Telecom Regulatory Authority of India

Recommendations

on

Approach towards Sustainable Telecommunications

23rd October, 2017

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INTRODUCTION

1.1 “Global warming” and “Climate Change” are now recognized as the key challenges facing humanity and are recognized as the prime concern across the globe. One of the main reasons for the climate change is the enhanced emissions of heat trapping or Green House Gases (GHGs) arising from the activities of humankind in an increasingly industrialized and globalizing world. These emissions are changing the composition of the atmosphere at an unprecedented rate.

1.2 A substantial portion of these GHG emissions have their origin in the combustion of fossil fuels. As the world's need for energy-based services increases, the impact is expected to become increasingly pronounced. Recognizing this fact, the United Nations has adopted “Take urgent action to combat climate change and its impacts” as its one of the Sustainable Development Goals (SDGs).

1.3 While contribution of the ICT (Information & Communication Technology) sector to the global carbon footprint is low compared to other sectors like transportation and construction, it nevertheless contributes a noteworthy share and increasingly so with growing reach of the telecommunications network. By 2020, ICT is expected to account for about 3% of global GHG emissions worldwide. Efforts are afoot, all over the world, to find measures to deal with this issue. The world’s increasing need for computation, data storage, and communication is driving the rapid growth in telecommunication and enhancing the emissions associated with such technologies.

1.4 Telecommunications have a vital role to play in environmental protection, and this is obviously something we should all welcome, since not one of us can afford to be indecisive or ignore the urgent need to protect our planet Earth from the threats hanging over it and hand it on to the future generations for whom we hold it in trust. With the level of development of the

modern telecommunication technologies, which are in the process of taking us from the industrial economy to the information economy, constitute extremely useful tools with which to take up this challenge.

1.5 In an endeavor to get stakeholders' views on greening the telecom sector, TRAI had issued a consultation paper on "Green Telecommunications" on 3rd February, 2011. Based on the comments received during the public consultation, the recommendations on "Approach towards Green Telecommunications" were issued on 12th April, 2011 by TRAI.

1.6 These recommendations broadly looked at the significance of energy efficiency in modern telecommunication networks and suggested directions for optimizing network performance in terms of energy demands. Keeping in view the various aspects of energy efficiency in telecom networks, the way ahead to achieve the renewable energy targets in telecom sector were recommended.

1.7 Based on the recommendations of TRAI, DoT on 04.01.2012 issued direction to the Telecom Service Providers. Following the direction, the telecom service providers have started submitting carbon footprint reports of their respective networks bi-annually to TRAI: first term spanning from April to September and the second term from October to March.

1.8 In March, 2013, DoT constituted a Renewable Energy Technology (RET) Committee to develop the roadmap, comprehensive program and viability gap funding for mobilizing the renewable energy technology deployment in telecom sector. The Committee submitted its report on 01.08.2014. The recommendations of RET Committee were further examined by a departmental Committee which has submitted its report in May 2015. In light of the above mentioned reports of the Committee and deliberation thereof, DoT vide letter No. 16-06/2011-CS-III/127 dated 23rd Nov 2015 (**Annexure-I**) sought recommendations of TRAI on 'Implementation of Renewable Energy Technology in Telecom Sector' for "Methodologies for

measuring Carbon Emission" and "Calibration of Directives issued by DoT in 2012 and approach for its implementation".

1.9 In light of above, the Authority issued a consultation paper on "Approach towards Sustainable Telecommunications" dated 16th Jan 2017, seeking the views of the stakeholders on many significant issues like:

(a) Approach for calculating the carbon footprint
(b) Need for auditing the carbon footprint of a telecom network by a third party auditor and its mechanism
(c) Formulas suitable for calculation of Carbon footprints from Grid supply and DG Sets
(d) Options available for renewable energy solutions, support to industry for effective implementation of RET/Energy efficient solutions
(e) Methodology for setting new Renewable energy targets in the telecom sector and the timeframe for achieving these targets etc.

1.10 With a view to bring out all the aspects of the relevant issues and to provide a suitable platform for discussion, written comments on the issues were invited from the stakeholders by 13th February 2017 and subsequent counter-comments by 27th February 2017. On the request of some of the stakeholders, the dates were extended for submission of comments till 3rd April 2017 and counter comments till 17th April 2017. A total of 23 Comments and 2 counter comments were received from stakeholders in response to the Consultation Paper. An Open house discussion was conducted on 5th July 2017 in New Delhi. After considering the submissions of the stakeholders and examining the issues in depth, the Authority has finalized these recommendations.

1.11 A detailed analysis of the issues raised in the consultation paper along with the responses given by the stakeholders is contained in the second chapter. The Authority has taken a holistic view of the existing scenario with a hope that it will set the tone for induction of technological solutions for reduction of carbon footprint and achieving the objectives of Green Telecom. The third chapter gives a summary of the recommendations.

CHAPTER-II

ANALYSIS OF ISSUES AND RECOMMENDATIONS

A. Methodology for Calculation of Carbon Foot Print

2.1 The type of emissions are divided into three categories as defined below:

Scope 1: Emissions from the sources that are owned or controlled by the organization such as emissions resulting from combustion of fuels.

Scope 2: Emissions from the use of purchased electricity for operation of telecom equipments fall under this category.

Scope 3: Emissions that are a consequence of the operations of an organization, but are not directly owned or controlled by the organization such as including employee commuting, business travel, third-party distribution and logistics, production of purchased goods, emissions from the use of sold products etc.

2.2 One of the issues raised in the Consultation Paper was to identify the types of Scope that should be considered in the assessment of carbon footprint in the telecom sector.

2.3 In the Consultation Paper, the Authority has also raised the issue of accuracy of the Carbon Footprint reports which basically relies on the correctness of data used for calculation. This includes:

- Amount of fuel consumed in DG sets
- Running hours of the telecom equipment
- Number of units of electricity consumed by telecom equipment from grid power supply.

2.4 The comments of the stakeholders were sought on the level of accuracy for data collected and basis of arriving at this threshold level. Further, in order to establish the credibility of the data provided by the

Service Providers, the issue of verification of the data through a third party was also raised. The comments of the stakeholders were also sought on the approach for calculating the Carbon Footprint.

2.5 Most of the stakeholders opined that the carbon emission footprint is being calculated based on the data of diesel consumption and purchase of electricity from the Grid. The figures of diesel consumption and electricity bills are based on invoices which are audited and duly verified. Therefore, the carbon footprint data is of high accuracy.

2.6 Few stakeholders commented that the owners of this data, in most cases, are the Infrastructure Providers (IP). Therefore, equal responsibilities should be placed on both TSP & IP for furnishing of reports.

2.7 Though few stakeholders were in favor of third party audit, most of the stakeholders suggested that since data is derived from the auditable sources, hence third party audit should not be required.

