AT THE SPEED OF IDEAS

TRAI CONSULTATION PAPER ON GREEN TELECOMMUNICATIONS

ALCATEL - LUCENT COMMENTS ON ISSUES RAISED

Carbon Footprint

3.1. How should the carbon footprint of Indian telecom industry be estimated?

First and foremost, a policy needs to be created that includes the development of an inventory following international standards for Green House Accounting, such as the WRI (World Resource Institute) protocol. Once a policy and a inventory structure is defined and in place, policy may dictate that telecommunications service providers and other players in the sector in India should adhere to it, thus mandating the reporting of Scope 1 and 2 emissions from their telecomm assets on timely fashion. An entity, public or private, might be the recipient and aggregator of such inventories, and would be able to generate a report that provides a whole view of the emissions of the Indian telecomm industry. In other words, we suggest that the industry adopt a model similar to the Carbon Disclosure Project CDP, which collects, analyzes and reports on companies and industry sector's emissions.

Primary data collected from service providers, e.g. annual energy consumption data converted to greenhouse gas emissions (carbon data) can be used. This can also be augmented with secondary data - network modeling tools that Alcatel Lucent has developed, which can provide carbon estimates based on a transaction approach to network traffic.

3.2. What is your estimate of the carbon foot print of the fixed mobile and broadband networks?

Providing an estimate of carbon footprint for specific telecomm assets, while a worthy effort, it may not provide an accurate view given all the variables involved, such as volume and technology. Additionally, given the fast paced of the telecomm industry, any estimate would be a continuous moving target.

Instead, what we propose is a well regulated process in which service providers managing telecom assets can report their emissions on a timely fashion following

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internationally recognized protocols such as the protocol from the World Resource Institute (WRI)
All of this supported by a policy, which from our point of view, should be the foundation from which further footprint monitoring and reporting would be based on. Such an approach would not only provide a total view of India's carbon footprint from telecomm assets but also a granular view of its components.

Alcatel - Lucent has developed modeling approaches and tools to estimate the energy consumption and carbon footprint of telecom networks end-to-end. This includes estimates for the sub-network elements such as fixed access, wireless access, and enterprise access (all of which have broadband components). Alcatel – Lucent can work with TRAI in evaluating the specific network elements within India and assessing the carbon footprint.

3.3. In case of mobile was would be the individual footprints of the radio access network and the core network? How are these likely to change with 3G and 4G technologies?

Using the modeling approaches and tools developed by Alcatel – Lucent's Bell labs, the individual carbon footprint of just the radio access network and core network can be derived. Our modeling experience has shown that typically 85 to 90% of the total network energy is consumed in the radio access portion with the remaining 10 - 15% being used in the core network portion. The change from 3G to 4G technologies will bring an increase in overall energy efficiency based on higher throughput, coverage by fewer base stations, and improvements in the equipment cooling needs. However, more definitive efficiency savings will need to be calculated based on detailed network configurations of the 3G and 4G networks deployed.

Carbon Credit Policy

3.4. How should the carbon credit policy for Indian telecom sector be evolved? What should be the timeframe for implementing such a policy?

Alcatel - Lucent agrees that in general a carbon credit policy can incentivize the shift towards renewable energy sources. An example can be giving carbon credits to operators for using renewable energy to power their exchanges and mobile base stations. Credits can also be given for demonstrating the use of more energy efficient network equipment to the deliver the same or more telecommunications functional-ity. The timeframe for such incentives should provide short-term (0 to 3 years) and long-term (5 to 10 years) objectives for incentivizing the operators.

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3.5. What should be the framework for the carbon credit policy?

An example of the framework can include carbon credits for:

● Increasing connectivity and driving productivity through mobile broadband access at home, in cities and in rural areas
● Engaging consumers and improving efficiency by enabling the mobilization of commercial and public services (particularly eCommerce, eLearning, eHealth and eGovernment)
● Reducing India's carbon footprint through machine-to-machine (M2M) technologies.

Availability of Power

3.6. What should be the metric to ensure success of the carbon credit policy in reducing the carbon footprint of the telecom industry?

