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CHAKR INNOVATION'S RESPONSE TO TRAI CONSULTATION PAPER NO. 02/2017 ON APPROACH TOWARDS SUSTAINABLE TELECOMMUNICATIONS

- In the year as early as 2002, the World Health Organization estimated that PM2.5 concentration contributes to approximately 800,000 premature deaths per year, ranking it the 13th leading cause of mortality worldwide. Worldwide, it is estimated to cause about 25% of lung cancer deaths, 8% of COPD deaths, and about 15% of ischaemic heart disease and stroke. However, many studies suggest that the relationship is even deeper and far more complicated than originally thought. [1][2][3]
- The "Harvard Six Cities study [4]," a cohort study published in 1993, followed 8,111 patients for 16–18 years and showed a 29% (95% Confidence Interval, 8–47%) increase in the adjusted mortality rate for the most polluted of the cities compared to the least polluted. Particulate air pollution was positively associated with death from lung cancer and cardiopulmonary disease. Particulate matter's increasing concentration also shows positive correlations with cerebrovascular diseases, though the effects are less pronounced. [5]
- The National Capital Delhi is also the pollution capital of the country. A very recent phenomenon was the "Great Smog of Delhi" which persisted in the region of national capital and adjoining areas between the dates November 1-9 which was termed as the "worst visualization" of how bad air quality had become. Many drew comparisons between this fog and the great smog of London which resulted in around 4,000 people dying prematurely.
- The severity of particulate matter pollution that Delhi is facing can be judged from the fact that if we take the data provided by CPCB (attached with this file) from just October 2016 onwards, we see average PM_{10} concentration comes out to be **389.27 µg/m^3** per day and the average $PM_{2.5}$ concentration out to be **204.5 µg/m^3** per day (taking RK Puram as Delhi's representative area). According to WHO, the safe limit of PM emission is –

PM_{10}	Annual Mean	20 $\mu g/m^3$
	24-Hour Mean	50 $\mu g/m^3$
$PM_{2.5}$	Annual Mean	10 $\mu g/m^3$
	24-Hour Mean	25 $\mu g/m^3$

[6]

- The terms used by CPCB and U.S. Embassy in Delhi to describe the environment of New Delhi is **'Severe'** and **'Very Unhealthy'** respectively. This phenomenon of pollution is not just limited to Delhi but is nationwide phenomenon with 10 Indian cities making it to the list of top 20 most polluted cities of the world in terms $PM_{2.5}$ as can be seen from the attached list of 'WHO ambient air pollution database'.

- The cities in the order of appearing on the 'WHO ambient air pollution' list are : Gwalior(2), Allahabad(3), Patna(6), Raipur(7), Delhi(11), Ludhiana(12), Kanpur(15), Khanna(16), Firozabad(17), Lucknow(18)(taken from WHO ambient air pollution database). We have to take note of the fact that a lot of Indian cities don't have a monitoring system for air pollution and hence are likely to go unnoticed.

- Delhi has more than 14,000 mobile towers. The generator sets installed on these mobile towers collectively produce more than 2100 tons of soot every year. Moreover, around 16% production of $PM_{2.5}$ can be traced from the generator sets. This humungous contribution in Particulate Matter production makes it obligatory for the Telecom Regulatory Authority of India to set limits on the emission of Particulate Matter in a fashion that is similar to restraints put upon CO_2 emissions. In fact, according to WHO, a reduction in just the particulate matter emissions from 70 $\mu g/m^3$ of PM_{10} and 35 $\mu g/m^3$ of $PM_{2.5}$ to 20 $\mu g/m^3$ of PM_{10} and 10 $\mu g/m^3$ of $PM_{2.5}$ respectively would result in ~15% reduction in deaths caused due to air quality. The time to act is now. [7][8]

- Thus, we propose that there should be a separate emission limit for the particulate matter (PM) considering the hazard that it poses for the general populace as established by various reports and studies referred in this response paper.

Question 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.

