2011 - 2012

ICTs and Environmental Sustainability

Mapping national policy contexts
India baseline study

DIGITAL EMPOWERMENT FOUNDATION
&
20 APC ASSOCIATION FOR PROGRESSIVE COMMUNICATIONS

Copyright @ 2011 Digital Empowerment Foundation &
Association for Progressive Communications

Report Authors: Syed S. Kazi & Divya Menon
Research Assistance: Ashok Karna

Design & Layout: Sapna Subba

Published by:
Digital Empowerment Foundation
House 44, Third Floor, Kalu Sarai, New Delhi – 110016, India
Tel: 91-11-26532786 / 26532787; Fax: 91-11-26532787
Email: syed.kazi@defindia.net
Web: www.defindia.net

Printed by: Wings Marketing Pvt. Ltd, New Delhi

ICTs and Environmental Sustainability

Mapping national policy contexts
India baseline study

Report Authors
Syed S. Kazi
Divya Menon

ACKNOWLEDGMENT

The issues around environmental sustainability and climate change have emerged at no less critical stage of development and growth process across the globe. World over, the areas around these issues have been discussed, and debated as to how to address the crucial challenges impacting our environments and climates as a retrogressive impact out of our development and modernization drives. The latest 17th Conference of Parties (CoP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Durban is the first such political leaders meet after the Cancun Summit.

One critical area here is the essential link between environment and climate with Information Communication Technology (ICT) sector.

There are twin aspects in the ICT, environment and climate linkage. One is how to stem the fall outs from IT sector surge impacting our environment and climate. This includes the disturbing challenge of e-waste phenomena, slowly but surely polluting our landscape, water bodies and ecosystems. The other is how to promote green IT practices across the public, private sectors in their institutional operations and management. Both these aspects are inter-linked and critical to hold together.

India is an emerging knowledge and economic power. The IT & ITeS sectors contribute to around 7% to India's GDP. Alongside, there is nationwide drive for computerisation, e-governance in public, private sectors. The procurement, usage, disposal, replacement rates of IT and ICT products are all time high. Logically then, the negative impacts out of these is a gross reality. E-Waste is a rising challenge. This is more so due to lack of stringent, focused holistic e-waste policy framework and implementation. Loosely framed guidelines and rules are not producing visible impacts on the ground. While the government has its own approach, the industry segment is applying its home grown measures to address e-Waste or green IT needs.

The APC-DEF India project 2011 came at the right time. This project, 'ICTs and Environmental Sustainability: Mapping national policy contexts,' India baseline study, was aimed to map, study and analyse policy frameworks and action steps in the ICT, environment, climate change within respective public, private, civil society institutional settings. The study brings out critical findings as relevant for both policy and action steps. At our level, post study the launch of the 'Green Prakriya' project is being counted as an imported outcome to be carried vigorously further.

I must thank with all sincerity Association for Progressive Communications (APC) to partner with Digital Empowerment Foundation (DEF) for this important mapping study first time in India. APC selecting India for this mapping study in its four nation comparatives is itself a significant and relevant decision. For DEF, this marks a new thrust and approach in its ICT, environment and climate change approach in India and South Asia.

I take this opportunity to thank my colleagues Syed S. Kazi and Divya Menon for undertaking this important study and completing it in time.

This report has been made, designed and printed with much care and focus. However, readers may excuse and forgive any errors and mistakes that may have occurred unintentionally.

I wish a thoughtful reading to all!

Sincerely

Osama Manzar
Founder & Director
Digital Empowerment Foundation
osamamanzar@defindia.net

CONTENTS

1. Introduction 8
2. Overview of key findings 10
3. Objectives of study 12
4. Methodology 13
   4.1. Conceptualization of ICTs and environmental sustainability 13
5. The e-waste phenomenon 14
   5.1. E-waste in India 14
   5.2. Source of e-waste in India 17
   5.3. Issues in e-waste management in India 17
6. ICTs and climate change 19
   6.1. ICTs and climate change in India: The initial steps have begun 22
7. Key stakeholders and initiatives 25
8. Policy and legislative analysis 26
   8.1. Global and regional policy context 26
   8.2. National policy and legislative context 27
   8.2.1 Key e-waste policies 32
   8.2.2. Key climate change policies 36
9. Findings and analysis 39
10. Advocacy opportunities for civil society 42
11. Conclusion 45
12. References 46
13. Annexures 50

1. INTRODUCTION

The importance and relevance of information and communications technologies (ICTs) in nation building and development processes is a real phenomenon today. Worldwide the increasing emphasis is on why and how the deployment of ICTs can contribute to gross domestic product (GDP), improve governance and public service delivery, improve information and communication processes, scale up work culture, and develop human resources with new skills, amongst them. The effective deployment of ICTs is seen to have a directly proportional link with growth and development.

The IT and IT-enabled services (ITeS) sector has been one of the mainstays of the Indian economy, contributing to over 5% of GDP. The use of ICTs has increased manifold in the past two decades. The government – national, state and local governments – has emerged as the single largest consumer of IT and ICT products and services.

While the larger focus so far has been on ICT deployment for development and growth, the fallout of this in terms of its negative impact on the environment and ecosystem has found less attention in relevant forums. For instance, an emerging but core realisation has been on management and disposal of e-waste[1] in terms of effective and sustainable handling of this waste during production, use, re-use and disposal. In India, the boom in ICT roll-out has created a new, dangerous and toxic waste stream, and concern has been expressed over the improper disposal of electronic equipment.[2] For instance, it is reported that e-waste is being dumped in the country by developed nations using loopholes in domestic rules, which allow NGOs and educational institutions amongst them to import electronic items freely on the pretext of donations. A recent survey reveals that nearly 800,000 tonnes of e-waste had been generated in India by the end of 2012[3] - and so far the country lacks an effective disposal mechanism.

The government, as the biggest stakeholder, led by the Ministry of Environment and Forests and a few local governments, recently introduced policy and executive decisions on managing ICTs, yet these steps have still to prove themselves. No policy has been passed

[1]E-waste is waste electronics or electrical goods which are not fit for their originally intended use or have reached to the stage of their end of life. This may include items such as computers, servers, mainframes, monitors, CDs, printers, scanners, copiers, calculators, fax machines, battery cells cellular phones, TVs, and electronics components. Even, its contain copper, silver, gold and platinum.
[2]MAIT-GTZ study on Assessment of e-waste in India, Business Standard (2008), India
[3]http://www.environment.gov.au, last visited on April 4, 2010.

into law at both national and local levels (other than a few administrative decisions). Industry has initiated a few measures – all independent and isolated ones – towards environmental sustainable practices in managing ICTs. However, this cannot be cited as part of widespread industry policy. Policy advocacy on the part of civil society and others is relatively absent, other than a few small interventions.

The issue of climate change has long transitioned from a mere scientific curiosity to one of the greatest challenges of today with multiple dimensions. According to the UNEP climate change is indeed the "defining challenge of our generation"." ICTs have had their share in being the victim, villain and hero in the context of climate change.

The day-to-day use of ICTs is growing at an exponential rate, and there are numerous debates on the carbon emissions, which contribute to overall global warming. It is estimated that the ICT industry currently accounts for about 2%-3% of the global carbon footprint due to greenhouse gases emitted. Apart from this, the indirect effects of using ICTs in other industries further aggravate the overall carbon footprint.

Nevertheless, the World Economic Forum[4] suggests that there is great potential for the ICTs to mitigate climate change by "decoupling of economic growth from energy consumption". ICTs are expected to play a major role in fighting climate change in areas such as infrastructure innovation, where major savings are expected in energy consumption, and also in reducing greenhouse gases. According to GeSi & EC.Europa,[5] using ICTs can help to reduce the total greenhouse gases by 15% by 2020.

While the debate continues on environmentally sustainable ICT practices, the fact remains there exists a wide divide between the national and institutional push in ICTs for driving development and growth and the equally relevant focus on the sustainable handling of ICTs.

[4]The Contribution of ICT to Climate Change Mitigation, https://members.weforum.org/pdf/ip/ittc/Contribution_ICTtomitigateclimatechange_ExecutiveSummary.pdf
[5]The Role of ICT to Combat Climate Change, http://unfccc.int/files/meetings/cop_15/climate_change_kiosk/application/pdf/09_12_09_13.00_donnelly-itu.pdf

2. OVERVIEW OF KEY FINDINGS

The subject of ICTs, environmental sustainability and climate change is a nascent one in terms of advocacy and pro-activeness in thinking about and implementing programmes addressing sustainable ICT usage and management. The focus at the national level has been on e-waste management spearheaded by the Ministry of Environment and Forests with the latest e-waste draft policy out for public review. Already there are differences emerging, especially among the IT industry, on various clauses like the one that puts the onus of e-waste management on the producers. The role of the Ministry of Communications and Information Technology is a subdued one: the IT Policy of 2000 has no mention of the environmentally sustainable management of ICT deployment and climate change impact. The Department of Science and Technology has a few independent measures catering to its departmental needs. The need for inter-departmental co-ordination among key ministries and agencies towards energy efficiency, procurement of products, and the re-use and recycling of used products is missing. The focus of the Parliamentary Standing Committee on IT is also silent on ideas and measures to address the underbelly of IT deployment. The government is still exploring how to handle the formal and informal segments of e-waste management.

Despite the emphasis on ICT infrastructure deployment in state and local governments, very few policy advocacy measures and initiatives are visible on the sustainable management of ICTs. Only few States like Delhi, Karnataka and Tamil Nadu have come forward to adopt preliminary measures.

In the absence of any government policy or legislation, the role of the IT industry is restricted to independent measures to manage its own procurement, use, re-use and disposal . The economics of e-waste management and production, usage and roll-out of environment friendly devises and applications is being considered and adopted by the industry. However, industry institutional measures are not a part of a larger organised and stated policy move.

So far civil society is playing a limited role in policy advocacy. The advocacy has largely focused on the study and documentation of issues with policy inputs for the government. This leaves enough scope for the civil society organisations to advocate on these issues, especially on the informal recycling of e-waste.

With regard to ICTs and climate change, the subject is in its initial stages of discussion and advocacy. Most initiatives have been by select government departments and ICT industry

players. At national level, the country has taken the first steps in green technology, limiting green-house gass (GHG) emissions through policies such as those aiming to improve energy and economic efficiency in production processes. The country is signatory to the Kyoto protocol that offers the Clean Development Mechanism (CDM) to offset emissions.

There are prevailing best practices in using ICTs for reducing GHG emissions. To negate the energy and carbon footprint, the IT industry has innovated a number of a number of promising technologies. One such technology is virtualisation, which enables organizations to safelyrun multiple operating systems and applications simultaneously, tasks previously relegated to separate servers. The ICT industry along with the World Wildlife Fund created the Climate Savers Computing Initiative (CSCI). The initiatives of hybrid car production (as Green Tech Infrastructure) by Honda Siel Cars India and Mahindra & Mahindra are a green signal of IT industry on environmental sustainability and climate change adaptation.

Still, despite the promising benefits of ICT-enabled technologies, the adoption and implementation of these solutions has been low. There are still issues to address such as the lack of initiative by public sector enterprises in integrating ICTs in enterprise activities, inadequate research and development support, and others. Over all, comprehensive policies articulating the role of ICTs in responding to climate change in India are rare.

e-waste material dumped at Seelampur ghetto in East Delhi, India

While the policies of the government and institutions are largely on ICT deployment for economic and institutional advantages, these have not incorporated sustainable practices, or clearly envisaged the role ICTs can play in adapting to and mitigation climate change. This despite the fact that the ICT sector has a critical role in helping meet India's goals as envisioned in the National Action Plan on Climate Change.

3. OBJECTIVES OF STUDY

By and large, there is no prior consolidated study in India of any sorts to measure the policy trends in relation to environmental sustainability, climate change and ICTs. This study attempts to address this. It also considers key aspects of the role of stakeholders – public, private, civil society and academia – maps hurdles in programme design and policy implementation in the field. Finally, it aims to identify the wider scope for policy inputs and interventions.

This study is part of the newly-created programme by the Association for Progressive Communications (APC) in the field of ICTs and environmental sustainability. It accompanies an inventory of sustainable tools and practices, and policy research into ICTs and environmental sustainability in four other countries: Bangladesh, Mexico, Egypt and Costa Rica. The survey, inventory and research have been made possible through funding from the International Development Research Centre (IDRC). This research and other activities in the APC programme area can be accessed on the organisation's website: www.apc.org.

e-waste material stock at Seelampur ghetto in East Delhi, India

4. METHODOLOGY

The report relies on both primary and secondary sources of data in order to come up with precise and objective findings. Primary data for this report has been collected in the course of interviews and survey. It has helped to plug the gaps due to limited published material on the subject researched. Facts and figures have been drawn directly from relevant stakeholders who include:

- National ICT policy makers (national government and departments)
- Provincial ICT policy makers (state governments and departments)
- Private sector agencies and business units
- Civil society and different associations
- Academia.

In the folder of secondary sources, the report has analyzed various policy documents, reports and parliamentary discussion notes, and provincial documents, books and articles. Clippings from newspapers, magazines and reports by civil society have also been analyzed. Both published and unpublished documents have been considered.

