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EFFECTIVE REVIEW ON ENERGY CONSUMPTION AND OPTIMIZATION ASPECTS IN MAHARASHTRA

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ABSTRACT

Energy Optimization and Consumption Management includes the planning as well as operation of the production of energy and related units. The key objectives are resource conservation, climate protection and cost savings, while the users have permanent access to the energy they need. It is connected closely to environmental management, production management, logistics and other established business functions. The VDI-Guideline 4602 released a definition which includes the economic dimension: "Energy management is the proactive, organized and systematic coordination of procurement, conversion, distribution and use of energy to meet the requirements, taking into account environmental and economic objectives". In this paper, a unique and pragmatic analysis as well as review on the energy optimization issues in state of Maharashtra and related aspects is underlined with the suggestive approach.

Keywords - Energy Consumption, Energy Management, Energy Optimization, Energy Management in Maharashtra

PREAMBLE

The term Energy Management means many things to many people.

One Classical definition is: *"The judicious and effective use of energy to maximize profits (minimize costs) and enhance competitive positions"*

Another comprehensive definition is*: "The strategy of adjusting and optimizing energy, using systems and procedures so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems"*

It is believed that Energy Management encompasses a wide range of activities and expertise in the optimal use of energy. This includes the areas of measurement and control; the development of management strategies, programmes and plans; and the expert implementation of techniques, technology and tools to improve the efficiency, productivity and sustainable use of energy.

INDIAN PERSPECTIVE AND DIMENSIONAL APPROACH

The power sector in India is mainly governed by the Ministry of Power. There are three major pillars of power sector these are Generation, Transmission, and Distribution. As far as generation is concerned it is mainly divided into three sectors these are Central Sector, State Sector, and Private Sector.

Central Sector or Public Sector Undertakings (PSUs), constitute 29.78% (62826.63MW) of total installed capacity i.e, 210951.72 MW (as on 31/12/2012) in India. Major PSUs involved in the generation of electricity include NHPC Ltd., NTPC Ltd.,, and Nuclear Power Corporation of India (NPCIL).

Besides PSUs, several state-level corporations are there which accounts for about 41.10% of overall generation, such as Jharkhand State Electricity Board (JSEB), Maharashtra State Electricity Board (MSEB), Kerala State Electricity Board (KSEB), in Gujarat (MGVCL, PGVCL, DGVCL, UGVCL four distribution Companies and one controlling body GUVNL, and a generation company GSEC), are also involved in the generation and intra-state distribution of electricity.

Other than PSUs and state level corporations, private sector enterprises also play a major role in generation, transmission and distribution, about 29.11%(61409.24MW) of total installed capacity is generated by private sector.

The PowerGrid Corporation of India is responsible for the inter-state transmission of electricity and the development of national grid.

The Ministry of Power is the apex body responsible for the development of electrical energy in India. This ministry started functioning independently from 2 July 1992; earlier, it was known as the Ministry of Energy. The Union Minister of Power at present is Sushilkumar Shinde and Minister of State for Power is K.C Venugopal.

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India is world's 6th largest energy consumer, accounting for 3.4% of global energy consumption, with Maharashtra as the leading electricity generator among Indian states. Due to India's economic rise, the demand for energy has grown at an average of 3.6% per annum over the past 30 years. At the end of December 2012, the installed power generation capacity of India stood at 210951.72MW, while the per capita energy consumption stood at 733.54 KWh(2008-09). The Indian government has set an ambitious target to add approximately 78,000 MW of installed generation capacity by 2012. The total demand for electricity in India is expected to cross 950,000 MW by 2030.

India is the sixth largest in terms of power generation. About 65% of the electricity consumed in India is generated by thermal power plants, 22% by hydroelectric power plants, 3% by nuclear power plants and rest by 10% from other alternate sources like solar, wind, biomass etc. 53.7% of India's commercial energy demand is met through the country's vast coal reserves. The country has also invested heavily in recent years on renewable sources of energy such as wind energy. As of March 2011, India's installed wind power generation capacity stood at about 12000 MW. Additionally, India has committed massive amount of funds for the construction of various nuclear reactors which would generate at least 30,000 MW. In July 2009, India unveiled a $19 billion plan to produce 20,000 MW of solar power by 2020 under National Solar Mission.

The per capita power consumption in India is 733.54KWh/yr, which is very minimal as compared to global average of 2340KWh/yr.