Metrics can include carbon reduction goals compared to a specific base-year. The telecom industry can then offer a voluntary code of conduct that individual entities can endorse. Their products, services and network solutions can then demonstrate energy efficiencies and resulting carbon reductions that can be applied towards these reduction goals. Methods for standardizing the energy and carbon measurement and reporting metrics have been either developed or are currently under development. These standards can be adopted for a broader international alignment on carbon reduction. Gold/Silver/Bronze status for companies & Star Labeling/rating system for equipments will help in this regard.

3.7. What proportion of tower infrastructure is in rural areas? Please comment on the grid/electricity board power availability to these towers.

In India, 70% of tower infrastructure is in semi –urban & rural areas with a grid power outage of 8 hrs and above at present.

3.8. To what extent can active sharing reduce the carbon footprint and operational expenses?

Potential exists to reduce reliance on DG by 75%-90% utilizing Photo Voltaic and Wind Turbines , carbon reduction would be directly proportional to the reduction in diesel run time reduction using alternative energy sources.

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Domestic Efforts for Reduction of Carbon Footprint

3.9. What proportion of non-grid power supply to towers in rural areas can be anticipated to be through renewable sources of energy in India in the next 5 years?

50% can be made at present rate of CAPEX involved & capital subsidies (CFA) / potential to increase this amount to 75%.

3.10. How much saving accrues per tower if supply is through a renewable source instead of diesel for towers that do not get grid power for 12 hours or more?

It can provide savings of 50% to 90% of the current OPEX**.**

3.11. How can migration to renewable sources be expedited?

The only way at present state of art & the prevailing prices of alternate energy sources is capital subsidy support. Carbon credits should be the added advantage for telecom since for telecom towers ,emission of approx 15 tCO2e/yr can be saved for single BTS sites and the present rate of CER $14 ,the yearly revenue per tower will be very less ($210/yr) compared to CAPEX for renewable energy sources. Also the tax credits and low interest financing must be sponsored by TRAI**.**

3.12. If you are a service provider what steps has your company taken towards use of renewable sources of energy? Have the gains from this move been quantified?

In India, it is limited but globally deployment of renewable sources is in large numbers. Vodafone Qatar is an example with OPEX saving over 90%.

Methods for Reducing Carbon Footprint

Metrics for Certification of Product and Services

3.13. What should be the metric for certifying a product green?

Network infrastructure products such as radio access and core network products should employ standardized metrics that measure energy efficiency and carbon emissions. For example, network energy efficiency standards have been developed

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by ETSI, ATIS and IEC standards development organizations (SDOs). For carbon foot printing within the full lifecycle stages of network equipment, WRI / WBCSD has provided high level carbon accounting / reporting handbooks, and is currently developing the guidelines for ICT products including Telecom Network Equipment. For consumer premises equipment (terminal devices, PCs, phones, etc.) energy efficiency metrics and threshold criteria has been developed by the International Energy Star specifications and labeling standards.

3.14. Who should be the metric for certifying a network or service as green?

For network equipment, the standards development organizations (e.g. ISO, WRI / WBCSD) provide testing/reporting measures for assuring specification conformance, with information that can be submitted to end customers (e.g., Carbon Disclosure Project).TEC in consultation with BEE/Any other agency.

Adoption of Energy Efficient Technologies

3.15. As a manufacturer/service provider have you started producing/using energy efficient telecom equipment? How is energy efficiency achieved? Please explain.

From hardware power consumption to new network architectures, Alcatel-Lucent's Bell Labs researchers are constantly developing new ways to enhance the energy efficiency of telecom equipment and networks. We are examining the fundamental mechanisms by which telecom networks operate. Our research shows that although today's networks are vastly more energy efficient than their predecessors, our research indicates that there is still tremendous potential for improvement. It is this realization that is motivating us to re-examine and revaluate the fundamental principles and technologies on which networks are based with an eye towards radically reducing the power required to transmit information – over wires, fibers, through the air, or via means we have yet to conceive. We recently developed network architectures that can reduce the overall demand for power while providing increased network functionality. Bell Labs research has produced new higher energy-efficient amplifier designs, remote radio heads and intelligent antenna arrays for mobile communications. Our research has found, for example, that the energy needed to power cellular networks can be reduced by combining arrays of tiny femto radio base stations with a few large coverage macro stations. Increased use of photonics in components is resulting in decreased heat generation, which means that less energy is lost as heat. We are examining new techniques to improve thermal management performance and reduce the energy required to cool equipment. Our recent development include: Thermal interface materials to more rapidly conduct heat; Vapor

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chambers to better spread heat; Heat sinks to more efficiently dissipate heat. One result of these ongoing development efforts is the Alcatel-Lucent Modular Cooling Solution.