4.1. Conceptualisation of ICTs and environmental sustainability

In this report, ICTs and environmental sustainability is an extensive and comprehensive definition. It encompasses the environmentally sound and sustainable management of ICTs, including their procurement, production, use, re-use and disposal. Prominently, it also involves using ICTs to mitigate and adapt to climate change. Finally, ICTs can be used more generally in support of environmental causes, or as tools to assist in protecting and preserving the environment and for mitigating environmental issues. However, the particular focus of this report is on e-waste and climate change.

Environmental sustainability, according to the Ministry of Environment and Forests (July, 2002), is defined as meeting the requirements of the present without compromising the aptitude of upcoming generations to meet their needs.

5. THE E-WASTE PHENOMENON

According to the United Nations Environment Programme (UNEP), e-waste comprises more than 5% of all municipal waste – which is nearly the same amount of all plastic packaging – and is growing steadily. 20-25 million tonnes[6] of e-waste are generated per year worldwide.[7] Developed countries, like the US, Canada, Australia, and the EU lead the statistics of e-waste generation. For instance: more than 500-million computers became obsolete in the US alone between 1997 and 2007. Around 130 million cellular phones were discarded in the US by 2005, resulting in 65,000 tonnes of phone waste.[8] In countries like Japan, Europe, and Australia the statistic is also not so different. In the EU, every year a citizen leaves behind 25kg of e-waste (UNEP 2010:2). In the 21st century, developing countries like India are also going through a similar situation and e-waste has become a matter of critical concern.

5.1. E-waste in India

India's experiment in ICTs and environmental sustainability is closely linked to the strong emphasis in the IT / ITeS sector as a contributor to economic growth. ITeS-BPO exports were estimated at USD49.7 billion in 2009-10, as compared to USD 47.1 billion in 2008-09, an increase of 5.5%. IT services exports are estimated to be USD27.3 billion in 2009-10 as compared to USD 25.8 billion in 2008-09, showing a growth of 5.8%. A task force was set up by the Department of Information Technology in August 2009 to suggest measures to stimulate the growth of IT-ITeS and the electronics hardware manufacturing industry. The software and services industry, which is export driven continues to dominate the industry.

The production and growth trends of the IT-ITeS industry since 2004-2005 has been as follows:[9]

YEAR	PRODUCTION (Rs.Crore)	GROWTH (%)
2004-05	152,420	28.9
2005-06	190,300	24.9
2006-07	244,000	28.3

[6]Houghton, John. 2009. ICT and the Environment in Developing Countries: An Overview of Opportunities and Developments. Communications and Strategies 76. p. 54.
[7]Bushehri, Fareed I . November, 2010. UNEP's Role in Promoting Environmentally Sound Management of E-Waste. Cairo, Egypt: 5th ITU Symposium on "ICTs, the Environment and Climate Change". p. 2. URL: www.itu.int/dms_pub/itu-t/oth/06/0F/T060F00601700405PPTE.ppt.
[8]OECD. 2009. ICTs for Development: Improving Policy Coherence. Paris: OECD Publications. p. 152.
[9]Ministry of Communications and Information Technology. 2009. Information Technology Annual Report 2009-10. Department of Information Technology, Government of India. p.08.

YEAR	PRODUCTION (Rs.Crore)	GROWTH (%)
2007-08	295,820	21.2
2008-09	372,450	25.9
2009-10	411,220	10.4

Source: Annual Report 2009-10, Ministry of Communications & Information Technology, Government of India.

Production and growth trend of the Indian electronics and IT industries, since 2004-05 to 2009-10

While the growth of the IT sectoral curve moves upward, the generation of e-waste also follows this upwards trend. However, the waste management practices do not include sufficient mechanisms to deal with this trend. Municipalities are unable to put into practice waste segregation policies, and lack institutional and financial means to implement waste processing and disposal schemes. The social and human welfare impact is a key determinant in this assessment. Recently, the death of a person in a New Delhi's scrap market and hospitalisation of seven others has brought to light the harmful effects of radioactivity and the urgent need for a national e-waste management policy to prevent any such incidents in the future.[10]

Sixty-five cities in India generate more than 60% of the total e-waste generated in India[11]. Ten states generate 70% of the total e-waste generated in India. Maharashtra ranks first followed by Tamil Nadu, Andhra Pradesh, Uttar Pradesh,West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab in the list of e-waste generating states in India. Among top ten cities generating e-waste, Mumbai ranks first followed by Delhi, Bangalore, Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat and Nagpur. The city of Mumbai currently tops the list of major e-waste generating cities, at around 11,017 tonnes per annum, followed by Delhi at 9,730 tonnes, Bangalore at 4,648 tonnes, Chennai at 4132 tonnes, and Kolkata at 4025 tonnes (in 2010). The recycling of e-waste involves handling toxic materials such as lead, cadmium, mercury, brominated flame-retardant, and polyvinyl chloride (PVC). All these result in environmental and health hazards if not properly handled. Though, there are 14 authorised e-waste recyclers, there is a need to enhance the recycling

[10] Jha, Durgesh Nandan. 12th of April, 2010. Burnt E-waste raises health alarm for locals. Delhi: The Times of India. URL:http://timesofindia.indiatimes.com/city/delhi/Burnt-e-waste-raises-health-alarm-for locals/articleshow/5785918.cms.
[11] Guidelines for Environmentally Sound Management of e-Waste, CPCB,, MoEF, available at http://cpcb.nic.in/oldwebsite/Electronic%20Waste/Final-Ewaste-Documents/Executive_Summary.pdf

facilities. A report by Toxicslink (2004) found that 70% of the e-waste collected at recycling units in New Delhi was actually exported or dumped by developed countries (UNEP 2005 : 03).[12] An official statement from the Ministry of Environment and Forests states that the Central Pollution Control Board (CPCB) assessment estimated that over 146,800 tonnes of e-waste was produced in 2005 in the country, which is predictable to increase to 800,000 tonnes by 2012.[13] It has been estimated that sixty-five cities in India generate more than 60% of the total e-waste generated in India and only ten States generate 70% of the total e-waste in India.[14] It is estimated that 90% - 97% of e-waste gets recycled in India in the informal sector in hazardous conditions.[15] The Ministry of Environment and Forestry (MoEF) has recently approved the import of 8,000 tonnes of e-waste by Attero Recycling, which has established a recycling plant at Roorkee.[16]

e-waste material collected at Seelampur ghetto in East Delhi, India

[12]URL: www.grid.unep.ch/product/publication/download/ew_ewaste.en.pdf
[13]Priya, D. V. L. Padma. 2nd February, 2010. City among top 10 places in e-waste generation. The Hindu. URL: http://www.hindu.com/2010/02/13/stories/2010021361030300.htm. Greenpeace. August 2008. TakeBack Blues: An Assessment of E-waste Takeback in India. Bangalore, India: Greenpeace. p.p. 3.
[14]Central Pollution Control Board. March 2008. Draft Guidelines for Environmentally Sound Management of Electronic Waste, Chapter 2. New Delhi: Ministry of Environment & Forests, Government of India.
[15]Mudur, G.S. September, 23, 2009. Not rubbish! India buys e-garbage - Centre allows e-waste imports for recycling, activists cry foul. Kolkata Edition. URL: http://www.telegraphindia.com/1090923/jsp/frontpage/story_11531142.jsp
[16]Ibid.

5.2. Source of e-waste in India

The major source of e-waste comes from the disposal of IT hardware from government offices, public and private sectors, academic and research institutions. Household consumers are also contributing a significant amount to the accumulation of end of-life electronics products. Apart from e-waste generated domestically in India, the volume of imported e-waste is growing substantially, even though unauthorised import is prohibited in India. Because of both of these factors, e-waste is one of the rapidly growing environmental problems in India.

There is an estimate that the total number of outdated computers originating from offices, houses, industries and household are of the order of two million. Manufactures and assemblers in a single calendar year are estimated to produce around 1,200 tonnes of electronic scrap. According to Abhishek Pratap of Greenpeace India, most of the e-waste is imported into India under cover of charity.[17] He says this is making India a dumping ground for e-waste. The Foreign Trade Act of 1992, which allows for donation of second-hand computers, is also blamed.

5.3. Issues in e-waste management in India

There is a lack of awareness of the hazardous nature of e-waste among people. The handling and dismantling processes are also disorganised and pose serious risks not only to the handlers, but to society as a whole. In the absence of a specific regulations, e-waste is handled in the informal sector as backyard operations using rudimentary techniques such as hammers for breaking apart components and burning and acid baths for recovery of wanted materials. The bits and pieces left over are then dumped, often in water, which can cause pollution and contamination. The informal e-waste recycling happens mainly in slums and only a small percentage of e-waste is recycled by organized industry. Due to the lack of governmental legislation on e-waste, including standards for disposal and proper mechanisms for handling hazardous materials, it mostly ends up in landfills or is partly

[17] Pande, Manisha. 25th of August, 2010. Scrapped Out. Business Standard. New Delhi. URL;http://www.business-standard.com/india/news/scrapped-out/405650/.

recycled in unhygienic conditions or disposed in waste streams. The lack of governmental legislation and of awareness among the public outlines the e-waste dilemma as an unmapped and invisible threat to India. While there are departmental initiatives dealing with e-waste, for their effective enforcement all the relevant stakeholders need to come together to enforce the laws and regulations.[18]

[18]Godbole, Nina. 2010. E-waste Management: Challenges & Issues. New Delhi, India: IBM Pvt. Ltd.p.p. 480-505.

6. ICTS AND CLIMATE CHANGE

The relationship between ICTs and the environment is complex and multifaceted, as ICTs can play both positive and negative roles.[19] Positive impacts can come from dematerialisation, such as online purchasing, transport and travel substitution, a host of monitoring and management applications, greater energy efficiency in production and use, and product stewardship and recycling. Negative impacts can come from energy consumption and the materials used in the production and distribution of ICT equipment, energy consumption in the use of ICTs, including for cooling, short product life cycles and unmanaged e-waste, and exploitative applications (e.g., remote sensing for unsustainable over-fishing).[20]

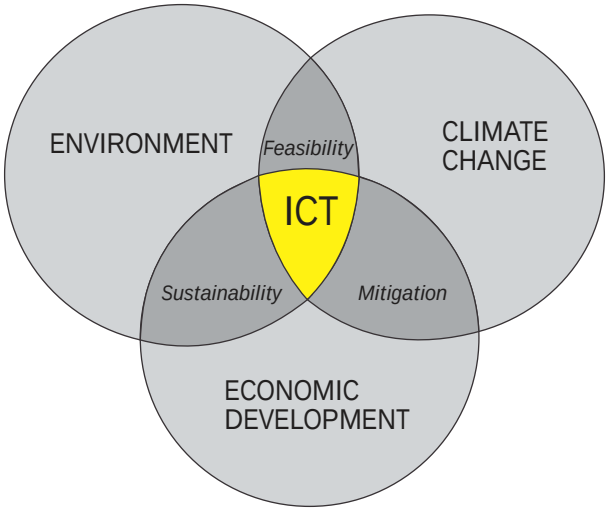

Figure 1: The Ecosystem in which ICT is an integral component

The impacts of ICTs on the environment can also be direct (i.e., the impacts of ICTs themselves, such as energy consumption and e-waste), indirect (i.e., the impacts of ICT applications, such as intelligent transport systems, buildings and smart grids), or third-order and rebound (i.e., the impacts enabled by the direct or indirect use of ICTs, such as a greater use of more energy efficient transport). Attempts to measure the impacts of ICT on the environment should take account of the potential rebound effects and the entire life cycle of a product, rather than simply the direct impacts of the product or application itself.[22]

Estimates of the direct impacts of the ICT industry vary with the definition of the industry and coverage of ICT-related energy uses, but the production and use of ICT equipment is estimated to be equivalent to 1% to 3% of global CO2 emissions (including embedded

[19]Houghton, John. 2009. ICT and the Environment in Developing Countries: An Overview of Opportunities and Developments. Communications and Strategies 76. p. 40.
[20]Daly, J. 2003. ICT and Ensuring Environmental Sustainability, Development Gateway (dgCommunities). URL:http://topics.developmentgateway.org, Accessed on 4th of December,2010.
[21]Plepys, A. 2002. The Grey side of ICT, Environmental Impact Assessment Review 22. p.p. 509-523.
[22]Hilty, L.M. 2008. Information Technology and Sustainability: Essays on the relationship between information technology and sustainable development. Norderstedt, Germany: Books on Demand Pvt. Ltd.

energy) and a higher and growing share of electricity use.[23] In 2006, it was estimated that ICT equipment (excluding broadcasting) contributed around 2% to 2.5% of worldwide greenhouse gas (GHG) emissions – 40% of this was reported to be due to the energy requirements of PCs and monitors, 23% to data centres, 24% to fixed and mobile telecommunications, and 6% to printers.[24] Already there are studies that show how advanced economies have reached a level of high-energy consumption due to an economy propelled by the mass ICT roll-out.