2.8 With regard to approach for calculating the carbon footprint, most of the stakeholders agreed to the calculation of Scope 1 and Scope 2 emissions. However, few of the stakeholders were of the view that only Scope 1 emissions should be considered for calculation of carbon footprint as they have no control over Scope 2 sources.

2.9 Some stakeholders also suggested that the report submission should be made annually in place of present bi-annual submission.

Analysis

2.10 The Service Providers are calculating the Carbon emission from the data of diesel consumed in DG sets and the units of electricity procured from gird. These expenditures are part of their financial data which are internally verified and are auditable. The self certification by the Service Providers about the accuracy of the data is sufficient to ensure the accuracy level of the data. Therefore, the Carbon Footprint so calculated should be taken as

sufficiently accurate and TSPs should be asked to submit the carbon emission data on self certification.

2.11 Further, it is noted that no financial incentive or disincentive is directly linked with the achievement of targets for Carbon Footprint. Therefore, no immediate need is felt for third party audit of the data submitted by the Service providers.

2.12 The existing approach for calculating the carbon footprint is methodological and also preferred by the majority where both the Scope 1 emissions & Scope 2 emissions have been considered contributing to pollution through Carbon Emission. Therefore, no change in the approach for calculating the carbon emission is required and the current practice of calculating carbon footprint with Scope 1 and Scope 2 emissions may be continued.

2.13 In earlier recommendation, bi-annual reporting requirements were recommended while the targets fixed were on the interval of two years. It is felt that collecting reports every six months when the target is fixed for two years gives four reports per target which appears to be on higher side. To make the reporting requirement optimum, the reporting period for target monitoring should be made annual.

2.14 **Accordingly, the Authority recommends that:**

(i) The accuracy level of the Carbon Footprint should be taken as adequate based on the self certification by the TSP. No independent third party audit of the Carbon Footprint is recommended in the current scenario.

(ii) The approach already adopted for calculating carbon footprint including scope 1 and scope 2 emissions should be continued.

(iii) The report of Carbon Footprint should be submitted annually within 45 days after 31st March of every year in the proforma as per

Annexure II. The first report of the Carbon Footprint for the base year 2011-12 as per revised formula should be submitted within 3 months from the date of issue of the directions/ instructions by DoT.

B. Formula for calculating the carbon footprint

2.15 In the Consultation Paper, the key points of the ITU-T L.1420 recommendation titled "Methodology for energy consumption and greenhouse gas emissions impact assessment of information and communication technologies in organisations" and TRAI's compliance with them in TRAI's recommendations on "Approach towards Green Telecommunications" dated 12th April 2011 has been explained. It has been explained that key points of ITU –T recommendations viz. the identification of GHG sources for calculation of carbon footprint, specifications of the boundary and scope of coverage, selection of an appropriate quantification methodology, selecting of a Base year and reporting year and disclosing the footprints have been suitably considered in the recommendations of TRAI.

2.16 TRAI in its above referred recommendation, had recommended the following formula for calculation of the Total Carbon Footprint :

$$\mathbf{C_{TOTAL} = C_{GRIDPOWER} + C_{DGSET}} \quad \text{in tonnes of } CO_2e \text{ per year}$$

Where, $\mathbf{C_{GRIDPOWER=} = 0.365(0.84*P*X)}$ **in tonnes per year,**

$$\mathbf{C_{DGSET} = 0.365\ [(0.528*Y*Z)/\eta]}$$ **in tonnes per year**

Where,

P = Power consumption in kWh

X= Average hrs with grid supply per day

Y = Running time of the DG set in hours per day

Z = Power capacity of DG set in kVA

η = efficiency of the generator

2.17 In this formula, the carbon emission from grid power is calculated based on the assumption that the CO_2 emission from the electricity grid will

be 0.84 tonnes of CO_2e/MWh. In case of carbon emission from DG sets, the same is calculated after taking into account the fact that a 15 KVA DG set consumes 3 litres of diesel per hour and 1 litre of diesel emits 2.629 kgs of CO_2 emissions.

Formula for calculation of Carbon Emission from Grid Power:

2.18 In addition to the formula mentioned in the para 2.16 for calculation of carbon emission from grid power, the following formula for Carbon Emission from Grid Supply has also been suggested in the Consultation Paper:

$$C_{GRIDPOWER} = (EF * A) \quad \text{tonnes of } CO_2e \text{ per year}$$

Where,

EF = Emission Factor of the grid (in tonnes of CO_2e/MWh)

A = Consumption of power from the grid by the telecom network per year (in 'MWh)

2.19 The emission factor in this formula has been proposed with respect to the methodology proposed by United Nations Framework Convention on Climate Change (UNFCC).[1]

2.20 As per the CO_2 Baseline data base published by Central electricity Authority, the emission factor (EF) of Grids[2] (adjusted for inter-grid and cross-country electricity transfers) in tonnes of CO_2e /MWh, for the year 2013-14 has been given in Table 2.1:

Table 2.1: Emission factor of electricity grids (in tonnes CO_2e/ MWh) for year 2013-14

GRID	Average	OM	BM	CM
NEWNE	0.82	1.00	0.95	0.97
South	0.82	1.02	0.96	0.99

[1] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf
[2] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver10.pdf

Where,

Average is the average emission of all stations in the grid, weighted by net generation.

OM (Simple operating margin) is the average emission from all stations excluding the low cost/must run sources.

BM (Build Margin) is the average emission of the 20% (by net generation) most recent capacity additions in the grid.

CM (Combined Margin) is a weighted average of the OM and BM (here weighted 50: 50).

2.21 The NEWNE and SR grids have been integrated as a single grid as of 31st December, 2013. This single grid has been considered for the calculations of CO2 emissions starting in FY 2014-15. As per the CO_2 Baseline database published by Central electricity Authority, the emission factor (EF) of Grids[3] (adjusted for cross-border electricity transfers) in tonnes of CO_2e /MWh, for the year 2014-15 and 2015 - 16 has been given in Table 2.2:

Table 2.2: Emission factor of electricity grids (in tonnes CO_2e/ MWh) for year 2014-15 and 2015-16

Year	Average	OM	BM	CM
2014-15	0.82	0.99	0.93	0.96
2015-16	0.82	0.97	0.91	0.94

Formula for calculation of Carbon Emission from DG Set:

2.22 In addition to the formula mentioned in the para 2.16 for calculation of carbon emission from DG Set, in the consultation paper, two options were proposed for the calculation of Carbon Emission from DG Sets as below:

[3] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

(i) Formula based on the diesel consumption of the DG set:

In this formula the total diesel consumed in a year is used directly for calculation of the emissions from DG sets.

One litre of diesel produces 2.629 Kilograms of CO_2e or 0.002629 tonnes of CO_2e. (1 tonne= 1000 kilograms)

Hence, the total carbon footprint is obtained by multiplying the number of litres consumed by the DG set (in one year) and 0.002629 tonnes of CO_2e, which can be expressed in the following equation:

$$\mathbf{C_{DGSET\_A} = 0.002629 * N} \quad \text{tonnes of } CO_2e \text{ per year}$$

Where N = total Diesel consumption of the diesel generator in litre in a year.

