Intelligent Energy

The True Cost of Providing Energy to Telecom Towers in India

Whitepaper

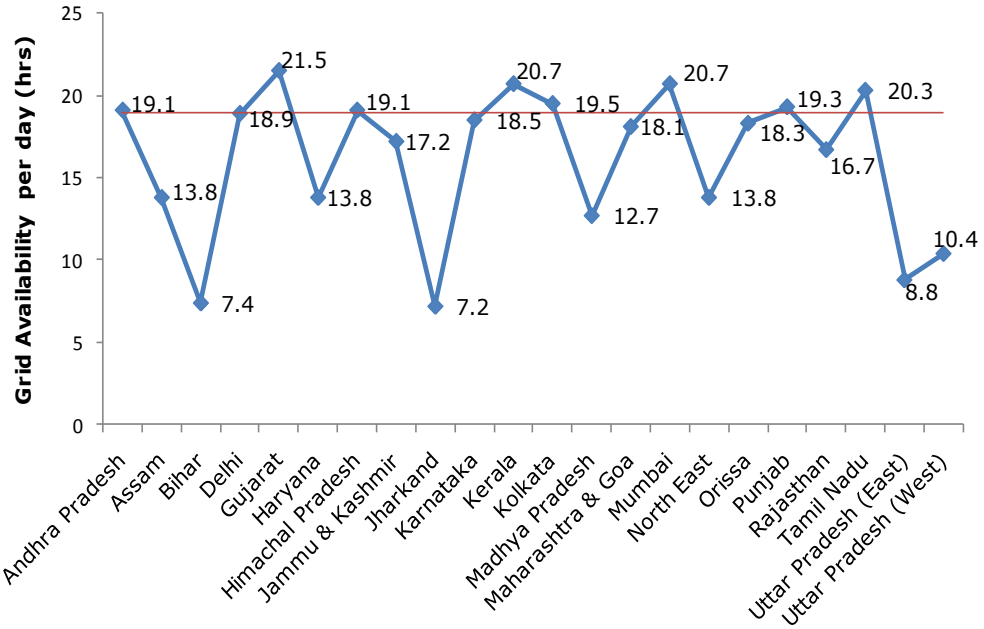
Contents

Introduction

Unreliable electrical grid supply is one of the biggest challenges faced by the rapidly growing telecom tower industry in India. Today, on average, 70 percent of the approximately 400,000 mobile towers in India face electrical grid outages in excess of 8 hours a day.

Telecom tower operators currently use diesel generators, batteries, and a variety of power management equipment to address the demand-supply gap. The resulting energy costs alone account for 25 percent of the total network operating costs[1], affecting the profitability of the operators.

Exhibit 1:
Average per day grid availability by region in India[2]



The telecom tower industry in India is estimated to consume over 2.5 billion litres of diesel annually making it the second largest consumer of diesel in the country. This business continuity service results in a revenue under-recovery[3] (revenue loss) of INR 14.64 per litre[4] of diesel to the public sector oil marketers totalling to approximately INR 3,660 Crore (USD 732 million approx) annually.

The 2.5 billion litres of diesel consumed, emit 6.6 million metric tons of CO_2 annually, making the current use of diesel generators both an environmentally and economically unattractive solution.

[1] http://www.ccaoi.in/UI/links/fwresearch/conceltation%20paper%203.pdf

[2] http://www.greenpeace.org/india/Global/india/docs/cool-it/reports/telecom-report-may-2011-web-optimized.pdf

[3] http://articles.economictimes.indiatimes.com/2011-11-07/news/30369629_1_diesel-margins-petrol-and-diesel-prices-oil-companies

[4] http://www.business-standard.com/elections/news/hpcl-to-reduce-petrol-rate-if-global-prices-go-down/136595/on

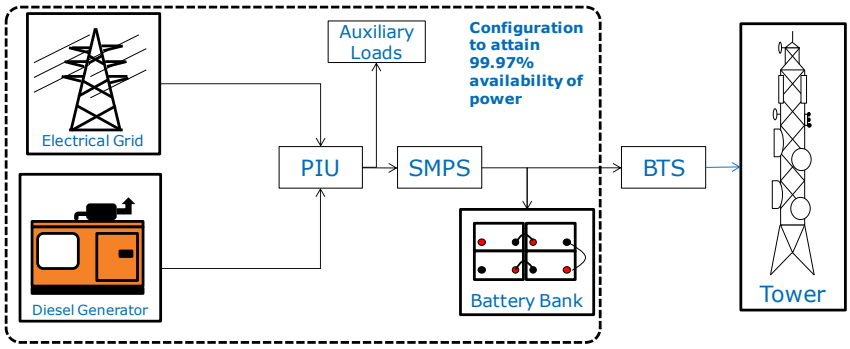
This white paper details true energy costs of a telecom tower site facing average power outage of 12 hrs a day. The above mentioned site is powered by a diesel generator and a pack of batteries, a configuration that currently exists in over 90% of the telecom tower sites.