Measuring the carbon footprint is necessary because:

- It can form part of an overall CR (Corporate Responsibility) or Sustainability/Environmental Strategy.
- It provides an excellent way of managing carbon emissions and energy use, helping you to reduce costs and limit your environmental impact.
- It signifies to shareholders, clients, NGOs, the general public and the media that your business is committed to being a responsible company in a sustainable world.
- It helps you to prepare and be ready, should mandatory reporting come into force for your area of business.
- A verified carbon footprint provides the backbone for carbon offset schemes, which in turn provide a route to "carbon neutral" status.
- As people look to be part of socially responsible organizations, it provides an excellent way of engaging, retaining and attracting staff.

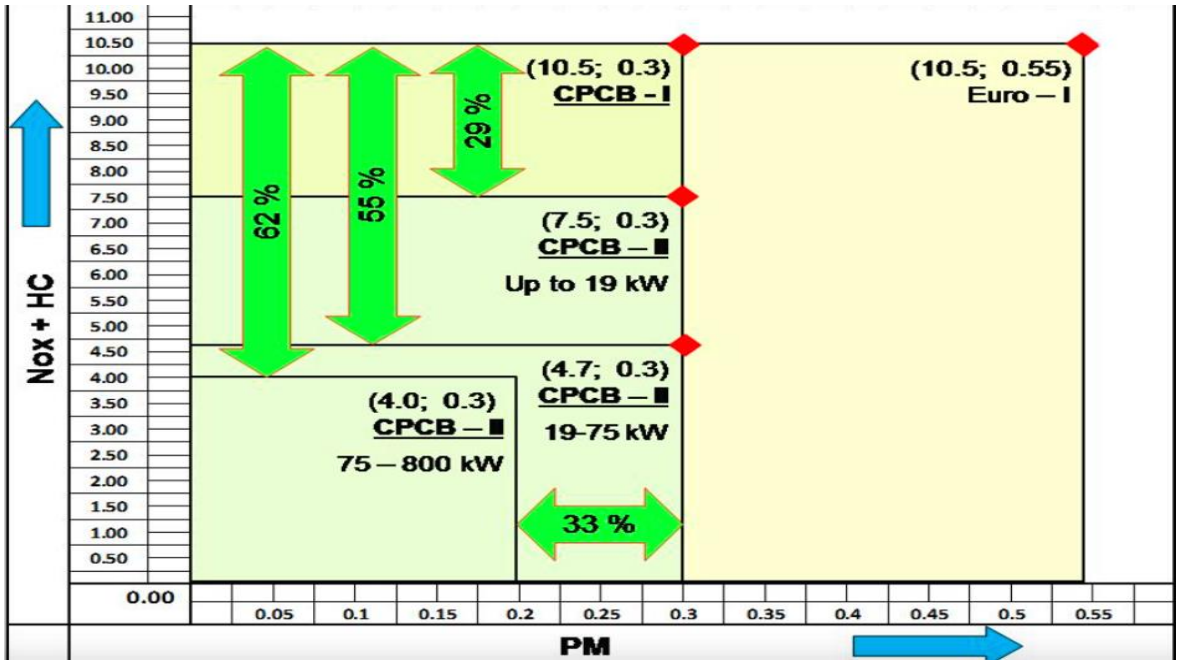
Independent carbon footprint verification gives you the assurance that your carbon footprint data are accurate and consistent.
Furthermore, being able to demonstrate that your carbon footprint has been independently verified satisfies your stakeholders' demands for accuracy, validity, materiality and transparency. Independent carbon footprint assurance is a key discriminator of real commitment and action, giving both your business and your carbon footprint credibility, thereby enhancing your market position.
The carbon footprint should be audited by a reputed lab which is recognised by Ministry of Environment and Forest and accredited by National Accreditation Board for Testing and Calibration Laboratories (**NABL**).

Summary: Auditing the carbon footprint of a telecom network by a third party auditor is highly recommended as this gives the assurance that the data collected is accurate and consistent. It would be a key discriminator of real commitment and action and would increase the stakeholders confidence in the matter

Question 3: Do you agree with the approach for calculating the carbon footprint? If so, please comment with justification.

