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STUDY OF ISSUES IN GREEN MOBILE MARKET OF INDIA

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ABSTRACT

The present scenario of pollution and then added effects of mobile networks inspired us to have a research on Green Mobile Market. This added to understand the effects of carbon emitted by the mobile tower networks. It is increasing abruptly with the increasing number of mobile and internet users. The research was carried by analyzing the awareness of the people about the factors effecting the environment, about their awareness regarding TRAIs recommendation of maximum value of radiation, carbon emission and reduction factors. After the analysis, the opportunities are calculated to be in the field of RET(Renewable energy technology) which reduces carbon emission, 4G and 5G technology where there may be LTE and other future technologies. Data was collected from self designed questionnaire which resulted into seven significant factors in Indian market. These factors have been identified using factor analysis.

Key Words: Green Mobile Market, Green Telecom, Carbon Emission, TRAI, Renewable Energy Telecom(RET), Carbon Emission Estimation & Reduction(CEER).

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I. INTRODUCTION

Wireless communication industries have brought in a tremendous increase of mobile networks globally. With the development of technology and systems, there has been a rapid growth in the energy consumption by the users. As a globally responsible nation, India accords responsibility to seek in this area. The reason behind this is the emission of carbon by the mobile networks. The amount of carbon emission currently has increased abruptly by the result of increasing Telecom Industries and their poor power situation with the increased data services. To improve the Quality Of Service (QoS), the Telecom Service Provider (TSP) increase the level of energy transmission which uplifts the performance but also affects the environment by the increased Carbon Emission.

TRAI (Indian Telecom Regulatory Authority) has timely introduced its recommendations on GREEN TELECOM and GREEN MOBILE NETWORKS. Timely initiative of Indian Telecom Regulatory Authority (TRAI) of releasing its "Recommendations on Green Telecom" in consolidating entire telecom sector stakeholders
opinion and providing clear direction for achieving green telecom objectives and later transforming them into mandatory operational requirements to Telecom Service Providers (TSP) is a strong step in the direction. (Krishna Sirohi,2013).Various industries and government have stated their comprehensive efforts for creating new protocols and algorithms, energy efficient architectures etc. they are focusing to create this by using various network types. Smartphone and increment in internet usage is another reason behind abrupt raise in emission of carbon because of internet data service functionalities to user which includes 2G network (GSM, CDMA), 3G (UTMS,CDMA2000), 3G+(HSDPA, EV-DO,WiMax) and 4G networks(LTE-Advanced and WiMax2).
Adopting green energy sources is required. Renewable Energy Technology (RET) Development will improvise this condition from the present scenario of Diesel Power Generated Energy Sources. All the TSPs must now urgently create and Telecom Carbon

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Emission Platform that understands the Carbon Emission from all TSPs and provide a Carbon Emission Estimation and Reduction (CEER) planning.

II. REVIEW OF LITERATURE

Among the energy-consuming industries, the Information and Communication Technology (ICT) industry takes 2% of global total *CO*2 emissions and 3% of global energy expenditure [2, 3]. In particular, 57% of the energy consumption of the ICT industry is
attributed to users and network devices in mobile and wireless networks [4], the scale of which is still growing explosively [1]. According to [5], the global mobile traffic is expected to reach 6.3 exabytes per month by year 2015, which is more than 26 times as much as the traffic load per month in 2010.Therefore the government of India has shown a keen interest in regarding this issue.(XiaofeiWang ,Athanasios V, Vasilakos ,Min Chen ,Yunhao Liu ,Ted Taekyoung Kwon,2011).The country needs a frame-work that establishes TSPs Carbon emission estimation of Telecom Service Providers which will draw useful intelligence required for the national statistical determination which eventually will help achieve a goal of higher energy efficiency resulting sustainable telecom infrastructure in India. Achieving the energy efficiency in telecom operation and also by converting the present dirty sources of energy (diesel power generated sources) into greener energy sources will be a step ahead in this direction.