A typical telecom tower site

At a typical cell tower, the power demand is determined by the number of base transceiver stations (BTS[5]) housed. The power demand ranges from 1 kW to 8.5 kW where more than 80% of these configurations have a demand less than 3.5 kW. To ensure power availability of more than 99.95%, tower owners backup the electrical grid with a combination of batteries and diesel generator.

At most sites, the tower owners install diesel generators of 10kVA to 15kVA capacity and supplement it with battery banks of 300Ahr to 900Ahr capacities. The diesel generator and battery configurations are decided based on the power outage pattern, equipment at site, geographical location and optimal CAPEX and OPEX economics.

Exhibit 2:
Schematic of power supply at the telecom tower



Telecom site operating conditions

When the power from the electrical grid is available, the Power Interface Unit (PIU) selects the best phase of the 3 phase electrical grid and provides power to the rectifier or switched mode power supply (SMPS). The SMPS converts the 220 VAC to -48 VDC (in some cases to 24 VDC) providing power to the telecom tower equipment and additionally, to charge the batteries.

When the power from the grid is interrupted, the PIU sends a signal to the diesel generator to turn on and the diesel generator comes on line in a few minutes. It supports the entire power requirement at the site. During the transition of supply from the electricity grid to the diesel generator, the batteries provide the power required by the telecommunication equipment at the tower and ensure uninterrupted

[5] http://en.wikipedia.org/wiki/Base_transceiver_station

operation of the telecom site. Tower owners may use various strategies on how the transition from electrical grid through batteries to DG works.

For example the tower companies may allow the batteries to discharge to a minimum state of charge before the diesel generator is turned on in order to minimize operation of the diesel generator. For the purposes of this white paper these cases have not been considered.

Case study: 3 BTS Site with 12 hours of electrical grid supply

The scenario in this case study is of a 3 BTS outdoor telecom tower site. The site includes a 10kVA diesel generator and a 48V, 600Ahr battery bank. The average electrical power demand of the site is 2.52 kW. On average, electrical grid power is available for 12 hours a day only. The information included in Exhibit 3 forms the basis for the calculation of energy costs. This information was derived from surveys of telecom tower sites and dealers of products used in providing power to the telecom tower sites.

Exhibit 3:
Case Scenario for a 3 BTS site with 12 hours of electrical grid supply

	Units	Value
Site Configuration		
Site type		Outdoor
Number of BTS		3
Average power demand from the site	*kW*	2.52
Electrical grid		
Unit cost of electricity	*INR/kWhr*	6
Diesel generator data		
Average DG run hour per day	*hrs/day*	8
Size of diesel generator	*kVA*	10
Landed cost of diesel generator	*INR*	2,00,000
Average diesel consumption for 2.52 kW	*lph*	1.8
Cost of diesel	*INR/L*	45
Delivery cost of diesel to site	*INR/L*	2
Battery bank data		
Battery bank capacity at 48 VDC	*Ahr*	600
Landed cost of battery bank	*INR*	1,44,000
Battery run hours	*hrs/day*	4
SMPS and PIU data		
Landed cost of PIU	*INR*	1,00,000
Landed cost of SMPS	*INR*	50,000

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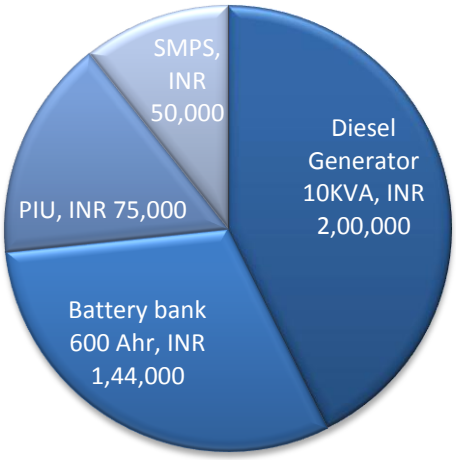
Cost calculations: CAPEX and OPEX calculations

CAPEX Calculations:

The purchase of a diesel generator, a battery bank, a PIU and SMPS constitute the CAPEX investments as detailed in Exhibit 4.