Central Pollution Control Board (CPCB) - II is the current norms applicable for Diesel Generators up to 800 kW in India. These were introduced in year 2014 . As per the gazette released on 11th December, 2013, by the by Ministry of environment & Forests (MoEF) the Central Pollution Control Board (CPCB)-II norms are applicable since 1st April 2014.

Compared to emission requirements of the earlier norms (Central Pollution Control Board (CPCB) - I), current allowable levels of nitrogen oxide (NOx) and particulate matter (PM) — the two main pollutants in diesel engines have been reduced significantly in Central Pollution Control Board (CPCB)-II. Attached is a comparison between these norms, you will observe that the Central Pollution Control Board (CPCB)-II norms are more stringent than the Central Pollution Control Board (CPCB)-I norms.



Since the telecom sector in India uses diesel generators following Central Pollution Control Board (CPCB)-I as well as Central Pollution Control Board (CPCB)-II standards, it is not justified to treat the emission from both these generators in the same way. Hence assuming the carbon dioxide emissions from diesel generators, based on fuel consumption alone is not scientifically sound. The exhaust composition and the CO2 equivalent (CO2e) of the various pollutants should be taken into account while calculating the net CO2 emissions and calculating the total carbon footprint.

Since direct measurements of GHG emissions are generally not applicable for ICT organisations, most emission data are based on (measured or estimated) activity data (such as amount of electricity and fuel used) which should recalculated into CO2e (i.e. the equivalent quantity of CO2 that would be needed to give the same greenhouse gas effect as the corresponding amount of CO2).

According to ITU-T L.1420, (Methodology for energy consumption and greenhouse gas emissions impact assessment of information and communication technologies in organizations) the recalculation from activity data into CO2e includes two steps:

·First the activity data is recalculated into GHG emissions using CO2 and other GHG related emission factors for the applicable amounts of fuels, electricity or energy. Such emission factors can either be calculated by the organization or be collected externally from verified sources.

·Secondly the calculated amount of GHG emissions is recalculated into CO2e using the most recent Global Warming Potential (GWP) factors for the different greenhouse gases, as defined by the IPCC (see [b-IPCC]), taking into account a timeframe of 100 years.
Note that for some fuels combined factors exist that combine both these recalculations into one step. For example an energy emission factor for a certain fuel can give the kg CO2e per unit of fuel, comprising the combined effect of the CO2, CH4 and N2O. In this case, the second step is not necessary.

Telecom Regulatory Authority of India shall select or develop emission factors that:

·are derived from a recognised origin,
·are appropriate for the GHG source concerned,
·are valid at the time of quantification,
·take into account the quantification uncertainty and are calculated in a manner intended to yield accurate and reproducible results, and
·are consistent with the intended use of the GHG inventory.

Summary: Quantification methodologies, principles to collect data and emission factors: Telecom Regulatory Authority of India, should provide for reporting, a list of the CO2 and CO2e emission factors used along with their source. For GWP factors, the applicable version of [b-IPCC] shall be stated.

Question 7: Which of the formulas, (i) or (ii), in para 1.23 is to be used for the calculation of carbon footprints from the Diesel generator along with views on possible values of power factor and efficiency? Please comment with justification.

The formula for calculating the carbon footprint should be based on the CO2e of the various gases coming out of the diesel generator. Central Pollution Control Board has declared standards for the diesel generators upto 800 KVA.

Another way to find the composition of the exhaust from diesel generators is to test the exhaust composition from the diesel generator by a lab recognised by Ministry of Environment, Government of India and forest and accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL). A sample of 10% towers owned and operated by each telecom company can be used to extrapolate the emissions from all the towers.

The composition of the exhaust, combined with the CO2e of the emitted gases, should be used to calculate the carbon footprint of the telecom industry.