Electricity losses in India during transmission and distribution are extremely high, about 28.44%(2008-09). India needs to tide over a peak power shortfall of 13% between 5pm and 11pm by reducing losses due to theft and pilferage.. Due to shortage of electricity, power cuts are common throughout India and this has adversely effected the country's economic growth. Theft of electricity, common in most parts of urban India, amounts to 1.5% of India's GDP. The condition of utilities are not good either, cumulative loss of 110 power utilities are estimated as Rs 86,136 crore which is expected to to rise to Rs 1,16,089 crore by 2014-15. Despite an ambitious rural electrification program, some 400 million Indians lose electricity access during blackouts. While 84.9% of Indian villages have at least an electricity line, just 46 percent of rural households have access to electricity.

ELECTRICITY TRANSMISSION

A power transmission cable operated by BEST in Mumbai, India. Transmission of electricity is defined as bulk transfer of power over a long distance at high voltage, generally of 132kV and above. In India bulk transmission has increased from 3,708 ckm in 1950 to more than 166000ckm, out of which 75556ckm is transmitted by Power Grid Corporation of India (as on 30 Sep. 2010). The entire

country has been divided into five regions for transmission systems, namely, Northern Region, North Eastern Region, Eastern Region, Southern Region and Western Region. The Interconnected transmission system within each region is also called the regional grid.

The transmission system planning in the country, in the past, had traditionally been linked to generation projects as part of the evacuation system. Ability of the power system to safely withstand a contingency without generation rescheduling or load-shedding was the main criteria for planning the transmission system. However, due to various reasons such as spatial development of load in the network, non-commissioning of load center generating units originally planned and deficit in reactive compensation, certain pockets in the power system could not safely operate even under normal conditions. This had necessitated backing down of generation and operating at a lower load generation balance in the past. Transmission planning has therefore moved away from the earlier generation evacuation system planning to integrate system planning.

While the predominant technology for electricity transmission and distribution has been Alternating Current (AC) technology, High Voltage Direct Current (HVDC) technology has also been used for interconnection of all regional grids across the country and for bulk transmission of power over long distances.

Certain provisions in the Electricity Act 2003 such as open access to the transmission and distribution network, recognition of power trading as a distinct activity, the liberal definition of a captive generating plant and provision for supply in rural areas are expected to introduce and encourage competition in the electricity sector. It is expected that all the above measures on the generation, transmission and distribution front would result in formation of a robust electricity grid in the country.

ELECTRICITY DISTRIBUTION

The total installed generating capacity in the country is 210951.72MW,and the total number of consumers is over 146 million. Apart from an extensive transmission system network at 500kV HVDC, 400kV, 220kV, 132kV and 66kV which has developed to transmit the power from generating station to the grid substations, a vast network of sub transmission in distribution system has also come up for utilisation of the power by the ultimate consumers.

However, due to lack of adequate investment on transmission and distribution (T&D) works, the T&D losses have been consistently on higher side, and reached to the level of 28.44% in the year 2008-09.The reduction of these losses was essential to bring economic viability to the State Utilities.

As the T&D loss was not able to capture all the losses in the net work, concept of Aggregate Technical and Commercial (AT&C) loss was introduced. AT&C

loss captures technical as well as commercial losses in the network and is a true indicator of total losses in the system.

High technical losses in the system are primarily due to inadequate investments over the years for system improvement works, which has resulted in unplanned extensions of the distribution lines, overloading of the system elements like transformers and conductors, and lack of adequate reactive power support.

The commercial losses are mainly due to low metering efficiency, theft & pilferages. This may be eliminated by improving metering efficiency, proper energy accounting & auditing and improved billing & collection efficiency. Fixing of accountability of the personnel / feeder managers may help considerably in reduction of AT&C loss.

With the initiative of the Government of India and of the States, the Accelerated Power Development & Reform Programme(APDRP) was launched in 2001. APDRP meant to upgrade the distribution system, minimize transmission and distribution losses, improve metering and assign responsibility for the realization of user charges —has not been able to bring down losses to 15% by the end of 2007, as originally targeted in 2000-01.

The APDRP programme is being restructured by the Government of India, so that the desired level of 15% AT&C loss could be achieved by the end of 11th plan.(estimated plan cost – Rs50000 crore)

The main objective of the programme was to bring Aggregate Technical & Commercial (AT&C) losses below 15% in five years in urban and in high-density areas. The programme, along with other initiatives of the Government of India and of the States, has led to reduction in the overall AT&C loss from 38.86% in 2001-02 to 28.44% in 2008-09.

RGGVY, which had a target of providing electricity to 125,000 villages and connecting 23 million below-poverty-line households across the country by 31 March, has also been faltering.
Power for ALL by 2012

The Government of India has an ambitious mission of POWER FOR ALL BY 2012. This mission would require that the installed generation capacity should be at least 200,000 MW by 2012 from the present level of 167278.36MW. Power requirement will double by 2020 to 400,000MW.

The government had earlier planned to add 78,000 MW of power capacity by the end of the 11th Plan, which the Planning Commission had scaled down to 62,000 MW. This may now be further curtailed to 58,000 MW (as on Dec' 2010).

