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Energy and Power in North East India

Subhadeep Bhattacharjee

**ENERGY AND POWER IN
NORTH EAST INDIA**

THE AUTHOR

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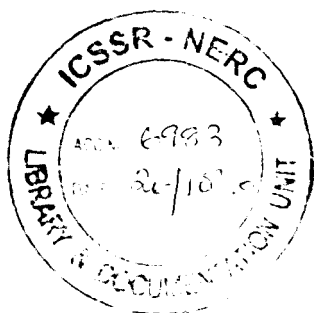
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PREFACE

A world whose energy will come from the sun, wind, water, land, forest and from the depth of our Earth – and not from fossil fuels. A world whose air, water and land will be more cleaner and safer. A world whose climate is stabilized and not sabotaged. We have to march towards that world.

Energy is fundamental to human development and to prosperity of nations. The Human Development Index (HDI) coined by UNDP is correlated to per capita electricity consumption. The disparity between our country and United States, superpower, is manifest in the differential in per capita consumption of electricity in India (about 606 kWh) and in USA (13000 kWh), which is a factor of about 22. A better life and improved standard of living are the fundamental aspirations of 70 per cent of humanity living in the developing countries. The socio-economic development is a means to achieve it. World-wide two billion people live below the poverty line and this situation is the fertile ground for social unrest. Hopelessness and despair also lead people to immigrate to the industrialized countries in search of better future. A better life first means satisfying the basic human needs, including access to the jobs, availability of food, health services, education and shelter. Energy is a key factor in satisfying these needs.

It is agreed that the current patterns of conversion and utilization of energy cannot be sustained and identifies two directions in which energy sources could evolve:

- Towards more efficient production, transmission and distribution (T & D), and end-use of energy, and
- Towards greater reliance on environmentally sound energy systems, particularly new and renewable sources of energy.

Although the above approaches are interrelated, coupled with high-energy end-use efficiency, renewable sources of energy are capable of covering large share of the world's energy needs. Among the renewable energy sources, India has made notable progress in

utilizing wind energy. However, other potential and abundantly available resources such as solar based and biomass based energy are yet to take off in our country.

Flanked by hills and with the mighty Brahmaputra River slashing a central path between its north and south, the North East India is bounded by the States of Manipur, Meghalaya, Mizoram, Nagaland, Tripura with Assam comprising the heart. Arunachal Pradesh lies to its north and Sikkim a little away in the north-west bordering China and Bhutan. Bangladesh and Myanmar lie to its south-west and east. The western side of the North East is connected to the eastern part of the Indian subcontinent by a narrow land corridor, sometimes referred to as the 'Chicken's Neck'. The eight states that comprise the region reflect ecological and cultural contrasts between the hills and the plains; there are also significant elements of continuity. Available medieval and modern records indicate interdependence and interaction between the hills and plains. The North East is one of the most biodiverse regions in the world. Tropical rain forest, rich in flora and fauna, spread their arms across Arunachal Pradesh into Assam. The area can be divided into three geographical divisions—the Shillong Plateau, the North Eastern Hill Basin and the Brahmaputra Valley.

North East India is bestowed with the natural resources like water, natural gas, oil, coal which could provide substantial quantum of energy for use in India as also in the adjoining countries like Bangladesh, Pakistan, Myanmar etc. In North East India, hydroelectric power accounts for 41.50 per cent of all India potential. Natural gas reserves are 151.68 BU which is capable of generating 7500 MW for 10 years. Coal accounts 864.78 million tonnes against 186 billion tonnes of reserves in the country. With the reserves in the NE Region approximately 240 MW/day can be generated for a period of 100 years. The renewable sources of energy particularly the solar, biomass and mini and micro hydel projects in the region deserves to be explored for power generation. Exploration of natural gas in Assam and Tripura if carried out vigorously could provide power to the country and if gas link between Myanmar and mainland India is established power generation and gas based industries could reach new heights in the country.

In spite of huge power potential in North East India, the region ranks lowest in terms of per capita energy consumption. The region is also economically backward compared to the other parts of India.

This has been due to the factors like inadequate infrastructure facilities, lack of communication facilities, difficult geographical conditions, inefficient centralised power systems etc. Therefore, in present scenario, electrical power generation and its effective utilization by using latest technology is the need of hour for North East India. The efficient use of electrical energy and the quality of power is required to improve agricultural production, turn the wheel of industry and providing better services to improve the quality of life of the people of this region.