A sample calculation for the same is as follows:

As per Central Pollution Control Board, the emissions from diesel generators should follow the following standards:

TABLE

Power Category	Emission Limits (g/kW-hr)			Smoke Limit (light absorption coefficient, m^{-1})
	NOx +HC	CO	PM	
Upto 19 KW	≤ 7.5	≤ 3.5	≤ 0.3	≤ 0.7
More than 19 KW upto 75 KW	≤ 4.7	≤ 3.5	≤ 0.3	≤ 0.7
More than 75 KW upto 800 KW	≤ 4.0	≤ 3.5	≤ 0.2	≤ 0.7

Note:

1. The abbreviations used in the Table shall mean as under: NO_x – Oxides of Nitrogen; HC – Hydrocarbon; CO – Carbon Monoxide; and PM – Particulate Matter.

As per Intergovernmental Panel on Climate Change (IPCC), the CO2e of the mentioned gases should be as follows:

1. PM = 460
2. CO = 3.3
3. NOx + HC = 19

Hence the total CO2e of emitted will be:

Power Category	Emission Limit (CO2e/kW-hr)			Smoke Limit (light absorption coefficient, m^{-1})
	NOx+HC	CO	PM	
Upto 19 KW	142.5	11.55	138	0.7
More than 19 KW upto 75 KW	89.3	11.55	138	0.7
More than 75 KW upto 800 KW	76	11.55	92	0.7

These calculations have been done using Anthropogenic and Natural Radiative Forcing By Gunnar Myhre (Norway) and Drew Shindell (USA) and accepted by Intergovernmental Panel on Climate Change (IPCC).
Telecom Regulatory Authority of India can use these values accepted by Intergovernmental Panel on Climate Change (IPCC).

Question 8: For calculation of average carbon footprint, which of the options mentioned in para 1.25 is to be used? Please comment with justification.

The formula used for averaging the total carbon footprint should be the one by number of unique users

OPTION 1: Averaging across total number of subscribers
Averaging out by using the number of subscribers might give erroneous perception. Let's say number of users remain same and number of subscribers increase by large amount(which can be the case after one point, that is people start buying/using 2nd sim), then to meet the demands the number of towers/the capacity of tower will have to be increased so will the carbon footprint increase. But as the number of subscribers is also increasing along with increase in carbon footprint, the average might remain same, increase or decrease depending on the proportion in which the numerator and denominator are increasing. Which might not give accurate perception of the increasing harms caused to environment.

OPTION 3: Averaging across total amount of traffic carried
Same is the case with calculating average carbon footprint using traffic carried by telecom networks because in cases where the number of users remains same and traffic increases(use by existing users increase) which require to build new towers hence increasing total carbon footprint, as the traffic is also increasing, the average hence calculated may increase, decrease or remain same.

OPTION 2: Averaging across total number of unique users
But in case of calculating average using the number of users, Case 1: If the number of users remain same and the number of subscribers increase which will lead to increase in the demand and hence increase in number of towers, the average will increase giving right perception of the harm to the environment which is increasing. Case 2: If number of users remain same and the amount of traffic carried or usage increases, which will lead to increase in the number of towers and hence increase in carbon footprint, the average will increase again giving right perception. Case 3: if the number of users increase, the total carbon footprint will increase and the average might remain more or less same or increase but it won't decrease unless and until a new technology has been introduced

Summary: The option of 'averaging across total number of unique users' gives the fairest idea regarding the calculation of carbon footprint among the options given. The reasons have been mentioned above.

Question 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.

There are various Renewable Energy Technologies mentioned in the consultation paper, namely, Solar Photovoltaic, Wind Power, Fuel Cells, Hybrid Power Systems and battery technologies for the telecom sector. To harness these solutions maximum potential various challenges would have to be met. A short case study for Solar Photovoltaic, arguably the most feasible RET, underlines the challenges which are faced by RET's in general as well –

1. Solar Photovoltaic – As stated in the paper Solar Power is currently the most commercialized technology amongst RETs used to power towers and still the number of solar sites continues to constitute less than 10 per cent of tower companies' portfolio. The main reason for this scenario is –