(ii) Formula based on the Capacity of the generator used

In this formula the capacity, efficiency and power factor of the DG sets are considered for calculation of the emissions from DG sets.

The net calorific value of diesel fuel is 43.33 Mega joules per kilograms or 36.59 Mega joules per litre (1 kilogram of diesel=1.184 litres of diesel) which means 10.16 Kilowatt hours of energy (1 kWh=3.6MJ) is generated from one litre of diesel. Also, one litre of diesel produces 2.629 Kilograms of CO_2. This means that 0.2587 kilograms of CO_2 is produced per kilowatt hour per litre of diesel.

If 'X Kilowatt-amperes (KVA)' is the capacity of DG set, 'φ' be the power factor of DG set, 'Y hours' is the number of hours the network element is in use per year and 'η' be the efficiency of the DG set, then the carbon foot print in tonnes per year is given by:

$$\mathbf{C_{DGSET\_B} = \frac{0.2587 * X * \varphi * Y}{\eta * 1000}} \quad \textbf{tonnes of } \mathbf{CO_2e} \textbf{ per year}$$

2.23 The views of stakeholders were sought to ascertain whether the existing formula for calculation of Carbon Footprints from grid need to be modified and the new proposed formula may be adopted. Also, views on the emission factor to be used in the formula (out of Average, OM, BM & CM)

was sought. In respect of DG set, the option out of the two proposed formulas was sought.

2.24 Majority of the stakeholders recommended to consider the new formula as proposed in the consultation paper dated 16th Jan 2017 for emission from Grid. However, few stakeholders supported for continuing the existing formula. It was also suggested to avoid calculation of Carbon footprints from Grid as certain factors like number of hours of availability of grid, is beyond the control of TSPs. In respect of emission factor, most of the stakeholders opined for considering the average emission of all the stations in the grid, weighted by the net generation capacity. However, some of the stakeholders commented that OM emission factor may be used and some favored the CM emission factor.

2.25 Few stakeholders suggested for considering Transmission and distribution losses in electricity grid supply in the formula for carbon footprint from electricity grid.

Analysis

2.26 The Authority notes that the calculation of Carbon Emission from Grid Power must be taken into account as it falls under the category of 'Scope 2' emissions and is responsible for polluting the environment. The TSPs can take action on induction of energy efficient equipments to reduce the consumption of grid power resulting in reduction in Scope 2 emissions.

2.27 The existing formula for calculation of carbon emission from grid power had a fixed Emission Factor. However, the proposed formula considers the emission factor of the concerned grid. Hence the existing formula is recommended to be replaced with the new formula presented in the Consultation Paper dated 16th Jan 2017, which is as under:

$\mathbf{C_{GRIDPOWER} = (EF * A)}$ tonnes of CO_2e per year

Where,

EF = Emission Factor of the grid (in tonnes of CO_2e/MWh)

A = Consumption of power from the grid by the telecom network per year (in 'MWh)

2.28 Out of the four emission factors - Average/OM/BM/CM, Average Emission Factor should be considered because it is calculated by dividing the absolute CO2 emissions of all power stations in the grid by the grid's total net generation. This has also been suggested by most of the stakeholders. The other emission factors consider only limited capacity of the total power generation by the grid, hence not preferred.

2.29 The existing formula for calculation of Carbon Emission from diesel generator (DG) set is based on the efficiency of DG sets, which has issues since the same generator will have different efficiencies at different loads. Further, it is based on fixed capacity value of DG set. Also, it has components which are based on assumptions and averages. The new formula proposed as option (i) (refer para 2.22) is directly linked to the consumption of diesel and has no other variable.

2.30 The usage of diesel generator can be minimized if the availability of Grid power is improved. This will help in reducing the Scope 1 emissions. The savings on diesel generator can be utilized in inducting renewable energy technologies thereby reducing the Scope 2 emissions also. Though, Ministry of Power has taken various steps in increasing the power availability, making regular power supply available to TSPs across the network would strengthen their efforts in reducing the carbon footprint. The Ministry of Communications may take up suitably with Ministry of Power for making reliable Grid power available to the TSPs on priority.

2.31 **Accordingly, the Authority recommends that:**

(i) The Total Carbon Emission should be calculated as sum of Carbon emission from Grid Power and DG Set:

$\mathbf{C_{TOTAL} = C_{GRIDPOWER} + C_{DGSET}}$ in tonnes CO_2e per year

(ii) Carbon Emission from Grid power:

$$C_{GRIDPOWER} = (EF * A) \text{ tonnes of } CO_2e \text{ per year}$$

Where,

EF = Average Emission Factor of the grid (in tonnes of CO_2e/MWh) taken from the report of the Central Electricity Authority for the corresponding zone as applicable from time to time

A = Consumption of power from the grid by the telecom network per year (in 'MWh')

(iii) Carbon Emission from DG Sets:

$$C_{DGSET} = 0.002629 * N \text{ tonnes of } CO_2e \text{ per year}$$

N = total Diesel consumption of the diesel generator in litre in a year.

C. Calculation of Average Carbon Footprint

2.32 In the consultation paper three options on calculation of average carbon footprint were presented and views of stakeholders were sought on the suitable option. These are given as below:

i. OPTION 1: Averaging across total number of subscribers

If the total number of subscribers in the network is N_{SUB}, then the average carbon footprint per unit subscriber is:

$$C_{TOTAL\_PER\ UNIT\ SUBSCRIBER} = \frac{CTOTAL}{NSUB} \text{ in tonnes per unit subscriber}$$

ii. OPTION 2: Averaging across total number of unique users

If the total number of unique users in the network is N_{USERS}, then the average carbon footprint per unit subscriber is:

$$C_{TOTAL\_PER\ UNIT\ USER} = \frac{CTOTAL}{NUSERS} \text{ in tonnes per unit unique user}$$

(*Subscriber is the term used to refer to a person that has an account with a mobile network carrier. Unique user refers to a single individual that has*

subscribed to a mobile service and that person can hold multiple mobile connections (i.e. SIM cards).)

iii. OPTION 3: Averaging across total amount of traffic carried

If the traffic carried by the telecom network is 'T Exabytes' then the total carbon footprint per unit traffic is given by:

$$\mathbf{C_{TOTAL\_PER\ UNIT\ TRAFFIC}} = \frac{\mathbf{CTOTAL}}{\mathrm{T}}$$ in tonnes CO_2e per unit Exabyte

2.33 Majority of the stakeholders preferred that calculation of average carbon footprint should be based on average amount of traffic carried by a Telecom Network in Exabyte whereas few stakeholders commented that the calculation of carbon footprint should be based on average number of subscribers in a telecom network.