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OBJECTIVES AND KEY GOALS OF ENERGY OPTIMIZATION

- Sufficient power to achieve GDP growth rate of 8%
- Reliable power
- Quality power
- Optimum power cost
- Commercial viability of power industry
- Power and Electricity for all with equal distribution
- Load Balancing

STRATEGIES IN ADOPTION

Power Generation Strategy with focus on low cost generation, optimization of capacity utilization, controlling the input cost, optimisation of fuel mix, Technology upgradation and utilization of Non Conventional energy sources

- Transmission Strategy with focus on development of National Grid including Interstate connections, Technology upgradation & optimization of transmission cost.
- Distribution strategy to achieve Distribution Reforms with focus on System upgradation, loss reduction, theft control, consumer service orientation, quality power supply commercialization, Decentralized distributed generation and supply for rural areas.
- Regulation Strategy aimed at protecting Consumer interests and making the sector commercially viable.
- Financing Strategy to generate resources for required growth of the power sector.
- Conservation Strategy to optimise the utilization of electricity with focus on Demand Side management, Load management and Technology upgradation to provide energy efficient equipment / gadgets.
- Communication Strategy for political consensus with media support to enhance the general public awareness.,

  Rural electrification

  Jharkhand, Bihar, Uttar Pradesh, Orissa, Uttranchal, Madhya Pradesh etc are some of the states where significant number (more than 10%) of villages are yet to be electrified.
- Number of Villages (1991 Census) – 593,732
- Villages Electrified (31/08/2010) – 503,924
- Village level Electrification % – 84.9%

ASSOCIATION OF SUBSIDIES

Several state governments in India provide electricity at subsidised rates or even free to some sections. This includes for use in agriculture and for consumption by backward classes. The subsidies are mainly as cross-subsidisation, with the other users such as

industries and private consumers paying the deficit caused by the subsidised charges collected. Such measures have resulted in many of the state electricity boards becoming financially weak.

At present (2012), the price per unit of electricity in India is about Rs. 4 for domestic consumers, and Rs. 9 for the commercial supply.

STRATEGIES

A long-term energy strategy should be part of the overall strategy of a company. This strategy may include the objective of increasing the use of renewable energies. Furthermore, criteria for decisions on energy investments, such as yield expectations, are determined. By formulating an energy strategy companies have the opportunity to avoid risks and to assure a competitive advance against their business rivals.

POTENTIAL ENERGY STRATEGIES

According to Kals there are the following energy strategies:

- Passive Strategy: There is no systematic planning. The issue of energy and environmental management is not perceived as an independent field of action. The organization only deals with the most essential subjects.
- Strategy of short-term profit maximization: The management is concentrating exclusively on measures that have a relatively short payback period and a high return. Measures with low profitability are not considered.
- Strategy of long-term profit maximization: This strategy includes that you have a high knowledge of the energy price and technology development. The relevant measures (for example, heat exchangers or power stations) can have durations of several decades. Moreover, these measures can help to improve the image and increase the motivationof the employees.
- Realization of all financially attractive energy measures: This strategy has the goal to implement all measures that have a positive return on investment.
- Maximum strategy: For the climate protection one is willing to change even the object of the company.

STRATEGIES IN THE CORPORATE WORLD

Many companies are trying to promote its image and time protect the climate through a proactive and public energy strategy. General Motors (GM) strategy is based on continuous improvement. Furthermore they have six principles: e.g. restoring and preserving the environment, reducing waste and pollutants, educating the public about environmental conservation, collaboration for the development of environmental laws and regulations.

Nokia created its first climate strategy in 2006. The strategy tries to evaluate the energy consumption and greenhouse gas emissions of products and operations and sets reduction targets accordingly. Furthermore, their environmental efforts

is based on four key issues: substance management, energy efficiency, recycling, promoting environmental sustainability.

The energy strategy of Volkswagen (VW) is based on environmentally friendly products and a resource-efficient production according to the "Group Strategy 2018". Almost all locations of the Group are certified to the international standard ISO 14001 for environmental management systems.

When looking at the energy strategies of companies it is important to you have the topic greenwashing in mind. This is a form of propaganda in which green strategies are used to promote the opinion that an organization's aims are environmentally friendly.
Even many countries formulate energy strategies. The Swiss Federal Council decided in May 2011 to resign nuclear energy medium-dated. The nuclear power plants will be shut down at the end of life and will not be replaced. In Compensation they put the focus on energy efficiency, renewable energies, fossil energy sources and the development of water power.

The European Union has clear instructions for its members. The "20-20-20-targets" include, that the Member States have to reduce greenhouse gas emissions by 20% below 1990 levels, increase energy efficiency by 20% and achieve a 20% share of renewable energy in total energy consumption by 2020.

