University of Manchester in the Electrical Energy and Power Systems Group. He holds a B.Eng. in Electrical Machines and Power Systems obtained in 1981 from the University of Zambia, an MSc in Electric Power Transmission and Distribution and a Ph.D in Power System Economics from the University of Manchester obtained in 1987 and 2000 respectively. His research interests are in pricing of transmission and distribution networks, technical and economic integration of distributed energy resources into power systems as well as rural electrification. Dr Mutale is a Fellow of the IET, a Senior Member of the IEEE, and a Chartered Engineer in the UK. He was a member of the CIGRE Working Group on Rural Electrification and chairs the IEEE Task Force on Sustainable Energy Systems for Developing Communities.

Dr. Chris Mensah-Bonsu is a Senior Regional Transmission Engineer at the California Independent System Operator Corporation (The ISO) with responsibilities for high voltage electric power grid planning, operations and electricity market operations.

Prior to that, Dr. Mensah-Bonsu was a Senior Market Design Engineer for over eight (8) years at California ISO where he was deeply involved in The ISO’s Zonal, and Locational Marginal Pricing-based (LMP) electricity market design, implementation, integration, testing, operations, regulatory policy compliance, and operational support to ensure efficient markets, system reliability, and compliance of US Federal Energy Regulatory Commission (FERC) Orders and tariff. He was also the Technical Subject Matter Expert on Full Network Model (FNM) for the LMP-based electricity markets and the Dispatchable Demand Response (DDR) initiatives.

Dr. Mensah-Bonsu is a Fellow of the Preparing Future Faculty Program, Senior IEEE Member, and reviewer of IEEE peer-reviewed journal papers. Chris is the chair of the IEEE PES System Economics Subcommittee’s Prize Paper Award Committee, and co-chairs the IEEE Task Force on Sustainable Energy Systems for Developing Communities.

Dr. Mensah-Bonsu holds a Master of Science and Ph.D. degrees in Electrical Engineering from Cleveland State University, Cleveland, Ohio and Arizona State University, Tempe, Arizona respectively. His professional interests relate to integrated electricity markets and power grid planning, operations, reliability and economics.

VII. APPENDIX

1. Task Force Members

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2. Survey Questionnaire

IEEE Task Force on Sustainable Energy Systems for Developing Communities

Questionnaire on Country arrangements for electrification

COUNTRY: _____

COMPLETED BY (NAME): _____

TITLE: _____

INSTITUTION/COMPANY AFFILIATION: _____

CONTACT NUMBERS(S): _____

FAX NUMBER: _____

EMAIL ADDRESS: _____

DATE COMPLETED: _____

Background

Present estimates put the number of people without access to electricity at just over a quarter of the World population, approximately 1.6 Billion people with most of them residing in rural areas of developing countries. The International Energy Agency (IEA) estimates suggest that even by the year 2030, there will still be 1.4 Billion people without electricity unless there are dramatic changes in electrification policies. Policy changes are needed to enable governments to reduce poverty. In recent years arrangements for electrification have been affected by deregulation of electricity industries in developing countries.

The purpose of the Institute of Electrical and Electronics Engineers (IEEE*) Task Force on Sustainable Energy Systems for Developing Communities is to study the impact of deregulation on Rural Electrification. Its scope of work is to:

- Undertake a critical review of experiences World-wide of the impact of deregulation and resulting electricity arrangements on sustainable electrification in developing countries;
- Propose options and approaches for sustainable electrification;

This questionnaire is one of the principal instruments to gather the required information that will inform the work of the Task Force.

Respondents will receive a copy of the final report of the Task Force.

1. Basic statistics on access to electricity

Country population (Millions)	
Population of typical rural community with electricity (Millions)	
Main employment types of the rural dwellers (List up to five).	
Percentage of total population residing in rural areas (%)	
Percentage of total population residing in urban areas (%)	
Percentage of population with access to electricity in urban areas (%)	
Percentage of population with access to electricity in rural areas (%)	
Percentage of total population with access to electricity (%)	
Country installed capacity (Megawatts)	

2. Structure of the electricity industry and arrangements for rural electrification

- Has the electricity industry in your country been restructured?
- If Yes, state the year the industry was restructured.
- Who is responsible for rural electrification planning /operation/financing?
 - Government Ministry (Please name it)
 - Electricity Company (Please name it)
 - Private (Please name it)
 - Other (Please name or give description)
- How is Electrification financed?
 - Role of Government
 - Role of customer
 - Form and structure of subsidies
- Tariffs – is there a difference between rural and urban electricity tariffs?
- What is the average income in rural areas?
- Is there an electrification master plan for the country?
- Is there a rural electrification master plan for the country?
- Who decides on rural electrification project implementation?
- If a master plan is in place, will you consider it aggressive enough and sustainable?

3. For restructured industries

- Is there any difference in arrangements for rural electrification before and after restructuring?
- In your opinion, what are the weaknesses/disadvantages in current arrangements for rural electrification in your country?
- What are the advantages/strengths of the current arrangements for rural electrification in your country?
- Sketch an accountability/organizational diagram for rural electrification (from the operator to Government Minister (or private entity) responsible).
- Role of the private sector if any in implementation and operation of rural electrification schemes
- Ranking of rural electrification in Government priorities /policies (high – medium - low).

4. System reliability, power quality and customer satisfaction in your country

- How would you rank the reliability and quality of the power delivery in terms of service availability/interruptions? **Circle one:** a) Excellent, b) Acceptable, c) Unreliable, d) Very unreliable
- Is the population generally satisfied with the electricity delivery service? Yes/No **Comment**

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Vision: To advance global prosperity by fostering technological innovation, enabling members' careers and promoting community worldwide.

Mission: The IEEE promotes the engineering process of creating, developing, integrating, sharing, and applying knowledge about electro and information technologies and sciences for the benefit of humanity and the profession.

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