3.16. How does the cost of energy efficient and the normal equipment compare?

The key to demonstrating the cost of energy efficiency improvement is through Total Cost of Ownership or TCO. By evaluating the benefits of an energy efficient design or component over the full life cycle of a product, Alcatel - Lucent can provide the total benefits and savings for that product relative to its cost. In this way the end customer can understand the net benefits of cost and energy efficiency over the life of the product.

Use of Renewable Energy Technologies

3.17. What are the most promising renewable energy sources for powering telecom network in India? How can their production and use be encouraged?

Solar PV Hybrid solution with Wind Generators is most promising but the productive annual average wind speed is limited to some part of India. Solar PV can be used for rest of the portion Also the advanced battery technology & Fuel cells can be used depending upon the site's power composition.

Infrastructure Sharing

3.18. What is the potential of infrastructure sharing in reduction of energy consumption?

Active sharing will help but passive sharing will not much save the energy consumption, it only save the multiple DG running and subsequently the diesel consumption. It also results in combined site interventions.

Waste Management

3.19. What is the current procedure for storing, disposing and recycling telecom waste by the service providers and manufacturers?

For telecom network equipment, service providers are given a choice as to how they can handle network equipment that reaches its end of life. Alcatel - Lucent offers all service providers and for all types of network equipment (Alcatel - Lucent branded or not) the capability to have us uninstall the equipment and ship it to approved recyclers located throughout the world. These selected recyclers provide proper dismantling, scrapping and recycling into new materials that go back into the supply

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chain. Additional options include remanufacturing, whereby selected products are processed and resold for extended use within various global markets. For each ton of equipment that Alcatel - Lucent handles at end of life from its customers, about 80% gets recycled, 19% gets remanufactured and only 1% goes to secured land disposal.

3.20. How can waste management be made more green?

Plastics provide problems at end of life due to their flame retardants and small percentage of reuse in primary and secondary markets for recycled plastic materials. This is one key area that Ict manufacturers working together with plastic / polymer resin manufacturers are beginning to work to develop long term solutions. Currently most plastics at end of life are incinerated or disposed in landfills. Incineration can be properly controlled to reduce harmful emissions. But uncontrolled incineration (e.g., open burning) can produced harmful emissions. The goal is to further develop reusable plastic resins that can be re-introduced into the raw materials end of the supply chain. Where ever organic waste is easily available small biomass plants can be deployed, feasibility study on long term operations & maintenance is required.

3.21. What steps can be taken by the service providers in planning green networks?

Installing weather station in most representative sites will give an accurate vision of the Alternate Energy solution and will help to size the associated CAPEX. Installing monitoring system in order to monitor the power consumption, the fuel consumption and the Co2 footprint to plan the green transformation. Define and align the operational processes associated to the network planning and the energy planning .

Standardization of Equipment

3.22. What standards do you propose to be followed in Indian telecom network for reducing the carbon footprint?

The first step to reducing emissions is in understanding what the baseline is. In order to accomplish this, it is imperative that a policy and an inventory are developed to create a baseline and track any future reductions. The standard developed by the WRI is the premier standard followed by public and private entities around the world.

As for reductions of carbon footprint, there is no standard; however we recommend the following steps:

1. - Generate inventory

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2. - Identify those areas (Scope) in the inventory that account for the biggest share of emissions
3. - Define a reduction target and develop a 10-yr mitigation plan

We should note that step 2 is dependent upon the industry sector .e.g. telecom equipment manufacturing, service provider or end user, others.