A closer view on study of various network segments suggests that mobile networks are the major portion that emits high amount of carbon. Statistically, the base stations in the mobile network contribute about 59% of the total carbon emission while the rest of the percentage participation by the entire mobile network is 41%. The Carbon Emission estimates depends on some factors i.e. power consumption and carbon emission factor. The power consumption along with its mandatory cooling system requirements and emission factor associated with power source being used for powering the telecom equipment plays major role in carbon contribution. An appropriate method for right measurement of power consumption required by telecom equipment over a cycle of 24hours need be calculated. The accurate power

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consumption measurement will realize exact Carbon Emission taking place.It is important to note that the average dynamic power consumption of any telecom equipment is significantly lower than the static maximum power consumption.(Krishna Sirohi,2013).The second part deals with the development of Renewable Energy Technology. The problem with this is that the reduction of diesel operated or other expensive power source is not really possible.There are about 5,88,000 mobile Base Transceiver Stations (BTS) towers in the country and each BTS is having 15–20 KVA diesel generators as power back-up. One liter diesel emits 2.68 kg of CO2. More than two billion liters diesel is being consumed every year in mobile tower stations generating 10 million tons of carbon.(Pratap Kumar Panigrahi,2011)

The estimation of CEER (Carbon Emission Estimation and Reduction) value will lead to understanding the traffic and requirements of the signals. Because, it happens that during some peak hours only there is much traffic otherwise the congestion isn't always there but the supply of signals driven by diesel operated power supply is always in the quantity not needed everytime.

Some of green mobile network technologies are given in the Fig 1 which is currently going on globally:

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Project	Organizer	Region	Participants	Targets	Working Emphasis
EARTH	European Commission FP7 IP (3 years / 15 million €)	Europe	European main mobile operators and research organizations	Mobile networks	• energy aware radio and network technology • energy-efficient deployment, architecture, adaptive management • multi-cell cooperation
Green IT	METI & JEITA (Japan)	Japan	Over 100 companies, institutes and organizations	IT	• power efficiency at data centers, networks, displays • policy and mechanisms to encourage green IT • collaboration of industry, academia and government
GreenTouch	GreenTouch Consortium	Global	Experts form industry and academia	Telecom networks and mobile networks	• reinvention of telecom networks • sustainable data networks • optical, wireless, electronics, routing, architecture, etc.
OPERA-Net	CELTIC / EUREKA (3 years / 5 million €)	Europe	European main mobile operators	Mobile networks	• heterogeneous broadband wireless network • mobile radio access network • link-level power efficiency, amplifier, test bed
GREEN-T	CELTIC (3 years / 6 million €)	Europe	European main mobile operators	Mobile networks (particularly 4G)	• multi-standard wireless mobile devices • cognitive radio and cooperative strategies • QoS guarantee
GreenRadio	MVCE (3 years)	UK	UK universities	Base station and handsets of mobile data service	• power amplifier, power efficient processing • backhaul redesign, multi-hop routing, relaying, • resource allocation, dynamic spectrum access
Cool Silicon	Silicon Saxony Management	Global	Over 60 global ICT companies and institutes	ICT	• micro-/nano-technology • media communication • sensor newtork.
Green Grid	8 Main Contributor Companies	Global	Global ICT Companies	Data centers	• data center energy efficiency (design, measurement, metrics)
GSMAMEE	GSM Association Congress	Global	Over 800 mobile operators and 200 companies	Mobile networks	• benchmarking of mobile energy efficiency networks
Green500	Virginia Tech	US	Virginia Tech	Supercomputer	• benchmarking of greenest & fastest supercomputers
Cool IT	GreenPeace	Global	GreenPeace	IT	• leaderboard of IT brands on the contributions to the green IT

Fig 1: Summary of green mobile network project

III. OBJECTIVES OF STUDY

The objectives of the study were:

1. Toknow aboutand identify awareness of green mobile market in India.
2. To analyse the factors affecting green mobile market .

IV. METHODOLOGY

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The main objective is to know the knowledge, awareness and study the issues of implementationof green mobile market.Data was collected by conducting a survey and method used to analyze the data is Factor Analysis. Factor analysis is used to identify, assumptionsunderline dimension to reduce the number of variable by eliminating redundancy.

The study has been conducted in a short duration of time from January to March 2016. A self-designed questionnaire wasused for analysis. The study mainly focused from India. The responses were received on email and thorough social networking websites and through online forms. The sample size was 133 respondents. The data was collected from 133 respondents from various IT sector firm employees, bank and financial institutions and other professional institute. The primary data for research project is collected through Self-structured questionnaire where respondents' degree of satisfaction is recorded on scale of 1 to 5. The scale measured from 1 as strongly disagree and 4 as strongly agree and 5 as neutral. The questionnaire consisting of 12 statements with demographic was used for the study.

The collected data is coded, filtered, tabulated using MS-Excel and analyzed with the help of SPSS software using Principal Component Factor Analysis with Varimax rotation. It resulted with Cronbach'salpha reliability of 0.688 in the study.