Analysis

2.34 The trend in the Telecom Sector shows tremendous increase in data traffic. In addition, TSPs are adopting VoLTE for carrying voice traffic over data. Therefore, the traffic carried by TSPs would predominantly be data traffic here on and hence averaging of the Carbon Footprint over traffic carried in Exabytes as proposed in option (iii) is preferred.

2.35 The following formula for conversion of voice traffic to data is proposed to facilitate calculation of average carbon footprint based on average amount of traffic carried:

(a) 2G & 3G Voice Traffic: Considering the voice codec used in carrying voice traffic in 2G and 3G technology carries voice traffic at 17.5 kbps (with 30% silence factor), the traffic carried in 1 minute would be equal to 1050 kilo bits or 131.25 Kilo Bytes. Therefore, 7.8 minutes of voice traffic would be equivalent to 1 MB of data.

(b) As the voice rides over data in case of VoLTE, there is no need for conversion of voice into data. Also, there is no need for conversion of traffic for any other application running over data.

2.36 **Accordingly, the Authority recommends that:**

The average carbon emission should be based on the average amount of data traffic as below:

If the traffic carried by the telecom network is 'T Petabyte' then the total carbon footprint per unit traffic is given by:

$$C_{TOTAL\_PER\ UNIT\ TRAFFIC} = \frac{CTOTAL}{T}$$ **in tonnes CO_2e per unit Petabyte**[4]

Where T should be calculated by adding the data traffic and voice traffic (after converting the voice traffic into data).

D. Energy Efficiency in Telecom Networks and Renewable energy targets

2.37 In the consultation Paper, drivers for designing energy efficient Telecom Networks were discussed. The three aspects of energy efficiency viz. demand management, supply management and renewable energy solutions were discussed. These included energy efficient technologies such as Active distributed Antenna Systems, Sleep mode Base Transceiver Stations, DC free air cooling units (DCFCUs), HVAC with hot aisle/cold aisle configuration, Tower remote monitoring solutions, integrated power management systems (IPMS), variable speed DC Diesel Generator and GenX. The renewable energy technology (RET) solutions such as solar photovoltaic, wind power, fuel cells, hybrid power systems (Grid-DG-Battery-Solar/Wind/Bio fuels/Biomass), battery technologies (lead acid, tubular VRLA, nickel based, lithium ion battery etc) were discussed.

2.38 The stakeholders' views were sought on options available for renewable energy solutions which may be harnessed to their maximum potential to power the telecom sector.

2.39 Almost all the stakeholders agreed with the various renewable energy technologies discussed in the consultation paper which are available for deployment in telecom sector. Many of the stakeholders commented on

[4] One Petabyte is 1,024 Terabytes. The data unit in Petabyte has been chosen considering the existing data usage in the Telecom Network.

deployment of hybrid solutions. One of the stakeholders has recommended for the use of Telecom Energy Storage Solution (TESU) to remove DG usages at site while another stakeholder has recommended small wind-solar hybrid solution.

2.40 Most of the stakeholders have opined that each of RET Solution has certain limitation with reference to its feasibility of implementation. The Solar Panels require land/ roof space, wind mill requires wind speed, fuel cells require continuous supply of fuel etc.. The stakeholders opined that in view of limitations of each of the RET with regard to feasibility of deployment, deployment of RET solutions should not be mandated by TRAI/DoT rather the approach should be overall reduction in Carbon Footprint.

Analysis

2.41 Various Renewable Energy Solutions available were explained in the Consultation Paper as referred in the para 2.37 above. However, due to limitations in different conditions including geographical conditions, none of the renewable technology can be specifically recommended for implementation across the networks.

2.42 In addition to the renewable energy solutions, there are certain technologies of storage devices which can be quickly charged and store energy for longer duration, resulting in less dependency on diesel generators. One such technology is of Lithium Ion Batteries. Conventional batteries used in telecom applications are of Lead Acid type. Lead acid batteries compare poorly to lithium-ion with regard to environmental friendliness. Lead acid batteries require many times more raw material than lithium-ion to achieve the same energy storage, making a much larger impact on the environment during the mining process. The lithium ion battery may be the next generation storage technology because of higher energy densities, reliability, safety, low maintenance costs and the ability to operate in a wide range of environmental conditions for long periods. Other advantages with Li-Ion batteries are:

- Lithium-based battery technologies offer a cost-effective solution given their higher energy densities, longer life and low maintenance costs.
- Lithium-ion battery may work for about 10 years if it is used properly.
- Lithium ion batteries provide more energy in less space, less maintenance, better performance and high reliability.
- Lithium-ion batteries offer longer float life over VRLA batteries.
- Lithium batteries are generally much lighter than other types of rechargeable batteries of the same size.
- Lithium-ion batteries have no memory effect and discharge capacity does not reduce on each charge/discharge cycle.

2.43 In India, the technology for Lithium Ion batteries has been developed by ISRO and Government of India is giving emphasis on transfer of technology and manufacture under 'Make in India' initiative. The mass production of Lithium Ion batteries would reduce the cost of these batteries which is the only impediment in large scale deployment of these batteries. The deployment of such energy storage technology solution will reduce the dependence of the TSPs over use of diesel generators.

2.44 In view of above, the TSPs should be free to implement any of the RET Solutions as per the feasibility and suitability on the specific locations. However, the primary objective of reduction of carbon footprint must be achieved.

2.45 **Accordingly, the Authority recommends that :**

The TSPs should voluntarily adopt the RET solutions, energy efficient equipments and high capacity fast charging storage solutions etc. to meet the target for reduction of Carbon Footprint.

E. Funding of RET Projects

2.46 In the Consultation Paper, the status of RET installations in Telecom Sector were discussed. Views were sought on whether the electricity

generated by a RET project (funded/ maintained by TSP) if also used for community, should be subtracted from overall carbon emission.

2.47 Further, views were also sought on whether the carbon emission should be counted if RET project powering the telecom infrastructure is funded / maintained by other agency.

2.48 Majority of the stakeholders opined that electricity generated by an RET project (funded/ maintained by TSP) if also used for community, should be subtracted from overall carbon emission of a TSP.

2.49 Most of the stakeholders were of the view that even if the RET project is funded / maintained by other agency, if the TSP is the end user, the reduction in carbon emission should be accounted to the TSP. However, a few stakeholders did not agree to it.

Analysis

2.50 The electricity generated by the deployment of RET solution for Telecom Networks meets the purpose of reducing the carbon emission. Therefore, it should be counted towards reduction in carbon emission by TSPs irrespective of the fact that it is funded or maintained by TSPs or any other agency. In case, excess capacity is generated by TSPs and shared for community purpose then that excess capacity will also help in reducing the overall carbon emission. Therefore, the total capacity of the RET solution should be counted towards reduction in carbon emission. This will encourage TSPs in deployment of more RET solutions and thereby reducing the overall carbon emission.

2.51 **Accordingly, the Authority recommends that**

(i) The electricity generated by the RET solution funded/ maintained by the TSP should be subtracted from overall carbon emission of the TSP irrespective of its use.

