A COMPARATIVE ASSESSMENT OF ENERGY MANAGEMENT SYSTEM AND STRATEGIES IN KANPUR CITY OF UTTAR PRADESH: A BOTTOM UP DISTRIBUTED GENERATION APPROACH

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ABSTRACT

In many developing countries, the electricity system is too weak to meet growing demand. The availability and reliability of generating capacity is also in short supply. Political interference, subsidized pricing, and corruption weaken the ability of developing countries like India electricity supply system, to finance and deliver service or attract new private investment. Electricity theft can be in various forms of frauds like meter tampering, stealing with illegal connections, billing irregularities, and unpaid bills. This work deals with power economics, policy, regulations and reforms. Random sampling with personal interviews was to be done for primary data collection from domestic users, industrial users, media and power distribution agencies. One more survey for Technology Feasibility of power system has to be done with personal interviews from generation, transmission and distribution units of Electricity system in Kanpur city. A comparative analysis to compare investment in DG versus a large-scale generator in the presence of uncertain demand growth has to be done. Net Present Cost, Cost of Energy, Break even Grid Distance are the three most important output variables of the analysis. The survey data shows that a huge amount of improvement needs in Energy system. This electricity system can be improved by applying technical solutions such as tamper-proof meters, various managerial methods such as inspection and monitoring of distribution system, and in some cases restructuring power systems ownership and regulation.
Keywords: Electricity System, Survey, Energy Loss, Cost of Production, Cost of Distribution, Bottom Up Approach;

1. INTRODUCTION

Power sector reform is an acute need in developing countries where implementation of a top-down liberalization approach has been pursued without adequately considering the social, political and economic conditions. Energy demand is expected to increase considerably in the coming years as the result of population growth and economic development [1]. Many people in the world are currently experiencing dramatic shifts in lifestyle as their economies make the transition from subsistence to an industrial or service base. The largest increases in energy demand will take place in developing countries where the proportion of global energy consumption is expected to increase from 46 to 58 percent between 2004 and 2030 [1].

A feature of the traditional approach to upgrading the network is that as demand grows gradually, network reinforcement is carried out in large increments requiring lumpy investments. As a result, a portion of grid capacity remains idle for long periods in anticipation that demand will eventually increase [2].

The financial losses are critical to many electric power organizations. Lost earnings can result in lack of profits, shortage of funds for investment in power system capacity and improvement, and a necessity to expand generating capacity to cope with the power losses [3]. Some power systems in worst affected countries are near bankrupt. Corruption increases and becomes entrenched as favours can be bought from power sector employees in the form of inaccurate billing and allowing illegal connections. Political leaders intervene to ensure that cronies and supporters are not prosecuted [4]. In many countries power theft is an issue of open discussion—even in the most efficient (such as in the USA) and moderately efficient (Malaysia) systems. In South Asian countries, electric power is rarely discussed without reference to power theft, since it is such a prevalent practice. However, in some countries (Thailand, China) the topic is rarely part the analysis of power systems [5]. Development, and simulation of an intelligent multi-agent system based on IEEE FIPA (Foundation for Intelligent Physical Agents) standards in context of distributed smart grid was done [6].

Distribution systems management is becoming an increasingly complicated issue due to the introduction of new technologies, new energy trading strategies, and new deregulated environment [7]. The Distributed Generation (DG) technologies, which include both conventional and non-conventional type of energy sources for generating power, are gaining
momentum and play major role in distribution system as an alternative distribution system planning option [8].

The last two decades electricity sectors in both developed and developing countries have been subject to restructuring to introduce private capital and increase competition was studied [9]. This has been accompanied by the introduction of new regulatory regimes. The effects of such reforms in a number of the developed economies are now well documented. This is important because privatization, competition and the reform of state regulation are key themes of donor aid programmes, notably those of the World Bank [10].

Currently, the revenue sources of distribution utilities have comprised of the regulated connection charges and use-of-system charges. Based on the type of consumer and regulatory framework model, new connection fees consist of shallow and deep cost charges [11]. Distributed generation (DG) technologies have promoted interest in alternative sources of energy for commercial building applications due to their potential to supply on-site heat and power at a lower cost [12]. A model based approach for efficiently locating and operating distributed generation (DG) without endangering stable system operation was introduced [13].

The impact of DG in system operating characteristics, such as electric losses, voltage profile, stability and reliability needs to be appropriately evaluated. For that reason, the use of an optimization method capable of indicating the best solution for a given distribution network can be very useful for the system planning engineer. A review of the relevant aspects related to DG and its impact that DG might have on the operation of distributed networks was done [14].

