LINKING INNOVATION AND LOCAL UPTAKE IN RURAL DEVELOPMENT

POTENTIAL FOR RENEWABLE ENERGY COOPERATIVES IN BANGLADESH

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Declaration

I declare that this thesis is my own account of my research and contains as its main content work, which has not previously been submitted for a degree at any tertiary education institution.

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Firoze A. Siddiqui

Dedicated to:

My those unfortunate countrymen,
whom I belong to, the rural millions in Bangladesh.

Thesis abstract

In Bangladesh, as elsewhere in the world, energy both commercial and non-commercial, serves as a major vehicle for development. In the last three decades, lopsided development efforts, without proper concern for the environment and productivity level of natural resources have created significant problems for development sustainability in Bangladesh. The energy sector faces deep crisis in meeting increasing energy demands for development of agriculture, industry, transportation and other sectors of economy.

The country is heavily dependent on import of commercial fossil fuel energy, petroleum, petroleum products and coal. Such dependency makes Bangladesh economy more vulnerable to external price shocks in the international energy market. Non-commercial energy plays a dominant role in overall energy consumption in Bangladesh. Use of non-commercial energy constitutes about two-thirds of the country's total energy balance and is almost entirely supplied from the already overstressed biomass resources of the country. The population size and the vast majority living in rural areas have created immense pressure on the country's biomass resources resulting in massive deforestation, decline of soil fertility and reduced productivity of agriculture. Desperate access to resources, particularly in rural areas is also causing uneven development of the rural population in Bangladesh.

The development of the energy sector is a time bound issue and demands proper and timely attention. For Bangladesh, substitution of current biomass energy use with

sustainable energy sources and their effective management is therefore critically important to sustain its overall development.

There is ample scope for introducing energy efficient technologies and energy conservation measures in commercial and non-commercial energy use in Bangladesh. Effective and realistic energy planning and policy formulation is therefore crucially important for sustainable development in Bangladesh.

The thesis explores the possibility of introducing an alternate approach to rural energy development through a series of case studies on selected technologies viz. biogas and improved efficiency cook stoves technology projects in the public sector and Grameen Shakti's renewable energy programme in the private sector.

Application of village energy supply system based on renewable energy technologies utilising abundantly available renewable resources of the country and already well in place technologies such as solar PV, bio digesters and energy storage batteries will be trailed within a framework that works with the participation of the (rural/village) community in running and managing energy supply in the villages.

Introduction of a community based energy supply system Rural Energy Cooperative (REC) has been examined as a model for rural energy development, targeting economic, environmental and community development at the same time, which forms together the necessary foundation for sustainable development in (rural) Bangladesh, as well as in other parts of the developing world.

Some of the work in this thesis has appeared in the following publications

1. Siddiqui, F. (2000), "Linking innovation and local uptake in rural development- case study on renewable energy innovation in Bangladesh", paper presented in *The 10th Science, Technology and Economic Progress (STEP) Conference*, 27 November- 1 December, Adelaide University, Adelaide, South Australia.

2. Ellery, M. Siddiqui, F. and Newman, P. (2000). "Sustainable Rural Development: Prospects of Renewable Energy in Bangladesh", *Science, Technology and Development,* Vol. 1, No. 2, pp.1-54, December 2001, BCSIR, Dhaka.

3. Siddiqui, F (2001), "Renewable Energy Technology (RET): A Sustainable Energy Option for Rural Development in Bangladesh", Anda, M. and Gordon, H. (Eds.) *Proceedings of The International Conference on Community Technology 2001- Governance & Sustainable Technology in Indigenous & Developing Communities*, vol. 2, pp.201-210, 4-7 July 2001, Murdoch University, Perth, Western Australia.

4. Siddiqui, F. and Ellery, M. (2001), "Micro Power Company: community based renewable energy enterprise for Rural Bangladesh", *Proceedings of 4th International Conference on Mechanical Engineering*, vol. 2, pp.131-137, 26-28 December 2001, Bangladesh University of Engineering and Technology (BUET), Dhaka.

5. Siddiqui, F. and Newman, P (2001), "Grameen Shakti: financing renewable energy in Bangladesh", Bouma, J.J., Jeucken, M. and Klinkers, L. (Eds.) *Sustainable Banking: The Greening of Finance*, pp. 88-95, Greenleaf Publishing Limited, Sheffield, UK.

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Glossary, acronyms and abbreviations

AIT	Asian Institute of Technology, Bangkok
Ansar-VDP	Ansar-Village Defence Party (Department of rural police)
BAEC	Bangladesh Atomic Energy Commission
BARD	Bangladesh Academy for Rural Development
BAU	Bangladesh Agriculture University
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BCSIR	Bangladesh Council of Scientific and Industrial Research
BIDS	Bangladesh Institute of Development Studies
BP	British Petroleum
BPDB	Bangladesh Power Development Board
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BSCIC	Bangladesh Small and Cottage Industries Corporation
BUET	Bangladesh University of Engineering and Technology
CIDAC	Carbon Dioxide Information Analysis Centre, USA
CMES	Centre for Mass Education in Science
CO	Carbon mono-oxide
DC	Direct Current
DESA	Dhaka Electric Supply Authority
DOE	Department of Environment
FAO	United Nations Food and Agriculture Organisation
FDI	Foreign Direct Investment
FYP	Five-Year Plan
GB	Grameen Bank
GDP	Gross Domestic Product
GOB	Government of Bangladesh
GS	Grameen Shakti
HIV/AIDS	Human Immune Virus / Acquired Immune Deficiency Syndrome
HYV	High Yielding Variety

ICLEI	International Council of Local Environmental Initiatives
IFRD	Institute of Fuel Research and Development
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producers
KgOE	Kilogram of Oil Equivalent
KT	Kilo Ton
KTOE	Kilo Ton of Oil Equivalent
KW	Kilowatt
LGED	Local Government Engineering Department
LPG	Liquefied Petroleum Gas
MJ	Mega Joules
MMT	Million Metric Ton
MOA	Ministry of Agriculture
MP	Member of Parliament
MT	Million Tons
MTCO	Million Tons of Coal equivalent
MW	Megawatt (1000 KW)
NGO	Non-Government Organisation
ODA	Overseas Development Assistance
OECD	Organisation of Economic Cooperation and Development
PBS	Palli Biddyut Samity (Rural Electric Society)
PDB	Power Development Board
PJ	Petta Jouls
PSMP	Power System Master Plan
PV	Photo Voltaic
R&D	Research and Development
RDI	Research and Development Institution
RE	Renewable Energy
REB	Rural Electrification Board
REC	Rural Energy Cooperative
RET	Renewable Energy Technology
RMG	Ready made garments
RPC	Rural Power Company

SARD	Sustainable Agriculture and Rural Development
SDNP	Sustainable Development Network Programme
SFYP	Second Five-Year Plan
SHS	Solar Home Systems
SPV	Solar Photo Voltaic
Sq km	Square kilometre
TCF	Trillion Cubic Feet
TFR	Total Fertility Rate
TFYP	Third Five-Year Plan
TK	Taka (unit of Bangladesh currency)
TYP	Two-Year Plan
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCHS	United Nations Commission on Human Settlement
UNDP	United Nations Development Programme
UNDSD	United Nations Division on Sustainable Development
UNEP	United Nations Environmental Programme
UNICEF	United Nations Children Emergency Fund
VAT	Value Added Tax
WCED	World Commission on Environment and Development
WSSD	World Summit on Sustainable Development, held in 2000 in Johannesburg, South Africa