(ii) RET deployed in Telecom Network, irrespective of the source of funding of RET project, should be counted towards savings from overall carbon emission.

F. Approach for Reduction of Carbon Emission

2.52 Different methods towards reducing and monitoring the Carbon Emission have been discussed in the Consultation Paper. The methods for reducing the carbon footprint are as below:

(i) In new mobile tower installations, the backup power to grid shall be based on Energy Efficient solutions/ RET power to the extent feasible such as to make the site diesel free.

(ii) In urban areas, the outdoor BTS installations should be made diesel free to the extent feasible with required capacity of efficient storage battery backup and RET systems.

(iii) The Non-EB (Non- Electricity Board) sites & the sites having grid power availability up to 8 hours and DG set more than 5 years old may be converted to RET.

(iv) Use of outdoor DAS (Distributed Antenna Systems) in uncovered, isolated, scattered and small locations including buildings.

(v) Active sharing of network infrastructure, which involves the sharing of antennae systems, backhaul transmission systems and base station equipment.

(vi) Adoption of cluster based, long term agreements indexed to Total Cost of Operation (TCO) wherever implementation of RET is through Renewable Energy Service Companies (RESCOs) or power management companies to make the RET adoption sustainable.

2.53 The stakeholders have generally opined that in respect of Green Telecommunication, the role of the government should be minimum regulation / self regulation. While the fixing of the target for reduction of carbon footprint as the overall objective of the policy has been generally agreed, many of the stakeholders are of the view that procedure to achieve the target should be left to TSPs.

2.54 The Authority is of the view that the objective of Green Telecom Policy should be reduction in carbon emission or the carbon footprint. The service providers should take all the possible measures including those mentioned in para 2.52 to reduce their dependence on diesel and use energy efficient technologies.

G. Calibration of the directions issued by DoT on 04.01.2012 based on the recommendations of TRAI:

2.55 The gist of directions issued by DoT in 2012 is placed as **Annexure III**. The issues covered by these directions are discussed in the subsequent paras.

2.56 The first direction is that at least 50% of all rural towers and 20% of the urban towers to be powered by hybrid power (Renewable Energy Technologies (RET) + Grid power) by 2015, while 75% of rural towers and 33% of urban towers to be hybrid powered by 2020.

2.57 Most of the stakeholders have commented that no RET target should be fixed by government. As discussed in the section related to renewable energy solutions to power the telecom sector, the stakeholders have explained the limitations of each type of RET solution available and have opined not to fix the targets with regard to RET induction but fix targets for reduction in carbon emission, which should be the primary objective of the policy.

2.58 The Authority is of the view the objective of the Green Telecom policy should be reduction in carbon footprint. The TSPs should be left to adopt suitable measures to achieve the targets in reduction of carbon footprint. The induction of Li-ion batteries or similar high capacity fast charge storage solutions is also solutions to reduce the dependence on diesel generator and reducing the carbon footprint. Further, induction of energy efficient technologies would also reduce the overall consumption of power and contribute towards reduction in carbon footprint. Thus, it can be concluded that the induction of RET solutions are not the only solution in achieving in the reduction of carbon footprint. Further, fixing the target for conversion of towers to RET powered may restrict the TSPs in exploring other feasible options in reduction of carbon footprint. Therefore, the Authority feels that there is no need to fix the targets for conversion of towers to RET powered for achieving the objective of reduction in carbon footprint.

2.59 DoT in its directive in 2011 has mentioned that all telecom products, equipments and services in the telecom network should be Energy and Performance assessed and certified "Green Passport [GP]" utilizing the ECR's Rating and the Energy 'passport' determined by the year 2015. Further, TEC was made nodal centre to certify telecom products, equipments and services on the basis of ECR ratings and was allowed to appoint independent certifying agencies under its guidance for this purpose or utilize Quality Assurance teams.

2.60 No comments were given on this issue by most of the stakeholders. One of the stakeholder has opined that no target may be fixed for Green Passport.

2.61 It is noted that TEC is still under the process of establishment of Lab for this purpose. In this regard, TRAI is of the view that TEC is required to finalise the ECR document delineating the specifics of the test procedures and the measurement methodologies utilised at the earliest. In addition, the setting up of the lab facility for testing and certifying the products, equipment and services for green passport is required to be expedited.

Government should set up at least a benchmark test lab for this purpose by the year 2018. Once the lab is setup and the test procedures are finalised, the condition of certification of the equipment may be mandated through license conditions so as to ensure that all the equipments introduced thereafter are Green Passport certified.

2.62 TEC may also prescribe norms for setting up laboratories for certification of products, equipments and services as green passport certified. The detailed test procedure and fees for conducting the testing by private test labs may be prescribed by TEC so that the Green Passport certification may be conducted by private agencies also. TEC would issue accreditation to these laboratories and monitor their activities at regular interval, as per the procedure prescribed by Government.

2.63 **Accordingly, the Authority recommends that**

(i) TEC should set up the model lab facility for certification of telecom products, equipments and service on the basis of ECR ratings. TEC should also finalise the 'ECR document' delineating the test procedures and the measurement methodologies utilised. Public/private agencies may be accredited for conducting such certification.

(ii) **Government should make necessary provisions mandating that all telecom products, equipments and services in the telecom network should be Energy and performance assessed and certified "Green Passport" utilising the ECR Rating and the Energy Passport determined. The above provision should be synchronised with the setting up of lab and finalisation of test procedures by TEC.**

2.64 The direction of DoT on submitting the report on reduction of carbon emission has already been discussed in earlier sections. (**Para 2.13**)

2.65 The DoT directions desired that the Service Providers would adopt a Voluntary Code of Practice encompassing energy efficient Network Planning,

infra-sharing, deployment of energy efficient technologies and adoption of Renewable Energy Technology (RET) including the following elements:

(a) The network operators should progressively induct carefully designed and optimized energy efficient radio networks that reduce overall power and energy consumption.

(b) Service Providers to ensure that the total power consumption of each BTS will not exceed 500 W by the year 2020 for 2+2+2 configuration of BTS. TEC shall regularly standardize and prescribe specifications for Telecom Equipments of different Technologies with respect to power consumption levels. Service providers should to adhere to the TEC specifications in order to reduce the total power consumption of BTS.

(c) A phased programme should be put in place by the telecom service providers to have their cell sites, particularly in the rural areas, powered by hybrid renewable sources including wind energy, solar energy, fuel cells or a combination thereof. The eventual goal under this phased programme is to ensure that around 50% of all towers in the rural areas are powered by hybrid renewable sources by the year 2015.

(d) Service providers through their associations should consensually evolve the voluntary code of practice and submit the same to TRAI within three months from the date of issue of the direction.