Exhibit 4:
CAPEX percentage contribution of DG, Battery, SMP & PIU



Total Capex = INR 4,69,000

OPEX Calculations:

OPEX costs are the monthly costs of running and maintaining the equipment that support the energy infrastructure at a telecom site. This mainly includes the cost of electricity from the grid, the cost of diesel to run the diesel generator in the absence of grid power and the maintenance of all power equipment installed.

The direct cost of energy per day is made up of the cost of grid power consumed and the cost of diesel consumed. The below table (Exhibit 5) totals the direct cost of energy per day.

The equipment installed to manage energy at the site requires regular maintenance. Telecom Tower companies invest man power to manage operations and maintenance activities. As the industry has matured, this activity is often outsourced to companies that provide specialized services in operating and maintaining either energy management equipment or both energy and telecom equipment. The below table lists the cost involved in the installation, commissioning and regular up-keep of energy management equipment.

Exhibit 5:
Direct cost of energy at the site per day

Direct Cost of Energy per day		
Cost of unit of grid energy	*INR/KWhr*	6
Grid energy consumed per day	*kWhr*	29
Cost of grid energy	*INR/day*	177
Diesel consumption per day	*lpd*	14
Total cost of diesel	*INR/day*	677
Total direct energy cost per day	***INR/day***	**854**

Exhibit 6:
Maintenance costs for diesel generator at site/day

Operation and Maintenance Costs		
Diesel generator maintenance costs		
Preventive maintenance costs	*INR/visit*	750
Frequency of visit	*hrs/visit*	300
Effective cost of preventive maintenance	*INR/hr*	3
Minor overhaul cost	*INR*	30,000
Frequency of minor overhaul	*hrs*	5,000
Cost of generator rental during overhaul	*INR*	1,648
Major overhaul cost	*INR*	50,000
Frequency of major overhaul	*hrs*	10,000
Cost of generator rental during overhaul	*INR*	3,944
Total cost of overhaul during life of gen	*INR*	85,592
Effective cost of overhauls for generator	*INR/hr*	5.35
Other costs for unscheduled maintenance	*INR/year*	16,000
Average diesel generator maintenance costs/day	***INR/day***	**107**
Battery, PIU and SMPS maintenance costs		
Preventive maintenances costs	*INR/visit*	750
Frequency of visit	*days/visit*	91
Other costs for unscheduled maintenance	*INR/year*	21,520
Average maintenance costs of battery etc	*INR/day*	**67.20**
Total cost of maintenance for power eqpt/day	***INR/day***	**174**

Based on the Exhibit 5 and 6, the total cost for operation and maintenance of the site per day is INR 1,028.

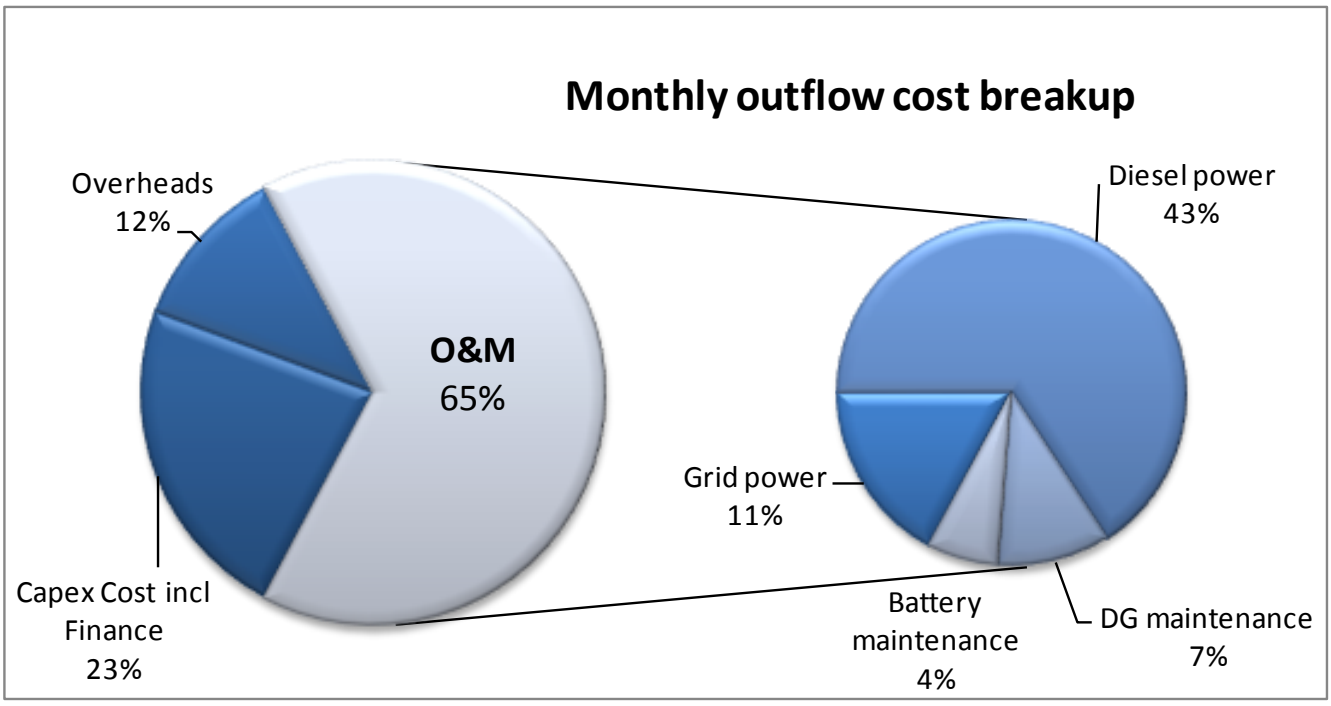
Hence on a monthly basis, the total cost of providing energy to the telecom tower site constitutes:

