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RESEARCH ARTICLE

USE OF SOLAR POWER IN TELECOM TOWER TO REDUCE ENVIRONMENTAL POLLUTION

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ABSTRACT

During the last decade, the considerable problem deriving from the growth of energetic consumption and from the environmental "emergency" due to the emission of greenhouse gases, push-people to find out new solution and new technologies for the production of primary energy fit for fulfilling the urging and growing energetic demand. The climate change is one of the most compelling global challenges of our time. There has been a considerable increase in the average temperature is attributed to the earth in past century. This rise in temperature is attributed to the earth in past century. This rise in temperature is attributed to the effect of global warming brought about accumulation of greenhouse gases (GHG) in the atmosphere. The reason for increase GHG, mainly Carbon dioxide (CO□), is because of the increased energy consumption, which results in emission of pollutants. As such growing telecommunication infrastructure requires increasing amount of electricity to power it and hence we opt our title of discussion as appropriate. This paper discusses how effective energy management system with the application of energy and environmental audit pave the way for Green telecom in terms of green telecom network, green telecom equipment maintenance, environmental friendly design of telecom building and shape telecom waste disposal. The discussion centered on use of solar energy in telecom towers and study carried out through case studies along with government directives to comply with requirement of strategic fit compliances for environmental protection

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INTRODUCTION

Indian telecom market is the second largest and fastest growing telecom sector in the world and is projected to overtake China. India currently has close to 900 million mobile subscribers, with ~8 million subscriber additions per month. It has been observed that teledensity is lower in rural areas than that in urban areas. Areas with low teledensity could offer potential for future growth but have limitations in terms of power & other infrastructure availability. There are ~650,000 telecom towers, 60% of which are in rural areas. It is estimated that total number of telecom towers would reach ~1,000,000 by FY17 primarily driven by increasing penetration in rural areas. With the recent spectrum reframing from 900 MHz to 1800MHz and upcoming 3G and 4G roll outs, the subscriber base is expected to grow from the current 951million to one billion during the coming year. This growth will require 1, 00,000 more towers to ensure network availability. The Indian telecom sector has seen an exponential growth in the past few years with teledensity increasing from ~10% in FY04 to ~74% in FY12.

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Operation of these telecom towers requires electrical energy, which accounts for a significant share of the operational cost of these towers besides our environment. Due to uncertainty of availability of grid electricity, and long power cuts (especially in rural areas), diesel generators are used to ensure continuous power supply. This is not an economical option as the government subsidy on diesel has been aggressively exploited by the telecom sector, given the absence of dual or differential pricing of the fuel by use. This also encourages inefficient consumption of diesel by the telecom sector. The sector annually consumes around 3 billion liters of diesel to power its network towers. This results in an annual loss of around INR 26 billion to the state by way of diesel subsidy. However it is evident from Indian Power scenario Power deficit in India is a continuing problem due to issues in generation (feedstock, land acquisition), transmission (lag in investments, ROW issues) and distribution (high losses and poor financial health of utilities).Combined effect of this is indiscriminant load shedding across India particularly in rural/ semi urban areas. Due to the precarious power scenario ~40% of the telecom towers face load shedding for more than 12 hours per day. All India Power availability at various cell sites Because of limited and uncertain grid power situation telecom tower companies are increasingly relying on diesel as primary fuel to keep them

up and running. Presently ~40% power requirements are met by grid power and 60% by diesel generators. Currently, the sector requires fourteen billion units of electricity annually to power its network infrastructure, in order to provide uninterrupted service to its consumers. The gap between the demands of customers connected to the grid and the available electricity supply reported by the Central Electricity Authority for 2009–2010 was almost 84 TWh, which is 10% of the total requirement. The peak demand deficit was more than 15 GW, corresponding to a shortage of 12.7%. As with other industrial, commercial, and residential consumers, this demand-supply gap poses a significant challenge for the continued operation of telecom towers, especially those located in rural and semi-urban areas. As Central Electricity Authority, Ministry of Power, Government of India reveals that electricity available over a day ranges from about 7 to 21 hours across the major telecom circles in India. As telecom networks expand into these markets they are increasingly troubled by the inadequacies of the power grids and risks of unexpected outages, sometimes of extended duration. Additionally, back-up power sources could be required to handle the entire load of BTS, including air conditioning and inevitable power losses. Typically, BTS sites are backed by a 15-25 kVA or 40 kVA diesel generators. Most sites are located in grid deficit areas that need diesel generators to run, for up to twenty hours per day. According to industry estimates, one third of the operational expense of BTS in India is the fuel cost to run the power back-up equipment. As a result, mobile towers in these areas heavily rely on Diesel Generator (DG) sets to power their network operations. Energy expenses constitute around one third of total OPEX costs for telecom towers. Given the power deficit, almost sixty per cent of the power requirement of telecom towers is met by diesel generated electricity.

