3.1: 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.

Ans.: Methodology for calculation of Carbon footprint: Researchers at University of Petroleum and Energy Studies (UPES) Dehradun carried out work in the area of green telecom. As per the research outcome, in a telecom service level area, the carbon footprints of telecom networks can be calculated on the basis of following:-

1. Number of units of electricity consumed by telecom equipment from grid power supply.
2. Amount of fuel consumed in DG sets.

The accuracy of data is of utmost importance. The submitted data should be verified by third party audit.

3.2: 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.

Ans.: The third party audit of carbon foot print is required to be made mandatory. The audited result is to be made available in public domain on half yearly basis. In absence of third party audit, the exercise of carbon foot print declaration will be futile like the existing reporting mechanism.

3.3: Do you agree with the given approach for calculating the carbon footprint? If not, then please comment with justification. New Formulae for calculation of Carbon footprint of Telecom network

Ans.: Researchers at University of Petroleum and Energy Studies (UPES) Dehradun have developed the formula for energy consumption and carbon emission of telecom networks based on international experiences and research findings.

Carbon Footprints from Grid supply in a telecom service level area =Grid Electricity Consumption by telecom equipments of the telecom service level area (in MWh)* Emission factor of the grid serving the location (MWh/ t CO_2)

If the emission factor of the grid is 'EF' (in tonnes of CO_2e/MWh),consumption of power from the grid by the telecom network is 'A MWh' per year, then the carbon footprint per year due to grid power is calculated as: CGRIDPOWER= (EF * A) tonnes of CO_2 per year

The carbon footprint of grid electricity is caused by the burning of fossil fuel at the generating station level , therefore average technical grid losses (transmission and distribution) for the year for the grid serving the telecom service level area are a significant contributor . For example transmission and distribution losses for Bihar and J&K are 42 and 46 percent

Therefore, Carbon Footprints of grid electricity per annum at generating station level = Yearly Carbon Footprints from Grid supply in a telecom service level area/ (1-T&D losses of the grid serving the telecom area (expressed as fraction))

Carbon footprints from the Diesel generator = Diesel Consumed by the generators *Emission Factor of diesel

The record of diesel purchased by the telecom operator is available. It can be taken as diesel consumed by the telecom operator. Alternatively, based on running hours, generators capacity and average diesel consumption, diesel consumption can be determined.

The emission factor due to diesel consumption in diesel generator given by United States' Environmental Protection Agency (EPA 2005) is 0.0027 tCO2 per liter.

3.4.: Whether the existing formulae for calculation of Carbon footprints from Grid (given in paras 1.16, 1.17 and 1.1.8) of Chapter I need to be modified? If so, please comment with justification.

Ans.: The existing formula needs to be modified. The proposed detailed approach for calculation of carbon foot print of telecom network has been explained in 3.3

3.5.: Which emission factors as mentioned in Table 1.2 of Chapter I need to be used for the calculation (Average/OM/BM/CM)? Is there any other factor(s) needs to be considered in the calculation? Please comment with justification.

Ans.: No Suggestion.

3.6.: Is the formula mentioned in Para 1.22 of Chapter I suitable for calculation of Carbon footprints from Grid supply? Please comment with justification.

Ans.: Carbon Footprints from Grid supply in a telecom service level area =Grid Electricity Consumption by telecom equipments of the telecom service level area (in MWh)* Emission factor of the grid serving the location (MWh/ t CO2)

If the emission factor of the grid is 'EF' (in tonnes of CO2e/MWh),consumption of power from the grid by the telecom network is 'A MWh' per year, then the carbon footprint per year due to grid power is calculated as: CGRIDPOWER= (EF * A) tonnes of CO2 per year

The carbon footprint of grid electricity is caused by the burning of fossil fuel at the generating station level , therefore average technical grid losses (transmission and distribution) for the year for the grid serving the telecom service level area are a significant contributor . For example transmission and distribution losses for Bihar and J&K are 42 and 46 percent.

Therefore, Carbon Footprints of grid electricity per annum at generating station level = Yearly Carbon Footprints from Grid supply in a telecom service level area/ (1-T&D losses of the grid serving the telecom area (expressed as fraction))

3.7.: Which of the formula, (i) or (ii) as given in para 1.23. of Chapter I is to be used for the calculation of carbon footprints from the Diesel 48 generator along with views on possible values Please comment with justification.

Ans.: The record of diesel purchased by the telecom operator is available. It can be taken as diesel consumed by the telecom operator. Alternatively, based on running hours, generators capacity and average diesel consumption, diesel consumption can be determined.

Carbon footprints from the Diesel generator = Diesel Consumed by the generators *Emission Factor of diesel

The emission factor due to diesel consumption in diesel generator given by United States' Environmental Protection Agency (EPA 2005) is 0.0027 tCO2 per liter.

3.8.: For calculation of average carbon footprint, which of the options mentioned in para 1.25 of Chapter I is to be used? Please comment with justification. Energy efficiency in Telecom networks

Ans.: Researchers at UPES Dehradun suggested accounting of carbon emission per subscriber basis as traffic based information is not available in India.

Considering International norms, OPTION 3: Averaging across total amount of traffic carried is to be used as it provides correct basis for comparison of carbon emission of telecom service providers.

3.9.: 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. Renewable Energy targets for Telecom networks

Ans.: **Energy efficiency in Telecom networks** **:** Research studies at University of Petroleum and Energy Studies (UPES) analysed the various renewable energy options for mobile telecom sites. It was observed that Solar Photovoltaic (SPV) and Hydrogen Fuel Cell are suitable options in Indian conditions. The payback period for both these technologies is around 3 years . GIS mapping (Longitude and latitude mapping) of all BTS sites is required to select appropriate renewable energy options .

3.10.: I f 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.

Ans.: The electricity generated by a RET project (funded/ maintained by TSP) being used for community, should it be subtracted from overall carbon emission of a TSP. It will attract the service providers to invest in RET project.

3.11.: I f the RET project is funded/ maintained by other agency, should that emission be counted? Please comment with justification.

Ans.: The agency funding the RET project can claim carbon credits under CDM mechanism. The emission should not be subtracted if the RET project funded/ maintained by other agency.

3.12.: P lease comment with justification on the approach suggested by the DoT committee.

Ans.: There is no roadmap and mechanism to achieve the targets set in 2012. There are no new targets. Well defined targets need to be set for energy efficient telecom network in India.

3.13.: 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.

Ans.: Incentives should be extended to TSP carrying out energy conservation measures. For off grid mobile sites support can be provided as suggested by the DoT committee under Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) and MNRE schemes.

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

Ans.: Year wise target should be fixed to fulfill the objectives of NTP-2012 (National Telecom Policy) and sustainability in telecommunication sector. 100% of rural towers and 50% of urban towers should be hybrid powered by 2020. Necessary financial incentives should provided to telecom service providers to meet the annual targets.