1. Huge Initial Capital Investment – Even after The Ministry of New and Renewable Energy (MNRE), providing a 30% capital subsidy, there remains a huge capital investment that would have to be made by the telecom companies to meet the regulations set by the government.
2. Lack of Infrastructure – According to a report by Ernest & Young and FICCI, "*Speeding ahead on the telecom and digital economy highway - Key priorities for realizing a Digital Bharat*" put forward in 2015-2016, the amount of solar needed to meet the regulations by 2020 would be thrice the solar power installed all over India.
3. Lack of Space – With majority of the tower installations in urban area being done on rooftop, its highly difficult to obtain the space needed by the solar panels to operate. This makes the process eve more cumbersome for the telecom operators.
4. Theft and other operational challenges - Another detriment to the installation of solar panels is the probability of the PV cells getting stolen since these provide high reselling value in the market. Additionally, dust accumulation on the panels, unpredictability of the weather conditions and reliability/efficiency of the charge controller pose other operational variabilities for the telecom sector thus hampering the harness of solar power to its maximum potential.

A more feasible option for the telecom sector is to use retro-fit emission reduction devices on the existing diesel generators. While the environmental performance of diesel engines is constantly improving, new emissions standards only apply to new engines. However, because diesel is truly the workhorse of the Indian Telecom industry- with engines often lasting thousands of hours- a sizable fleet of equipment manufactured over five or seven ago is still in operation. Fortunately, many of the same advances used to improve new engines can be applied to this existing fleet.

The term "retrofit" covers many technologies and activities to reduce emissions from older engines, vehicles and equipment and has typically been defined broadly. While the term is frequently used as a label describing various exhaust emissions control devices such as the diesel oxidation catalysts and particulate filters, it can also encompass a broader range of options to reduce emissions, including re-powering, rebuilding and in some instances replacing existing equipment.

Installation of various emission control technologies may also improve emissions from older diesel engines. A regulation that takes into account the

CO_2e of the emission, and not just the amount of fuel used, will promote use of such emission reduction technologies.

Summary: There are various challenges that need to be addressed before we can begin to harness the maximum potential of Renewable Energy Technologies to power the telecom sector. A better approach would be to use these technologies along with other technologies that make the existing power sources better, like retro fit devices.

Question 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.

- According to a report by Ernest & Young and FICCI, "*Speeding ahead on the telecom and digital economy highway - Key priorities for realizing a Digital Bharat*" put forward in 2015-2016, the amount of solar needed to meet the regulations by 2020 would be thrice the solar power installed all over India.
- In the same report, it is mentioned that - "*Given that the industry is already under significant debt, arranging finance for RET is extremely difficult. According to the DoT's estimates, the total investment required for implementation of RET in three years (2013–2015) is around INR 337.5 billion, and in eight years (2013–2020) is around INR 576.0 billion*"
- This raises the need for an important introspection as to what is the result that we seek to achieve by setting renewable energy targets in the telecom sector. The investment in RET should not be an event unto itself but should be seen along with the bigger picture, that is, reduction of pollution by the telecom sector.
- Setting Renewable Energy Targets (RET) makes process of achievement of the above mentioned result of pollution reduction rigid. It also snuffs out the possibility of innovation that might achieve the same results with a much higher acceptance rate. Hence, we recommend setting up of stringent pollution reduction targets instead of RET targets.
- In fact, Delhi Pollution Control Committee (DPCC) has been following up with same ideals where they don't try to control the technology that

will be used to control pollution, rather they keep a stringent check upon the pollution itself. In generators 800 KVA and above, they have welcomed the usage of wet scrubbers which brings the pollution level of gensets within compliance limit.

- We propose that a similar approach should be followed by TRAI as well. There are various technologies available, such as many retro fit devices mentioned above which can bring the generator sets well within compliance limit and also have high acceptance level within the telecom sector. +

Summary: Rather than setting targets for renewable energy, targets should be set for reducing the carbon footprint of the telecom sector. The approach to be used to meet these targets should be decided by the telecom sector.

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