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Energy Efficiency in Green Telecom

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pwc

Business Unit

Energy Efficiency: Green Telecom
Perspectives

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Draft

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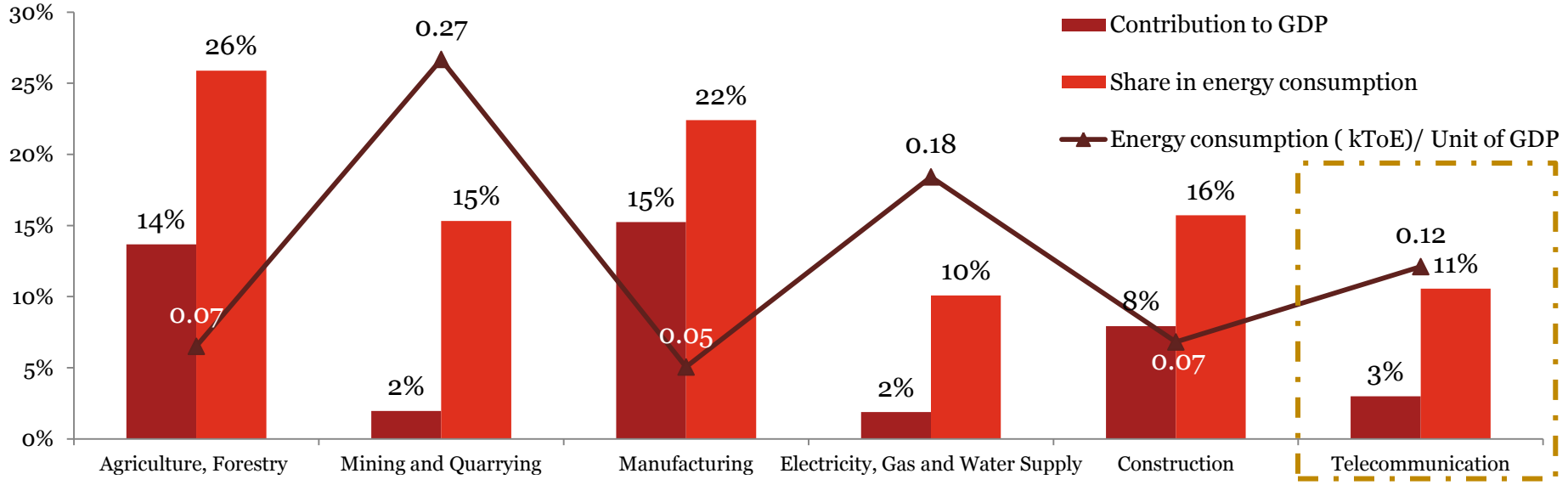
Agenda

Section 1
Energy Efficiency: Green Telecom

Telecom sector is amongst the better performing sectors on energy intensity and potential exists in comparison with global standards

- From 2007-2012, telecommunications services sector has grown rapidly (Source: TRAI consultation paper)with mobile subscriber base rose to around 905million at the end of Oct,2013. With this growth rate, Telecom now contributes more than 3% to the Indian GDP.
- In terms of energy consumption, telecom sector consumes 20,000 million tons of Oil equivalent for powering the sector. In terms of energy intensity (Energy consumption / unit of GDP added) telecom is amongst the better performing in the country
- Potential exists on comparison with global benchmarks where the energy intensity from telecom is close to 0.07-0.09. Hence, there may exist a potential to reduce energy intensity in the sector



Source: Energy Statistics, 2013 ; TRAI report on telecom spectrum , 2013

Drivers for energy efficiency in Telecommunications

Rising energy costs of network operation

Falling costs of energy efficient equipments

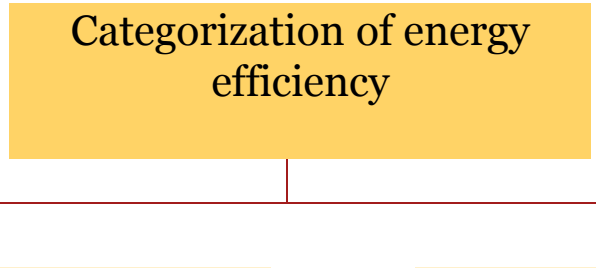
Non reliable grid supply

Need for expansion of network into lower electricity supply areas

Obligations of corporate social responsibility (CSR)