It also has the disadvantage of increasing carbon emission, which has a negative impact on the environment. The diesel generators also emit 6.6 million metric tons of CO_2 annually. Although the share of telecommunications sector to the global carbon emissions is low, compared to other sectors like transportation and construction, but as increasing number of people will become connected by fixed and mobile telecommunications networks, the challenges related to providing electricity to these expanding networks will become greater. Therefore, with increasing energy consumption and rising cost of fossil fuels, it is important that we shift to energy efficient technologies and environment-friendly sources of energy to power the telecom sector. Increased carbon emissions, It is estimated that telecom towers alone consume ~2 billion liters of diesel per year. Diesel consumption from telecom towers accounts for ~5 million tons of CO_2 per year, which is 2% of total greenhouse gas emissions from India. This has started attracting the attention of the regulators. Telecom Regulatory Authority of India (TRAI) in a recent discussion document, proposed to power at least 50% of all rural towers and 20% of the urban towers by hybrid power (Renewable Energy Technologies (RET) + Grid power) by2015 & 75% of rural towers and 33% of urban towers by hybrid power by 2020. TRAI is also contemplating telecom service providers to aim at Carbon emission reduction targets for the mobile network at 5% by the year 2012-2013, 8% by the year 2014- 2015, 12% by the year 2016-2017 and 17% by the year 2018-2019.

The general goal of the paper is to study a set of solutions which may allow

- To obtain a rationalization of the consumptions of a BTS through the intervention of Energy Management System.
- To generate energy coming from renewable sources in the site where the BTS are located. That is adoption of Renewable energy technology (RET) – aiming to reduce the emission of polluting agent in the atmosphere.
- To implement intelligent monitoring systems for the energy consumptions and the relevant impacts on the environment.

It has been evaluated, from a technical and economical point of view, the feasibility of some solutions, including-

- Energetic auditing for a telecom tower in different operational contexts (urban and rural, semi urban and urban areas, different periods in the year, different working load, etc.);
- Interventions of efficiency and energy saving such as reduction of transmission apparatus consumptions, optimization of air conditioning consumptions, efficiency in the temperature control system;
- Evaluation and development of interventions and technical solutions based on the production of a part of the energy used by apparatus in telecom towers through the use of photovoltaic cells on the infrastructures themselves;
- Analyses of case study for possible uses of other renewable sources (for example, wind micro turbines) generating energy usable for telecommunication power systems located in areas not reached by the electricity network;
- Analyses of the social and environmental advantages in the introduction of technologies based on renewable sources for covering a part of the energy requirements of telecom tower installations;
- Simulation studies useful to estimate the amount of energy that can be saved using a software system that helps to use the BTS-GSM transmission power in a more efficient way according to the telecommunication traffic features.
- Environmental monitoring of the sites where prototypal solutions has been installed, aimed to compare the conditions before and after the intervention.

MATERIAL AND METHODS

Adoption of Telecom Energy Management System with the application of Renewable Energy Technology.

Telecom Energy Management System Opportunities

A telecom Energy Management System is instituted using the basic management techniques of

Identifying: Opportunities for energy from RET and technology option for energy conservation by improving

energy efficiency of tower infrastructure and accordingly reduction in CO_2 emission. Two aspects assume critical important under the study

Managing energy

Costs can be saved by powering network operations through renewable sources, combined with optimal energy efficiency measures and standards.

Managing carbon

The sector continued reliance on diesel for its energy needs results in higher emissions, representing a serious liability in terms of carbon and climate change. The growth of the sector should not be at the cost of climate. The non-availability of reliable grid power, especially in rural and semi-rural areas, adds to the already high costs of operations as telecom towers need to be powered by diesel generators. Diesel generators have been the choice of telecom operators despite their high carbon footprint, primarily because diesel is heavily subsidized and therefore low cost. If these subsidies were to be removed, the prices of power generation for the telecom sector could jump by 30-40%. As such the growth of the telecom sector continues at the cost of the climate. Simultaneously, this growth has also come at significant and growing loss to the state exchequer, raising fundamental questions on its long-term robustness and profitability. Move to renewable energy would not only reduce carbon emissions but would also help reduce operating expenses. The telecom tower companies would benefit in multiple ways from renewable energy.