a) *OPEX*: Energy operations and maintenance costs per month sums up to INR 31,254.

b) *CAPEX and overheads:* Financing costs based on an interest rate of 14% for the life of the energy equipments i.e DG, battery, PIU, SMPS and overheads totals to INR 16,440/month

Hence the true cost of providing energy to the telecom tower site on a monthly basis is INR 47,694.

Exhibit 7:
Energy cost breakup



Plausible additions

In addition to the calculations above, the total monthly cash outflow is influenced by one or more of the scenarios listed below.

Fuel Losses: Fuel losses including diesel pilferage[6] are estimated to be 15 to 20 percent of the total diesel consumed. This addition raises the monthly cost of energy from INR 47,694 to INR 57,233.

Deregulation: The under-recovery of revenues for diesel is approximately INR 14.64 per litre[3] as of April 2012. If the deregulation of diesel is to be considered, the true cost of providing energy to the telecom tower site will be INR 54,106 instead of the current INR 47,694.

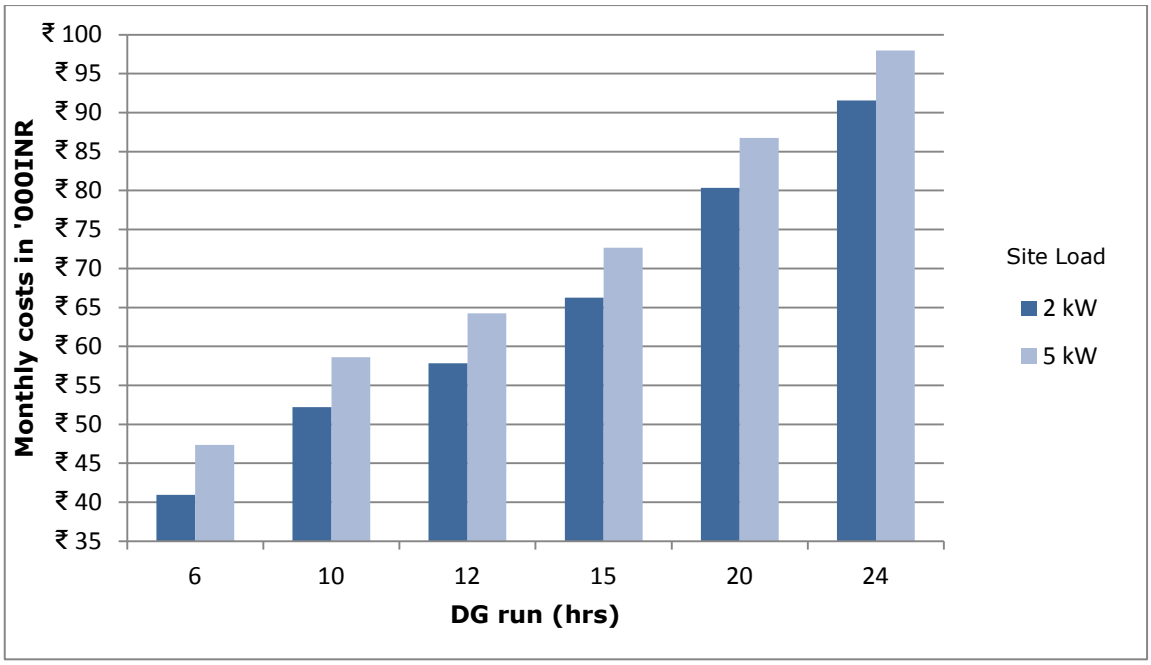
6 http://www.myiris.com/newsCentre/storyShow.php?fileR=20120404160043200&dir=2012/04/04&secID=fromnewsroom

Carbon Credits: The current carbon credit market values one carbon credit (one metric ton of CO2) to be between USD 12 and USD 27 in 2013[7] which equates to a potential of USD 72 million to USD 162 million. Currently with very limited exposure to green technologies, the telecom market is not benefitting from carbon credits.