The distribution network tends to be more hierarchical (radial rather than looped) than the transmission network and for this reason there is less system wide interdependency. In terms of hours lost per year, the distribution sector accounts for the greatest losses, but there is the least long term risk, since distribution can be constructed relatively quickly, and because the incentive for connection is local, then the opposition to loss of visual amenity is reduced [15].

Overview of coordinated charging of electric vehicles (EVs) was done. The optimization objective, scale and method of each coordination strategy are the three parameters used to characterize and compare different approaches. The correlation between the three parameters and the research category are investigated, resulting in a correlation mapping of the different approaches on electrical vehicles [16][17].

Estimates of the extent of electricity theft in a sample of 102 countries for 1980 and 2000 are undertaken [18]. Load models can significantly affect the optimal location and sizing of DG resources in distribution systems [19]. A comparative study of real and reactive power loss, real and reactive power intake at the main substation and MVA support provided by installing DG resources for different type of loads models has been performed [19].

Distributed generation (DG) has gained interest as an alternative source of power for new and existing buildings in the residential, commercial, and industrial sectors [20]. Rather than solely purchasing electricity from a centralized utility, a building owner can invest in an on-site system to supply power using non-renewable technologies such as reciprocating engines, micro turbines, and fuel cells, and renewable technologies such as photo-voltaic (PV) cells and wind turbines [20]. Distributed Generation (DG) is gaining in significance due to the keen public awareness of the environmental impacts of electric power generation and significant advances in several generation technologies which are much more environmentally friendly (wind power generation, micro-turbines, fuel cells, and photovoltaic) than conventional coal, oil and gas-fired plants.
A comprehensive model for Distribution Systems Planning (DSP) in the case of using Distributed Generation (DG), with regard to load models was provided. Proposed model optimizes size and location of the distributed generation. This model can optimize investment cost in distributed generation better than other solutions. It minimizes the operating costs and total cost of the system losses [21]. Recent technological and economic changes are expected to challenge and transform the electric utility industry. These changes (or disruptive challenges) arise due to a convergence of factors, including: falling costs of distributed generation and other distributed energy resources (DER) [22].

The energy demand of the Plug-in hybrid electric vehicles (PHEV) is supplied both by the fuel tank based on renewable resource and the power grid, which makes the power distribution among different power components more complex than HEVs, meanwhile the energy management strategy has a significant impact [9]. An optimal distribution power flow strategy is proposed and implemented to solve problem into two components: economic dispatch for energy based on market prices at the system level; and loss minimization at the distribution level [23]. The load model can significantly affect the predicted system performance [24].

The demand for investment in the electricity sector in the world between 2000 and 2030 is estimated to be USD9.8 trillion. Developing countries would require more than half of this investment [25]. The electricity distribution network operators (DNOs) are responsible for, expansion, reinforcement and maintaining the safety and reliability of the network to support power flows and ensure quality of supply [26].

Effective and sustainable energy-planning policies are needed in developing countries to stimulate investment in power-plant modernization and in rationale energy usage. Power markets in developing countries should be organised to deliver modern energy services to promote poverty alleviation and economic growth, since these are the overriding priorities for these countries. Previous various researches were done regarding DG focuses on various aspects of the optimal system design and dispatch [27]. Many studies are also addressed the optimal performance of an individual DG technology, but do not resolve the system-level design and dispatch problem of integrating, sizing, and operating multiple technologies [20].

1.1. Power Sector 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 depend 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. 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. 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 increasing 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.

In this backdrop, during the scale 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 Ghatampur, Kanpur in a joint collaboration with Neyveli Lignite Corporation Limited.

The Government has envisioned to meet 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.

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

1. Power plants of 600 MW in Rosa and 600 MW in Anpara (Unit-I) have already been commissioned
2. Several other Power plants of the aggregate of 3030 MW are scheduled to be commissioned by March 2012 which include:
   - 2 x 250 MW Harduaganj Extension
   - 2 x 250 MW Parichha Extension
   - First 500 MW unit of Anpara 'D' under state sector
   - 1 x 600 MW Anapara 'C' Thermal Extension (Unit-II)
   - 4 x 82.5 MW Shri Nagar Hydro
3. Power plant of 450 MW cogeneration in sugar mill is being commissioned under private sector.
4. The work for 3 x 660 MW Bara Thermal Power Project and 2 x 660 MW Karchhana Thermal Power Project have been entrusted to private developers and work has already commenced.
5. The work for 2 x 660 MW Mega Thermal Power Project (Allahabad) is also underway 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 x 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 3 x 660 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 x 660 MW Lalitpur Power Project and 2 x 660 MW Bhognipur Power Project (District Ramabai Nagar).

