I. INTRODUCTION

1.1 Information and Communication Technology (ICT) sector worldwide is responsible for around 2% of the global Green House Gas (GHG) emissions and for around 0.7% of global CO_2 emissions. India's share in this emission is just 0.38% of the total global carbon footprint. But this does not mean that India ICT should not further work on limiting this carbon footprint. We have already seen a jump of almost 70% in the carbon emissions over the past two-three years in India. India currently has close to 900 million mobile subscribers with ~8million subscriber additions per month. It is estimated that to support this growth of mobile subscribers and to achieve a disruption free network, number of towers would be increased from the present ~4,50,00 to ~1,000,000, which essentially means an increased carbon footprint.

1.2 But, before we embark on to answer the specific questions around the methodology for measuring carbon footprint and the way ahead for the ICT sector, which are the primary questions in this Consultation Paper (CP), it is important to understand that we discuss some basic issues behind the carbon footprint of the ICT industry. As mentioned in the CP, components that contribute majorly to the carbon emission footprint include Scope 1 emissions from telecom network which primarily constitutes tower industry where considerable fossil fuel is burnt. In the FY12, telecom towers accounted for ~INR 4300 cr of the total diesel subsidy provided by Indian government. Presently, only ~40% of the power requirement of tower companies are met by grid power while 60% are met by diesel generators due to limited and uncertain grid power situation in the country.

1.3 Energy costs to sustain these towers are ~30-34% of the total operational expenditure for a telecom tower company which primarily includes the cost of power through DG sets which is around Rs 12-14 per unit unlike the grid power cost of Rs 6-8 per unit. Further, diesel pilferage losses of ~20% have been observed in the industry which further increase the overall cost of generation of electricity to a whopping Rs 22-26 per unit.

1.4 Resultantly, telecom tower alone consume ~2 billion liters of diesel per year which releases around 5 million tons of Co_2 per year, which constitutes a majority (~60%) of the GHG emissions from the telecom industry when compared with the data available for October 15- March 16 for Telecom Service Providers (TSPs). **As the government is unable to provide a regular flow of electricity to the tower industry, it becomes a compulsion for the telecom service providers to use DG sets for running of the towers**. We need to understand that the **onus of providing electricity, which is a public service utility, relies on the government and it is the result of failure of delivery of this responsibility, that we are seeing high level of carbon emissions in the telecom industry**.

1.5 According to a recent report of Central Electricity Authority in May 2016, the country is expected to become power surplus in 2016-17. Despite the tall promises of surplus electricity, there is no availability of 24 x 7 power, either due to issues with transmission infrastructure or due to the lack of power in the area. Take, for instance, Odisha, Mizoram and Tripura, which are expected to be power surplus in 2016-17 going by CEA data. But as of May 2016, the percentage of un-electrified rural households varied 22 and 52 per cent, with Odisha at the top end. Further, the true picture is captured by India's per capita electricity consumption: at 957 kWh (kilowatt hour) in 2013-14, it was less than one-third the world average of 3,104 kWh in 2013. It, basically, means that there despite government's claims of having surplus power, power availability across country is uncertain. **We need to remember that the role of TSPs is to establish communication network and not power generation**. **It is because of lack of governments' efforts in ensuring power availability that the TSPs now even have to arrange their own power for their systems to function**.

1.6 Though TRAI in an earlier discussion document proposed to power at least 50% of all rural towers and 20% of the urban towers by hybrid power by 2015, but it was not possible to achieve this target, due to high cost of installing renewable energy generation equipments, issues with the battery storage in the case of solar energy due to unreliability of the solar power, issues with the land related requirements for solar energy equipments installation and limited geographical feasibility for the generation of wind energy .

1.7 Even in the present consultation paper, TRAI has proposed the similar models of the Renewable energy. **In the case of solar energy, it mentions, "technology is best suited for rural areas, which offer a vast expanse of land for panel installation", without suggesting a remedial measure for availability of the land for the same**. The CP further accepts that wind energy installation will not be possible beyond certain geographical areas and there too, the models are not very effective to supply power on a continuous level. The idea of fuel cell further is not sustainable due to highly expensive nature of hydrogen as a fuel, along with unavailability of the fuel in India and issues related to its transportation to far flung areas of the country.