Energy costs at various sites

Using the same calculation method as in the case scenario above, Exhibit 8 plots the cost of energy per month as a function of site power requirement and the number of hours of DG set is run. Running DG for 24 hours each day for a 7 kW load site might cost upwards of INR 102,252 per month. However, in reality the battery bank at the off-grid site may be adequate enough to support the load for a certain portion of the day thus reducing the overall cost of energy at a particular site.

Exhibit 8:
Monthly cash outflow at telecom site for variable loads



The effects of diesel price increase

To tackle subsidy burden and large deficits, the Finance Minister of India has pegged the fuel subsidy burden[8] for 2012-13 at INR 43,580 Crore, compared to INR 68,481 Crore in the revised estimates for this financial year. This is a definite indication for increase in diesel prices.

[7] http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.1819389

[8] http://www.business-standard.com/india/news/petrol-price-increase-likely-in-april-decisiondiesel-soon/468142/

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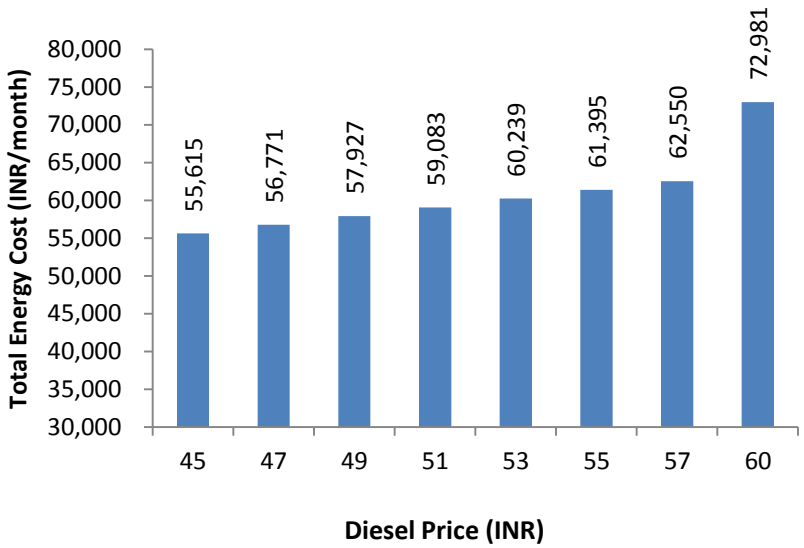
Increase in diesel (either due to deregulation or increase in oil prices) will increase the monthly outflow at 2.3 percent for every INR 2 increase in the diesel price. For example, if diesel were to be at INR 59.64, the monthly outflow for energy would be INR 72,981.

In the last 12 months diesel has risen by INR 4 and is at INR 45.99 per litre[9]. A fully deregulated price of diesel at the current oil prices will be significantly higher. It is just a matter of time that diesel prices will be deregulated in India.

Exhibit 9 shows the rise in cost of energy at a tower site for every INR 2 increase for a litre of diesel.

Exhibit 9:
Rise of current cost against rise in diesel prices



Conclusions

The total cost of energy to operate a telecom site is major cause of concern for Telecom Tower Infrastructure Providers. The rising operating costs, the logistical issues, the deregulation in price in the near future and the environmental cost of using diesel, all together are pushing the telecom industry to look for alternative solutions.

The government is encouraging renewable solutions to overcome the challenges faced by the economy and environment due to increased diesel usage. To come up with an optimal solution, it is essential to explore different alternative solutions.

[9] http://www.mypetrolprice.com/3/Diesel-price-in-Mumbai

White Paper feedback

Intelligent Energy welcomes feedback and further questions on the issues discussed in this white paper and are always happy to receive new perspectives. Please contact "marketing@intelligent-energy.com"

About Intelligent Energy

Intelligent Energy is a leading power technology company with a globally scalable business, operating in the stationary power, motive and consumer electronic sectors. With our proprietary fuel cell technology. Intelligent Energy is a global company located in the UK, and the US, with offices in Japan and India.