Sustainability initiatives awareness increase – Better visibility

Aspects of energy efficiency



Demand Side

- This pillar includes a wide range of actions and practices to reduce demand for electricity (or for hydrocarbons) and/or to attempt switching demand from peak to off-peak hours

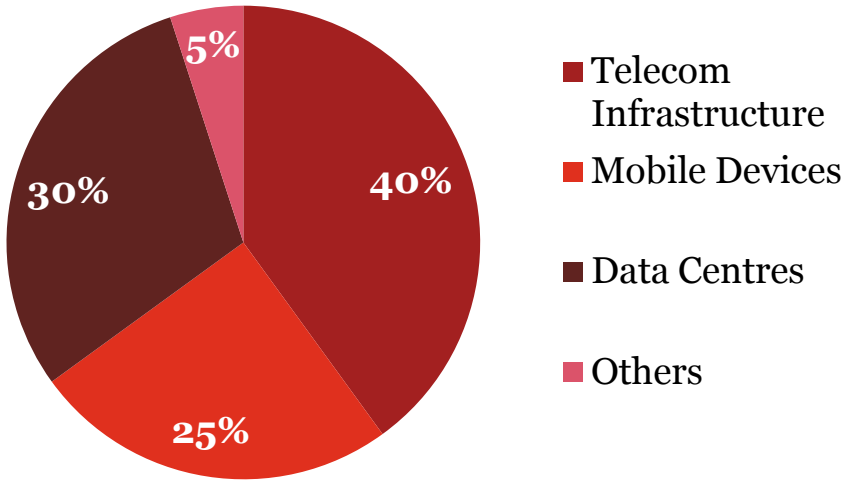
Supply Side-

- This pillar refers to a set of actions adopted to ensure efficiency through the electricity supply chain.
- Companies look at means to make rational use of their least efficient generating equipment.
- The objective is to improve the operation and maintenance of existing equipment or upgrade it with state-of-the-art energy-efficient technologies.
- In context of telecom, network optimization and operations management will play a key role in supply side energy efficiency management

Telecom Towers and Data Centres consume more than 70 % of energy consumption in telecom sector

- The total energy consumption of the ICT industry emanate mainly from three different sectors –Telecommunications and Data centers
- The Telecom sector comprises of telecom devices and telecom infrastructure. For a typical telecom tower the energy consumption is segregated in **active and passive energy consumption**.
- In data centers, the increase in the number of servers, cooling equipment and data storage are the reasons for increased energy consumption. The primary components of a data centre can be divided into 4 main areas–
  - **IT infrastructure**
  - **Cooling Systems**
  - **Power Systems**
  - **Auxiliary Services**

% Energy consumption (By element)* - FY 2012



Source: Industry analysis, Stakeholder Interactions, TRAI report on spectrum pricing, FY 2012

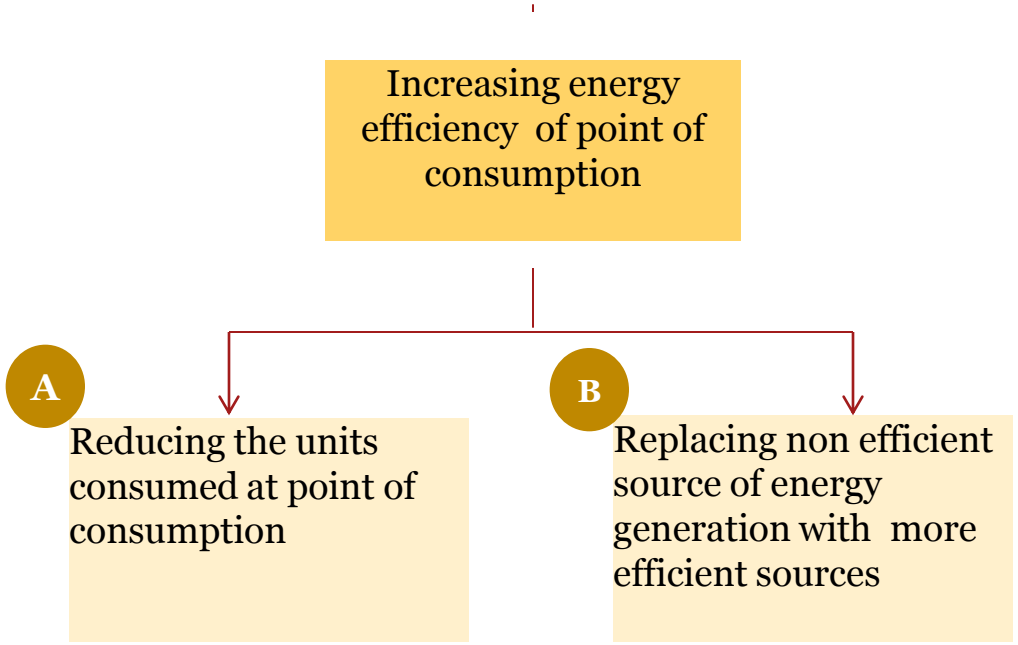
Cost based energy efficiency enhancement in telecom has two key levers – units and effectiveness of source of power