1.3. Transmission

At present UP has a transmission network to cater about 8000-10000 MW of power. To cater the enhanced generation by the end of 11th plan, UP transmission system is being augmented to evacuate 15000 MW of power. Accordingly, transmission development programme has been worked out and numbers of 765 KV/ 400 KV/ 220 KV/ 132 KV substations and associated transmission lines are under construction. These includes sub-stations of 765 KV (3 in numbers), 400 KV (9 in numbers) along with associated transmission lines under public private partner-ship model for evacuation of power from 3 x 660 MW Bara, 2x660 MW Karchhana and 3x660 MW Mega Thermal Power Projects.

Apart from above, sub-stations of 765 KV (2 in numbers), 400 KV (3 in numbers), 220 KV (24 in numbers) and 132 KV (54 in numbers) are to be constructed under State sector.

1.4. Distribution

In order to improve the performance of the power sector, and for bringing financial and operational independence, besides creating conditions for competitive and self sustainable developments of the power sector, Government of India has enacted Electricity Act 2003 with effect from June 2003. Govt. of UP has undertaken an input-based franchisee distribution model in cities like Agra and Kanpur for economizing on power. While the distribution system in Agra has already been handed over to a private partner M/s Torrent Power Ltd. with effect from 01.04.2010, things are moving in a similar direction for Kanpur. The process would soon be rolled out in nine other towns.

With an aim to attract more and more companies to participate in open bid for the selection of input based franchisee, UPPCL will provide the following facilities to the prospective distribution franchisee:

- Distribution franchisee can use utilities distribution assets
- Distribution franchisee can utilize other services of utilities such as testing facility of HT/LT between switching / sub-stations and distribution transformer and/or other technical assets.
- Utility shall provide inventory of first three months
Utility shall ensure the supply of power to the distribution franchisee
Utility shall allow distribution franchise to purchase power through open access.

To augment distribution system, 202 numbers of new 33/11 KV sub-station are under construction and 174 numbers are under planning stage.

It is certainly not the end here; the Government is mulling all available options and relentlessly striving hard in making U.P. a power surplus state, to create an industry friendly ambience so as to compete in true sense with all the peer states across the country and also enshrine U.P. among the most developed states within the country and globally as well. The mission may seem difficult but is surely not impossible once the people of the state from all walk of life shall also be determined and join their hands to bolster every initiatives taken by the Government for the better future prospects of the state so that the benefits of development may reach the doorsteps of every citizen of U.P.

This work deals with both qualitative and quantitative methods need to be examining for the feasibility of different DG Technology under existing political environment. This will helps to cross-check the consistency and accuracy. This work will uses both qualitative and quantitative methods. Balance and integration between qualitative and quantitative data is also needed to provide a more cogent picture of reality and to better inform decision makers who use the research.

2. MATERIAL & METHODOLOGY

To enable and to understand various factors influencing the DG and Bottom up model an approach model is adopted.

Research strategy was used on adopted model to conclude three main aims:

1. Identify a decision or set of decisions
2. Explain detailed why they were taken
3. How to implemented and what are the possible results

The situation in Uttar Pradesh, India is adopted as an approach model to get insight for specific and generalised results. Uttar Pradesh offers this natural ground of laboratory due to following salient factors:

1. First, Uttar Pradesh has underserved rural areas that are remote from "robust" grid connections.
2. Second, the state is scattered industrialised with a high proportion of captive power in operation.
3. Third, there is a current power shortage and rapid demand growth highlights the need for additional generation capacity.

2.1. Sampling
1. Apart from offering above referred advantages, Uttar Pradesh fulfils the authors a natural Convenience sampling.
2. For primary data, research was conducted on Kanpur city based on purposive sampling.
3. Based on random sampling survey has done at approx 50-60 households/Busines units/Industries to get the respondent figure of 100 from these two cities.
Statistical tool: Creation of charts, tables, and frequencies was done using Excel packages.