2.66 The stakeholders have commented on the above that they are applying feasible options to reduce the carbon emission. Many of the stakeholders have agreed to limit the total power consumption of each BTS with 2+2+2 configuration to 500 W. However, one of the stakeholders has commented that the present technology does not support the targeted power consumption of less than 500 W. Many stakeholders have commented that industry should be allowed to voluntarily deploy solutions for reduction of carbon footprint.

2.67 The Authority is of the view that the government should fix the target for overall carbon footprint reduction and the procedure to meet the target should be left to the TSPs. Therefore, from above directions of DoT, the specific steps provided towards achieving the goal of reduction in carbon emission should be dropped.

2.68 The time line for submitting the voluntary code of practice has as mentioned in earlier directions has already passed. However, the code of practice prepared by the TSPs would give an overview to the approach adopted by them. Therefore, in view of revised recommendations, TSPs should be asked to submit the voluntary code of practice to TRAI afresh within 3 months from issue of the instructions/ revised directions from DoT.

2.69 **Accordingly, the Authority recommends that:**

The Service Providers would adopt a Voluntary Code of Practice encompassing energy efficient Network Planning, infra-sharing, deployment of energy efficient technologies and adoption of Renewable Energy Technology (RET). Service providers through their associations should consensually evolve the voluntary code of practice and submit the same to TRAI within three months from the date of issue of the direction.

2.70 The last two directions issued in 2012 are as below:

- Service providers should evolve a 'Carbon Credit Policy' in line with carbon credits norms with the ultimate objective of achieving a maximum of 50% over the carbon footprint levels of the base year in rural areas and achieving a maximum of 66% over the carbon footprint levels of the base year by the year 2020. The base year for calculating all existing carbon footprints would be 2011, with an implementation period of one year. Hence the first year of carbon reduction would be the year 2012.
- Based on the details of footprints declared by all service providers, service providers should 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.

2.71 In respect of the Carbon Credit Policy most of the stakeholders have not made any comment. One of the stakeholders has commented that the directives of DoT provided multiple targets for the industry which includes the target for reduction in carbon intensity (17% by year 2018-19), implementation of RETs by 2015 and 2020, Carbon Credit Policy, Green Passports for all telecom equipments and services and mentioned that consolidation of emission reduction target will enable the operators to adopt a focused and cost effective approach towards emission reduction.

2.72 The recommendations of TRAI on Carbon Credit Policy made in April 2011 are quite elaborate and provides directions to the industry for adoption of carbon credit policy based on which the directions were issued by DoT in this regard. The targets provided in reference to Carbon Credit Policy are guiding reference for adoption of carbon credit policy. Therefore, it is felt that the same may be retained.

2.73 Further, the target for reduction of carbon emission from mobile network was specific targets being monitored. None of the stakeholders have provided any view on these targets except some of the stakeholders claiming that they have met the targets. The carbon emission reduction target for mobile network has been given upto the year 2018-19. Since we are already in the year 2017-18, it is felt appropriate to define the targets for at least next 3 – 4 years after which the recommendations and targets could be reviewed. The carbon emission reduction targets for the mobile network have been fixed at 17% by the year 2018-19 taking the based year 2011-12. In view of the fact that the average reduction of carbon footprint by 2015-16 is 26.96%, the carbon emission reduction by 30% should be met by 2019-20, and 40% by the year 2022-23. The same should be reviewed in the year 2022-23 to fix the targets for the future.

2.74 **Accordingly, the Authority recommends that:**

(i) Service providers should evolve a 'Carbon Credit Policy' in line with carbon credit norms with the objective of achieving the reduction in carbon footprint target.

(ii) The target for reduction in Carbon Emission be set as 30% by year 2019-20 taking base year as 2011-12 and 40% by the year 2022-23. The targets should be reviewed in the year 2022-23.

H. Support to Industry.

2.75 In the Consultation Paper, the views of stakeholders were sought on the ways to support the industry of adopting RET solutions and reducing the carbon emission. In this context, the following suggestions given the report of the RET Committee of DOT were also included in the Consultation Paper:

- In order to enable industry to access resources for deployment of RET power solutions, DoT should facilitate in processing the industry's proposals for financial assistance, if required under various government schemes such as MNRE cluster based scheme for providing micro-grids and mini-grids with telecom as anchor load and Ministry of Power capital subsidy scheme under Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY).

- In the event of a proposal being received from industry, the Government may consider support through (National Clean Energy Fund) NCEF or bilateral financing agencies like World Bank or (Asian Development Bank) ADB to fund capital requirements for green telecom initiatives.

- For realizing the impact of inclusion of Telecom as an Infrastructure sub-sector in the harmonised master list, the benefits for accelerated depreciation and concessional loans with longer tenure may be extended to telecom companies, so that the Service Providers qualify for claiming depreciation on the capital cost of PV system with associated tax benefits. This would support in faster deployment of RET in telecom sector.

- A rebate of 1%, 2% and 3% in license fees in the financial year subsequent to installation to licensees (TSPs) which deploy RET solutions in 20%, 35% & 50% of their total BTS's in India respectively.

2.76 Most of the stakeholders have agreed on above support scheme. Most of the stakeholders have agreed to incentivisation of the use of renewable energy and the rebate in license fee linked with reduction in carbon emission.

2.77 It is felt that the measures mentioned above to support the industry are reflecting the role of government as a facilitator to the industry in induction of RET power solutions. The industry, in this case, has to take suitable decision itself for induction of RET solutions and wherever the support from government is required on above lines the same could be provided. This is consistent with the view that the TSPs should take necessary decision on the induction of RET solutions to meet the target of reduction in carbon emission.

2.78 In the context of financial support referred in the recommendation of the RET Committee of DoT, it is observed that the same is based on providing rebate in license fee based on meeting the target of deployment of RET Solutions in specific percentage of total BTSs. Since the target is not being provided in terms of conversion of BTSs into RET powered therefore, the incentives should not be linked with it.

2.79 The other possibility is of linking the proposed rebate in License Fee with achievement of target of reduction in carbon emission. In this context, it may be noted that any third party audit / independent audit of the data submitted by the TSPs has not been recommended. The process of verification of any data for the purpose of any financial incentive would require being verifiable at a very detailed level. The verification of the data submitted by TSPs would be a very complex process. Therefore, no financial incentive linked with meeting the targets of carbon emission is being recommended.

2.80 **Accordingly, the Authority recommends that**

The government should consider passing all possible benefits related to deployment of RET power to the Service Providers as per extant government schemes.