What do we mean by energy efficiency?

- Efficiency of the energy consumption can be looked at from varying angles - Parameter of overall energy consumption , energy intensity or energy cost.
- Telecom needs to relook at energy efficiency as a means of reducing operational expenditure for energy consumption.

What are key levers for energy efficiency enhancement?

- Reducing the units consumed on a per location basis - This would include introduction of better technology at the site or undertake configurationally changes.
- Efficiency associated with the power source being used for powering telecom equipment - Replacing lesser efficient sources like Diesel with cleaner Grid power / renewable sources of energy



A

Reducing the consumption at site via technological/ configuration changes a key metric to enhance energy efficiency in telecom space ...(1/2)

Lever -1 : Reducing units of consumption – Passive Infrastructure

Some key developments in **passive domain** relevant to the operational expenses reduction are detailed as below:

(a) Free air cooling units (FCUs) : The system module takes over the control of the existing comfort A/C units and adds economical direct free cooling to the energy-intensive compressor cooling function. Whenever the ambient temperature allows, FACU is activated and the comfort A/C units are switched off.

(b) HVAC systems along with hot aisle/cold aisle configuration and management of air flow in data centre can reduce the energy by 25%

(c) Tower remote monitoring solutions

Tower Remote Monitoring Solution can do remote monitoring & control of onsite equipments, and energy on a 24 x 7 basis. Business analytics on this data enables Tower Co and CTS to drive further excellence towards operational efficiency

(d) Integrated Power Management Systems(IPMS) :-IPMS is targeted for all sites having poor grid availability where low voltage and single phasing are pertinent problems.

(e) Variable Speed DC DG : Bharti Infratel pioneered and found that variable speed DC DGs whose fuel consumption for similar load applications in case of DC DGs is up to 30% lesser than AC DGs thus significantly saving on diesel consumption

(f) Configuration shift in site / Tropicalization of equipments:

Shifting from indoor to outdoor configuration in cell site reduces the energy consumption by more than 35-40% as the need for air conditioners goes away.

A

Reducing the consumption at site via technological/ configuration changes a key metric to enhance energy efficiency in telecom space ...(2/2)

Lever -1 : Reducing units of consumption – Active Infrastructure

Some key developments in **active domain** relevant to the operational expenses reduction are detailed as below:

(a) Distributed antenna systems

- DAS is a network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure.
- A single antenna radiating at high power is replaced by a group of low-power antennas to cover the same area. The idea works because less power is wasted in overcoming penetration and shadowing losses, and because a line-of-sight channel is present more frequently, leading to reduced fade depths and reduced delay spread.

(b) In-Building Cellular Enhancement Systems

- An in-building cellular enhancement system is a telecommunications solution which is used to extend and distribute the cellular signal of a given mobile network operators.

(c) Sleep mode BTS:

- Sleep mode BTS can turn power Off when the call traffic is low. This capability can be simply added to the site with minor software modifications in BTS technology.
- This technology has the potential to reduce power consumption by more than 40% under low traffic conditions and more than 10-15% on an overall level.

B

Replacing lesser efficient fuel sources like Diesel with more efficient sources like Grid supply can lead to enhanced energy efficiency

Lever -2 Replacing diesel with efficient sources of power

1. Replacement with grid power

- A battery is device that stores energy to serve as back up in 24X 7 points of consumption like DCs/sites.

- Typical VRLA battery with battery life of 3 years provides backup for 3-4 hours to the telecom site at 50% DoD. Newer batteries like Li-ion batteries provide for more than 8-10 hours of backup. These batteries provide a viable option to increase efficiency of telecom

2. Replacement with renewable power –

- Replacement of diesel with renewable sources also provides a way for increasing energy efficiency.