2.2. Source of data

2.2.1. Secondary data

Secondary data on reforms, policies, institutions etc. are collected from existing literature, websites, offices, reports of various committees set up from time to time, books, magazines and journals etc. Details of such secondary sources are given in the references.

2.2.2. Primary Data

To demonstrate the case for this bottom-up reform path, it is necessary to evaluate both technological and Political Economical options. In order to answer the mooted research questions, primary data of various technological and Political Economical influencing factors need to be collected.

Source of Primary data identified are as follows

1. Filed visits during feasibility study
2. Personal Interview
3. Schedule/Questionnaire Method

Table 1: Data collection Methodology - Technology Feasibility

<table>
<thead>
<tr>
<th>Technological Option</th>
<th>Govt Source</th>
<th>Private Sector</th>
<th>Targeted question I</th>
<th>Targeted question II</th>
<th>Targeted question III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td>UPRVUNL</td>
<td>Industrial Captive plants</td>
<td>Technology choice</td>
<td>Grid Integration</td>
<td>Fuel Availability</td>
</tr>
<tr>
<td></td>
<td>PGCIL, SEB</td>
<td>Grid Quality</td>
<td>Grid performances</td>
<td>Limitations</td>
<td></td>
</tr>
<tr>
<td>Distribution</td>
<td>SEB, Torrent Power</td>
<td>Power Loss</td>
<td>ROI</td>
<td>Limitations</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Data collection Methodology - Political Economy Feasibility

<table>
<thead>
<tr>
<th>Political economics</th>
<th>Sample Count</th>
<th>Targeted Question I</th>
<th>Targeted question II</th>
<th>Targeted question III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Users</td>
<td>200</td>
<td>Subsidy</td>
<td>Pricing</td>
<td>Availability</td>
</tr>
<tr>
<td>Domestic users</td>
<td>300</td>
<td>Pricing</td>
<td>Availability</td>
<td>Theft</td>
</tr>
<tr>
<td>Media</td>
<td>5</td>
<td>Corruption</td>
<td>Theft</td>
<td>Public Grievances</td>
</tr>
<tr>
<td>Power Distribution Agency</td>
<td>2</td>
<td>Theft</td>
<td>Pricing</td>
<td>Collection</td>
</tr>
</tbody>
</table>
3. RESULTS & DISCUSSION

The electric power systems are undergoing major modernization process due to demands that are placed on the electrical grid, including environ-mental compliance, energy efficiency, improved grid reliability and customer-centric relationship management. All this has the effect on energy business from both technical and economic points of views.

### Table 3: Detail collected with the help of press reporters

<table>
<thead>
<tr>
<th>S.No</th>
<th>Media Name</th>
<th>Media Type</th>
<th>News related to Electricity Management in the city of Kanpur Related to Theft by domestic users or industries, corruption by govt. Officer for claiming any electricity bill or connection or involvement in any theft, Public Grievances in govt offices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dainik jagarn</td>
<td>Print media</td>
<td>Mass People are disturbed due to roistering in power dated 28.10.2013</td>
</tr>
<tr>
<td>2</td>
<td>Dainik Aaj</td>
<td>Print media</td>
<td>Due to Privatization of Electricity Dist. In Agra up Govt. lost around Rs.5000 cr. Dated 21.09.2013</td>
</tr>
<tr>
<td>3</td>
<td>Rastriya Sahara</td>
<td>Print Media</td>
<td>Due to Distribution transformer fault people cannot avail the water on dated 21.09.2013</td>
</tr>
<tr>
<td>4</td>
<td>Hindustan Print media</td>
<td></td>
<td>Corruption with the consumers who default to pay till last in the month dated 16.09.2013</td>
</tr>
</tbody>
</table>

### Table 4: Shows the places visited in Kanpur city during data collection

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Place</th>
<th>Sr. No.</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prerna Vihar</td>
<td>8</td>
<td>Panki</td>
</tr>
<tr>
<td>2</td>
<td>Barra - I</td>
<td>9</td>
<td>Pareda</td>
</tr>
<tr>
<td>3</td>
<td>Barra - II</td>
<td>10</td>
<td>Gumti</td>
</tr>
<tr>
<td>4</td>
<td>Barra - III</td>
<td>11</td>
<td>Sarvodya Nagar</td>
</tr>
<tr>
<td>5</td>
<td>Barra - I</td>
<td>12</td>
<td>Kalyan Pur</td>
</tr>
<tr>
<td>6</td>
<td>Gujani</td>
<td>13</td>
<td>Kakadev</td>
</tr>
<tr>
<td>7</td>
<td>Daboli</td>
<td>14</td>
<td>Chamanganj</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>Bakarganj</td>
</tr>
</tbody>
</table>
Table 5: Data collected from different power distribution agencies of Kanpur city