Decentralised power generation technologies offer electric utilities an alternative to large system capacity investments. This book presents power scenario of North East India and examines the possibilities and potential for energy resources for the development of decentralised power system in this region in supporting available capacity to meet peak power demands, provide critical consumer loads with emergency standby power, improve user power quality, and provide low-cost total energy in CHP applications. At present the most of the power need is being fulfilled by the fossil fuels alone, which are exhaustible. The NER and Tripura are entirely dependent on centralized conventional power generation system. Comprehensive studies on N-E Indian power sector identifies a number of problems that have been facing by the electric utilities such as capacity addition, evacuation of power, T&D losses, poor PLF etc. The only solution to overcome the situation is to tap the renewable energy sources like solar, biomass, small hydro and wind etc. to develop decentralized power systems.

The author express his gratitude to Prof. (Dr.) B. Ghosh, Director, School of Energy Studies, Jadavpur University for his immense inspiration and encouragement. The author is thankful to Mr. S.L. Deb of Tripura State Electricity Corporation Ltd. (TSECL) for his kind help.

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Though utmost care has been taken in completing this, a few unintended errors might have crept in which is highly regretted and positive criticism is always invited.

SUBHADEEP BHATTACHARJEE

1

INTRODUCTION

The three great challenges facing mankind in the new millennium are preservation of peace, eradication of poverty and conservation of our environment. Undoubtedly, each of the aforesaid goals is intertwined with questions of sources of energy, their demand and supply, access and harnessing. The measure of development in any region in these days is synonymous with quantum of energy consumption. This is why energy has been recognized as a critical input parameter for the regional development as well as national development.

Most developing countries are passing through the initial stages of industrialization. As a result their energy consumption is growing at a greater rate in comparison to the developed countries. The world energy consumption is expected to increase 59% from 2000 to 2020 according to 'International Energy Outlook 2001'. More than half of the world's growth in energy demand is expected to be in the developing countries and Central America. World electricity use will increase by two third by 2020. The strongest growth will be in the developing countries. In industrialized countries electricity use will grow at a slower pace along with population and economic growth and efficiency gain of newer appliances (washing machine 35% and air conditioners 20% more energy efficient). But this will offset by rising computer and new electronic devices. Growth in demand for USA means that 1300 new power plants will be needed over the next 20 years.

In spite of the higher rate of growth of energy consumption, the present per capita energy consumption in the developing countries like India is ridiculously low as compared to that in developed nations. The annual per capita consumption of electrical energy in some countries is: USA 13000 kWh, Canada 16000 kWh, Japan

8000 kWh, UK 7200 kWh, Russia 6000 kWh, and India 606 kWh (as on 31.03.2005). The annual per capita consumption of electricity shows a great variation from region to region and state to state. In spite of huge power potential in North East India, the region ranks lowest in terms of per capita energy consumption which means the entire region is still under developed compared to other parts of India. During the year 2002-03, the per capita consumption was the highest in Western Region (543.8 kWh) and the lowest in North Eastern Region (NER) (113.7 kWh). Among domestic consumers, the highest per capita consumption was in Southern Region (106.80 kWh) and lowest in North Eastern Region (34.12 kWh). Among industrial consumers, the highest per capita consumption was in Western Region and lowest in North Eastern Region. In agriculture, the highest per capita consumption was in Southern Region (135.08 kWh) and lowest in North Eastern Region (3.41 kWh).

Electrical energy losses are very high in India (32.15%) (2004-05) and are about 4-5 times compared to those in USA. These losses are in transmission, distribution, transformation and energy theft. The losses vary from state to state over a wide range. The transmission and distribution losses in NER are much higher than all India average. In Mizoram, one of the North Eastern states, the losses have been reported to be nearly 50%. Moreover, many parts of India particularly most parts of the North Eastern Region (NER) does not have access to commercial energy and electricity. It is also expected that demand for energy in NER will continue to grow at high rates for a number of decades to come. Therefore, it is to be ensured that supply of electricity does not become a constraint to the economic growth of the region.

In the north eastern region energy resources remain undeveloped on account of narrow industrial base due to years of suppressed economic growth. River Brahmaputra and its tributaries flow across the North Eastern Region and is bestowed with the highest hydroelectric power potential — about 48,000 MW — out of which only a minuscule part (less than 3%) have been developed so far. The region also contains a large reserve of natural gas which can contribute a further 4000 MW (at least) of thermal power. Even if a part of these power potentials are developed, the North Eastern Region can become a true Power House and supply cheap and clean power not only to the rest of the country but also to our neighbouring countries like Bangladesh and Myanmar. This would bring about a rapid economic development in the region truly. Even

though there are huge potential, the growth of power industries is not very congenial. Various factors attribute the slow growth of power projects in the N-E region which are mainly:

- Poor infrastructure/communication links
- Difficult terrain
- Land acquisition and environmental issues
- Geological surprises
- Problem of insurgency
- Lower duration of working season
- Poor financial health of SEBs/State DoP
- Transmission bottleneck, inadequate sub-transmission system
- Poor efficiency of old plants
- Poor system load factor

Access to quality, reliable and affordable power is critical for promoting economic and social development of the developing countries. Without quality power, there can be little economic development, clean water, refrigerated foods and medicines, no telephones, radios, televisions, or the most basic forms of sustainability. India is the world's second largest populous country and 6th largest consumer of energy. Over the past twenty years, with a population growth of under 1% the energy consumption is observed to have a growth of about 2.5%. As per 2001 census, 3.74% of Indian population lives in the seven states of North Eastern Region of India.

North Eastern Region of our country is experiencing a rapid population growth. With the population growth, electricity consumption is also increasing day by day. The number of power generating stations located in this region is not sufficient to meet the demand of the people of the North East States. The gap between the supply and demand causes tremendous power cut particularly during peak load period through out the year. Moreover poor quality power supply (long and short-term interruptions of power supply, frequency and voltage instability, waveform abnormalities, poor response time and restoration time), large transmission and distribution losses affect the consumers in this region. Another type of deprivation exists in this region where, by virtue of their physical location, provision of grid electricity is neither technically feasible nor commercially viable.

To mitigate the above problems there are three alternatives:

- To build-up conventional new power plants for additional electrical power generation
- Take steps for energy conservation and management and
- Decentralized generation through locally available resources

The first proposal, i.e. build-up conventional power plants is very difficult to handle because the conventional power plants need land and water. As the population increases, the pressure on both land and water resources also increases. Land on the both sides of high ways is going to be converted into industries and to balance the agricultural products there is big constraint on the water. Moreover, due to short of rain fall and silted problem in the major rivers there will be acute shortage in supply of water even for agricultural purposes. In addition to these, supply of conventional fuel will cause problem of emission of Green House Gases (GHG). All these factors will impose serious problems in building up new conventional power stations. The second option has also been taken care by the industries but not in a rapid way. A vivid awareness and human resource development is essential for choosing the second proposal. The third option is a better choice to meet the demand of N-E states.

How much a society progresses largely depends on the resources available to it. Owing to its large population, India's demands on natural resources are constantly increasing and it is essential that these resources are scientifically managed in a contemporary and eco-friendly manner before it's too late. Natural resources are often classified into renewable and non-renewable resources. As long as they are dealt with sensibly and in sustainable way, renewable resources can be used indefinitely. Renewable natural resources include water, wind, tides, solar radiation and biomass which are important energy sources for non-conventional power generation purpose. North East States of our country are fortunate enough to be endowed with both exhaustible and renewable energy sources. Despite this, after crossing more than half a decade after independence, because of lack of proper planning on the utilization front, development and progress remains very mind disconcerting particularly in this part of India. Till date we are facing severe power cuts and shortage throughout the region.

This book discusses the power scenario on North East Indian Power Sector with special reference to Tripura. Various issues and constraints in the power sector in this region have been discussed. Available natural energy resources for decentralized power generation are presented in this book alongwith some promising technologies suitable particularly for this region. Various current statistics, diagrams and pictures on North Eastern power sector have been included in the book. It is probably the first time that such a book has been prepared on North East Indian Power Sector that addresses the several power sectoral problems and directs towards a possible solution. It will serve as a reference for researchers and technocrats who will find the book very useful and handy.

Rs. 350



Subhadeep Bhattacharjee (b. 1978) did his B.E. (Electrical) from Tripura Engineering College (Presently NIT, Agartala) in 2001, M.E. (Electrical) from Jadavpur University in 2003 and Ph.D. (Engineering) from Jadavpur University, Kolkata in 2009. His research field is Embedded Generation. Currently he is working as Coordinator of Department of Electrical Engineering, Tripura University (A Central University). He has several publications in peer reviewed journals and conferences and guided number of M.Tech theses. He is a Life Member of Indian Society for Technical Education (ISTE), Member of Institution of Electronics & Telecommunication Engineers (India) (IETE), Associate Member and Chartered Engineer (C. Eng.) of The Institution of Engineers (India) (IEI), Life Member of Solar Energy Society of India (SESI) and Life Member of Biomedical Engineering Society of India (BMESI). He is a contributor of many articles in various popular science magazines. He is the Principal Chief Investigator of a AICTE funded R & D project on Solar Photo voltaic Power System.

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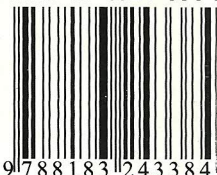


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