1.8 Thus, we suggest that while it can be a possible measure to encourage TSPs to generate their own energy by installing various renewable energy generation equipments, it is important that government take the responsibility to provide uninterrupted power to the telecom industry. **Providing electricity and transmitting it to the last corner of the country is the job of the government and TSPs should not be forced to worry about it or make provisions for the same.** GoI is already working on increasing the Renewable energy share in the total energy generation basket. If government makes sure, through their Rural Electrification Programme, that the power infrastructure related to rural India is up

to date and there is a quicker disposal of complaints with regards to the power related infrastructure issues in the country, this problem of the high GHG due to the usage of DG sets will eliminate itself. **Thus, this issue is primarily related to the problems that power sector in the country faces than it being telecom sector centric problem**.

1.9 Though TRAI briefly touched upon Life Cycle Assessment (LCA) of a device, **but no further points were raised with regards to the issue of E-Waste related to ICT industry in general**. Unofficial statistics reveal that India generates e-waste at an average of 17 lakh tonne a year and it is rising at a rate of 5% per year with 95% of the total e waste being directed to the informal sector. Though E-Waste management rules have established the responsibility of manufacturer for the disposal but it is particularly aimed at mobile industry. Thus it is important that ICT industry in general is taken under the broad overview of E-Waste Management rules which include the usage of electronic equipments used in the office, on the site and by the staff**. As a beginning, Green Technology managers, who have the knowledge of environmental engineering can be recommended to be appointed by each firm in the ICT industry,** who would be responsible to oversee the green efforts of the company and help in minimizing direct and indirect GHG emissions of their respective firms.

1.10 Further, **TRAI has not delved enough on the issue of pollution related to cloud computing and data centers**. A 2012 McKinsey & Company report found that the average data center uses just 6 to 12 percent of its electricity for actual computation. The rest, the *Time s*reports, "was essentially used to keep servers idling and ready in case of a surge in activity that could slow or crash their operations." In short, online companies keep their facilities running "at maximum capacity around the clock, whatever the demand," because they fear what could happen if their sites ever went down. We need to understand that ‘cloud is not some magical ether, but rather a network of big, power-hungry, polluting, and often wasteful physical data warehouses that store a lot of stuff we need but also tons of stuff we don't need”. As we are moving towards a society which is digitally connected with schemes like smart cities and Digital India, we need to devise some pro-active strategy for this issue related to the environmental consequences of cloud computing and data centers.

II. RESPONSES FOR CONSULTATION PAPER

2.1 What accuracy level may be set for collecting the data and also, what should be the basis for arriving at this threshold level? Please comment with justification.

2.2 Is there a need for auditing the carbon footprint of a telecom network by a third party auditor? If yes, what is the mechanism proposed? Please comment with justification

2.3 Do you agree with the approach for calculating the carbon footprint? If so, please comment with justification

(Combined Answers for 2.1, 2.2 and 2.3)

Scope 1 emissions which include emissions under the direct control of the organization should be included in the collection of the data, as every firm **ideally maintains the data related to the use of diesel/petrol primarily for the daily functioning of the firm**. Emission from the use of electricity is required to be reported in case the electricity is being generated through DG sets. In the case where electricity used is being supplied by the government, it would not be possible to evaluate the source of generations, thus firms should not be required to report for such electricity consumption. This diesel reporting should also include the usage of diesel in company authorized transportation.

Moreover, each firm is responsible for the GHG emissions from the equipments they are using along with the emissions as a result of their disposal, thus, it is important that **each firm report the type of technology and equipments utilized by the firm along with their carbon emission rating to calculate the potential emission of each firm.** We need to understand that even with the best possible sources to estimate carbon emissions; we will not be able to measure the exact rate of carbon emission from each source.

To the best possible extent, large stationary sources of CO_2 emissions should work to install continuous emissions monitoring. Other sources should keep a detailed inventory of fuel use by type and quality, as well as quantity. With this method, we would be able to create an auditable data at least from the sources with direct emissions. In the case of indirect emissions, we will still have to wait for more sophisticated technologies and rely on the reporting of the companies. Moreover, with majority of the direct emissions scope included in the auditable data, we would be able to have a data on major sources of emissions which can be then be fine-tuned to reduce the emissions.

For a period of next 5 years, it is advisable to not audit the data by an external agency and let companies develop their own strategies for green technology as it is an increasing demand of various stakeholders. Thus we may expect the pressure from investors and other stakeholders on ICT companies to develop their own best practices for efficiency. Government, in the meantime, should work on promoting green technology and bringing down its cost, to further encourage a green ICT system. Once there is a comfortable environment which facilitates green technology, TRAI can move on to strengthening the regulations and create an authority for the auditing of the reporting data.

2.4 Whether the existing formulae for calculation of Carbon footprints from Grid (given in paras 1.16, 1.17 and 1.18) need to be modified? If so, please comment with justification.