<table>
<thead>
<tr>
<th>S.No</th>
<th>Agency Name</th>
<th>Agency Type</th>
<th>Any Theft found in amount or economic balance?</th>
<th>Any Public Grievances regarding bill or connection?</th>
<th>Actual price per unit for domestic and commercial?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KESCo Kanpur DISCOM</td>
<td>15 lacs per month theft recovery</td>
<td>500 grievances per month</td>
<td>Rs. 03.00 per unit commonly for domestic and commercial</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Kanpur Zone (DVVNL) DISCOM</td>
<td>05 lac per month</td>
<td>100 grievances per month</td>
<td>Rs. 03.00 per unit commonly for domestic and commercial</td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Data collected from different users (Domestic, commercial, Industrial) of Kanpur city.

<table>
<thead>
<tr>
<th>Source</th>
<th>Price per unit of KW</th>
<th>Additional surcharge</th>
<th>Additional Tax</th>
<th>Availability per day</th>
<th>Thefts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>upto 200 units Rs 4.00/unit, upto 500 units Rs 4.5/unit, above 500 units Rs 5.00/unit and Electricity Duty 5% additional</td>
<td>No</td>
<td></td>
<td>20 Hours</td>
<td>Lot of people have unauthorized connection (Katiya)</td>
</tr>
<tr>
<td>Commercial</td>
<td>upto 300 units Rs 6.00/unit, above 300 units Rs 6.50/unit and Electricity Duty 7.5% additional</td>
<td>302</td>
<td>239</td>
<td>20 Hours</td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>rupees 06 per unit and 07.5 percent electricity duty</td>
<td>302</td>
<td>239</td>
<td>24 Hours</td>
<td></td>
</tr>
</tbody>
</table>
Factors Influencing Technological Options:

Based on various review of literature following factors (but not limit to) are identified and need to be explored in detail during research work:

- Geographic availability
- Load type
- Fuel availability
- Grid status and availability
- Pricing

3.1. Data Analysis

Based on the surveyed data and techniques by power generation pants, two places in Kanpur city where maximum numbers of thefts found. Thefts are in the form of fraud (meter tampering), stealing (illegal connections), billing irregularities, and unpaid bills. These places are:

1. Chamanganj
2. Bakarganj

Three places where few thefts in the form of fraud (meter tampering) were found. This theft in the local language known as Katiya. These places are

1. Barra - I
2. Barra - II
3. Barra - III

The illegal lines are easy to detect as they are often above ground and highly visible. However, one finds reports of staff being assaulted and needing police security to carry out the removal of the lines. Corrupt staff from the electricity organization may take bribes to allow the practice to continue. On a larger scale, businesses may bribe power organization staff to rig direct lines to their buildings or offices and the power does not go through a meter. The bribes can be much less than the cost of the power. Money also can be given to inspectors to keep them from finding and/or reporting the theft.

Three methods are identified for the upgradation of Power system in this paper.

3.1.1. Technical Up gradation

Most of the power systems in different states of India devote inadequate resources and effort to generation, transmission and distribution systems and do not use the latest technologies. The investment necessary to reduce losses includes upgrading power lines, transformers, information technology monitoring systems, and installing and maintenance of modern metering systems that are at the interface of the organization and the consumers of the electricity.

Grid connected renewable based power system

Grid-interactive renewable power projects based on wind power, biomass, and small hydro and solar are mainly private investment driven, with favourable tariff policy regimes established by State Electricity Regulatory Commissions (SERC), and almost all-
renewable power capacity addition during the year has come through this route.

**Wind Power:** It aims at generation of competitively priced grid-interactive wind power. The program also covers research and development and survey and assessment of wind resources.

**Bio power:** Four sets of programmes are being implemented with the aim to generate competitively priced bio power and/or heat from agricultural, agro-industrial residues and plantations and urban & industrial wastes. These are:

- Biomass power / Bagasse Cogeneration
- Non-bagasse cogeneration
- Biomass gasifier
- Urban & Industrial wastes

**Small Hydro Power:** Aims to generate competitively priced Small hydro power (upto 25 MW station capacity).

**Solar Power:** Aims to generate competitively priced Solar Thermal and Solar Phot voltaic Power.

Tamil Nadu had the highest installed capacity of grid connected renewable power (6500 MW) followed by Maharashtra (3005 MW) and Karnataka (2882 MW), mainly on account of wind power.