- Although this route requires higher capital investment , but the diesel is being replaced by carbon free renewable source.

Regulatory push for Green energy by TRAI

Government has approved Telecom Regulatory Authority of India (TRAI) recommendations on Green Energy for telecom towers:

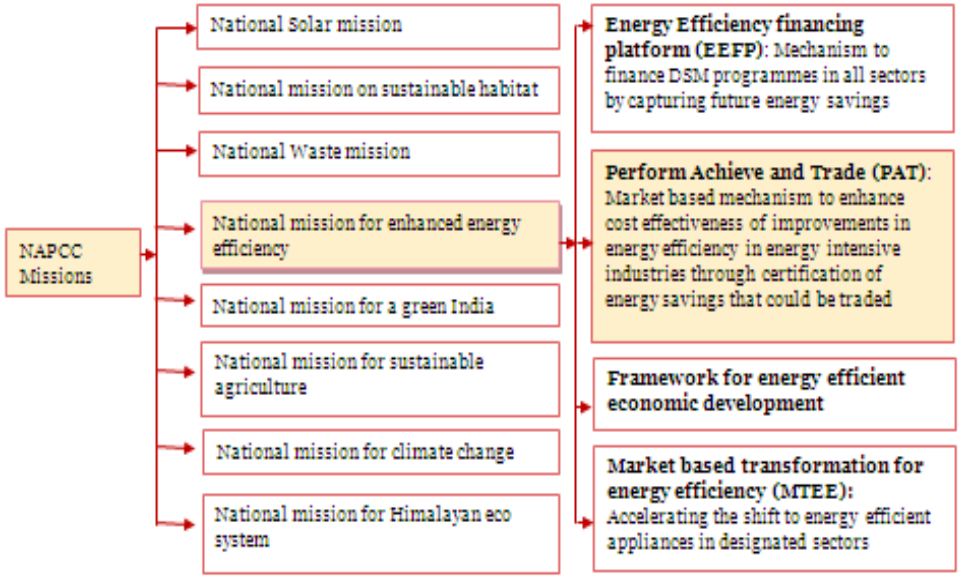
"At least 50% of all rural towers and 20% of the urban towers are to be powered by hybrid power (Renewable Energy Technologies (RET) + Grid Power) by 2015, while 75% of rural towers and 33% of urban towers are to powered by hybrid power by 2020."

For rationalizing carbon footprints from telecom towers, TRAI has come out with carbon neutrality targets for telecom towers:

"Service providers should aim at Carbon emission reduction targets for the mobile network at 8% by the year 2012-2013, 12% by the year 2014-2015, 17% by the year 2016-2017 ,25% by the year 2018-2019 and 50% by the year 2020.

Incentivization of energy efficiency in telecom space via regulatory route

NAPCC Missions – Promotion of Energy Efficiency: In response to the growing challenge of climate change, the Government of India (GOI) released the National Action Plan on Climate Change (NAPCC). The NAPCC enunciates eight key National Missions.. Other than tradable energy efficiency certificates(" Green Passports"), currently no incentive under NAPCC missions exist for energy efficiency in telecom space.



CASE STUDY:

National Energy Conservation Awards – Bureau of Energy Efficiency undertakes an annual awards where energy intensive sectors are awarded on basis of energy efficient practices in the year.

A total of 40 different sectors including industries like Fertilizers, Steel rolling, automobile, consumer goods, refinery, sugar mills, glass, tyre, soap etc are awarded on energy efficiency. This provides an incentive for players to under efficiency measures.

Telecom sector does not have a category for these awards. Considering its size and efforts of industry , inclusion of telecom as a category energy efficiency in telecom space for telecom operators and infra providers should be considered

Section 2
Way ahead

Key discussion points

1. Telecom sector is amongst the better performing sectors on energy intensity and some potential exists on comparison with global standards

2. Telecom Towers and Data Centres consume more than 70 % of energy consumption in telecom sector

3. Cost based energy efficiency enhancement in telecom has two key levers – units and effectiveness of source of power

4. Reducing the energy consumption at site via technological/configuration changes a key metric to enhance energy efficiency in telecom space

5. Replacing lesser efficient fuel sources like Diesel with more efficient sources like Grid supply can lead to enhanced energy efficiency for telecom sector

6. No major incentive for telecom sector to undertake energy efficiency measure exist . Going forward incentives like Green Passport, ESCO company funding etc may be able to support promotion of energy efficiency in telecom.