The existing formulas for the calculation of the carbon emissions do not take into the consideration the complex system of network infrastructure. Unlike the modified formulas proposed, it does not take into consideration the grid power emission as relevant to the telecom provider. Further, it does not take into account the carbon emission per unit of traffic which is a more accurate way to calculation as it involves metrics related to cloud computing and data pollution.

2.5 Is the formula mentioned in para 1.22 suitable for calculation of carbon footprints from grid supply? Please comment with justification.

2.6 Which emission factors as mentioned in Table 1.2 need to be used for the calculation? Is there any other factor need to be considered in the calculation? Please comment with justification

(Combined answer for 2.4 and 2.5)

Based on the calculation that of the total energy consumption of the telecom sector, almost 60% of the energy requirements are met by DG sets as mentioned in the introduction as well, **the actual consumption of telecom sector minus consumption by towers and data centers do not constitute a majority of the power consumption from the main grid**. In such situation, the calculation from DG set consumption should provide the majority of the carbon emissions calculation. For the rest, OM (Simple operating margin) is a more accurate source of calculation of the total energy consumption from the grid as it will take the average weighted consumption instead of BM (which takes into account recent energy addition) or CM (which is a combined mechanism of both OM and BM)

We agree with the formula to calculate Grid power emissions per telecom user as mentioned in the para1.22. Though we believe, in the likelihood of inclusion of carbon emission by DG sets, we would be able to record majority of the carbon emission, thus there would hardly be any requirement to include calculation from grid power. **Moreover, as grid power is ideally a public service utility, the carbon emission from it should not be counted towards individual consumption emissions**.

2.7 Which of the formula, (i) or (ii) as given in the para 1.23 is to be used for the calculation of carbon footprint from Diesel generators along with possible views on possible values of coefficient? Please comment with justification

Formula based on the capacity of generator used is more efficient as it includes capacity, efficiency and power factor of the DG sets while the first formula simply calculates the total diesel consumed in a DG set and its respective carbon emission in a year. As the various DG sets proposed in the CP are more efficient in nature, it is important that this factor is taken into consideration while calculating the total emission factor from the DG sets.

2.8 For calculation of average, carbon footprint, which of the options mentioned in para 1.23 can be used? Please comment with justification.

The modified formula for calculation of emissions per unit traffic **should include the total amount of traffic carried by the network in exabytes** as instead of using the number of unique users or total number of mobile subscribers in the network, as both the latter ones will not be accurate measure of emissions because unique users can have multiple accounts and there could be a huge variation between one subscriber to another; **but traffic per unit will take into consideration the overall data which is a more accurate measure to include pollution from cloud and data as well**.

2.9 What are the options available for renewable energy solutions which may be harnessed to their maximum potential to power the telecom sector? Please comment with justification.

In the likelihood that government starts providing a regular electricity supply in rural areas, the issue of pollution related to DG sets would not arise in the first place. But until that is a possibility, various methods could be applied to reduce GHG. Sleep mode based Transceiver Stations is a viable method as it does not require huge investments and power consumption can be considerably reduced with the addition of a simple software modification. For the renewable energy utility, solar power is the most feasible option unlike wind, or fuel cells. With the reduced prices of photovoltaic cells, and availability of an appropriately sized battery bank, the issue of interrupted power from solar mode has been resolved. But, one important factor that is important to consider here is the issue related to land to harness solar energy. **TRAI should recommend government to facilitate the land where ICT companies are ready to invest in solar technology so that issues related to land management can be resolved.**

Systems in rural areas where biofuels and biomass are utilized for the generation of energy are also stable modes of providing electricity. Thus, the hybrid model of solar energy with biofuels and efficient DGs can be utilized a favorable model for the availability of the electricity.

2.10 If electricity generated by a RET project (funded/maintained by TSP) is also used for community, should it be subtracted from overall carbon emission of a TSP? Please comment with justification.

2.11 If the RET project is funded/maintained by other agency, should that emission be counted? Please comment with justification

(Combined answers for 2.10 and 2.11)

It is important that industry is provided enough time and resources to adjust to these changes in their technologies. Thus it is advisable that wherever RET energy projects have been implemented by the TSPs and further being utilized to provide electricity to the community, the emissions from such projects should be subtracted from

the total emissions. Further, even if the RET project is funded by other agency, the emissions should be subtracted for the simple reason that TSPs chose to utilize electricity from a RET source. **This will allow the proliferation of a new segment of business in the country which will solely work on providing electricity to ICT sector with the usage of RET technology. TRAI should recommend the government to work on developing such entities which can invest in RET and then provide electricity to the ICT sector at a reasonable cost.** Various studies have shown that investment in renewable technologies allows break even in an average of 5-7 years. Thus government should allow such agencies to work in the sector which invest in RET technologies and TSPs who utilize energy from these agencies should be given sops in the form of tax benefits.

