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A Distributed Generation Model Based On Current Scenario Of Uttar Pradesh: A Socio-Economic Approach

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Abstract: This study demonstrates the hybrids distributed generation model which can be a cost effective solution for providing energy services in rural Uttar Pradesh. Distributed Generation can help to reduce both technical and non-technical losses by decreasing the grid issues, needed to deliver adequate and quality electricity. The high costs of delivering power to remote areas has not been adequately accounted for in past by energy planning in Uttar Pradesh and should be taken into account when choosing energy supply options in remote areas. The susceptibility of the system to non-technical loss may also be reduced by pushing the center of control closer to the user, thus improving the incentives and control on theft through social, managerial, and technical means. By initiating the generation sector from the bottom-up, the market power of incumbent utilities may be reduced, which would encourage a range of innovations in the Uttar Pradesh electricity sector. It is anticipated that the findings of the study will be helpful to market players in India and beyond as reform attempts are shaped by more private players and partnerships.

Keywords: Distributed Generation Model; Utter Pradesh; Waste to power generation plant; Renewable Energy; Kanpur.

INTRODUCTION

Energy is a key building block for sustaining any nation socio-economic development. As the global economy continues to grow, global energy needs as well as global emissions will increase by approx. 60% between 2004 and 2030 as per the World Energy Outlook 2004 published by the International Energy Agency (Sheidaee and Kalanter 2011). Policy makers in developed as well as developing countries have realized that economic security of a nation has direct linkage with its energy security; hence for the sustainable growth of an economy it is essential to ensure the availability of dependable and affordable energy sources. Nations are now encouraging pragmatic energy policies and implementing state-of-the-art technology to mitigate the harsh economic impact of volatile energy prices, global climate change and to manage their energy security requirements (Singh and Mishra 2009). We believe that technology innovations can significantly contribute towards the development of clean, efficient, affordable energy sources over the longer term, while continuing to contribute towards improving the efficiency across various segments of the energy value chain.

Energy Scenario in Uttar Pradesh

Electricity has become the lifeblood of the modern world, without which the world will come to a virtual standstill. Any sluggishness in the growth of the power sector can throw the region far behind other regions in industrial, economic and social growth. Thus, power has been recognized as one of the key factors of infrastructure for a sustained growth of the state economy. Electricity is a primary input factor for the progress of the economy of the state. Full utilization of other input factors, such as manpower, land including irrigation and capital-related resources heavily depends upon the uninterrupted availability of electricity. Electricity has therefore, become the most essential factor in improving the social conditions and welfare of people.

Over a period of time, Industrial growth has been so fast that the increase in energy supply could not maintain an equal pace. The major problems faced worldwide are fast depletion of non-renewable energy sources, increasing costs for energy, and inability to create sufficient returns for investment for growth (Sudipta et al 2010). These problems have created a shortage of power in both quantity and quality. Power sector was mainly treated as a Government business worldwide, considering its importance as a vital infrastructure for the growth of the state. But growth in this sector, however impressive it was, looked insufficient to cope with the impulsive growth in industrial and other sectors (Mishra and Singh 2007).

In UP's perspective, there had been no substantial augmentation in the state power generation capacity till the 1990s. Power has been the bane of UP's industry, with the current demand-supply gap widening to almost 3,000 MW. The current demand in the state is estimated at 10,000 MW. Taking it as a cue, the Government of UP has formulated UP Power Energy Policy 2009 for in-creasing the role of public private partnership in generation, transmission and distribution, in addition to the work already being carried out under State sector. The Government is slowly but surely inching ahead towards the development of Power sector with the help of private sector through Public Private Partnerships (PPPs), joint ventures, memoranda of understanding and co-generation by sugar mills (Thomas 2004).

In this backdrop, during the fiscal 2011-12, the Government has proposed budgetary provisions of Rs. 8,227 crore towards various projects in the power sector. Out of this amount, Rs. 1,267 crore has been earmarked for augmenting the generation capacity in the state. An amount of Rs. 200 crores has been proposed to be set aside for thermal power project being set up at Ghatam-pur, Kanpur in a joint collaboration with Neyveli Lignite Corporation Limited.

The Government has envisioned meeting out the power demand fully across the state by the year 2014, and to increase the annual per capita consumption power up to 1000 units, the Government has taken many pro-active measures in Generation, Transmission and Distribution sectors.

Uttar Pradesh has developed itself as an industrial hub of North India and it has potential to grow at an even better pace. The economy of Uttar Pradesh has undergone several changes which have come about with collaborative efforts of the government and other stake holders. It is all set to scale new heights to emerge as a strong economy with sustainable and inclusive growth, going forward (Keyser and Peeters 1996).

Power Generation in Uttar Pradesh

During 11th Five year plan, many initiatives have been taken, which includes:

Power plants of 600 MW in Rosa and 600 MW in Anpara (Unit-I) have already been commissioned.

Several other Power plants of the aggregate of 3030 MW are scheduled to be commissioned by March 2012 which includes:

2 * 250 MW Harduaganj Extension

2 * 250 MW Parichha Extension

- First 500 MW unit of Anpara D under state sector

1 * 600 MW Anapara C Thermal Extension (Unit-II)

4 * 82.5 MW Shri Nagar Hydro

Power plant of 450 MW capacity based on co-generation in sugar mill is being commissioned under private sector.

