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Environmental Sustainability and Green Policies of ICT Industry

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Abstract: Over Environmental past two decades, change in climatic condition is a worldwide concern that is affecting humans and economies all around the globe. This paper explicates qualitative study of green computing executions and environmental sustainability peculiarly by Information Communication Technology (ICT) companies. Antecedent results through a large online inspection are considered in this research work. This research study cynosure on environmental protection and scrutinizes technologies implemented for compliance with the government rules. Green Computing technologies actualizes an organization to remarkably scale down the energy consumption, evolve energy efficient products and cut down e-waste by embracing reuse and recycle policies. Efficient policies can slash down the utilization of non-renewable resources and rebate the generation of waste. This publication deliberates numerous attributes of environmental sustainability and strategies enforced or proposed to minimize the pernicious effect caused by usage of computing.

Keywords: Environmental Sustainability, Greenhouse gases (GHG) emission, Climate Change, Sustainability, CO2e.

I. INTRODUCTION

Research studies are currently being carried out on the regulatory structures and policies of government authorities and private sector compliance with government policies and regulations. Research Approach section furnishes information on the various research analyses on numerous parameters of sustainability. This paper provides information on various policies defined by government authorities to monitor and regulate GHG emission, Energy Utilization, Data Centre Energy Efficiency and generation of E-waste. Comparison between countries on numerous act and rules established to control and inspect private sector sustainability.

II. RESEARCH FRAMEWORK

This paper will explore the various dimensions of sustainable of Information Technology sector, discussing on the steps of improving efficiency to reduce the over cost and aligning with corporate sustainability strategies. Governments are monitoring and regulating the sustainability of private sector companies. National level government authorities have established "Act and rules to regulate the GHG Emission by companies and also implemented initiatives to encourage companies to focus on environmental sustainability.

This paper provides information on various policies established by national and state level governments to reduce impacts of energy consumption of Data centre and reduction of heat generated by Data centres. Governments have introduced schemes to motivate industrial sector to introduce new ways to reduce overall energy consumption and energy requirements for Data centres. This paper portrays government policies for private sector companies which are have to be followed to dispose and recycle e-waste generated by these companies. This research publication showcases comparison and analysis of various policies laid down by government to get better outcome of the initiatives taken by government sector to make the world a healthier place for future generations.

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III. GOVERNMENT SECTOR

Government Sector is the sector monitoring Environmental sustainability of private sector companies. Governments of various countries has established various laws and regulations to control and monitor environmental sustainability. Government sector also promotes private sector companies to improve sustainability policies to reduce overall costing. Government authorities have defined various parameters which are mandatory to be followed by private sector.

A. Greenhouse Gas (GHG) Emissions policies by Government Sector

United States of America

In October 2009 U.S. Environmental Protection Agency (EPA) define 2 groups: First rule proposed 2010 and second group comes these industry which emit fluorinated greenhouse gases (GHGs) oil and natural gas system this group define 2010 and data collection start 2011.

US Department of the Interior has defined three scopes of greenhouse gases rules.

Scope 1: This Scope can be described as the Co2 emission caused by vehicles and equipment stationary sources on site landfill &waste water treatment and fugitive emission.

Scope 2: This Scope is described as the SF6, CH4, N2O IN produced by purchased electricity, heating/cooling, steam. These two Scopes of GHG emission are directly owned or controlled by Federal Agency and has set below mentioned goals for Scope1 & Scope 2: Reducing growing energy intensity, increasing the use of clean and renewable energy, implementing on-site renewable energy generation projects, reducing the use of fossil fuels in both buildings and fleet.

Scope 3: This is described as the Scope of Emission of HFC, PFC generated during transmission and distribution losses from purchased electricity, business travel, contracted waste disposal and contracted waste water treatment. This Scope of Emission does not is not directly owned by Federal agency but related to agency activities. This reflects the business behaviour of employees and supplier's activities. Below mentioned goals are defined for Scope 3:Implementing lower-carbon commuting and travel strategies for employees in coordination with the GSA, reducing business travel, reducing purchased electricity consumption to minimize transmission and distribution losses. Implementing of on-site renewable energy projects, and also increasing sources for reduction and diversion of nonhazardous solid waste. [11] [16][18] [19]

As per the EPA Electronics Manufacturing — Greenhouse Gas Emissions Reported to the GHGRP.