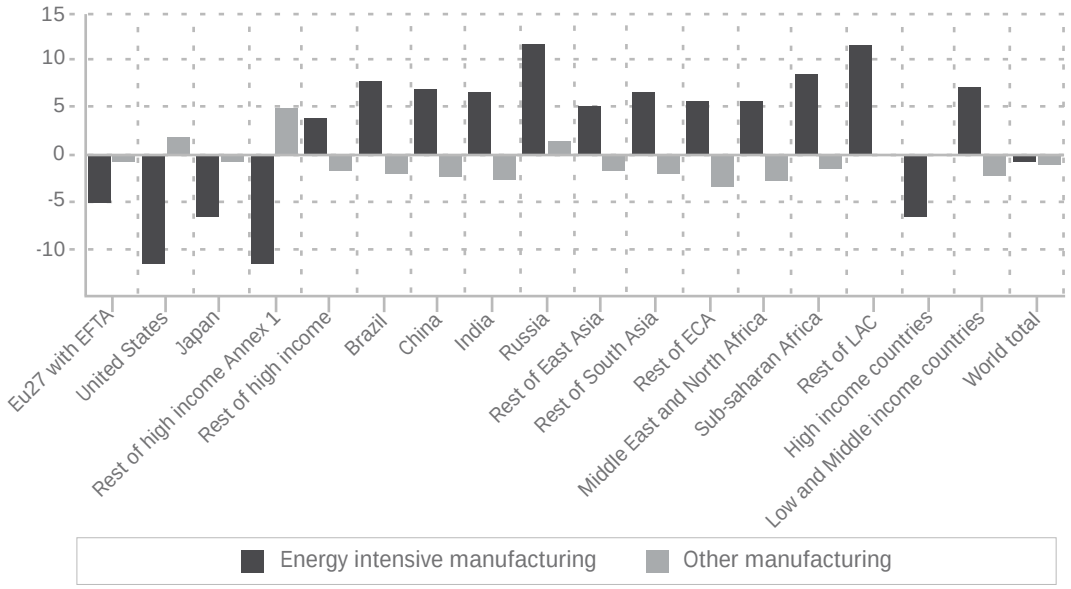

Figure 2: The consequence of climate change policy on high income countries

ICTs can also contribute to the resource and energy efficiency of many products, embedded in either the products themselves or their production processes.[25] For example, automotive electronics in the form of ignition chips have greatly improved the energy efficiency of motor vehicles, and industrial and household equipment and the design, construction and management of buildings increasingly includes 'smart technology' to better control resource and energy use, emissions, serviceability and durability.

[23]Kumar, R. & Mieritz, L. 2007.Conceptualizing Green IT and data center power and cooling issues", Gartner Research Paper. URL:http://www.gartner.com/DisplayDocument?id=519717
[24]Ibid.
[25]Houghton, John. 2009. ICT and the Environment in Developing Countries: An Overview of Opportunities and Developments. Communications and Strategies 76. p. 42.

Looking at ICTs as tools for dealing with environmental issues from a developing and emerging country perspective, the International Telecommunication Union (ITU, 2008) noted six application categories, as follows:[26]

- → Environmental observation
- → Environmental analysis
- → Environmental planning
- → Environmental management and protection
- → Impact and mitigating effects of ICT utilisation
- → Environmental capacity building.

The ITU also points out that producing, using and disposing of ICTs require materials and energy and generate waste, including some toxic waste in the form of heavy metals. ICT use can mitigate the environmental impacts directly by increasing process efficiency as a result of dematerialisation, and indirectly by virtue of the secondary and tertiary effects resulting from ICT use in human activities, which in turn reduces the impact of humans on the environment. Capacity building includes efforts to increase public awareness of environmental issues and priorities, the development of professionals, and integrating environmental content into formal education.

Focusing on the use of computers by businesses and consumers worldwide, the ICT industry along with the World Wildlife Fund created the Climate Savers Computing Initiative (CSCI). The CSCI has established aggressive new targets for energy-efficient computers and is educating businesses and consumers regarding the energy efficiency benefits of power-management tools. CSCI believed these efforts can cut GHG emissions by 2010 by an amount equivalent to removing 11 million cars from the road. Through this initiative, the ICT industry had pledged to reduce its carbon footprint by 54-million tonnes a year and save more than USD5.5 billion in energy costs. In India, the goal was to reduce 4 million tonnes of CO2 emissions and saving Rs. 2,250 Crores in energy costs (DESC:04).

[26] ITU. 2008. ICTs for e-Environment: Guidelines for developing countries, with a focus on climate change. ITU, Geneva. http://www.itu.int/themes/climate/

ICT technologies and enabled solutions have a substantial energy saving and GHG emission reduction potential.[27] There are numerous ways in which ICTs can be used to mitigate environmental impacts, including through their contribution to measuring, monitoring and managing, and enabling more efficient use of resources and operation of infrastructures through dematerialization, transport substitution and intelligent transport systems.[28]

6.1. ICTs and climate change in India: The initial steps have begun

India has introduced measures to limit green house gass emissions and improve the energy and economic efficiency of industrial production capacity. It has also focused on energy development, both conventional and renewable, which aims at improved environmental quality and limiting human health hazards from air pollution.[29] As a signatory to the Kyoto protocol it party to the benefits from the Clean Development Mechanism (CDM) that offers developing countries financing and technology to invest in emissions reduction.[30] Outside of government, virtual services such as ticket booking, banking and distance learning also play their part – even if stimulated by the economics of efficiency rather than climate change mitigation.[31]

The ICT sector has a critical role to play in helping meet India's goals as envisioned in the National Action Plan on Climate Change, both for climate change mitigation as well as adaptation.[32] A recent IDC study 'Reducing Greenhouse Gases through intense use of ICT' states that ICT use in industry offers a significant opportunity for greenhouse gas emissions reduction in India. The energy consumption of data centres in the country has grown rapidly in recent years, prompting the industry to innovate very promising technologies to reduce that growth.

[27]DESC. 2010. ICT's Contribution to India's National Action Plan on Climate Change: National Mission on Enhanced Energy Efficiency. India: Confederation of Indian Industry (CII-ITC). P.11.
[28]Houghton, John. 2009. ICT and the Environment in Developing Countries: An Overview of Opportunities and Developments. Communications and Strategies 76. p. 44.
[29]Jyoti K. Parikh and Kirit Parikh. 2002. Climate Change: India's Perceptions, Positions Policies and Possibilities. OECD. P. 25.
[30]ibid.p.21. While the government sees that a CDM project leads to real technology transfer, giving the country the ability not only to operate the technology but also to replicate and innovate, the issue of pricing of technology remains a major concern.
[31]TERI. 6th of February, 2008. RoundtableTable Discussion on "ICT and Climate Change". New Delhi.
URL: http://www.k4rd.org/ICT_CC_report.pdf.4 Ibid.
[32]DESC.2010. Forging Energy, Economic, and Environmental Solutions:The Case of India.

One such technology is virtualisation, which enables organisations to safely run multiple operating systems and applications simultaneously, tasks previously relegated to separate servers. Focusing on the use of computers by businesses and consumers worldwide, the ICT industry along with the World Wildlife Fund created the Climate Savers Computing Initiative (CSCI).

In India, the goal is to reduce four million tonnes of CO2 emissions and save Rs. 2,250 Crores in energy costs.[33] National government in India is leading the way by creating telecommuting programmes for their own workforces, putting more public services online and creating platforms that recognise innovative uses of ICTs. Initiatives like hybrid cars production (as Green Tech Infrastructure) by Honda Siel Cars India and Mahindra & Mahindra is a green signal to the IT industry on environmental sustainability and climate change adaptation.

National programmes like the Revised Accelerated Power Development and Reform Program is being connected to the larger national focus on alternative sources of energy as well as a focus on energy efficiency. But the pace needs to be sustained the removal of infrastructural and other bottlenecks as identified by a report by the IT Task Force.]

NASSCOM, India's premier trade body and chamber of commerce for IT-BPO industry, has also started its “Green IT” initiative. NASSCOM has partnered with TERI-Business Council for a new initiative called: “Corporate Action Plan on Climate Change: ICT as a Game Changer”. This initiative aims to identify the sectors where ICTs can play a game-changing role in carbon emission reduction, thereby significantly contributing towards India's action on climate change.

The establishment of the Bureau of Energy Efficiency, the declaration of 2020 voluntary targets and efforts to move towards a low-carbon economy reflect India's resolve to improve the energy efficiency of the industry and its commitment to tackle the issue of climate change using ICTs.

[33] ibid.

Still, despite the promising benefits of ICT-enabled technologies, the adoption and implementation of these solutions has been low.[34] This is due to various barriers:

- → A lack of initiative by public sector enterprises
- → A lack of awareness of the available technologies
- → A lack of ICT skills
- → The high cost of technology
- → Inadequate research and development support.

Over all, comprehensive policies articulating the role of ICTs in responding the climate change in India are scarce. At best, there exist sector specific policies and initiatives that explore the adoption of ICTs,[35] for instance in power, iron and steel sector. The National Environment Policy 2006 through its Action Plan talks little about the innovation of clean technologies and new ideas to tackle the climate change problem as well as to address environmental sustainability. Through its Action Plan, it suggests the adoption of clean technologies by industry, in particular the small and medium sector,[36] and talks of capacity building in the financial sector for appraising clean technology. At another level, the government offers a 30% subsidy to companies that power their telecom towers with solar energy. Several companies and banks have joined forces to provide solar power to poor villages currently without access to energy – for the same price of the kerosene villagers have been using to light their lamps. But sustained efforts are required at policy advocacy and implementation level across the three major platforms – public, private and civil society. The role and pro-activeness of the civil society in advocacy and implementation issues is key.

[34] DESC.2010. ICT's Contribution to India's National Action Plan on Climate Change: National Mission on Enhanced Energy Efficiency. India.p.14.
[35] Ibid.p.15.
[36] Ministry of Environmnet and Forests. 2006. National Environment Policy 2006. India: MoEF, Government of India.p.46.

7. KEY STAKEHOLDERS AND INITIATIVES

The growing boom of ICTs in India today is also simultaneously witnessing a growing impact on the environment and climate change. There is no denying the positive impacts that ICT implementation has brought about, but there is a lack of a stringent policy framework to mitigate the negative effects. This calls for action from various stakeholders and an effective role played by them in implementing these policies.

The primary stakeholders in India are the government agencies, nodal agencies that assist the government agencies, corporate bodies and the civil society organisations. For a list of key stakeholders and their respective initiatives please see Appendix 2. It notes the various perspectives of the stakeholders identified based on the one-to-one interviews that were conducted as part of this study.

Workers extracting valuable parts from e-Waste materials collected and processed at Seelampur ghetto in East Delhi, India

8. POLICY AND LEGISLATIVE ANALYSIS

The ongoing processes of e-waste management in developing countries like in India suffer from a number of drawbacks like the difficulty in unhealthy conditions of informal recycling, inadequate legislation, poor awareness and a reluctance on the part of businesses to address the critical issues. E-waste from developed countries finds an easy way into developing countries in the name of free trade and further complicated the problems associated with the e-waste management.[37] In India, recycling of e-waste is almost entirely left to the informal sector, which does not have adequate means to handle the increasing quantities or to perform certain recycling process safely, leading to a high risk for the human health and the environment. The existing policies dealing with e-waste address issues of production and trade of electronic products and services rather than from production and trade to final disposal of e-waste. At macro level, the concretisation of policy focus is yet to see shape. The national draft policy on e-waste is still being debated and discussed. Already differences have surfaced on the draft policy among the industry representatives.

The various policy drives dealing with climate change, like the National Environment Policy, National IT Policy and the National Action Plan on Climate Change, do not refer directly to how ICTs can be used in this role. However, these policy efforts touch upon the larger thematic area of reducing green house gas emissions and the carbon and energy footprint by the industry and government sectors, including the ICT industry. In turn, the latter touches indirectly on the issue of ICTs and climate change as witnessed in many parts of the world.

8.1. Global and regional policy context

The Indian policy context has to be seen in the context of the global policy context, for instance, the issues raised by the Basel Convention[38] and Free Trade Policy, of which India is a signatory. The Basel Convention, on the control of the trans-boundary movement of hazardous waste and its disposal, was adopted in 1989 and entered into force in 1992. country of import.

[37]Foreign Trade Act (Development and Regulation) of 1992

[38]Basel convention is the United Nations Environment Program (UNEP) Convention on the control of trans boundary movement of hazardous waste and their disposal. There are 32 countries (or regions) that have ratified the Basel Convention among 46 countries (or regions) in Asia-Pacific Region as of July 2008.

It was created to prevent the economically motivated dumping of hazardous waste from developed to underdeveloped and developing countries. The Basel Convention defines waste by disposal destination or recovery processes. These various processes are listed in the item no.4 of Annex IV of the Convention. The Convention has put the onus on exporting countries to ensure that hazardous waste is managed in an environmentally sound manner in the country of import.

8.2. National policy and legislative context

The Environment Protection Act – 1986 is one of the earliest pieces of legislation that was enacted to provide for the protection and improvement of the environment in India. The Act was the primary legislation that broadly covered all aspects of protection, improvement and enforcement of environment-friendly operations. Regulations that deal with environmental impact related to any waste management has been broadly covered by this Act under the category of pollutants affecting air and water and hazardous substances.