- Reduction in energy cost – 30% to 40% savings
- Reduction in carbon emissions
- Reduction in diesel logistics costs
- Regulatory Compliance

Going ahead, telecom growth is expected from rural areas which would mean greater dependence on diesel for power and hence higher energy cost. Higher dependence on liquid fuel along with intense competition would put pressure on margins for telecom tower companies going forward. Also in absence of 100% fuel pass through mechanism renewable energy appears to be a better option.

Technology Selection

A typical telecom tower has an energy requirement in the range of 3-5 kW. Various technology solutions are available for powering telecom towers, but success of each of the available technology depends on multiple factors like capital expenditure, operating cost, reliability etc. While there are complex technologies like fuel cells available, viability in Indian context becomes a question. In India, solar and wind have been widely used in various distributed generation applications and have been successful in the past. Solar & Wind energy are the most mature technologies amongst all the other sources of green power and could be looked as a long term power solution for telecom towers in India. Reduction in energy consumption by 20-30% by, following way- Initiatives Sharing of telecom towers, Energy Management, Alternative fuel and technologies.

Forecasting

Identifying benefits of RET. Technology Options –Solar PV / Wind Turbines, Benefits are --Diesel consumption can be reduced to bare minimum–Drastically reduce operational costs–Reduce emissions and noise pollution Dependence on grid can be completely eliminated Allow penetration of cellular networks in rural Maintenance required is reduced Attractive payback period–2 years for cell towers 24 hrs. Powered by DG Saves 40,000 tons/year of carbon emission caused by DG of 100,000 cell towers attractive government subsidy–Present Government Subsidy @ Rs 100 / watt

A detailed analysis could be undertaken by with an objective to optimize energy costs by addressing following levers

- Benchmark the energy consumption
- Identify energy efficiency measures
- Assess time of day (TOD) tariff implications

Planning: Using the forecast to plan how policy enablers wants to layout it, when and how much energy to use including under the envisage of ``power saving'' system for the reduction of the BTS electromagnetic pollution emission.GOI could look to provide incentives (in the form of tax Holidays/ accelerated depreciation etc.) to tower companies to adopt renewable energy thereby reducing diesel subsidy burden on the exchequer. To promote renewable energy application in telecom sector, tower companies could be allowed to trade Renewable Energy Certificates. This would prove as an added incentive for tower companies to adopt green sources of power. It is easy to understand that as per requirement of the traffic scenario use of a "power saving" system software can give a valid contribution to the reduction of the BTS emissions. In fact, switching off the transmitters when the traffic goes down, means to get a null emission of the electromagnetic fields and a reduction of the daily average value emitted by the radio base stations. If we consider that, following to the activation of the "power saving" algorithm there is a switch off of 70% of transmitters during nighttime (from 24 to 8), we can estimate a daily average reduction of the electromagnetic emissions of 15-20%.

Execution: Executing the plan – infrastructure of telecom are turning to `green' power management solutions, which can be broadly classified into three categories-- (a) Demand Management (reducing consumption); (b) Supply Management (increasing efficiency of the power source) and (c) Renewal Energy adoption. This will certainly way forward for minimizing dependency on diesel and thereby, carbon footprint reduction. Activities like passive infrastructure sharing, replacement of old base transceiver stations (BTS) with new generation BTS, usage of outdoor BTS, optimized cooling at shelter, usage of intelligent transceivers (TRXs), reduction of air conditioner load by using cold ambient air for shelter cooling and operating air conditioners using stored energy in the batteries to reduce diesel consumption and carbon emission are some of the initiatives that have been implemented so far. Technologies like 'Integrated Power Management Systems (IPMS)', variable speed DC diesel generators (DC-DG) and fuel catalysts are a few of the solutions that have been

implemented to increase power source efficiency. Technologies like solar photovoltaic, wind power, fuel cell and other renewable or clean energy sources have been deployed in about 4,021 telecom sites in India. Approximately 1,000 Indus towers sites use solar photovoltaic to augment the grid and diesel generated power. TERI will evaluate estimates and guidelines on implementation laid down by the Department of Telecommunications (DoT) to identify issues related to execution and will also provide guidance on technology adoption and rules of execution.

Feedback: Comparing the executed performance against the plan. To explain it we may discuss case studies for better understanding of the fact.