7. In case energy efficiency initiatives are expanded to include both demand as well as supply side management , the potential can increase manifold.

8. IT may also play a major role to play in increasing the potential of energy efficiency in telecommunications

Adding value...

Appendix 1
Success Stories on use of technology for reducing energy consumption in telecom

Success stories on use of technology to reduce energy consumption at site ...(1/3)

Location : The telecom tower was located in Shreepati Nagar located 180 km from Kolkata

No. Of BTS – 3. Cellular Operators being Vodafone, Reliance and BSNL.

Energy Consumption - 50 units a day

Energy Efficiency measure followed:

Process followed : Factors considered included - optimal load sizing, reduction in power losses, accurate data on BTS load pattern & potential renewable energy sources.

Solution used : SPV array of 10 KWp has been designed with common storage battery of 2500 AH VRLA Gel type (taking into consideration one day autonomy), common SMPS and DC distribution panel.

Metric	DG Set	SPV with DG Set	Savings
Hours of DG run/day	16	2	14 hours a day
Fuel Consumption	1320 litres/ month	165 litres/month	1065 litres/month
Carbon Emission	3537 kg/month	442 kg/month	3095 kg/month

Location : Shivampura, District Tumkur, located in the state of Karnataka

No. Of BTS – 3. Cellular Operators being Vodafone, Airtel and BSNL.

Energy Consumption - 74 units a day

Energy Efficiency measure followed:

Process followed : Factors considered included - optimal load sizing, reduction in power losses, data on BTS load pattern & renewable energy sources in rural area.

Solution used : A **solar-wind hybrid** solution was used with an SPV array of 10 KWp and a 5 KW wind turbine generator.

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Metric	DG Set	SPV with DG Set	Savings
Units of DG run/month	1022 units	448 units/month	574 units/month
Fuel Consumption	865litres/ month	231 litres/month	634 litres/month
Carbon Emission	2318 kg/month	619 kg/month	1699 kg/month

* *Source* : Pratap Kumar Panigrahi, *"Green Energy : A Perspective for Indian Rural Telecom"* Journal of Green Engineering, Vol.2 103-114

Success stories on use of technology to reduce energy consumption at site…(2/3)

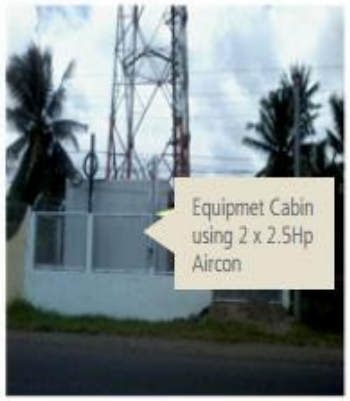
Before Transformation

Legacy BTS equipment and rectifier system

End of Useful Life Genset, Change-over Switch and Fuel Tank with no remote monitoring capability

Indoor to Outdoor transformation:

Before Transformation



Site located beyond 3KM from shoreline. No corrosion issue due to air salinity. Can be converted to outdoor setup being "a last mile site"

End of Useful Life Genset, Change Over Switch and fuel tank with no remote monitoring capability

Indoor to Outdoor transformation:

Location : Nigeria

Operator: Orange

Source: GSMA Analysis, Jan 2013

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After Transformation

From legacy outdoor BTS equipment and rectifier system to new outdoor set-up using IP 55 cabinets, high efficiency rectifier system with 5 hour battery back up time

New Genset, Change-over Switch and Fuel Tank with intelligent remote monitoring system

Transformations for savings

a) Indoor to Outdoor
b) Remote monitoring systems
c) High efficiency rectifier systems

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Success stories on use of technology to reduce energy consumption at site…(3/3)