2.12 Please comment with justification on the approach suggested by DoT committee.

2.13 For effective implementation of RET/Energy efficient solutions in telecom sector, how can the industry be supported? Should incentives be provided to licensees (TSPs)? If yes, what should be the milestone? Please comment with justification.

2.14 What methodology can be proposed for setting new energy targets in telecom sector? What should be the timeframe for achieving these targets? Please comment with justification

(Combined answer for 2.12, 2.13 and 2.14)

DoT's approach to increase the use the renewable energy sources in the ICT is correct but we would need to align it with the business interests of the ICT sector. Suggestions related to conversion of backup power grid to energy efficient solutions, using RET for powering BTS installations and conversion of more than 5 years DG sets to RET are important guidelines that should be followed to reduce the GHG emissions from the use of diesel. Active sharing of network infrastructure is recommended for the optimal resource utilization.

Recommendation related to the creation of a monitoring and management system to be devised by industry is important as it will allow ICT industry to develop the method at their own pace while following a broader goal to reduce emissions.

Further TRAI's suggestion of financial assistance to the industry for deployment of RET should be considered by the government as government assistance will give fiscal space to the industry. Further, **projects related to rural areas could be funded partially from USOF fund and partially from the support of National Clean Energy Fund**. But, this should be applicable to cases only where companies have shown interest in reducing their carbon emissions initially by employing certain organizational level standards for green technology.

Government can provide tax benefits to the companies which have reduced the emissions by more than 10-20% in a span of two years. This should be dealt on a case to case basis

and in this situation; the data provided by the companies should be audited (even before the earlier suggested limit of 5 years), so as to ensure that the data has not been manipulated to get tax benefits.

As a recommendation, each company can be **asked to hire green managers who will formulate firm specific energy targets,** and will have a say in business projects to increase energy efficiency. The industry should be given enough time to develop firm level energy efficiency strategies.

TRAI need to follow up on the earlier set targets of 2015 which has not been completed as yet and **this time, should try to accomplish it in a more realistic span set up in discussion with the industry**. For the new technologies to be deployed from here on, energy efficiency measures should be followed, while at the same time, targeting for the conversion of old system into more efficient systems should be the way forward. The emission data should continue to be reported by the industry on bi-annual basis and TRAI should monitor this data for abrupt increase in the emissions, in which case, companies should be allowed a chance to explain the cause for the same.

It is important that for a reasonable duration industry is not coerced but given a more liberal chance to change their technologies to the more efficient ones**. Also, if the government fulfills it duty to provide electricity to the last mile, the issue of ICT emission will resolve itself to a considerable extent**. Moreover, government needs to create an environment where energy efficiency should become the motto of businesses as it will pressure the various stakeholders in the industry to adopt more efficient technologies. It is only when such an environment is created that we can move for a stricter approach for the players who still have not adapted the green energy practices.

Conclusions/Suggestions

(TSP) is to provide transportation for carriage of data. The essentials required for delivering that task, especially prime power is that of the Government, its agencies or others who have acquired licenses to provide power. Therefore, prima facie the control or otherwise responsibility of GHG emission has to be tackled at a national level by the provider of power.

The onus or responsibility has been shifted to control GHG on the TSPs only because of the inadequacy of prime power or the non-availability of grid at some of the remote places. Whereas the GOI is harping on excess power i.e. production/supply exceeding demand, but what defies logic is the unavailability of prime power where it is needed as has been highlighted in the introduction as well. Clearly, it is the distribution system or the poor grid which is the major issue here.

In order to overcome this, steps must be taken to improve grid system to supply prime power, might be by getting funds from USOF.

Indeed, localized generation of renewable energy is an option by the installation of 10 to 50kw of solar, wind turbines farms etc, but any scattered options bring with them

attendant problems of additional operational and maintenance costs. Certainly, as an alternative, in very remote areas of the country such an option would find a place, but that should not become a standard solution allowing governments to abdicate their responsibilities.

Finally, a complete go by appears to have been given to Hydel Generation, whether they are mega projects or micro Hydel stations, thus invariably reducing the emissions from grid.

We believe that GHG has to be controlled at National level as a National subject and not that of Telecom. Any calculation of emissions by Telecomm caused by inadequacy of prime power is running away from reality, responsibility and restitution-ability of bigger issue of distribution of prime power.