Case Study 1: Shreepati Nagar, West Bengal

Power availability- Grid power for ~8 hours, Diesel generators~16 hours Solution employed- Solar PV used; DG running hours reduced to 2.5 hrs/ day Reduction of 1000 / month of diesel and ~3000 kg/ month of CO2 Savings- Rs. 13.87 million per annum

Case Study 2- Shivarampura, Karnataka

Power availability- Grid power for ~14 hours, diesel generator ~10 hours Solution employed- Hybrid of solar and wind technology adopted; diesel generator hours reduced to 0 Reduction of ~600 litres/ month of diesel and ~1700 kg/ month of CO2 Grid power consumption brought down by ~35%. Savings- Rs. 7.66 million per annum

Correction: Identifying areas of laxity and alerting responsible telecom infrastructure companies to take corrective action.

Some of the measures that could be followed as corrective action for reducing the telecom sector footprint could be broadly classified as

- Better network planning
- Infrastructure Sharing
- Adoption of energy efficient equipment and innovative technologies
- Improvement in supply of Grid Power
- Use of Renewable sources of energy

Costing: Identifying the real cost of adoption of renewable energy in terms of CAPEX & OPEX relative to existing power sources. CAPEX is in higher side but OPEX always remains in lower side. Henceforth payback or break-even comes in a fix period of time.

RESULT AND DISCUSSION

- Tower equipment was left running unnecessarily.
- Tower equipments were unnecessarily having over-rated capacity.
- No electrical demand control.
- There is no clear provision of network saving control and hence most of time unable to work in power saving mode.
- There is a vast opportunity to design a Hybrid models for strategic fit.

Telecom Energy Management System Opportunities

Saving Opportunities of the Telecom Energy Management System is most commonly in the potential of avoided costs in the operation of telecom tower. Today with the use of Renewable Energy Technology (RET), There exist many opportunities to conserve 50% to 60% of the energy consumption and hence the carbon emission in the concerned area. Requisites to grab the opportunity and to pave the way for Green Telecom requires the following things-

- Performance Monitoring and evaluation and hence publicly disclose their carbon emissions and set progressive emission reduction targets.
- Commit to shifting the sourcing of their energy requirements significantly towards renewable sources.
- Make clear investment plans for the co-development of renewable energy based generating capacity sources along with development of new telecom infrastructure.
- Enable a low-carbon economy by playing a significant role in advocating strong climate and energy policy changes in favour of renewable energy sources and technologies at national and international levels.

Strategies

Which may be employed coincident to the installation (As per guideline of Government of India) of a TEMS to facilitate greater avoided costs and enhanced cost effectiveness with environmental friendly approach are easier to implement.
Worthy steps for consideration may include-

Tuning, Operation and Maintenance (TOM) Program to assure that losses are minimized.

Auditing System

Auditing system and processes and redesigning and resizing, where appropriate to avoid unnecessarily energy consumption.

Hybrid Model

Hybrid model may be inexpensively considered in applications, where generators are in place for emergency use, also in application where study indicates favourable potential.

Training and awareness Programmes

Training and awareness programmes should be planned for employees and management of telecom tower service providers.

Incentive Programmes

Incentive programmes for conservation ideas should be offered and accordingly shared with the employees.

Integrated system architecture

Since the technology is regulated through at least one source. That is rule laid down by Government of India agencies like MNRE, TRAI etc.

Telecom-a business opportunity and solution for climate change and beyond

Telecommunications can make a significant contribution to this daunting challenge. Wireless telecoms enable remote monitoring through machine-to- machine (M2M) 'smart services' using cellular connections. Increasingly, many industry sectors are integrating M2M smart services in monitoring and control systems. As many as a trillion networked devices could be in use by 2020**.** Of the wide range of possible opportunities for wireless telecoms to reduce carbon emissions and energy costs, some of the key areas where these exist include Dematerialization, smart-grid, smart logistics, smart-cities, Telemedicine, Tele education and Telebanking.

Key imperative for adoption

No carbon emission, environment friendly, significantly reduced manpower, Zero fuel cost tremendously reducing Opex, Insulation from tariff fluctuations, Assured supply with limited local dependencies, Government subsidies / Financing –Less Capexburden, Carbon Credits, Green Balance Sheets, CSR.

RESULT AND CONCLUSION

A good Energy Management System specification leads to a reasonable first cost, good payback, reliability, acceptance and expandability. For growth in rural India is likely to throw challenges with respect to sustainable and economic energy management for telecom tower companies. Given the current scenario, renewable energy appears to be a prudent solution for powering the telecom towers. For telecom operators, the benefits of a more proactive approach to carbon and energy-oriented management will be significant. Revenue generation opportunities are there to be capitalized by the first movers in an extremely competitive market space. Unfortunately, telecom companies are yet to integrate low energy and low carbon considerations across their operations and portfolio. This is a working towards making a world better. However discussion has made in this paper on the basis of TRAI Report-2012 and modeled accordingly existing programs and facilities already on-line.

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