The work for 3660 MW Bara Thermal Power Project and 2*660MW Karchhana Thermal Power Project have been entrusted to private developers and work has already commenced. The work for 2 * 660 MW Mega Thermal Power Project (Allahabad) is also under way in Joint Sector with NTPC and UP Rajiya Vidyut Utpadan Nigam Ltd.

By the end of 11th Five Year Plan, it is hoped that the state would get 2000 MW from the state-run projects, 2130 MW from the private sector, 450 MW from MOU route projects and 1571 MW from various projects being implemented by the central agencies. Under 12th Five year plan (April 2012 - March 2017), the Government of U.P. has planned for 25000 MW capacity additions. This envisage capacity addition of 5000 MW under State/Joint sector, 15000 MW under Private sector and 5000 MW to be procured through competitive bidding, by which power can be supplied from any power project located in any State of the country.

As on date, bid process for 2 * 660 MW Jawaharpur Thermal Power Project has already been initiated. Consultant has been identified and the bidding process for selection of developer is underway for 3x660 MW Sonebhadra Thermal Power Project. The selection of consultant for 2000 MW Yamuna Expressway Thermal Power is also under process. Department will provide land, coal linkage, water linkage and environmental clearance to the developer and power will be purchased on levelised tariff through competitive bidding. Further, Government of U.P. has signed MOU(s) with the developers for 3*660 MW Lalitpur Power Project and 2x660 MW Bhognipur Power Project (District Ramabai Nagar).

The main objective of this study is to formulate the market presumptions of power sector in Uttar Pradesh and to develop a theoretical Distributed Generation model which provides a socio-economic tool alternate power generation in Uttar Pradesh context (Kanpur). This overcomes the provision of reliable electric power services in sufficient quantity to meet affordable demand at the lowest cost, reflecting the resources and impacts involved in their production and transportation.

MATERIALS AND METHODS

15 places visited in Kanpur city during data collection to understand the load profile apart from other applicable information. Areas visited for sampling are: Prerna Vihar, Panki, Barra – I, Pareda, Barra – II, Gumti, Barra – III, Sarvodya Nagar, Barra – I, Kalyan Pur, Gujani, Kakadev, Daboli, Chamanganj, Bakargan. Survey revealed the Domestic load profile for 50 Domestic users is as follows:

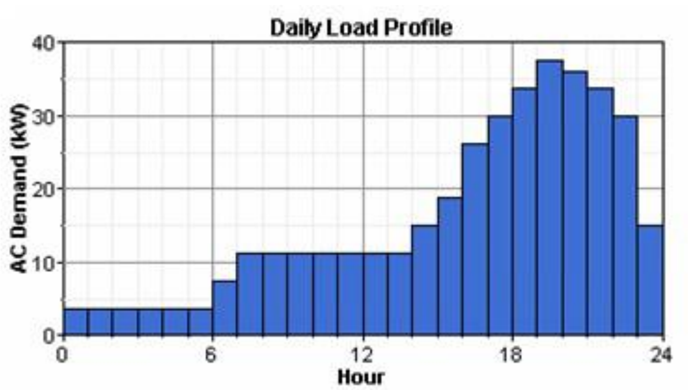

Figure 1. Load Profile for domestic users

The high use during the evening hours reflects the high demand for lighting and power for radio and television and the lower relative demand for industrial uses in rural areas. As small scale factory (small concrete parts factory) operates seven days a week from 7:00 AM to 11:00 PM, with two shifts of workers. The equipment requires a reliable three-phase supply during all operating hours and the demand is near the full capacity of the genset. The engineer in charge commented that the addition of more than a light bulb would trip the system and he estimates that the load factor during operating hours was near 95 percent.

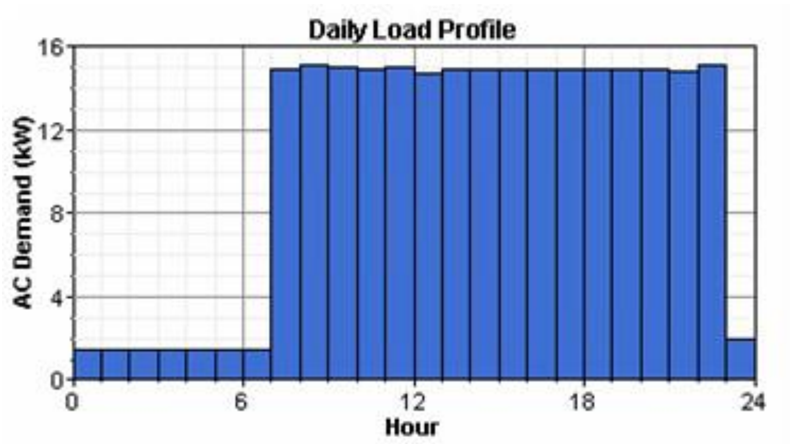

Figure 2. Load Profile for Industries

RESULTS AND DISCUSSION

Electricity is not only one of the most important infrastructure sectors, but also a commodity that facilitates the development of an economy; bringing quality of life to people and creating necessary conditions for education levels improvement and health care facilities. Besides, the options chosen by a country to produce electricity have serious implications regarding tariffs, carbon emissions, environmental impacts, fossil fuel security from politically unstable regions, social inclusion, industry development, etc (Vogel, 2009).