Chapter-III

Summary of Recommendations

1. **The accuracy level of the Carbon Footprint should be taken as adequate based on the self certification by the TSP. No independent third party audit of the Carbon Footprint is recommended in the current scenario. (Para 2.14)**
2. **The approach already adopted for calculating carbon footprint including scope 1 and scope 2 emissions should be continued. (Para 2.14)**
3. **The report of Carbon Footprint should be submitted annually within 45 days after 31st March of every year in the proforma as per Annexure II. The first report of the Carbon Footprint for the base year 2011-12 as per revised formula should be submitted within 3 months from the date of issue of the directions/ instructions by DoT. . (Para 2.14)**
4. **The Total Carbon Emission should be calculated as sum of Carbon emission from Grid Power and DG Set:**

   $C_{TOTAL} = C_{GRIDPOWER} + C_{DGSET}$ in tonnes CO_2e per year

   Carbon Emission from Grid power:

   $C_{GRIDPOWER} = (EF * A)$ **tonnes of CO_2e per year**

   Where

   EF = Average Emission Factor of the grid (in tonnes of CO_2e/MWh) taken from the report of the Central Electricity Authority for the corresponding zone as applicable from time to time

   A = Consumption of power from the grid by the telecom network per year (in 'MWh')

   Carbon Emission from DG Sets:

   $C_{DGSET} = 0.002629 * N$ **tonnes of CO_2e per year**

   N = total Diesel consumption of the diesel generator in litre in a year. (Para 2.31)

5. **The average carbon emission should be based on the average amount of data traffic as below:**

   If the traffic carried by the telecom network is 'T Petabyte' then the total carbon footprint per unit traffic is given by:

   $C_{TOTAL\_PER\ UNIT\ TRAFFIC} = \frac{CTOTAL}{T}$ **in tonnes CO_2e per unit Petabyte**

   Where T should be calculated by adding the data traffic and voice traffic (after converting the voice traffic into data). (Para 2.36)

6. **The TSPs should voluntarily adopt the RET solutions, energy efficient equipments and high capacity fast charging storage solutions etc. to meet the target for reduction of Carbon Footprint. (Para 2.45)**
7. **The electricity generated by the RET solution funded/ maintained by the TSP should be subtracted from overall carbon emission of the TSP irrespective of its use. (Para 2.51)**
8. **RET deployed in Telecom Network, irrespective of the source of funding of RET project, should be counted towards savings from overall carbon emission. (Para 2.51)**
9. **TEC should set up the model lab facility for certification of telecom products, equipments and service on the basis of ECR ratings. TEC should also finalise the 'ECR document' delineating the test procedures and the measurement methodologies utilised. Public/private agencies may be accredited for conducting such certification. (Para 2.63)**
10. **Government should make necessary provisions mandating that all telecom products, equipments and services in the telecom network should be Energy and performance assessed and certified "Green Passport" utilising the ECR Rating and the Energy Passport determined. The above provision should be synchronised with the setting up of lab and finalisation of test procedures by TEC. (Para 2.63)**
11. **The Service Providers would adopt a Voluntary Code of Practice encompassing energy efficient Network Planning, infra-sharing,**

deployment of energy efficient technologies and adoption of Renewable Energy Technology (RET). Service providers through their associations should consensually evolve the voluntary code of practice and submit the same to TRAI within three months from the date of issue of the direction. (Para 2.69)

12. **Service providers should evolve a 'Carbon Credit Policy' in line with carbon credit norms with the objective of achieving the reduction in carbon footprint target. (Para 2.74)**
13. **The target for reduction in Carbon Emission be set as 30% by year 2019-20 taking base year as 2011-12 and 40% by the year 2022-23. The targets should be reviewed in the year 2022-23. (Para 2.74)**
14. **The government should consider passing all possible benefits related to deployment of RET power to the Service Providers as per extant government schemes. (Para 2.80)**

List of Acronyms

S. No.	Acronym	Expansions
1	ADB	Asian Development Bank
2	BM	Build Margin
3	BTS	Base Transceiver Stations
4	BWA	Broadband Wireless Access
5	CM	Combined Margin
6	CO2	Carbon-di-oxide
7	CO2e	Carbon Dioxide Equivalent
8	DAS	Distributed Antenna System
9	DC FCU	DC Free air Cooling Unit
10	DoT	Department of Telecommunication
11	ECR	Energy Consumption Rating
12	EB	Electricity Board
13	GHG	Green House Gases
14	GP	Green Passport
15	HVAC	Heating, Ventilation and Air Conditioning
16	IP	Infrastructure Provider
17	IPMS	Integrated Power Management System
18	LCA	Life Cycle Assessment
19	Li-Ion	Lithium Ion
20	MNRE	Ministry of New Renewable Energy
21	NCEF	National Clean Energy Fund
22	NEWNE	Northern, Eastern, Western & North Eastern
23	NMEEE	National Mission on Enhanced Energy Efficiency
24	OM	Simple Operating Margin
25	PV	Photo Voltaic
26	RGGVY	Rajiv Gandhi Grameen Vidutikaran Yojana
27	RET	Renewable Energy Technology
28	TERM	Telecom Enforcement Resource and Monitoring
29	TRAI	Telecom Regulatory Authority of India

30	TSP	Telecom Service Provider
31	UNFCC	United Nations Framework Convention on Climate Change
32	USOF	Universal Service Obligation Fund
33	VoLTE	Voice over LTE
34	VRLA	Valve Regulated Lead Acid

Annexure I

No. 16-06/2011-CS-III /127
Government of India
Ministry of Communications & IT
Department of Telecommunications
Sanchar Bhawan, 20 Ashok Road, New Delhi –110 001.
Dated : 23.11.2015

The Secretary (TRAI)
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhavan
Jawahar Lal Nehru Marg (Old Minto Road)
New Delhi-110002

Subject:- Seeking recommendation of TRAI on "Implementation of Renewable Energy Technology in Telecom Sector" under Section 11 (1) (a) of TRAI Act 1997 as amended.

TRAI had issued recommendations dated 12.04.2011 & 02.09.2011 on 'Approach towards Green Telecommunications'. Government of India has accepted the TRAI recommendations and decided to adopt measures to green the telecommunication sector setting broad directions and goals to achieve the desired reduction in carbon emission through the use of Renewable Energy Technologies (RET) and energy efficient equipments. Accordingly, DoT issued directives to TSPs in January, 2012. One such letter that was issued to NLD Service Providers is attached as Annexure-I. Similar letters were also issued to other service providers. Subsequently, to develop the roadmap, comprehensive programme and viability gap funding for mobilizing the Renewable Energy Technology (RET) deployment in telecom sector, DoT constituted a RET Committee which submitted its report on 01.08.2014(Annexure-II). The recommendations of RET committee were further examined by a Departmental committee. This Departmental Committee has submitted its report (Annexure-III) in May, 2015.

2. In its report, the Department Committee has, inter alia, discussed the issue of (a) Methodologies for measuring Carbon Emission and (b) Calibration of Directives issued by DoT in 2012 & Approach for Implementation.

(a) Methodologies for measuring Carbon Emission:

TRAI, in its recommendations dated 12.04.2011 & 02.09.2011 on "Approach towards Green Telecommunications", had defined the methodology for measuring carbon emission. This methodology is detailed in Annexure-I of TRAI recommendations under heading "Metrics for estimating the carbon footprint of telecom network and Reporting structure". Based on TRAI recommendations, DoT issued directives (Annexure-I) for greening the Telecom in 2012, including the guidelines to measure the carbon emission on the basis of methodology defined by TRAI.