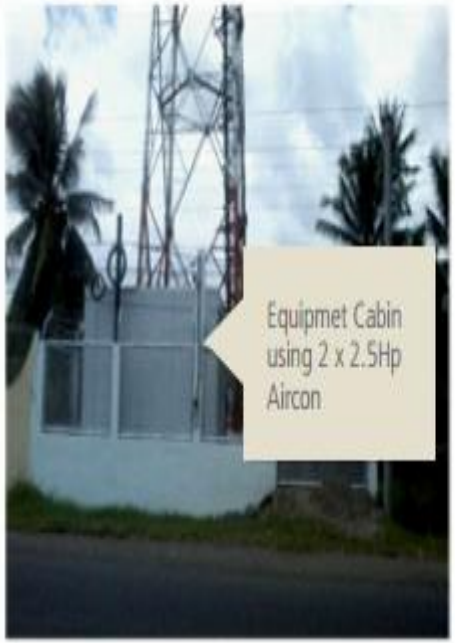
Location: Mali

Operator : Aircon

Transformation: FCU installations, configuration change, remote monitoring

Indoor to Outdoor transformation:

Before Transformation



Site located beyond 3KM from shoreline. No corrosion issue due to air salinity. Can be converted to outdoor setup being "a last mile site"

End of Useful Life Genset, Change Over Switch and fuel tank with no remote monitoring capability

After Transformation

Using existing shelter, new high efficiency rectifiers with 8 hour battery back up time. Aircon run time to be reduced by using free cooling low wattage fans and battery coolers to support battery

New Genset, Change-over Switch and Fuel Tank with intelligent remote monitoring system

Appendix 2
Domestic experience of telecom sector in energy efficiency

Industry Experience ...(1/3)

Telecom Infra operator	Initiatives (From primary research)
Large Telecom Infra provider in NE States	1. **Alternate energy sources like solar etc.** –Deployment on more than 650 sites, which has saved 6.9 Mn litres of diesel and around Rs. 280 Mn for the company. 2. **Energy efficiency measures like Integrated Power Management System (IPMS) and variable speed DC generators (DCDG)** – This has reduced diesel consumption by 1.2 Mn litres and already saved Rs. 47 Mn across almost 900 sites where this has been implemented 3. **Demand side** management like Free Cooling Units (FCU) instead of air conditioners etc. substantially reducing the electrical load requirement. This has already been implemented across 3400+ sites, saving consumption of 4.1 Mn litres of diesel
Large Telecom Operator	1. **Free Cooling Boxes (FCB)** – Company has successfully implemented this at 1500 sites. This equals a reduction in CO_2 footprint by 5.8 Mn $kgCO_2$ per annum. 2. **Solar Powered Sites** – Company has piloted this concept at 4 sites in 2010, and they seek to replicate this, where there's an absence of grid power, thereby saving 2.8 Mn $kgCO_2$ per annum. 3. **Hybrid Solutions** – Company has deployed hybrid solutions (diesel generator and battery working in alternate mode) at 2200 sites to effectively reduce diesel consumption by 26,28,548 litres or 7 Mn $kgCO_2$ in 2011.

Industry Experience ...(2/3)

Telecom Infra operator	Initiatives (From primary research)
Large independent telecom infra provider	1. **Solar energy initiatives** are currently being tested with few sites already under trial. 2. **CNG generators** are being explored in place of DG Sets that can reduce fuel opex to the extent of 14% 3. **Energy storage platform** are being explored from Deeya Energy with pilot project implemented on 10 sites. 4. **Fuel Cell** instead of conventional Diesel Generator Set in non-EB sites can potentially reduce fuel opex by 25%. 5. Free cooling units are being considered at existing sites which can save AC opex up to 25%
Large Telecom infra provider	1. **Green Sites-** In 12 months and across 15 telecom circles, company has created 20,000 green sites where Zero diesel is used 2. As of 31st March 2013, 20,000 sites, comprising 20% of compainies portfolio of towers, are green. 3. **15000 FCUs** have been installed so far. 4. **2500 sites have Smart Battery charging solutions** for faster charging, leading to energy savings.

Appendix 3
Global experience of telecom sector in energy efficiency

Global Experience …(1/3)

Country	Company	Measures Taken	Impact
China	China Mobile	Renewable Technology used for telecom towers 2135 base stations powered by alternative energy, 75% by solar energy	Use of low carbon telecommunication solutions saved China 48.5 million tons of direct carbon dioxide emissions and is expected to save 615 million metric tons of carbon by 2020
Switzerland	Swisscom	Optimisation of energy cooling in telecom towers using “Mistral Mobile” cooling systems	Reduction of up to 80% in energy for cooling equipment
Multiple Countries	Nokia	Nokia has launched a recycling initiative in many countries (including India) by placing recycling kiosks at public places. The Kiosks are used to collect old phones to be recycled and used.	It is estimated that over 10,000 phones were recycled internationally, resulting in over $1 million in savings