Network infrastructure products such as radio access and core network products should employ standardized metrics that measure energy efficiency and carbon emissions. For example, network energy efficiency standards have been developed by ETSI, ATIS and IEC standards development organizations (SDOs). For carbon foot printing within the full lifecycle stages of network equipment, WRI / WBCSD has provided high level carbon accounting / reporting handbooks, and is currently developing the guidelines for ICT products including Telecom Network Equipment. For consumer premises equipment (terminal devices, PCs, phones, etc.) energy efficiency metrics and threshold criteria has been developed by the International Energy Star specifications and labeling standards.

3.23. Who should handle the testing and certification of green equipment and networks?

For network equipment, the standards development organizations (e.g. ISO, WRI / WBCSD) provide testing/reporting measures for assuring specification conformance, with information that can be submitted to end customers (e.g., Carbon Disclosure Project). TEC in consultation with BEE and MNRE will provide the guidelines.

Manufacturing Process

3.24. How can manufacturers help in reducing GHG across the complete product life-cycle?

Thorough and systematic use of life-cycle assessment (LCA) forms the foundation of Alcatel - Lucent's effort to reduce the environmental impact of our products and networks. By evaluating the impact of each product, including its sub-assemblies, we can continually improve design, material selection and such operating characteristics as energy efficiency. What is more, life-cycle assessment enables us to identify environmental issues at multiple levels and to track eco-sustainable evolution over time.

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● Network or system-level LCA: to evaluate new architecture features to conserve energy use and promote increased functionality.
● Product assembly level LCA: to set targets for future new products, for example for energy efficiency.
● Component-level LCA: to help select materials.

The Alcatel-Lucent life-cycle assessment (LCA) estimator makes it easier for product developers to evaluate the environmental impact of a new product over the course of its entire lifetime -- while the product is still on the drawing board. Developers integrate life-cycle eco-impact into the design process right from the outset by comparing estimated greenhouse gas emissions of a new Alcatel-Lucent product to industry-based LCA data. The estimator also has the unique capability of assessing eco-impact for all life-cycle stages of a product – manufacturing, transport, and use and end-of-life treatment. This information is valuable not only for developers but for customers, who may need it for their own sustainability assessments. Life-cycle assessment (LCA) is becoming a fundamental methodology within the broader sustainability management framework for businesses to assess and take action on the environmental impact of their products, solutions and processes. Until now, the time and volume of information needed to perform a LCA has discouraged more widespread adoption of this extremely valuable technique. Now, Alcatel-Lucent has developed a simplified LCA framework that more efficiently evaluates eco-impact information for ICT products.

Monitoring and Reporting

3.25. What should be the rating standards for measuring the energy efficiency in telecom sector?

The specific parameters used to measure energy efficiency may vary depending on what sector of the industry an entity is part of. However, there is in general two accepted ways to measure energy efficiency: total emissions reduction and carbon intensity.

Carbon intensity is typically defined as the amount of carbon emissions involved in producing an economic benefit divided by a measure of such economic benefit. For example, a traditional measure of carbon intensity could be Carbon produced to generate 1 dollar in revenue.

Again, multiple variations of carbon intensity can be derived. In general, carbon intensity is a better method to benchmark energy efficiency across the industry and we would recommend its implementation.

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For the telecom sector, network energy efficiency standards have been developed by ETSI, ATIS and IEC standards development organizations (SDOs).The GSMA has established standards and metric that are accepted by most SP that utilize GSM standard.

3.26. Please give suggestions on feasibility of having energy audit in the telecom sector on the lines of energy audit of buildings.

Audits for assessing the energy efficiency of telecom networks is a viable mechanism and has been employed voluntarily by equipment makers such as Alcatel - Lucent for their customers (service providers). Alcatel - Lucent offers network optimization services whereby we can perform an inspection and assessment of a customer's network (central offices, cell towers, remote facilities) and provide recommendations on energy efficiency improvements. Alcatel - Lucent also employs network modeling tools to further assess a customers specific network configurations and to help them select / optimize potential new products and configurations that can deliver more energy efficiency and low-carbon ICT solutions. Energy audits for telecom are possible with OMC and data collection form energy consumption and energy production per site. This allows analysis and recommendation on prescriptive measures.