The above mentioned RET Committee and Departmental Committee in their report examined the issue of methodologies for measuring Carbon Emission. The

Departmental Committee has recommended that ITU-T L.1420 based methodology may be used for measuring the carbon emission. As the methodologies for measuring carbon emission as per ITU-T L.1420 will be in deviation with TRAI recommendation "Approach towards Green Telecommunications" dated 12.04.2011 & 02.09.2011 and DoT directive issued in 2012, the Departmental Committee has also recommended that the matter may be referred to TRAI bringing out the above facts for giving fresh recommendations.

(b) Calibration of Directives issued by DoT in 2012 & Approach for Implementation:

DoT directives for greening the Telecom issued in 2012 (Annexure-I) also included the targets for implementation of RET as "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 be powered by hybrid power by 2020." The above mentioned RET Committee and Departmental Committee have also examined these targets. The Departmental Committee has recommended that the targets given to telecom industry vide directives issued by DoT require calibration taking into account the current status of RET deployment, learning, significant changes in technologies including optimum energy solutions like VRLA+, Lithium Ion, Nickel Cadmium batteries etc. now available for telecom networks, current status of policies of MNRE & Ministry of Power.

As the calibration of directives as proposed above will be in deviation with TRAI recommendations dated 12.04.2011 & 02.09.2011, the Departmental Committee has also recommended that the matter may be referred to TRAI bringing out the above facts for giving fresh recommendation. Further, the Committee has recommended that based on the calibration exercise, the implementation approach may also be intimated by TRAI.

3. In light of report of above mentioned Committees and deliberations thereof (Refer Annexure-II & III), recommendations of TRAI are sought under section 11 (1) (a) of TRAI Act, 1997, on the above issues.

4. This issues with the approval of competent authority.

Subhash
23.11.15

(Subhash Chandra Kesarwani)
Assistant Director General (CS-III)
Tel: 011-23372644
Email: sc.kesarwani@nic.in

Copy to: DDG (EW), DoT HQ, for information, please.

Annexure II

Calculation of Carbon Emission From use of Grid Power

Name of the Service Provider: **Report for the year:**

Sl. No.	Name of LSA	Total Power consumed from Grid (in MWh) in Quarter I	Total Power consumed from Grid (in MWh) in Quarter II	Total Power consumed from Grid (in MWh) in Quarter III	Total Power consumed from Grid (in MWh) in Quarter IV	**Total power consumed from Grid in MWh in a year**	**Grid Emission Factor**	**Total Carbon Emission from Grid in the Year (in tonnes)**
		A1	A2	A3	A4	**A (A1+A2+A3+A4)**	**EF**	**Cgrid=EF*A**

Calculation of Carbon Emission from running of DG Sets

Name of the Service Provider: **Report for the year:**

Sl. No.	Name of LSA	Total diesel consumed by DG set (in litre) in Quarter I	Total diesel consumed by DG set (in litre) in Quarter II	Total diesel consumed by DG set (in litre) in Quarter III	Total diesel consumed by DG set (in litre) in Quarter IV	**Total diesel consumed by DG set (in litre) in the year**	**Carbon Emission from DG Sets**
		N1	N2	N3	N4	**N (N1+N2+N3+N4)**	**Cdgset = 0.2629*N**

Calculation of Total Data Usage

Name of the Service Provider: **Report for the year:**

Sl. No.	Name of LSA	Total data usage (in petabytes) in Quarter I	Total data usage (in petabytes) in Quarter II	Total data usage (in petabytes) in Quarter III	Total data usage (in petabytes) in Quarter IV	**Total Data Usage in the Year (in Petabytes)**
		T1	T2	T3	T4	**T**

Calculation of Carbon Footprint

Name of the Service Provider: **Report for the year:**

Sl. No.	**Name of LSA**	Total Carbon Emssion from Grid for the Year	Total Carbon emission from DG sets for the year	**Total Carbon Emission from Grid and DG Sets**	**Total data usage for the year**	**Carbon Footprint for the year**
		Cgrid	Cdgset	**Ctotal**	**T**	**Ctotal/T**

Annexure - III

Directions of DoT on 4.01.2012 based on the recommendations of TRAI

(DoT has issued separate directions to ISPs, NLDs and CMTS/UASL/Basic Service Licensees on this matter)

1. 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 be powered by hybrid power by 2020.
2. All telecom products, equipments and services in the telecom network should be Energy and performance assessed and certified "Green Passport [GP]" utilizing the ECR's Rating and the Energy 'passport' determined by the year 2015.
3. TEC shall be the nodal centre that will certify telecom products, equipments and services on the basis of ECR ratings. TEC may either appoint independent certifying agencies under its guidance or shall certify the same through their Quality Assurance teams. TEC shall prepare and bring out the 'ECR Document delineating the specifics of the test procedures and the measurement methodology utilized.
4. All service providers should declare to TRAI, the carbon footprint of their network operations in the format prescribed by TRAI. This declaration should be undertaken after adopting the formulae and procedures prescribed by TRAI. The Declaration of the carbon footprints should be done twice in a year i.e. half yearly report for the period ending September to be submitted by 15th of November and the succeeding half yearly report for the period ending March to be submitted by 15th of May each year.
5. Service providers should adopt a Voluntary Code of Practice encompassing energy efficient Network Planning, infra-sharing, deployment of energy efficient technologies and adoption of Renewable Energy Technology (RET) including the following elements:

(a) The network operators should progressively induct carefully designed and optimized energy efficient radio networks that reduce overall power and energy consumption.

(b) Service providers should endeavour to ensure that the total power consumption of each BTS will not exceed 500W by the year 2020 for 2+2+2 configuration of BTS. TEC shall regularly standardize and prescribe specifications for Telecom equipments of different technologies with respect to power consumption levels. Service providers should adhere to the TEC specifications in order to reduce the total power consumption of BTS.

(c) A phased programme should be put in place by the telecom service providers to have their cell sites, particularly in the rural areas, powered by hybrid renewable sources including wind energy, solar energy, fuel cells or a combination thereof. The eventual goal under this phased programme is to ensure that around 50% of all towers in the rural areas are powered by hybrid renewable sources by the year 2015.

(d) Service providers through their associations should consensually evolve the voluntary code of practice and submit the same to TRAI within three months from the date of issue of the direction.

6. Service providers should evolve a 'Carbon Credit Policy' in line with carbon credits norms with the ultimate objective of achieving a maximum of 50% over the carbon footprint levels of the Base Year in rural areas and achieving a maximum of 66% over the carbon footprint levels of the Base Year in urban areas by the year 2020. The base year for calculating all existing carbon footprints would be 2011, with an implementation period of one year. Hence the first year of carbon reduction would be the year 2012.

7. Based on the details of footprints declared by all service providers, service providers should 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.