Ministry of new & renewable energy, Govt. of India has started providing subsidies and CFA for the Biowaste to biogas Power Generation Plants in India. This is for the small communities like schools, hospitals, hostels, or for any organizations. Latest example is Potato waste biogas generation plant in Lukhnow city of Uttar Pradesh as shown in Figure 2.

![Figure 2: 85 cubic meter Biowaste based Power Generation Plant](image)

This is 85 m³ K.V.I.C Floating drum type with water jacket, external guide frame for gas holder and a gas cleaning system.

The value of the plant is equal to the sum of the cash flows, discounted at the risk free rate, minus the cost of risk, applied individually to each profit centre, with a centralized aggregation of the risk diversity benefit, handled by capital management. These are shown in Figure 3.
3.1.2. Reducing Theft problem

Electricity theft can be estimated, but not measured exactly. The most accurate estimate of theft is by conducting a thorough analysis of the power system. The standard method of measuring power theft is by analysis of transmission and distribution losses (T&D losses). The method takes the difference between the amount of electricity generated (minus system use and gratis) in relationship to the amount metered and sold. If an accurate calculation is made of technical line losses, theft may compose a large part of the unaccounted amount the non-technical line losses in the distribution network.

Corruption is one of the most difficult problem areas for electricity organizations because power theft occurs with the connivance of employees of the power organization. In some cases, employees may be bribed to record the meter at a lower number than is shown. The consumer pays the lower bill and the meter-reader earns unofficial salary. Legal actions should be taken by Govt. for these peoples. It is important to detect and prosecute corrupt power sector employees this includes, if necessary, the ones at the very top of the organization. Employees should be paid adequately so that they will not have to resort to bribes in order to support a family.

Significant technological advancement in metering has occurred. Since much theft is from meter tampering, it is important to replace old, easy to tamper-with meters.

Reduction in power theft and keeping it within reasonable bounds is more likely to be successful in systems with a good governance culture. This is because the theft reduction mechanisms find a friendly environment for initiation and implementation. As part of generating and sustaining good governance in communities, electric power systems have the opportunity to take the lead in promoting sound corporate governance. The technological innovations make this task easier should the managerial skills and desire exist. Electric power systems can be restructured to make power sector organizations operate in competitive environments where efficiency and effectiveness in service delivery are both virtues and necessities.

3.1.3. Electricity Markets

Two main types of electricity markets are

1. Wholesale markets typically involve the sales of electricity among electric utilities and electricity traders before it is eventually sold to consumers;
2. Retail markets involve the sales of electricity to consumers by retailers.
The wholesale market and retail market are highly interdependent since the wholesale price is the largest component of the retail price of electricity. The reconstruction of the electricity industry is expected to trigger more competitive wholesale market that will presumably set lower wholesale prices. This will allow electricity retailers to set lower retail prices for their product and still remain financially viable.

**Gratis**

A type of loss is electricity markets allocated gratis. Some power systems provide free electricity without charge to certain people and organizations. The presidential or prime-minister’s residence, members of parliament or the royal palaces may not be charged for electricity or telephone. Free electricity may be provided to employees of the power system. In a competitive electricity market, it is necessary and important to develop an appropriate risk management scheme for trade with full utilization of the multi-market environment in order to maximize participant’s benefits and minimize the corresponding risks.

**4. CONCLUSION**

The electric power systems are undergoing major modernization process due to demands that are placed on the electrical system. This has an effect from both technical and economic points of view. The evidence points to the increasing levels of power theft, Corruption news by govt. officer for claiming any electricity bill or connection or involvement in any theft in many areas and the financial losses for some systems are so immense that the utility is in financial troubles. Investment in improving the system and adding additional capacity cannot be undertaken, loans and payments cannot be met, and the consumer faces increased electricity charges. 

Investment in improving the system and adding additional capacity cannot be undertaken, loans and payments cannot be met, and the consumer faces increased electricity charges. Even in efficient systems, theft losses can account for millions of dollars each year in lost revenue.

Electric power systems can be restructured to make power sector organizations operate in competitive environments where efficiency and effectiveness in service delivery are both virtues and necessities. As part of generating and sustaining good governance in communities, electric power systems have the opportunity to take the lead in promoting sound corporate governance.

**REFERENCES**