From a regulatory perspective, it is advised that specific norms be set in place and communicated to the operators through mutual discussions. These can be subjected to periodic audits by TRAI / other Government agencies and the results published.

3.27. What should the monitoring mechanism for implementation of green telecom?

The service providers should be in the best position to monitor their telecom networks and to provide improvements to them. Government can provide incentives to help stimulate improvements and provide short and long terms advantages.

3.28. Who should be the monitoring agency?

TRAI in collaboration with support of the GSMA and other industry support associations.

3.29 What type of reports can be mandated and what should be the frequency of such reports?

Again GSMA has a series of reports and reporting frequencies that can be used as a model.

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Incentives for Green Telecom

3.30. What financial and non-financial incentives can be useful in supporting the manufacturers and service providers in reducing the carbon footprint?

The TRAI can encourage local governments to review and streamline country and town planning procedures to facilitate faster and wider roll-out of mobile broadband. Frameworks can also be put in place at a national level for specific exemptions, and/or public-private investment, for eco-efficient towers and masts. The TRAI can ensure that policies for electromagnetic fields are consistent with World Health Organization recommendations. The TRAI can encourage commercially-based infrastructure sharing, where it is technically feasible, to promote energy and cost efficiency.

Promoting R&D for Green telecom

3.31. What R&D efforts are currently underway for energy efficient and renewable energy telecom equipment?

Research conducted by Bell Labs shows that today's networks have the potential to be 10,000 times more energy efficient. A concerted effort to bring energy efficiency closer to this theoretical limit would shrink the estimated 2% of the world's carbon emissions directly contributed by ICT. More importantly, it would also lower the 98% contributed by all the other sectors touched directly and indirectly by ICT. The Solution - The GreenTouch™ global consortium is committed to reinventing the network as we know it. The goal is to invent the technologies needed to make communications networks 1,000 times more energy efficient than they are today. To achieve a fundamental re-design of networks, the consortium aims to deliver, within five years:

- reference architecture
- specifications
- technology development roadmap
- demonstrations of key components, including entirely new technologies

The Alcatel-Lucent Alternative Energy Program aims to make it possible for operators of wireless networks to use alternative energy virtually anywhere in a cost effective way. The program is bringing to market the very first integrated, pre-tested, mass produced alternative energy solution to power wireless base stations, which can be deployed on a global scale with standard delivery lead times. The program, launched in 2009, is designed to address a market of more than 100,000 sites by 2012.

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3.32. How can domestic R&D and IPR generation be promoted?

Provide a robust incentive program (e.g., R&D stipends / co-funding programs, tax credits, etc.) that promotes domestic R&D and IPR generation.

3.33 Would it be a good idea for TRAI to evolve a best practices document through a process of consultation with the stakeholders?

Yes, best practice sharing is a good idea.

At Alcatel-Lucent, we are convinced that this can take place only through an open, collaborative approach that we can collectively fully address all the facets of the eco-sustainability challenge. Alcatel-Lucent has made **open innovation** a strategic priority and has taken an active or leading role in various collaborative initiatives, ranging from research consortia and partnerships to standards bodies and industry groups. Our creation of the **GreenTouch™** consortium (greentouch.org), our commitment to the Global eSustainability Initiative (GeSI), and our engagement in the World Economic Forum's efforts to combat climate change are examples of how Alcatel-Lucent translates its drive towards eco-sustainability into concrete collaborative initiatives.

At Alcatel-Lucent, the success and sustainability of our business depends on our ability to help customers reduce their carbon footprints. Through our own products, services and solutions, and in concert with industry partners, we are determined to contribute to reduced greenhouse gas emissions across broad sectors of the economy.

Best practices: In the paper "ICT, enabler of a low carbon economy", we identify the many opportunities for Information and Communication Technologies (ICT) to support environmental sustainability and describe the role of ICT for a low-carbon economy. You can download it at: http://www.alcatel-lucent.com/eco/low-carbon/

For further information on Alcatel-Lucent's eco-sustainability approach, please visit: http://www.alcatel-lucent.com/eco

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