Biomass fuel availability and sensitivity

Bio mass fuel availability changes depend upon the fuel type and the climatic condition. Hence the Bio mass power availability during different part of year comes out to be a critical factor. To understand the same a sample biomass power plant is considered.

Figure 3. 85 cubic meter potato waste power generation plant

- The plant is installed for the generation of 10 kW of using up to 85 cubic meters per day gas generation capacity.

- K.V.I.C Floating drum type with water jacket, external guide frame for gas holder and a gas cleaning system.
- A power generation unit comprising of 30 kVA 100% Biogas generator set has been installed near the plant whereas the electricity line has been laid for almost 1 km distance to the potato cold storage for its use to power lights.

The most important variable in determining the viability of a hybrid system is the Biomass usage. In mentioned figure the sensitivity results are shown for a Biomass based 30 - 40 cubic meters against changes in primary load levels. Focusing on the x-axis, the winter days, not surprisingly, show the only-diesel option as the most economical, but that dominance only lasts to biogas production.

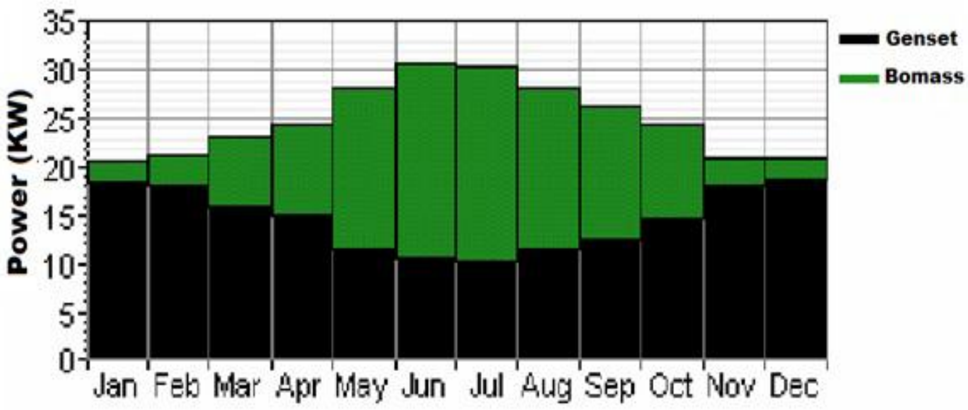

Figure 4. Sensitivity results for Biomass based 30 - 40 cubic meter plant

Social Cost benefit analysis/Economic Analysis

In view of above observations Distributed generation can have following Social Cost benefits:

1. Green Jobs (20 Jobs per MW)
2. Reduced fossil fuel imports ($ 125 Billion Coal + Oil Import bill)
3. Energy Security (No coal in world market - OPEC, Geopolitical - Oil)
4. Local Community development
5. Economic Growth
6. Carbon Credits earned will help improving the NPV and IRR

Evaluation of Small-scale Electricity Generation

In order to better understand the potential for DG electricity systems; this work presents the results of fieldwork carried out in the Kanpur province of Utter Pradesh, both to quantify the problems in the power sector and to form a basis for comparison with hybrid, distributed systems. First part presents an overview of the resources available to supply power on a distributed basis in Kanpur, including: renewable, fossil fuel and hybrid systems that employ some combination of renewable and fossil fuel power, and often include battery storage. In second part, a scenario-based approach using the Homer optimization model is used to understand the costs of operating a hybrid power system in Kanpur within the constraints of rural environments. Inputs for the model are from existing data, pilot projects, and interviews with industry experts.

CONCLUSIONS

In geography like Uttar Pradesh, with a fast growing urban population, a dispersed rural population and a nascent heavy industrial sector, the bottom-up model is uniquely suited to address the market needs. This could be possible when State utility commissions as well as local and regional electric system planning processes, models, and analytical tools should modify to include DG as potential resource options, and thus provide a mechanism for identifying opportunities for integrating DG into the modern electric system.

Distributed generation is being more widely implemented worldwide as countries and local jurisdictions work to reduce the barriers. Working to streamline the process and adopt fair, cost based standby rates for DG is a good starting point for the developing countries.

The new market and licensing arrangements will open up the opportunities for individuals and community generation schemes to make more extensive use of DG. This will have carbon benefits through the use of low carbon generating technologies including CHP, reduced network losses and the potential to exploit local, renewable sources of energy. Moreover, DG has the advantage of reducing transmission and distribution losses, increasing local employment, utilizing local primary energy sources and allowing for incremental expansion of the electricity system with locally raised capital because of its small-scale modularity. However, cost per unit of power is normally higher for DG projects compared to large power plants. In addition to the technical T&D losses inherent in centralized power delivery models, there is the prevalence of power theft.

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