RENEWABLE ENERGY POLICY 2015 OF MAHARASHTRA

Maharashtra Government has finalized its final Renewable Energy Policy. The policy will be known as Maharashtra Renewable Energy Policy 2015. Regional committee will be established to monitor the overall progress of the policy and will be headed by the principal secretary of energy. The brief details of the guidelines and targets defined in the policy are given in the below-mentioned points:

The new policy announced, has set some ambitious targets for different Renewable Energy sources. The targets defined under the policy are listed in the table below:

Power Projects	Target
Wind Power Projects	5000 MW
Sugarcane waste/Agricultural remedial projects	1000 MW
Small Hydro	400 MW
Agricultural waste power generation project	300 MW
Industrial waste power generation project	200 MW
Solar power project	7500 MW

Wind Energy

A total of 5000 MW capacity of wind energy projects shall be commissioned, out of that initial 1500 MW will be used to fulfil RPO of distribution companies and the rest 3500 MW capacity of wind project can be utilized open access for interstate/ intrastate open access/captive consumption/REC etc.

1. Wind generators will be given permission for re-powering.
2. Land acquired for commissioning of the wind project will be deemed as Non-Agricultural land.

3. Concessions will be granted for these projects to get NOC from pollution control board.
4. Supervision charges for grid evacuation will be waived off.
5. Wind energy projects can register themselves as industrial unit.

Sugarcane / Agricultural co- generation projects

Target of 1000 MW has been set for power generation through sugar co-gen/agricultural co-gen projects. Distribution companies shall have first right to fulfil their RPO at fix rate decided by MERC.

1. Exemption from Supervision charges for grid evacuation.
2. Exemption from E-duty for captive power plants for 10 years from the date of commissioning
3. Exemption from sales tax on purchase of sugarcane for all projects having capacity more than 3MW (35 lacs units).
4. Promotional elements will be applicable on project which has got consent for infrastructure after the announcement of policy.
5. MahaGenco will give consent for basic infrastructure and evacuation facility to establish co-gen project

Small Hydro projects

A target of 400 MW is set up for small Hydro projects. All the small hydro projects will be obligated to sale power firstly to any distribution company within Maharashtra so that they can fulfil their RPO at rates prescribed by MERC, after this they can go on interstate /intrastate third party power sale through REC route.

1. Exemption from E-duty for captive power plants for 10 years from the date of commissioning
2. Promotional elements will be applicable on project which has got consent for infrastructure after the announcement of policy.
3. MahaGenco shall give subsidy of Rs.50000 per KW to maximum up to Rs. 1. Cr from green energy fund.

Agricultural manures based power generation projects

Target of 300 MW is set up for Agricultural manures based power generation projects. MSETCL/MSEDCL will help developers with grid evacuation of LV/HV/EHV projects and Grid.

1. Exemption from E-duty for captive power plants for 10 years from the date of commissioning.
2. Promotional elements will be applicable on project which has got consent for infrastructure after the announcement of policy.
3. All projects shall get capital subsidy up to 1 Cr from green energy fund.

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Solar Power

A total of 7500 MW of Solar energy projects shall be commissioned, out of that 2500 MW will be used to fulfil RPO through Public private partnership in association with MahaGenco. And rest 5000 MW will be developed by other developers.

1. A total 10 % of all PPP projects i.e. 250 MW will be established on canals, lakes and irrigation project. Minimum of project capacity will be 1MW.
2. Minimum of project capacity will be 1MW.
3. Development of Solar Park.

Incentives

1. Land acquired for solar projects will be granted deemed status of Non-agricultural land.
2. Solar projects having capacity up to 2 MW can be given land 4 hectors as per availability and 50 % discount shall be given on rental/ lease charges. All such transactions will be governed as per Maharashtra land acquisition act.
3. Government land if available requires for manufacturing of solar modules/panels/etc. shall also be given 50 % discount on lease/rental charges.
4. Concessions shall be granted for these projects to get NOC from pollution control board.
5. Solar project developers can sell electricity generated from solar projects to distribution companies /captive use/third-party sale/ REC.
6. Open Access shall be granted for interstate as well as intrastate projects as per MERC regulations
7. Exemption from Supervision charges for evacuation.
8. Projects can register themselves as industrial units.
9. Exemption from E-duty for captive power plants for 10 years from the date of commissioning.
10. Developers will be given the necessary support for development solar projects, but there will separate provisions for interstate power transfer.

CONCLUSION

Energy management and optimization is one of the prominent and key areas of research in the resource management. In this paper, an effective review and analysis on the energy optimization, harvesting, reuse and management is depicted and found that there is huge scope of research in assorted sectors.

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