(All emissions values presented in million metric tons CO2e)

Table 1: Year wise CO2e emission

Category	2011	2012	2013	2014
Number of facilities:	53	53	53	52
Total emissions (CO_2e):	6.8	6.5	5.0	5.7
Emissions by greenhouse gas (CO_2e)	1.6	1.5	0.7	0.7
Carbon dioxide (CO_2):	**	**	**	**
Methane (CH_4):	0.2	0.2	0.2	0.2
Nitrous oxide (N_2O):	0.2	0.2	0.2	0.3
Hydro fluorocarbons (HFCs):	**	**	**	**
Hydrofluoroethers (HFEs):	3.8	3.6	3.1	2.7
Perfluorocarbons (PFCs)	0.3	0.3	0.3	0.7
Sulfur hexafluoride (SF_6):	0.6	0.6	0.5	0.4
Nitrogen trifluoride (NF_3):	**	**	**	0.7
Other:				

Ref:http://www.epa.gov/ghgreporting/ghgrp-2014-electronics-manufacturing (United States Environmental Protection Agency)

In the year of 2014 Green Gas Emission was 6,870 million metric tons which is 1% increase of 2013. In 2015 it fell down 145 million MTCO2e.

United Kingdom

In UK Government define Climate Change Act and UK regulations which take action regarding GHG Emission and it also signed Kyoto Protocol since 1995. UK defines three categories described as scope.

Scope 1 (Direct Emission): - In this section describes which part of emission are include direct harm environment and generation of pollution is controlled and owned by industry.

Scope 2 (Indirect Emission): - In this section describe which part of emission are include indirect harm environment and generate pollution, these pollution company has no controlled.

Scope 3 (Other Indirect): - In this section which pollution are come which are not come neither scope 1 nor scope 2. Example: - Transport, journey for organization work causing emission, waste disposal etc.

In UK, these controls come under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Department for Environment, Food and Rural Affairs (DEFRA) is a government department responsible for environmental protection, food production and standards. [11][18] [38] [42] [43]

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GHG emission covers seven direct GHG under Kyoto protocol.

1. Carbon Dioxide(CO2) 2. Methane(CH4)
3. Nitrous Oxide(N2O) 4. Hydro fluoro carbons (HFCs)
5. Perfluorocarbons (PFCs) 6. Sulphur Hexafluoride (SF6)
7. Nitrogen Trifluoride (NF3)

India

In India, Smart 2020 report indicated that GHG emission by ICT sector will reach up to 2.8 % of the total GHG emission.

India Policy Structure (GHG Mitigation)

India has established an in-depth policy, regulatory and legislative structure. In 2006, Integrated Energy policy was adopted with below mentioned provisions: Promoting energy efficiency in all sectors, Mass transport, utilization of renewable resources (bio-fuels), improving development of nuclear and hydropower for clean energy. Research and Development on new technologies on several clean energies.

Greenhouse Gas (GHG) Mitigation options in Industry Sector: GHG Mitigation options in industry sector can be categorized as follows: Sector Specific Technology: Currently various GHG Mitigation technology options are being researched in India related to cement, aluminum, fertilizer and steel etc. Cross-Cutting Technology: Wide ranges of industries are adopting cross-cutting energy efficient technology. Fuel Switch: Natural gas availability is increasing; industries may switch to from coal /fossil fuels to natural gases. Co-Benefits: Measure of energy efficiency by industrial sectors also lead to co-benefits such as reduction in fuel consumption and material will reduce the emission in air, solid waste. [11]

In the year of 2014 Green Gas Emission was 40 billion tones which was 1% increased by 2013.

Recommended font sizes are shown in Table 1.

B. Comparison of Greenhouse Gas (GHG) Emissions policies by Government Sector

Emissions policies by Government Sector

United States of America and United Kingdom have defined 3 scopes of GHG emission for awareness and identification of GHG emission. This categorization helps to monitor and categories GHG emission at various levels which provokes private sector companies to control and reduce GHG emission. India on the other hand has provides guidance for reduction of GHG emission. This guideline showcases the several policies which minimizes the GHG emission at different levels.

Information Technology Industry Council (ITI) and member organization are participating in this response through three strategic commitments: (1) reducing the carbon footprint of our operations; (2) reducing the carbon footprint of our products over their lifecycle; and (3) delivering the ongoing innovations needed to transition the world to vibrant, sustainable low-carbon global economy.

Information Technology Industry Council (ITI) research replicates that by supporting government policies and by sharing best strategies which promote relevant public and private sector collaboration will result an acceleration of transition to a sustainable low-carbon economy. This will lead to multiple benefits towards economic growth, resilience to natural disasters, public health and global environment.

Title must be in 24 pt Regular font. Author name must be in 11 pt Regular font. Author affiliation must be in 10 pt Italic. Email address must be in 9 pt Courier Regular font.