There is no specific mention of e-waste in the Act, but several provisions in the Act could be made applicable as e-waste falls under the category of hazardous waste. These include the definition of handling hazardous waste – covering its processing, storage, usage, disposal and destruction. The Act requires Central and State governments to enact legislation to safeguard the environment and people from exposure to toxic and hazardous waste, and violators of the provision of this act can be liable for punishment and penalties. The Act acts as the umbrella legislation and guideline for the other Acts such as the amended hazardous waste management Act and the newly drafted e-waste policy.

The National Environment Policy of 2006 does not specifically talk about steps or measures to address issues of ICTs, environmental sustainability and climate change in India. Among its objectives are the conservation of critical environmental resources, the integration of environmental concerns in economic and social development, and environmental governance. According to the policy, in order to ensure faster decision-making with greater transparency and access to information, the use of information technology-based tools will be promoted, together with the necessary capacity building in all action plans. Access to environmental information is the principal means by which environmentally conscious stakeholders may evaluate compliance by the concerned parties with environmental

standards, legal requirements, and covenants. The policy talks about development and enforcement of regulations and guidelines for management of e-waste, as part of the hazardous waste regime. However, it is silent as to how and where the regulations will be introduced and implemented with clauses that bind the stakeholders to a set of roles and obligations.

The Information Technology Act was enacted in 2000 under the mandate of Ministry of Communications and Information Technology. Among others it provides for legal recognition for transactions carried out by means of electronic data interchange and other means of electronic communication, commonly referred to as electronic commerce; approves and legalises digital signatures for transactions; provides for the authentication of electronic records and legal recognition of records; and penalties for tempering with documents. However, the Act does not talk about how to address instances of ICTs impacting on environmental and climate factors or how to address issues of e-waste.

Under the draft "E-waste (Management and Handling) Rules, 2010" based on the Environment Protection Act, 1986 (Sections 6, 8 & 25), the Ministry of Environment and Forests, apex body of the government, has finally decided to address the issue of e-waste management in India and has put forward a set of draft rules developed in conjunction with inputs from MAIT, GTZ, Greenpeace and Toxicslink. These rules are currently in their draft stage and open for suggestions from stakeholders. These would come into effect from January 2012.

Addressing one of the most serious environmental concerns, these rules have been explicitly formed to regulate the management of e-waste in India for the very first time and are seen as a welcome positive response to the call for stringent policy-level action on e-waste management. They have at least partially adopted the global framework of e-waste management by incorporating extended producer responsibility and also the need for Restriction of Hazardous Substances (RoHS) compliance that would follow international standards for the use of restricted hazardous substances in electronic manufacturing.

The major highlight of this draft legislation is that of the detailed enlisting of responsibilities of various stakeholders involved in the supply chain of e-waste management, ranging from consumer, producer, distributer, refurbisher, collection centres, dismantlers and recyclers. The draft set of rules also has for the very first time identified and categorised e-waste by

distinguishing between IT and telecom equipment and consumer electrical and electronics. The rules have also decentralised authority by vesting enforcement powers on every state-level pollution control board.

However, on the negative side, the rules though in draft stage, at some points fail to address some of the key concerns such as those related to the informal recyclers. The rules seem to promise regulation of the informal sector by proposing penalties for all unregistered recyclers. But this clause fails to address the practicality of the Indian informal sector scenario. It fails to offer an integrated business model to the informal sector to be involved in collection, segregation and dismantling of e-waste, while the formal sectors would recycle e-waste through government approved mechanisms. Further, the new draft rules seem to declare the import of electronic goods under charity as illegal. While this might be touted as a welcome regulation given the huge volume of illegal import from western countries, the ban does not take into account import under the pretext of metal scrap and does not ban or restrict the import of goods for recycling, which goes against the Basel Convention.

The rules also do not seem to address the issue of historic waste and disposal mechanisms for this. Most of the responsibility in the supply chain has been vested in the producer, though the rules lack clarity in detailing the exact scope of the producer's responsibility with respect to a need for common standards and frameworks that every producer can adhere to. Lastly, the rules do not specify any specific framework of standards for collection, evaluation, and disposal of obsolete electronic goods that every stakeholder could follow. The major drawback in this would be the heavy responsibility on the central and state pollution control boards for monitoring and supervision which may not be practical given the red tape and bureaucratic nature of the Indian political system. There needs to be a further breakdown and inclusion of more regulatory bodies in the enforcement of these policies.

These draft rules are indeed a sign of positive changes in the ICT and environment policy agendas which India had been grappling with for some time now. If the government incorporates the various suggestions from different stakeholders into the draft policy by next year, India could expect legislation that would most definitely take into account ICTs and its impact on environment and the country would not lag behind in this arena.

Considering issues of energy consumption and climate change or as a response to combat the impacts of climate change, the Prime Minister released India's National Action Plan on Climate Change (NAPCC). NAPCC has eight missions that provide a framework for addressing climate change as a core development issue.[39] With an economy closely linked to its natural resource base and climate sensitive sectors, India is faced with the challenges of poverty eradication; this means it must sustain rapid economic growth while also dealing with the global threat of climate change. India has to chart its own course of sustainable economic development and the ICT sector has a critical role in helping meet the country's goals as envisioned in NAPCC, both for climate change mitigation as well as adaptation.

It believed that central government policies play a crucial role in supporting the energy efficiency benefits of implementing ICTs in sectors where such technologies have not ubiquitously penetrated. The national Mission for Enhanced Energy Efficiency, for example, has identified nine of the most energy intensive sectors in the Indian economy – iron and steel, fertilizer, cement, chloralkali, aluminium, textiles, paper and pulp, and railways and power. A recent IDC study called "Reducing Greenhouse Gases through Intense Use of ICT'" estimates that ICT use in industry will provide a significant opportunity for GHG reduction in India. ICTs have both a direct and an indirect role in the energy any society consumes. ICT devices themselves consume energy – that is their direct energy and climate "footprint". But as documented by ACEEE, and more recently by The Climate Group and the Global e-Sustainability Initiative in their "Smart2020" report, ICT devices also help decrease the energy and climate footprint of other sectors through the energy productivity services they deliver (Digital Energy Solutions Consortium India:01).[40]

DESC believes that such a national strategy should include three complementary strands of policies and actions:

- → Policies to make private industries and government more energy efficient
- → Policies to create behavioral changes to make people more energy efficient
- → ICT industry actions to reduce the direct footprint of ICTs.

[39]Ministry of Environment & Forests. 2010. National Mission for a Green India. New Delhi: Government of India.

[40]Currently the Digital Energy Solutions Consortium in India (DESC India) includes a healthy mix of both non-ICT and ICT companies together with other important stakeholders and thought leaders like ACC Limited , Cairn Energy, Center for Study of Science Technology & Policy (CSTEP), CII-ITC Center of Excellence for Sustainable Development, Cisco, Dell, G.E. India Industrial Pvt. Ltd., HCL, Honeywell Automation India Limited, HP, IBM, ICF International, Infosys, Intel, Johnson Controls, KLG Systel, MAIT, Microsoft, NDPL, Nokia, RIM, Schneider, Tata Indicom, TCS, The Climate Group, Wipro and WWF-India.

Tamil Nadu has become the first state in India to come up with a separate e-waste policy in the country.[41] The state nodal agency, Electronics Corporation of Tamil Nadu (ELCOT), is identified as the nodal agency to play an active role towards e-waste management[42] The state policy gives more importance to citizen awareness and community-based participation as the first step in trying to address the e-waste problem. It has given priority to central facilities and different states co-operating in the process of e-waste management.

The Electrochemical Society of India and Karnataka Pollution Control Board recently conducted a one day workshop on e-waste regulations, hazards and solutions at the Indian Institute of Science, Bangalore.[43] The workshop was aimed at creating awareness about e-waste management and its associated challenges and issues. The participants of the workshop were witness to an interesting and insightful amalgamation of various thoughts and concerns highlighted by the numerous stakeholders comprising an elite group of academicians, policy-makers, industrialists, formal recyclers, researchers and scientific advisors. This workshop was touted as one of the proactive initiatives by an Indian state government body to provide a platform to bring together all stakeholders associated with e-waste management so that solutions and strategies in understanding and handling e-waste can be discussed.

The key highlights that arose from the various discussions were mostly related to the lack of awareness of e-waste and its associated environmental hazards, lack of effective e-waste disposal facilities for the general public, the disconnect between the existing laws and policies and their applicability on e-waste management, a lack of a multi-stakeholder perspectives in e-waste management, discrepancies in the felt sense of the levels of responsibility that should be shared, and the lack of effective material support to existing formal recyclers due to the heavily interconnected informal recyclers. Other issues that were highlighted involved a lack of effective legislation such as those of RoHS and the loopholes in policies related to import of used electronic goods from western countries.

[41] Ranganathan, Shyam, and Ramya Kannan. May 16th, 2010. Tamil Nadu frames separate e-waste policy. The Hindu. URL: http://www.hindu.com/2010/05/16/stories/2010051652041700.htm
[42] ibid.p.1
[43] Workshop conducted on January 29, 2011

The key outcome of the workshop was the flagging off India's first e-waste collection initiative. This is a one-of-a-kind initiative by a formal recycler, E-Parisaraa, that would visit various e-waste collection centres in the city such as malls, colonies, electronic service centres and collect the e-waste for recycling. This activity is to be managed by E-Parisaraa.

8.2.1 Key e-waste policies

Measures taken by Ministry of Environment and Forests

The Ministry of Environment and Forest has issued a number of notifications related to the safe disposal of hazardous waste, as follows:

- Hazardous Wastes (Management and Handling) Rules, 1998/2000/2002/2003
- MoEF guidelines for Management and Handling of Hazardous Wastes, 1991
- Guidelines for Safe Road Transport of Hazardous Chemicals, 1995
- The Public Liability Act, 1991
- Batteries (Management and Handling) Rules, 2001
- The National Environmental Tribunal Act, 1995
- Bio-medical Wastes (Management and Handling) Rules, 1998
- Municipal Solid Wastes (Management and Handling) Rules, 2000 and 2002
- Guidelines for Environmentally Sound Management of E-Waste 2008
- Draft E-Waste (Management and Handling) Rule 2009

Hazardous Waste (Management and Handling) Rule 1989 and Amendment[44]

The Hazardous Wastes (Management and Handling) Rules, 1989 were introduced under Sections 6, 8, and 25 of the Environment (Protection) Act of 1986. The rules provide for the control of waste generated, its collection, treatment, transport, import, storage and disposal. The kinds of waste affected are listed in the schedule annexed to these rules. The rules are implemented through the State Pollution Control Boards and Pollution Control Committees in the states and union territories. There were a few limitations to the implementation of the rules and amendments to these rules were introduced in 2000,

[44]Ministry of Environment & Forests. May, 2006. National Environment Policy 2006. New Delhi: Ministry of Environment & Forests, Government of India.

2002 and 2003, broadening the definition of hazardous waste and harmonising the hazardous waste list with that of the Basel Convention.

The Hazardous Waste (Management and Handling) Rules and its amendment in 2003, includes e-waste in schedule 1, schedule 2 as constituents and contaminants and List A and B of schedule 3. Schedule 1, which is the list of hazardous waste, includes the electronic industry at S.No. 31, along with industries producing identified wastes. The activities of the electronic industry come under the purview of this rule and these industries are required to obtain authorization from the State Pollution Control Boards. Electrical and electronic assemblies are covered under category B-1110 of Schedule 3 of the Hazardous Waste (Management & Handling) Rules 2003.

Batteries (Management and Handling) Rules, 2001[45]

These rules apply to every manufacturer, importer, re-conditioner, assembler, dealer, recycler, auctioneer, consumer and bulk consumer involved in the manufacture, processing, sale, purchase and use of batteries or components. These rules confer responsibilities on the manufacturer, importer, assembler and re-conditioner. They govern the registration of importers, the customs clearance of imports of new lead acid batteries, procedures for registration or renewal of registration for recyclers and also the responsibilities of consumer or bulk consumers,[46] and the responsibilities of auctioneers.

Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2008[47]

The objective of these rules are to put in place an effective mechanism to regulate the generation, collection, storage, transport, import, export, recycling, treatment and disposal of hazardous materials and hazardous waste destined for disposal. These rules came into force in exercise of the powers conferred by Sections 6, 8 and 25 of the Environment (Protection) Act, 1986 and in terms of the Hazardous Waste (Management and Handling) Rules, 1989. Electrical and electronic assemblies have been categorised under B1110. Interestingly, the Ecomark initiatives taken by the government in 1991 contains various

[45]ibid.
[46]Bulk consumers means a consumer such as department of central government like Railways, Defence, Telecom, Posts and Telegraph, the department of State Government, The Undertakings, Boards and other agencies or companies who purchase hundred or more than hundred batteries per annum.
[47]ibid.

guidelines on production, distribution, consumption and disposal of products and services including electrical and electronic equipment. The eco-labelling scheme known as `Ecomark' was meant for easy identification of environment-friendly products. Any product which is made, used or disposed of in a way that significantly reduces the harm it would otherwise cause the environment can be considered as Environment-Friendly Product.[48] This can be seen as one of the first pro-active roles of the government to assist producers and consumers become eco-friendly by providing incentives and encouraging customers to purchase eco-friendly products. However, due to various factors such as a lack of consumer demand for eco-marked products,[49] there was a decline in the producers applying for such a label. Even though India has begun its foray into this sector, challenges such as raising awareness about the importance of the eco-mark amongst both consumers and producers remain a pressing issue. The scheme did not create desired impact. Moreover, the new guideline has failed to show any direction for developing a proper policy to address the problem of properly managing hazardous waste.