Case Processing Summary

		N	%
Cases	Valid	132	100.0
	Excluded[a]	0	.0
	Total	132	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.688	17

V. ANALYSIS AND FINDINGS OF THE STUDY

Factor analysis is used to identify, assumptions underline dimension to reduce the number of variable by eliminating redundancy. The feasibility of data for factor analysis was determined

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by the Kaiser- Meyer- Olkin measure of sampling adequacy which resulted in 0.698 at significance level of 0.0.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.698
Bartlett's Test of Sphericity	Approx. Chi-Square	414.525
	df	136
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.556	20.918	20.918	3.556	20.918	20.918	2.591	15.242	15.242
2	1.545	9.087	30.004	1.545	9.087	30.004	1.984	11.670	26.912
3	1.394	8.202	38.206	1.394	8.202	38.206	1.448	8.518	35.430
4	1.348	7.932	46.138	1.348	7.932	46.138	1.393	8.192	43.622
5	1.234	7.256	53.394	1.234	7.256	53.394	1.285	7.558	51.179
6	1.100	6.472	59.866	1.100	6.472	59.866	1.268	7.457	58.636
7	1.047	6.161	66.027	1.047	6.161	66.027	1.256	7.391	66.027
8	.904	5.315	71.342						
9	.787	4.627	75.969						
10	.726	4.271	80.240						
11	.642	3.779	84.018						
12	.614	3.611	87.629						
13	.532	3.128	90.757						
14	.463	2.726	93.483						
15	.433	2.549	96.032						
16	.376	2.210	98.242						
17	.299	1.758	100.000						

Extraction Method: Principal Component Analysis.

The factpr analysis resulted into generation of seven factor havinng a cumulative variance of 66.027% as displayed in total varainace explained table above. Further variamx rotation with

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laiser normalization resulted in to identfication of factor loadings with each factor. This is been given in form of table below.

S.NO.	NAME	FACTOR LOADING	FACTOR NAME
1.	Renewable energy resource used in green mobile market	0.704	**Energy efficiency,** Eigen value of 2.519 having 15.242 % of variance
2.	Green telecom technology which leads to minimum energy consumption.	0.675	
3.	Name	0.620	
4.	Green Mobile Market	0.616	
5.	TRAI	0.612	
6.	Gender	0.836	**Social group,** Eigen value of 1.984 having 11.670 % of variance
7.	Age	0.792	
8.	Educational qualification	0.623	
9.	Harmful effect of carbon emission on environment.	0.688	**Harmful effect of carbon emission**, Eigen value of 1.448 having 8.518 % of variance
10.	SAR	0.622	
11.	Carbon emission of mobile network	0.740	**Overall Network,**Eigen value of 1.393 having 8.192 % of variance
12.	Occupation	0.581	
13.	Mobile radiation	0.802	**Radiation,**Eigen value of 1.285 having 7.558 % of variance
14.	Side effect of mobile radiation	0.846	**Side effect of radiation,**Eigen value of 1.268 having 7.457 % of

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			variance
15.	Maximum limit of SAR value allowed is below 1.6w/kg.	0.727	**SAR limit**,Eigen value of 1.256 having 7.391 % of variance
16.	Carbon footprint	0.716	

VI. LIMITATIONS OF THE STUDY

Green Mobile Market is a new concept and further work is going on in this area. Since the time of study was limited due to academics, so further study could not be done and is limited only to India. Further cross sectional study can be done on judgmental sampling.The study was purely exploratory and further longitudinal and horizontal study can be done on the topic.

VII. CONCLUSION

In this paper we have presented a survey of green mobile market. What all technologies are used in India for making our environment free from carbon? In our paper we have discussed issues related to carbon emission and mobile radiation from telecom towers and how much it is damaging our environment. We have also conducted a survey about knowing the awareness of people about green mobile and found out that still a lot of work is needed in building new technologies and making people aware and the green network. The current technology used in India for green mobile network is the use of Renewable Energy Technology (like solar, wind etc) to give power to mobile towers and make it energy efficient hence reducing carbon emission in environment, and technologies like 4G and 5G . However still a lot of work is required to be done in this field and government authorities like TRAI and TSP are working to build a good platform for better implementation of green mobile

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market in urban and rural parts of India and reducing the carbon emission in environment, and making people aware about the green mobile and its benefits and long term sustainability in environment and telecom providers.

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