Global Experience ...(2/3)

Country	Company	Measures Taken	Impact
Morocco, Mexico, Ethiopia	Ericcson	Over 200 photovoltaic "Sunsites" (solar powered base stations) installed	Over 4.5 million tons of carbon avings per year
Indonesia	PT Telekomunikasi Selular (Telkomsel)	Latest generation low power consumption RBSs which are powered by Solar technology from Ericsson to provide macro coverage in Sumatra and rural areas of Indonesia.	Energy usage has dropped by 50% in areas where the solution has been deployed
United States	AT&T	As part of a commitment to going green, AT&T has invested about $43.6 million to take specific actions to improve efficiencies based on the results of comprehensive energy audits of the company's highest energy-consuming facilities.	The projects launched by AT&T had saved a total of $151 million by 2013 from a total of 14,300 energy reducing projects

Global Experience …(3/3)

Country	Company	Measures Taken	Impact
United States	Sprint	The Network Vision program by Sprint will reduce GHGs by replacing the older telecom infrastructure to newer infrastructure which requires less space and consumes less energy.	The company has reduced energy by 24% over the past 4 years as a part of this program
United Kingdom	BT	BT has pledged an 80% reduction of its 1996 carbon emission totals by 2016.	The company has been able to reduce its carbon emissions by 60% from levels in 1996. In the U.K., nearly all of BT's electricity now comes from renewable sources and combined heat and power plants.

Appendix 4
Some issues in carbon emission tracking in telecom space

Issues in carbon emission estimation methodology for telecom ...(1/2)

Carbon emission for telecom sector depends on two factors:

1. Power consumption of telecom equipment
2. Carbon emission factor associated with the power source being used for powering telecom equipment

Key issues in carbon emission estimation methodology for telecom sector in India are:

1. Right measurement of power consumption deployed in live network that varies significantly over the time cycle of 24 hours
   - Current Carbon emission estimates are done based on maximum power consumption of telecom equipment - Average dynamic power consumption of any telecom equipment is lower than static maximum power consumption. This overestimates the carbon footprint in the TRAI methodology
   - In this connection, ETSI has evolved a high level framework for developing the energy efficient measurement standards based on dynamic power systems in mobile networks.

Advantage of issue resolution for industry:

a. Carbon emission estimates are accurate and lesser than current estimates. This will improve Indian telecom benchmark of carbon emissions on a per subscriber basis in comparison of international standards

b. Further identification of various existing potential cases of sub optimal energy utilization

c. Identification of prevailed such cases of sub optimal energy efficiency will motivate Telecom Service provider's operation experts to align telecom equipment design experts to evolve necessary design refinements to eliminate the sub optimality. This will lead to significant potential carbon emission reduction and hence significant power saving i.e. the OPEX reduction.

Issues in carbon emission estimation methodology for telecom ...(2/2)

2. Applying the right matrix for carbon emission measurement
   - Carbon emission (CE) formulae from- TRAI is as below:-

   CE = P * CFg*Tg + DG Capacity * CFd*Td

   Where,
   Tx = Time duration from " X" power source
   CFx = Carbon emission factor for " X" power source
   P= Grid/RET power source

   Key industry concerns are as below:

   a) Common methodology is detailed for assessment of carbon emissions from RET enabled sites – Perfect Green Sites
   b) No provision has been provided for sites running on batteries and charged by non green power. This would reduce the carbon footprint for the site.
   c) DG capacity taken instead of site load is for estimation of carbon footprint in conditions of non availability of grid supply.
   d) Full DG capacity is taken as standard and assumed to be just above the site load. In practical conditions it can be more than 4 times that of the site load.

Net Impact on Telecom Industry from carbon emission:

1. Accumulated effect of both factors has lead to TRAI calculations of 21 kg of carbon emissions per subscriber in India against the international figure of 8 kg/ per subscriber.

2. Up-till now government regulations have been aimed at reducing diesel consumption via replacement by RET solutions.

3. But this requires huge investments on part of telecom operators which increases non core energy costs.

4. In all these regulations however energy efficiency enhancement measures have been promoted for reduction in carbon emissions by telecom sector.

Way ahead

1. **Review TRAI calculations of carbon emission estimation**

2. **Incentivize energy efficiency measures in telecom industry for carbon emission reduction**