Table 2: Policies and legislative measures taken towards ICTs and e-waste management

INITIATIVES/DRAFTED POLICIES & ACTS IN PUBLIC SECTORS	MINISTRY/DEPARTMENT	YEAR
The Environment Protection Act 1986 (23rd of May)	Ministry of Environment and Forests	1986
Hazardous Wastes (Management and Handling) Rules, 1989 (Amended in 2000 and 2003)	Do	1989
Municipal Solid Wastes management and Handling Rules 2000:	Do	2000
Batteries (Management and Handling) Rules, 2001	Do	2001
National Environment Policy, 2006 (18th of May)	Do	2006
The Hazardous Wastes Management, Handling and Trans-boundary Movement Rules 2008 (1998 Amended Act)	Do	2008
The National Green Tribunal Bill 2009 (31st July)	Do	2009

[48] http://cpcb.nic.in/oldwebsite/Eco-mark%20Scheme/THESCEME.html
[49] http://www.cai-india.org/index.php?option=com_docman&task=doc_download&gid=123

INITIATIVES/DRAFTED POLICIES & ACTS IN PUBLIC SECTORS	MINISTRY/DEPARTMENT	YEAR
E-waste (management and handling) Rules, 2010 (March)	Do	2010
Technology Policy Statement 1983	Department of Science & Technology	1983
Science and Technology policy 2003	'do'	2003
Guidelines for Environmentally sound management of E-waste 2008 (12th of March)	The Central Pollution Control Board (CPCB)	2008
Municipal Councilors Initiated Proposal on E-waste Management	Chandigarh, India	December 2008
Initiatives of Financial assistance and involvement of rag pickers in e-waste management.	Department of Environment, Government of Delhi	2010
Creation of awareness and training programme on the threat of e-waste and its proper management	The Municipal Corporation of Goa	2010
Collaborative initiatives with the Japan Government for proper management of e-waste	Gujarat Government	March 2010
Launch of "CRYSTAL" pilot project and bringing of informal recyclers into mainstream to manage e-waste	Karnataka Government	2010
Processing of safe re-use of e-waste and awareness programmes in collaboration with the Swiss Federal laboratories and central pollution control board of India	Do	May 2009
Flying Squads (initiative taken by minister of state for environment Sachin Ahir to check th proper disposal of e-waste in the state)	Maharashtra, India	2010
Creating awareness on e-waste through workshops	Government of Odisha, India	2010
Minimization of e-waste generation, utilization of e-waste through green technology, and sound disposal of e-waste (E-waste Policy 2010)	Government of Tamil Nadu	2010
Community Based collection of e-wastes	Do	2010
Tendering for the development of an Electrical & Electronic Waste management facility (31st August, 2010)	Pollution Control Board, West Bengal, India	2010

8.2.2. Key climate change policies

The Indian policy framework for climate change consists of policies most of which are contained in the Five Year Plan developed by the Planning Commission. Most recently, the Integrated Energy Policy highlights the need for a technically efficient mechanism of mitigating climate change issues. Climate change is integrated into the national development planning process and is directly supervised by the Prime Minister's Council on Climate Change.

Overall, the Indian policy framework focuses more on the development and use of renewable sources of energy through the use of efficient technology to mitigate climate change. There have been efforts both at the national and state level by the government to offer incentives in order to encourage such activities.

Even though the policies till date do not directly acknowledge the use of ICTs for mitigating climate change in India, there has been an emphasis on use of energy efficient technology. This can also be seen through the initiation of the National Action plan on Climate Change and other state policies.

Table 3: Policies & Legislative Measures taken towards ICTs and Climate Change Issues in India

TAKEN INITIATIVES / DRAFTED POLICIES & ACTS IN PUBLIC SECTORS	MINISTRY/DEPARTMENT	YEAR
Indian Forests Act - for environment and energy efficiency	Ministry of Environment and Forests	1927
Fuel Policy Committee		1974
Water (Prevention and Control of Pollution) Act	Central Pollution Control Board	1974
The Forest (Conservation) Act	Ministry of Environment and Forests	1980
The Air (Prevention and Control of Pollution) Act	Central Pollution Control Board	1981
The Forest Policy - highlights environmental protection through preservation and restoration of the ecological balance through efficient techniques	Ministry of Environment a nd Forests	1988
The Environment (Protection) Act	Ministry of Environment and Forests	1986

TAKEN INITIATIVES / DRAFTED POLICIES & ACTS IN PUBLIC SECTORS	MINISTRY/DEPARTMENT	YEAR
Public Liability Insurance Act	Ministry of Law and Justice	1991
The Policy Statement for Abatement of Pollution	Ministry of Environment and Forests	1992
India signed the UN Framework Convention on Climate Change (UNFCCC)		1992
The National Environment Tribunal Act	Ministry of Environment and Forests	1995
The National Environment Appellate Authority Act	Ministry of Environment and Forests	1997
The Energy Conservation Act – first legal framework in India that encourages energy efficiency	Ministry of Power	2001
Bureau of Energy Efficiency (BEE)	Ministry of Power	2001
National Hydro Energy Policy – stressed on use of Hydropower in India		
The Electricity Act	Ministry of Power	2003
The National Auto Fuel Policy - mandates 4 wheelers to comply with Euro IV standards by 2010 for emissions.	Ministry of Petroleum and Natural Gas	2003
Disaster Management Act	National Disaster Management Authority	2005
Integrated Energy Policy (IEP).	Planning Commission, Govt. of India	2005
National Environment Policy (NEP)	Ministry of Environment and Forests	2006
The National Tariff Policy – mandates that SERCs should purchase a minimum percentage of power from renewable sources	Ministry of Power	2006
Rural Electrification Policy – mandates electrification of 80,000 villages through renewable energy.	Ministry of Power	2006
The National Urban Transport Policy and the National Urban Renewal Mission		2006
Technology Information Forecasting & Assessment Council	Department of Science & Technology	1988
Punjab State Water Policy	State Government of Punjab	2008

TAKEN INITIATIVES / DRAFTED POLICIES & ACTS IN PUBLIC SECTORS	MINISTRY/DEPARTMENT	YEAR
Assam State Water Policy	Government of Assam, Assam Science Technology and Environment Council	2008
National Action Plan on Climate Change (NAPCC) – identified 8 core national missions including those dealing with solar power, energy efficiency and sustainable habitat.	Prime Minister's Council on Climate Change, Government of India	2008
National Water Mission	Ministry of Water Resources	2008-2009
Implementation of a mandatory program for the introduction of ethanol-blended gasoline (5% gasohol) nationwide .	Ministry of Petroleum and Natural Gas	2008
Kerala state disaster management policy – to implement a techno-legal framework for disaster management in the State.	Kerala State Disaster Management Authority	2009
State Forest Policy of Jammu and Kashmir (2010)	Forest Department (Government of Jammu and Kashmir)	2010
Coastal Regulation Zone (CRZ) Notification 2011	Ministry of Environment and Forests	2011

9. FINDINGS AND ANALYSIS

Policy advocacy and initiatives at national level have lately begun to be led by the Ministry of Environment and Forests, which has brought out a draft e-waste policy. Among others, the draft policy puts the onus of managing the waste on producers. However, there does not seem to be a common consensus on the appropriateness of this. While the policy calls for major responsibility to be taken by the producers of ICTs, the producers argue for shared responsibility. Prior to this, there were measures introduced by the ministry, but these lacked a strict implementation plan and visible outcomes. Surprisingly, there are no such policy advocacy and departmental measures from the Ministry of Communications and Information Technology. Initial efforts have been made by the Department of Science and Technology.

Advocacy and initiatives at state or provincial government level are marginal except for few like the governments in Karnataka, Tamil Nadu and Delhi. For instance, the Municipal Corporation of Delhi government has brought out enforcement mechanisms for effective disposal of e-waste. The Delhi Pollution Control Board (DPCC) has highlighted that the main issue that Delhi is grappling with is the lack of an facility for a safe disposal site of e-waste. The DPCC had initiated an e-waste management project calling for a public-private partnership and also for the integration of the informal sector into an e-waste management system. The DPCC has also initiated the establishment of e-waste recycling and treatment facility that would be in line with the existing guidelines in India for establishing and operating recycling and treatment and disposal facilities for hazardous wastes. In Karnataka, policy advocates such as the Karnataka State Pollution Control Board (KSPCB) have argued that the absence of specific legislation for the regulation of the management of e-waste poses a serious hurdle in taking stringent action against violators. KSPCB has issued authorisation notices to all the major IT companies to dispose of their e-waste with KSPCB registered recyclers in the city.[50] Due to the efforts of the KSPCB, Bangalore today has six authorised e-waste processing units that could handle around 10,840 metric tonnes of waste annually.[51] Apart from this, KSPCB has also ventured into addressing climate change issues through an educational awareness programme[52] (a web-based multilingual

[50] http://kspcb.gov.in/downloadableforms.htm
[51] http://expressbuzz.com/cities/bangalore/city-of-it-solutions-has-one-e-problem/245289.html
[52] http://expressbuzz.com/topic/kspcb-ngos-to-fight-climate-change/128893.html

interactive service). The city can also boast some key IT players who have been pro-actively formulating internal company policies for green procurement, production and disposal of e-waste such as Infosys, Wipro, Tata Consultancy Services and HP India. Civil society groups such as E-Parisaraa and ATREE have also been advocating for the need for guidelines that would deal with end-to-end regulation in e-waste management.

E-waste advocacy and programmes set up by industry are not necessarily in line with the larger national focus. They are more towards micro programmes rolled out by selected industry agencies and that too without any formal policy and organizational mandate and documents.

The role of the civil society and other stakeholders is a nascent one. Advocacy has been seen in pockets such as in the state of Karnataka and led by bodies like Centre for Science and Environment. It is only in recent times that the focus has shifted to the impact of ICTs on the environment and on climate change due to the pressure of energy and carbon footprint challenges.

The crux of the issue remains the lack of awareness and organised approach amongst stakeholders. There needs to be a change in attitude towards least-cost procurement practices (a total cost of ownership scenario needs to be calculated, which includes energy consumption); understanding of the economic, social and ecological benefits of adopting energy-efficient practices in the use of ICTs; and ensuring the proper management of e-waste through recycling and refurbishment and the use of formal recyclers.

The national policy process is absent in terms of ensuring an ecosystem where the entire supply chain of ICT procurement, usage and disposal involves shared responsibility of various stakeholders. Any such policy must act as an enabler rather than hinder developments on this front. The policy must not aim at penalising defaulters. Rather it must offer incentives for pro active and future players.

A sense of the importance that needs to be placed on sustainable ICT use and management is missing among stakeholders. The relevant government authorities as the main driver of sustainable ICT practices is missing, which could otherwise complement the stand-alone practices initiated by industry.

India is already achieving a high percentage of recycling because of the informal sector as compared to the Western countries. However, there is a lack of initiatives on the government side to collaborate the informal and formal sector either by ways of incentives, offering alternate economic benefits and creating awareness.

The current focus on climate change does not deal with the pros and cons of ICT usage, impact and sustainable ICT practices. The government and the industry has directly and indirectly acted upon advocating and initiating critical measures with a bearing on climate change. For the government the focus has shifted to reducing energy and carbon footprints as well as on alternative energy sources. The industry is focusing on energy-friendly devices and applications. The latest trend is towards promoting green IT. For the government, e-governance services are one way of reducing the energy and carbon pressure through virtualisation of services delivery. Despite such measures, there remains scope to advocate on sustainable ICT practices which will help to meet India's goals as envisioned in the National Action Plan on Climate Change, both for climate change mitigation as well as adaptation.

Overall, there is wider scope for stakeholders to collaborate and work together in arriving at sustainable solutions to manage ICTs in development and growth process, including managing climate change issues. The government and industry has great scope to learn and share from each other based on past, current and upcoming programme initiatives and experiences. There is need for convergence of ideas, resources, and knowledge sharing and a need for accommodating each other's concerns within the larger framework of the ICT-led development trajectory in India.

10. ADVOCACY OPPORTUNITIES FOR CIVIL SOCIETY

The role of the civil society has not been pro-active so far. There are initiatives from civil society organisations in terms of e-waste management at national level. There is some isolated activity – but not at national level – advocating on issues regarding ICTs and their link climate change. One reason is that the manifold advantages of ICTs are outweighing the negative fallouts, which have yet to receive the urgent attention of stakeholders. However, initiatives are picking up from select civil society groups, including studies, workshops and consultations where the policy areas are being discussed and debated – such as the pros and cons of the latest e-waste policy draft. In other words, the scene has beenset to intervene meaningfully with qualitative inputs and focus on why and how India's ICTs and environmental sustainability policies should be more inclusive, participative, and have more teeth to achieve desired results.

A recently held one-day national workshop in Bangalore, Karnataka, by the Electrochemical Society of India and Karnataka Pollution Control Board that focused on on e-waste regulations, hazards and solutions is an instance of this growing scope and role for civil society. At the same time, Jamia Millia Islamia University was organising a national seminar on e-waste management and recycling in India in March 2011. The main objective was to deliberate on various aspects of e-waste such as the challenges and prospects of the draft legislation, use of technology in e-waste management, capacity building, role of informal sector and the management, health and environmental hazards of e-waste and the legal and policy implications of this.

On ICTs and climate change, the advocacy focus and thrust from civil society seeks greater emphasis and organized attempts to address the key issues. Efforts so far have been limited despite this country home to one of the largest ICTD projects. There is the Civil Society Coalition on Climate Change (CSCCC), a coalition of over 40 civil society organisations in India, advocating on climate change issues. However, the integration of climate change advocacy and ICTs has not been clear in the coalition's activity framework.

At an institutional level, Greenpeace India has been looking at how the country's ICT sector can continue to grow and, at the same time, lower its carbon emissions and set India on a path to a low-carbon economy. It is advocating for companies to develop climate-friendly policies and policies for energy efficiency.

India's ICT sector has revolutionised India's economy. Together with civil society it now has the opportunity to play a key role in revolutionising the country's energy sector – placing India firmly on the path to clean and sustainable development.[53] The current focus on climate change advocacy by the civil society groups has been restricted to the overall thematic focus on sustainable development and practices that addresses adverse climate change issues like rising sea levels, the melting of glaciers and resultant floods. Specific focus on the link between ICTs and climate change can therefore focus on how sustainable ICT practices can reduce climate change's adverse impact in the midst of the emphasis on a technology-led development process in India.

Table 4: Initiatives Taken by the Civil Society, Associations and Institutions on e-waste management in India

INITIATIVES TAKEN	CIVIL SOCIETY/ASSOCIATIONS/ INSTITUTIONS
Prevention of pollution through cleaner technologies and e-waste minimization techniques	Industrial & Urban Environment Systems Group (IUSG) (New Delhi, India)
Recycle the e-waste and has made accountable to the technology companies like HP, IBM to collect their own e-waste	E-Parisaraa (Karnataka, India) (Supporte by the Indo-German e-waste initiative)
Organized talks, seminars and workshops on proper e-waste management around the Goa city	Rotary Club (Goa, India)
Has set up a collection system for frequently generated e-Waste products like dry cell batteries, CDs and floppies. It has around 200 collection receptacles set up in public locations, schools, apartments and corporate offices.	SAAHAS (Karnataka, India)
Do Research and has published various papers on climate change and e-waste	The Energy Research Institute (TERI) New Delhi
It provides education and organize workshops on environment issues and has published several papers on environment issues relating to e-waste	Center for Environment Education (CSE)

[53] http://www.greenpeace.org/india/en/Blog/going-green-with-ict-in-india/blog/29277

INITIATIVES TAKEN	CIVIL SOCIETY/ASSOCIATIONS/ INSTITUTIONS
They purchase and collect e-waste all over India and reuse or recycle those collected e-wastes. They are authorized by the Karnataka Pollution Control Board, India.	ASH Recycler (Karnataka, India)
Protect of environment through reuse and proper recycling of e-waste	AER Recycler, India

11. CONCLUSION

The mapping of policy advocacy on ICTs, environmental sustainability and climate change in India is relevant in a country home to one of the world's largest consumer bases and commercial drives in the ICT sector. The capability of ICTs to provide wider growth and inclusive development is very well understood at both programme level and in policy domains. The ICT industry today makes up the largest segment of the country's GDP. There is an increase in the applications of ICTs to streamline governance and public services delivery in both rural and urban areas. Two negative fallouts of this are clear by now. One, the e-waste phenomena and its impact on the sustainable development processes. Second, India being one of the biggest producers, consumers and traders of ICT products and services, there is the associated pressure form a rising carbon and energy footprint.

Policy advocacy and interventions by the government have begun. Basic and specialized efforts have been made, including the drafting of a national e-waste policy. The industry has also responded to the rising challenge of the sustainable use of ICTs. Institutional efforts as well as collaborative programmes have been rolled out in terms of advocating green IT measures, procurement of energy efficient and environment friendly appliances, producing and distributing energy saving devices, streamlining the disposal of e-waste, and so on. Civil society has also responded, although this response is restricted in terms of reach and impact.

This leaves scope for policy advocacy and initiatives by the stakeholders in India. There is a gap in relevant inter-ministerial and inter-departmental coordination on issues such as e-waste. Despite having plethora of rules and departmental guidelines, the implementation has of these has shortcomings. There is an absence of a clear cut ICT procurement and distribution policy and disposal mechanisms. Surprisingly, the pro-active role of the ministry responsible for communications and IT is missing.

Policy advocacy in India on ICTs, environment and climate change calls for multi-stakeholder engagement and networking. This calls for convergence of ideas, efforts, learning and sharing of resources, knowledge and technology. Sustainable ICT procurement, usage, distribution and disposal mechanisms have to guide economic and social development programmes. Policy formulations and regulations need teeth to see end results. There is an urgent need to advocate for fresh ideas and implementation at various levels. The public sector needs to show leadership. The Parliament of India, as the apex body, has to discuss, debate and pass vital legislations to this effect.

12. REFERENCES

Bushehri, Fareed I. November, 2010. *UNEP's Role in Promoting Environmentally Sound Management of E-Waste.* Cairo, Egypt : 5th ITU Symposium on "ICTs, the Environment and Climate Change". p.1. URL: www.itu.int/dms_pub/itu-t/oth/06/0F/T060F00601700405PPTE.ppt.

Daly, J. .2003. *ICT and Ensuring Environmental Sustainability,* Development

Gateway (dgCommunities). http://topics.developmentgateway.org

Latham, R., and S. Sassen. (eds.). 2005. D*igital Formations: IT and new architectures in the global realm.* Princeton: Princeton University Press.

Kuehr, R. & Williams, E (Editors.): Computers and the Environment. *Understanding and Managing Their Impacts.* InfoDev. 2009. ICTs and Climate Change. URL: infoDev, www.infodev.org.

Johri, Rakesh. 2008. *E-waste: Implications, regulations, and management in India and current global best practices.* New Delhi, India: Pvt. Ltd.

Priya, D. V. L. Padma. February 2, 2010. City among top 10 places in e-waste generation. The Hindu. url: http://www.hindu.com/2010/02/13/stories/2010021361030300.htm

Ranganathan, Shyam, and Ramya Kannan. May 16, 2010. Tamil Nadu frames separate e-waste policy. The Hindu. URL: http://www.hindu.com/2010/05/16/stories/2010051652041700.htm

Pande, Manisha. August 25, 2010. *Scrapped Out.* Business Standard. New Delhi. URL;http://www.business-standard.com/india/news/scrapped-out/405650/. URL: www.grid.unep.ch/product/publication/download/ew_ewaste.en.pdf

Thakur, Pradeep. September 6, 2010. Government may ban Import of E-waste. The Times ofIndia. URL:http://epaper.timesofindia.com/Default/Scripting/ArticleWin.asp?From=Archive&Source=Page&Skin=TOINEW&BaseHref=CAP/2010/09/06&PageLabel=12&EntityId=Ar01201&ViewMode=HTML&GZ=T

Bridgen, K., Labunska, I., Santillo, D. & Allsopp, M. 2005. *Recycling of electronic waste in China and India: Workplace and Environmental contamination.* India: Greenpeace.

Ospina. A.V. and R. Heeks.2010. *Linking ICTs and Climate Change Adaptation: A Conceptual Framework for e-Resilience and e-Application.* Manchester: University of Manchester.

Walraven. K. 2007. E-waste: *Impacts, Challenges and the role of Civil Society.* APCNews, 28th February. URL: www.apc.org/en/news/e-waste-impacts-challenges-and-role-civil-society.

Robinson, B.H. 2009. E-waste: *An Assessment of Global Production and Environmental Impacts.* Science of the Total Environment 408 (2). p.183-191.

Houghton, John. 2009. *ICT and the Environment in Developing Countries: An Overview of Opportunities and Developments.* Communications and Strategies 76.

Plepys, A. 2002. *The Grey side of ICT.* Environmental Impact Assessment, Review 22. p.p. 509-523.

Hilty, L.M. 2008. Information Technology and Sustainability: Essays on the *Relationship between information technology and sustainable development.* Norderstedt, Germany: Books on Demand Pvt. Ltd.

Kumar, R. & Mieritz, L. 2007.*Conceptualizing Green IT and data center power and cooling issues",* Gartner Research Paper. URL:http://www.gartner.com/DisplayDocument?id=519717

Basel Convention .2003. *Report of the Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal,* UNEP.URL: www.basel.int/meetings/cop/cop6/english/Report40e.pdf

ITU. 2008. *ICTs for e-Environment: Guidelines for Developing Countries, with a Focus on Climate Change.* Geneva, Switzerland: ITU Publications. p.3.
URL: www.itu.int/ITU-D/cyb/app/docs/itu-icts-for-e-environment.pdf

OECD. 2009. *ICTs for Development: Improving Policy Coherence.* Paris: OECD Publications. p. 152.

Department of I*nformation Technology, Government of Assam. 4th of August, 2009. Information Technology Policy of Assam 2009.* No. 233. p.1220.
URL: http://assamgovt.nic.in/pdf/ITPOLICY-2009-Final-Gazette-Style.pdf

Greenpeace. August 2008. TakeBack Blues: An Assessment of E-waste Takeback in India. Bangalore, India: Greenpeace.
p.p.URL:http://www.google.co.in/#hl=en&source=hp&biw=1280&bih=883&q=take+back+blues&aq=f&aqi=&aql=&oq=&gs_rfai=&fp=23201b100c14c2b6

Ministry of Communications and Information Technology. 2009. Information Technology Annual Report 2009-10. Department of Information Technology, Government of India. p.08.

DESC. 2010. *ICT's Contribution to India's National Action Plan on Climate Change: National Mission on Enhanced Energy Efficiency. India:* Confederation of Indian Industry (CII-ITC). P.11. Annual Report of the Ministry of Power, Government of India, 2009.

ITU. 2008. ICTs for *e-Environment: Guidelines for developing countries, with a focus on climate change.* ITU, Geneva. http://www.itu.int/themes/climate/
Mudur, G.S. September, 23, 2009. *Not rubbish! India buys e-garbage - Centre allows e-waste imports for recycling, activists cry foul.* Kolkata Edition.
URL: http://www.telegraphindia.com/1090923/jsp/frontpage/story_11531142.jsp

Central Pollution Control Board. March 2008. Draft Guidelines for Environmentally Sound Management of Electronic Waste, Chapter 2. New Delhi: Ministry of Environment & Forests, Government of India.

Greenpeace International. 2009. *Where does e-waste end up?*
URL: www.greenpeace.org/International/en/campaigns/toxics/electronics/the-e-waste-problem/where-does-e-waste-end-up/

OECD.2009. *Measuring the Relationship between ICT and the Environment.*
URL: www.oecd.org/dataoecd/32/50/43539507.pdf.

Greenpeace. 2010. Guide to Greener Electronics.
URL: www.greenpeace.org/International/en/campaigns/toxics/electronics/how-the-companies-line-up.

Intergovernmental Panel on Climate Change (IPCC).
URL: www.ipcc.ch/organization/organization_history.htm.

United Nations Environment Programme. 2009. *Recycling from E-waste to Resources.* URL: www.unep.org/PDF/PressReleases/E-Waste_publication_screen-FINALVERSION-sml.pdf.

Sinha, S, and P. Mahesh. 2007. *Into the Future : Managing e-waste for Protecting lives and livelihoods.*
URL: www.toxicslink.org/pub-view.

Wath, S.B., P.S. Dutt, and T. Chakrabarti. 2010. *E-waste Scenario in India: Its Management and Implications.* Environmental Monitoring and Assessment. Springer Link, 12th February.

Dimitrakakis, E., Gidarakos, E. Basu, S. Rajeshwari, K. V. Johri, R. Bilitewski B., and M. Schirmer. 2006. *Creation of Optimum Knowledge Bank on e-waste Management in India. I*SWA Annual Conference.
URL: www.iswa2006.org/papersalpha.htm.

Labelle, R., Rodschat, R. and Vetter, T. 2008. *ICTs for eEnvironment: Guidelines for Developing Countries with a Focus on Climate Change.* URL:www.itu.int/ITUD/cyb/app/docs/ituictsforeenvironment.pdf

Ospina, A. V. and Heeks, R. 2010. *Linking ICTs and Climate Change Adaptation: A Conceptual Framework for e-Resilience and eAdaptation.* URL:www.niccd.org/ConceptualPaper.pdf

IPCC.2007. IPCC Fourth Assessment Report. IPCC (Intergovernmental Panel on Climate Change), Geneva.

Jyoti K. Parikh and Kirit Parikh. 2002. Climate Change: India's Perceptions, Positions Policies and Possibilities. OECD.

TERI. 6th of February, 2008. Roundtable Table Discussion on *"ICT and Climate Change"*. New Delhi.

Sinha, Ketriwal., D. Kraeuchi P., and Schwaninger M. 2005. *A Comparison of Electronic Waste recycling in Switzerland and in India.* Environmental Impact Assessment Review. 25. p.492-504.

Ramachandra, T.V., and V.K. Saira.2004.Environmentally sound options for waste management. Envis Journal of Human Settlement, March.
Veena, K. 2004. *E-waste in India, System failure Immine*nt : Take action now.
URL: www.toxicslink.org/pub-view.php?pubnum=40.

Shyam Ranganathan, and Ramya Kannan. The Hindu. May 16th, 2010. T*amil Nadu frames separate e-waste policy.* Tamil Nadu Edition.
URL:http://www.hindu.com/2010/05/16/stories/2010051652041700.htm,

V.L. Padma Priya . The Hindu. *City among top 10 places in e-waste generation.*
URL:http://www.hindu.com/2010/02/13/stories/2010021361030300.htm.

Thakur, Pradeep. 6th of September, 2010. *Govt may ban import of e-waste: Used PCs Being Smuggled In From US, Canada & Oz Prompts Crackdown.* New Delhi: The Times of India.

URL:http://epaper.timesofindia.com/Default/Scripting/ArticleWin.asp?From=Archive&Source=Page&Skin=TOINEW&BaseHref=CAP/2010/09/06&PageLabel=12&EntityId=Ar01201&ViewMode=HTML&GZ=T

Pande, Manisha. 25th August, 2010. Scrapped Out. New Delhi: Business Standard.URL:http://www.business-standard.com/india/news/scrapped-out/405650/.

Environmental Legislation in India. January, 2008.
URL: www.scribd.com/doc/30588775/Environmental_Legislation_of_India.

MoEF. 1997. White paper on pollution in Delhi with an action plan. New Delhi: Ministry of Environment & Forests.

TERI.2000. Urban Transport, Energy and Environment: A Case of Delhi. New Delhi: TERI.

CPCB. 2005. Annual Report 2004-05. New Delhi: Central Pollution Control Board.

Department of Forests and Wildlife.1998b. Greening Delhi Action Plan 1998-1999. DoEF, Government of NCT of Delhi.

World Wide Fund for Nature (WWF). 1995. Delhi Environmental Status Report. New Delhi:WWF.

Department of Environment and Forest. 2010. *State of Environment Report for Delhi 2010.* New Delhi: DoEF, Government of Delhi.

Websites

www.pewclimate.org/docUploads/India_Factsheet_09_08.pdf.

www.e-waste.in/weee_policy.

beta.thehindu.com/news/cities/Delhi/article433742.ece.

www.expresscomputeronline.com/20100517/news06.shtml.

www.ewaste.in

pmindia.nic.in/Pg01-52.pdf.

www.http://expressbuzz.com/states/orissa/e-waste-monitor-on-cards/212866.html

URL: http://www.k4rd.org/ICT_CC_report.pdf.4 Ibid.

13. ANNEXURES

Annexure 1: List of stakeholders interacted with for this report

S. NO	STAKEHOLDER	SECTOR
1	Department of IT, Ministry of Communications and Information technology	Govt. of India
2	Ministry of Environment & Forests	Govt. of India
3	Department of Science and Technology, Ministry of Science and Technology	Govt. of India
4	Department of Environment	Govt. of NCT of Delhi
5	Delhi Pollution Control Board	Govt. of NCT of Delhi
6	Karnataka State Pollution Control Board	Govt of Karnataka
7	Wipro	Corporate
8	Infosys	Corporate
9	General Electric, India	Corporate
10	Panasonic India	Corporate
11	Tata Consultancy Services	Corporate
12	Raritan	Corporate
13	Intel India	Corporate
14	Microsoft India	Corporate
15	NASSCOM	Corporate
16	GTZ India	Corporate
17	Karnataka Hybrid Micro Devices	Corporate
18	Hewlett Packard India	Corporate
19	E-Parisaraa	Corporate
20	Greenpeace India	Civil Sector
21	Toxicslink	Civil Sector
22	Centre for Media Studies, India	Civil Sector
23	Earth Sense	Civil Sector
24	Electro Chemical Society of India	Civil Sector
25	Development Alternatives	Civil Sector
26	Centre for Environment Education	Civil Sector
27	It for Change	Civil Sector
28	Centre for Science, Technology and Policy	Civil Sector

Appendix 2: List of key stakeholders

DEPARTMENT OF INFORMATION TECHNOLOGY (DIT), MINISTRY OF COMMUNICATIONS AND INFORMATION TECHNOLOGY. (http://www.mit.gov.in/)	GOVT. OF INDIA
The Department of Information Technology is one of the key government bodies responsible for policy matters pertaining to ICTs in India. According to the department, the country is witnessing a gradual rise in the application of ICTs for mitigating climate change issues and environmental concerns. However, the department feels that e-waste poses a serious threat to the environment and is concerned about its effects in the long term. E-waste policy should consider the gradual introduction of producer responsibility policies.	
MINISTRY OF ENVIRONMENT & FORESTS (MOEF) (http://moef.nic.in/index.php)	GOVT. OF INDIA
The Ministry of Environment & Forests (MoEF) is the nodal agency in the administrative structure of the central government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes. The MoEF recently issued a draft policy on e-waste management and disposal which would come into effect by January 2012. As per the new draft policy, the MoEF believes that the major responsibility should be on the producers to set up collection centres and ensure that their products reach authorized recyclers only. The onus would be on the producer to devise a system of collection. They also believe that the critical issue of informal recyclers in India can be managed only by offering them incentives to register with their respective State Pollution Control Boards.	
DEPARTMENT OF ENVIRONMENT http://www.delhi.gov.in/wps/wcm/connect/Environment/environment/home	GOVERNMENT OF NATIONAL CAPITAL TERRITORY (NCT)
The department is actively engaged in overall environmental assessment, monitoring, protection and awareness raising among the people of Delhi. It takes the view that e-waste is already covered under the Hazardous-Waste-Management Rules, which just need amendments to support the installation of a recycling management system (see below).	
CENTRAL POLLUTION CONTROL BOARD (MINISTRY OF ENVIRONMENT AND FORESTS) HTTP://CPCB.NIC.IN	GOVT. OF INDIA
The CPCB has published guidelines for the environmentally sound management of e-waste in India (March 2008). The objective of these guidelines is to provide guidance for identification of e-waste and prescribed procedures for handling e-waste in an environmentally sound manner. These guidelines shall apply to all those who handle e-waste which includes the generators, collectors, transporters, dismantlers, and recyclers irrespective of their scale of operation. Since e-waste or its constituents fall under the category of hazardous and non-hazardous waste, they are technically covered under “The Hazardous Waste Management Rules, 2003”. The guidelines cover many aspects of e-waste management. For instance, the establishment of e-waste recycling and treatment facility is expected to be in line with the existing best practices in India for establishing and operating recycling, treatment and disposal facilities for hazardous waste. Such facilities are	

to be set up in the organized sector. However, the activities presently operating in the informal sector need to be upgraded to provide a support system for the integrated facility. This would help to bring the informal sector into the mainstream to ensure environmental compliances.

DELHI POLLUTION CONTROL COMMITTEE (DPCC) http://delhi.gov.in/wps/wcm/connect/DOIT_Pollution/pollution/home	GOVT. OF NCT DELHI

The Delhi Pollution Control Board is a State Government body under the Delhi Government that has been vested with powers to monitor and regulate functions and duties under the Environment Protection Act, Water Act and Air Act and Prevention and Control of Pollution in the city of New Delhi. The DPCC highlighted that the main issue that Delhi is grappling with is that of lack of an earmarked facility for a safe disposal site of e-waste. There also seems to be a lack of authentic and comprehensive data on e-waste. The various State Pollution Control Boards have initiated the exercise to collect data on e-waste generation. On their part, DPCC had initiated an e-waste management project calling for a public-private partnership and also for integration of the informal sector. The DPCC has also initiated the establishment of E-waste Recycling & Treatment Facility that would be in line with the existing guidelines in India for establishing and operating Recycling and Treatment and Disposal Facilities for hazardous wastes.

KARNATAKA STATE POLLUTION CONTROL BOARD (KSPCB) http://kspcb.gov.in/default.asp	GOVT. OF KARNATAKA

The Karnataka State Pollution Control Board was constituted in 1974. The KSPCB is equally aware of the harmful effects of e-waste if not managed and disposed off properly. According to the KSPCB, the major impact of ICTs on the environment today is that of their crude disposal mechanisms. It attributes this to a lack of awareness among the masses and the strong network of the informal recyclers. The KSPCB believes that effective disposal poses a serious issue in Karnataka due to the large number of software companies who are the major consumers of ICTs. It holds the lack of proper legislation responsible for part of the problem. KSPCB for its part has established e-waste collection centres at strategic points in the city and are involved in promoting awareness and helping the IT software companies to install e-waste bins on their premises. The KSPCB is hopeful that with the new e-waste legislation, the issue could be curtailed to a certain extent. However, any such legislation does not do enough to address the major issue of informal sector collection and disposal.

WIPRO http://wiproecoenergy.com/	CORPORATE

Wipro EcoEnergy is the cleantech business of Wipro Ltd. Wipro aims to provide intelligent, sustainable alternatives for energy generation, distribution and consumption through its EcoEnergy business unit. Wipro has been a pro-active leader among the corporate giants in India in helping customers reduce their energy footprint, recover higher energy efficiencies from energy deployment and replace conventional with renewable energy sources. Every country has its own unique set of energy consumption issues and challenges. energy consumption and cooling costs are two of the critical issues of the highly evolving intensive computing industry especially such as those of the Telecom industry. ICT by itself does not have a serious impact on the ecology.

However, ICTs have to be used to mitigate the other serious ecological concerns. The Government must rise to the occasion in terms of providing supportive infrastructure and incentives to pro-active players in this field. Indian industries today are already realizing the potential of the economic value of eco friendly services and initiatives. The government must create an ecosystem which would allow the various stakeholders in the supply chain of procurement, usage and disposal of ICT products smoothly operate. Wipro has also made huge contributions in their PC manufacturing business by taking into consideration energy efficiency, RoHS and Take-Back (recycling) program. As part of the e-waste recycling programme, Wipro has actively started e-waste initiatives since 2005 and has been proactively engaging their customers to discard their old and used products to Wipro established collection centers and they ensure that the e-waste is handed over to authorized recyclers.

INFOSYS http://www.infosys.com/pages/index.aspx	CORPORATE

Infosys has been focused on Green IT initiatives as part of their environmental sustainability practices to improve quality of life, reduce environmental damage and transforming business. Infosys is all set to become carbon neutral by the year 2012 through their ecofriendly business solutions such as InGreen management, Smart workplaces, carbon footprint calculator, responsible computing. As far as policies are concerned, Infosys believes that corporates in India are already proactive key players in adopting global environmental sustainability policies beyond the confines of the existing guidelines in India. It had earlier started off as a business need to cater to foreign clients but now they believe the trend is changing as more and more companies are realizing the economic benefits of sustainable practices which has multifold benefits. Infosys Sustainability practices follow the Global Reporting Initiatives (GRI) framework and take into account the proactive engagements with global stakeholders to nurture local communities, conserve natural resources and reduce the environmental impact of operations. They map their sustainability initiatives with GRI parameters and the principles of the United Nations Global Compact (UNGC). As quoted by senior personnel at Infosys, “Environmental sustainability is now becoming our core of existence, our way of doing things and it is here to stay.”

GENERAL ELECTRIC INDIA http://www.ge.com/in/	CORPORATE

GE is primarily into development of Eco-energy products through their Eco Imagination initiative. Unlike most corporate, GE does not incorporate this separately as part of their Corporate Social Responsibility but their entire business vision involves environment sustainability and climate change focus. They assist customers to cut down on energy emissions, carbon emissions and deploy renewable sources of energy by using waste generated from sugar manufacturing for producing bio gas to run various plants in the rural sectors. As part of combating the impact of ICTs on environment and climate change is concerned, GE abide by the rules of the MoEF and the State Pollution Control Board in clean disposal of their wastes. GE India ensures a “take back” policy from their customers for their end of life products and recycles it through formal recyclers only. GE India feels that there is already a lot of noise being created in this domain. However, Indian Government today needs to speed up drafting policies that assist in implementation of best practices adopted from key market players and offer incentives in order to promote the same. Penalizing defaulter may not be the solution as many would still find a work around to avoid penalties.

PANASONIC INDIA http://www.panasonic.co.in/	CORPORATE

At Panasonic, designers and engineers follow stringent process to develop products that are more energy efficient, water efficient and long lasting. Under its global Eco Ideas programme, which includes Eco Ideas for Life styles & Business – styles, the company develops energy-efficient, state-of-the-art products and encourages customers to live eco-conscious lifestyles with an aim to reduce CO2 emissions in households and manufacturing units.
From a producer's perspective, Panasonic voices certain concerns with the newly drafted e-waste legislation policy. The emphasis on producer responsibility in the draft e-waste policy is a draconian measure and would pose a huge burden on the producer. The management of e-waste should be a shared responsibility. There cannot be a generic policy covering all producers and one needs to understand the nature of consumer durable industry given salvage nature of products. The collection of e-waste should be the responsibility of the municipality and putting the burden on the producer would result in delays in the entire process.

TATA CONSULTANCY SERVICES http://www.tcs.com/homepage/Pages/default.aspx	CORPORATE

TCS E-waste policy works in conjunction with the Environment policy and Green Procurement Policy. Through this policy TCS procures computers and associated hardware from USEPA/similar Energy star labelled vendors who would take back e-waste. It aims at minimizing e-waste by extending the life of useful hardware. TCS adheres to WEEE directives for handling e-waste and carry out e-waste disposal only through authorized recyclers.
However, TCS feels that India is finally realizing the importance of adopting environmental sustainability practices in their production, management and disposal but there is a serious lack of collaboration of the various stakeholders to ensure a smooth implementation of policies. TCS believes that the Government alone cannot be held responsible for implementation of policies and that there needs to be a multi-stakeholder collaboration to address the gaps in policies.

RARITAN http://www.raritan.co.in/	CORPORATE

Raritan, in the last 2 years they have stepped into the domain of power management for data centre operations and would be moving towards Asset Management within data centers too. According to Raritan, there is a fine line between using ICTs for convenience and causing an adverse impact on the environment and it's the user who has to decide where the line is. The sector will not move towards environmental sustainability initiatives unless there are policy changes that require them to move in a certain direction. But before these policies are enacted, the people need to be educated about the impact of their actions on the environment and this will be a huge education program. Raritan feels that the Department of IT can ensure that data centers run efficiently and do not waste energy. The basic problem is that the legislators or policy makers themselves are not very clear about optimum power and energy consumption levels. Also, the Civil Society Organizations have a big role to play in educating people about the importance of Green IT as they have access to the right kind of research data and can advocate for the adoption of green technologies. Companies need to be informed and educated about inefficiencies of sever utilizations within their system and be made to understand the magnitude

of wastage that these inefficiencies bring in and how it will not only help the environment but also their own bottom lines to plug these leaks. This calls for effective policy and legislation that incorporates such practices at a national level.

INTEL INDIA http://www.intel.com/index.htm?en_IN_01	CORPORATE

Intel India is an active member of the Digital Energy Solutions Consortium (DESC). According to Intel India and DESC, India is already poised to develop a “3E” (Economy, Energy, Environment) national policy framework. It believes that adopting good practices from other countries alone would not solve the problem but we need to address our own unique challenges through policies that are tailored to our political realities.
There is a need for a National strategy that includes three complementary strands of policies and actions – policies that make private and government more energy efficient, policies to create behavioral changes towards energy efficiency and ICT industry actions to reduce ICTs direct footprint. It believes that each stakeholder can contribute in their unique manner and the Indian Government must lead by example by adopting environmental sustainability practices as they are the largest consumers of ICTs today.

NASSCOM http://www.nasscom.in/	ASSOCIATION

According to NASSCOM, there has been a big challenge on how to deal with e-waste but there is no real policy on e-waste and that too at an implementation level at every State level. One of the biggest challenges for NASSCOM members is that lot of their facilities use custom bonded units and there is periodic refresh of computers. The issue is how to move the ICT devices from the custom bonded units and reuse or refurbish them after the periodic refresh
e-waste is not just e-waste and the Government has to look at the whole policy on how to deal with the technology refresh cycle and how to deal with the entire supply chain and this has been one of the problematic areas in India. The new policy will take a long time to come into effect and there is also a need to look at historic waste that has been collected over the years. However, NASSCOM member industries have been following good practices even in the absence of a national policy as can be seen in various IT corporate initiatives.

GTZ INDIA	CORPORATE

As part of development cooperation between countries, Indian Government and German government have focused on addressing issues in sustainable environmental and economic development. German Technical Cooperation in India has set up an Advisory Services in Environment Management with the Ministry of Environment and Forests. According to senior GTZ India personnel, the absence of legislation on monitoring and enforcement for recovery and recycling procedures poses a growing issue in India. Unfortunately, only about 40% of India's e-waste is recycled and the remaining is stored in storehouses due to an inefficient collection system. According to them, most of the organizations do not have any effective policy on disposal of obsolete IT products. Most of the processing remains concentrated in the informal sectors which due to poor technologies and lack of availability of infrastructure have significantly contributed to

pollution and climate change. Policy must emphasize institutional users to mandatorily have an effective e-waste management and disposal mechanism in place. Also, the policy must look into the issue of “cherry-picking” where only valuable waste is recycled. There is lack of initiative from the government to adopt an inclusive model by identifying and defining the roles of each stakeholder including vendors, users, recyclers and the regulator for environment-friendly recycling. As quoted, “Sensitization, awareness creation and introducing projects suited to the cultural ethos of the respective cities are the most important aspects.”

KARNATAKA HYBRID MICRO DEVICES PRIVATE LTD. (KHMD) http://www.khmdl.com/	CORPORATE

KHMD believes that another issue of e-waste management is that of the restriction of hazardous substances (RoHS) while production or manufacturing ICT products. India does not have a RoHS legislation though there have been attempts at drafting regulations. The main issue lies in the lack of awareness of what is the optimum level above which hazardous components should not exceed. Hence, this calls for extensive scientific research on identification of optimum tolerance levels of inclusion of hazardous components in ICTs. India needs to establish practices for restricting this inclusion and there has to be a mandatory compliance certificate for Indian manufacturers to export their products. However, the policy makers need to address this issue holistically as any stringent measures can have far reaching consequences on the product life cycle management.

HEWLETT PACKARD INDIA http://www8.hp.com/in/en/hp-information/about-hp/index.html	CORPORATE

Hewlett Packard India has a product take-back and recycling program as part of its comprehensive end-of-life asset recovery services since 2003 apart from its Eco solutions aimed at reducing energy consumption and climate change for their customers. Currently, with increasing ICT infrastructure and devices, urgency is around disposing of ICT equipments in an environmentally sound manner. According to HP, IT industry contributes to only 2% of green house gases however the key fact is that ICT can help reduce 98% of green house gas emissions if used in an eco friendly and energy efficient manner. HP has been focusing on environment sustainability issues for over a decade now and believes that Government policies must map with company policies to ensure that the entire supply chain of procurement, usage and reuse or disposal of ICT products happens in an environmentally sustainable manner.

E-PARISARAA http://www.ewasteindia.com/	CORPORATE

E-Parisaraa is India's first Government approved scientific e-waste recycling unit and aims to reduce pollution and landfill waste, recover valuable metals, plastics and glass from e-waste in an eco-friendly manner. According to E-Parisaraa, the newly drafted e-waste guideline has duplication of authorization which would pose a hurdle especially during transportation of e-waste between states. The government must first change their mindset of treating e-waste in the same category as hazardous waste and the policy should look at “managing” e-waste rather than “handling”. In the absence of a policy, neither the producer nor the consumers are bound by any regulation or r esponsibility.

E-Parisaraa has signed a MoU with E-Waste Agency (EWA) of Bangalore and M/s. Umicore Precious Metal Refinery, Belgium (in the presence of Karnataka State Pollution Control Board (KSPCB) and GTZ under the name "Crystal Project") to purchase printed circuit boards from the informal sector for export.

GREENPEACE INDIA http://www.greenpeace.org/india/en/	CIVIL SECTOR

Greenpeace India has been working on various issues related to the environment since 2001. Their work in India is focused on four broad campaigns namely, stop climate change, sustainable agriculture, preserving the oceans and preventing another nuclear catastrophe. With notification of draft e-waste rule, there is possibility in near future of level playing field on green product manufacturing and responsible recycling based on producer's responsibility. Government needs to adopt a clear and ambitious but mandatory standard on energy consumption within IT sector. IT products should be of highest energy efficiency standard. Further, it also directs all companies to disclose their carbon emission and corresponding action to reduce it with clear time-frame. Finally, IT producers should be made final responsible for management of own-branded post consumer electronic waste with clear penalty for those not doing it.

TOXICS LINK http://www.toxicslink.org/	CIVIL SECTOR

Toxics Link is an environmental NGO dedicated to bringing toxics-related information into the public domain, both relating to struggles and problems at the grassroots as well as global information to the local levels. According to a Toxics Link representative, the newly released draft e-waste policy has long been due and it was high time the government issued one. They feel that the new policy seems to be focused towards enabling "recovery and reuse", thereby relegating the objective to safeguard environment and human health, which should have been the primary objective and focus of a Rule notified by Ministry of Environment & Forests. India being a country comprising of a vast geography, the new policy should have been formulated as an evolving framework rather than trying to plug all holes through one policy. Also, the new policy does not integrate the informal sector and create opportunities for its participation. Segregating responsibilities unequally will result in an inefficient monitoring and supervision mechanism due to the widespread corruption.

EARTHSENSE http://www.earthsenserecycle.com/	CIVIL SECTOR

EarthSense is an authorized and licensed recycler by the government for safe collection, transportation, dismantling, segregation and disposal of waste. According to them, the current legislation concerning e-waste is very fragmented and apparently not transparent for the industry. The challenge is in difficulty of changing mind-sets, which is an extremely long process, but an essential need of efficient environmental policies. As formal recyclers, their main concern revolves around effective collection mechanism of e-waste. Due to the strong network of informal recyclers, formal recyclers do not get much quantity for recycling. They appeal to the government to lay down helpful policies that would assist formal recyclers rather than stringent laws that would be difficult to implement due to red tape and bureaucracy within the Indian system.

ELECTROCHEMICAL SOCIETY OF INDIA http://www.ecsi.in/	CIVIL SECTOR

The Electrochemical Society of India aims at bringing together scientists and technologists working in different disciplines of electrochemical science and technology to exchange views and ideas. As part of their various initiatives, ECSI had recently organized a national conference on E-waste management that brought together various stakeholders from the government, corporates and civil sectors to debate and discuss the e-waste issues in India. According to the ECSI, there needs to be an effective collaboration between government-universities-corporates for quality research infrastructure that could assist in the replacement of hazardous components.

DEVELOPMENT ALTERNATIVES http://www.devalt.org/	CIVIL SECTOR

Development Alternatives has been involved in creating large-scale sustainable livelihoods for over a decade now through their various projects that focus on climate change and environment sustainability. They strongly believe that civil society can play a crucial role in providing analysis, raising awareness and calling attention to growing environment concerns. According to Development Alternatives, policy makers and stakeholders need to identify and devise simple and practical measures using localized solutions rather than generic solutions. They have initiated various climate change mitigation projects in Bundelkhand , Madhya Pradesh and Himachal Pradesh. They are also involved in capacity building initiatives in the area of energy efficiency for the overall strengthening of the Bureau of Energy Efficiency mandate of India. They have also initiated a knowledge base for decentralized renewable energy solutions.

CENTER FOR ENVIRONMENT EDUCATION http://www.ceeindia.org/cee/index.htm	CIVIL SECTOR

The Centre for Environment Education (CEE) was created in recognition of the importance of environmental education in India's overall environment and development strategy. They are strong advocates for the need for educating the masses, especially students, on issues related to climate change and environment sustainability practices. They work on areas related to creation of awareness, sensitization and helping to understand the underlying science, social and economic issues, as well as the ethical issues relating to sustainability and climate change.

CENTER FOR SCIENCE, TECHNOLOGY AND POLICY (CSTEP) http://www.cstep.in/	CIVIL SECTOR

CSTEP has been actively involved in policy advocacy and research on areas related to energy issues and climate change issues. According to CSTEP, the Indian power sector requires significant upgrading and reforms, in particular in power transmission and distribution, in order to reduce electricity losses and improve efficiency. As part of this initiative, researchers at CSTEP are involved in working on innovative IT-based solutions for a state-of-the-art “smart-grid”. CSTEP believes that ICTs can act as a devil's advocate when it comes to sustainability and climate change issues because ICT devices consume energy too. However, ICT devices also reduce energy and climate change footprint through their innovative technology solutions. India today may have certain laws and national action plans such as the national climate change plans in place but the key lies in its effective implementation and multi-stakeholder collaboration, which is currently lacking.

green prakriya

Empowering an ICT enabled sustainable habitat using nature's wisdom

An initiative of Digital Empowerment Foundation with the focus on India & South Asia.

http://greenp.engo.in

Digital Empowerment Foundation
House No. 44, 3rd Floor (Next to Naraina IIT Academy)
Kalu Sarai, (Near IIT Flyover), New Delhi – 110016

Tel: +91 11 26532786
Email: def@defindia,net
URL: www.defindia.net
Fax: +91 11 26532787

APC Executive Director's Office
PO Box 29755
Melville 2109, South Africa

Tel: +27 11 726 1692
Email: lisa@apc.org
URL: www.apc.org
Fax: +27 11 726 1692