C. Energy Utilization policies by Government Sector

United States of America

As per the data published by EPA industrial consumption is 27% of the total electricity consumed in 2014. The use of electricity gives impact on environment EPA defines some rules which reduce the impact of the environment to generate electricity.

Energy Efficiency: - End user adopts these rules which reduce the energy consumption.

Clean Centralized Generations: - Use new technology which reduce heating and cooling and energy supply.

Clean Distributed Generation: - Use renewable recourses which minimizes the impact on environment.

Combined Heat and Power (CHP):-Use that resources which generate both heat and power use both recourses that time. [19] [22] [48] [49]

United Kingdom

European Union (EU) policy define on for computer in UK,

EU define how we use gadget securely, affordable and environment friendly and reduce energy consumption.

As per the industry sheets electricity consumption has increased from 6.3 to 8.0 Mtoe.

Green Deal energy efficiency scheme which helps companies to reduce energy consumption.

Energy Consumption in the United Kingdom' (ECUK) is an annual analytical publication which present a brief review of energy consumption and modification in efficiency, intensity and outputs.

Energy Companies Obligation (ECO) is for Private sector companies which belong to green deal. [19] [20] [26] [27] [29] [30]

In UK 2015 energy consumption was 2,291kteo which was 1.7% higher than 2014.

India

In 2014 Energy consumption of Information Communication Technology (ICT) infrastructure was forecast to crossed 31 trillion-watt hours (TWh). Indian Industry sector accounted about 43% of the total commercial energy consumption (2007-2008) was 112.91 Mtoe. National Mission for Enhanced Energy Efficiency (NMEEE) is the 8th mission under National Action Plan on Climate Change (NAPCC).

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NMEE is future divided into four initiatives mentioned below to improve energy efficiency.

Perform Achieve and Trade Scheme (PAT): Reduction of specific energy consumption in energy intensive industries, which is associated with market based mechanism to enhance the cost effectiveness by certification of excess energy saving.

Market Transformation for Energy Efficiency (MTEE): Acceleration of energy efficient appliances in designated sectors by innovative measures for making products more reasonable.

Energy Efficiency Financing Platform (EEFP): Creating mechanisms helping finance demand side management programs in all sectors through capturing future energy savings.

Framework for Energy Efficient Economic Development (FEEED): Developing fiscal instruments to promote energy efficiency [51]

D. Data Centre polices by Government Sector

United States of America

Energy consumed by servers and data centres is significant in United States. This sector consumes around 61 billion kilowatt-hours (kWh) in 2006 which is 1.5 % of U.S. total electricity consumption and the total electricity cost goes up to $4.5 billion.

Federal Government Policies:

To develop a procurement specification for energy performance of outsourced data centres. To work with industry to develop better tools, such as total cost of ownership models and life-cycle risk models that are incorporate energy costing to manage data centres energy consumption. To separately meter all federally owned data centres with significant energy use. To charge data centre tenants for energy consumption of IT equipment in government owned data centres. To partner with electric utilities, universities, and the data centre industry to develop one or more neutral, "real-world" testing and demonstration centres ("National Centre for Data Centre Best Practices") to verify new technologies for reducing energy consumption in data centres. To help organize a technology procurement program to bring to market energy-efficient products for data centres. To partner with training organizations to develop education and training information and curricula about energy efficiency in data centres .To target data centres for efficiency upgrades using energy services performance contracts (ESPCs) and utility energy service contracts (UESCs).To provide technical assistance for demonstration projects of energy efficiency in data centres. To conduct demonstration and education projects for fuel cells and alternate clean, efficient DG technologies used for CHP in data centres .To develop procurement specification to enhance efficiency of high performance computing facilities.

State and Local Governments: For consider requiring separate utility meters on large data centres, either through utility regulation or building codes .For consider offering financial incentives for clean, efficient technologies used for CHP in high-availability installations (data centres, telecom facilities, etc.).

Data Centre Industry: To consider partnering with the federal government to develop an objective, credible energy-performance rating system for data centres. To consider partnering with the federal government to develop improved tools, such as "energy aware" total cost of ownership models and life-cycle risk models, for management of energy in data centres. To consider partnering with the federal government to develop a neutral, "real-world" testing and demonstration centre to verify new technologies for reducing energy consumption in data centres.

Current Energy Efficiency Programs Applicable for Data Centres

Over 30 years, the government agencies and public utilizes are promoting energy efficient services and products through their incentive programs. There various barriers to energy efficiency such as Defining Energy, First Cost, Split Incentives, Risk Aversion, Learning Curve, Quickly Changing Technology and Lack of Energy Monitoring.

Current Energy Efficiency Incentives and Voluntary Programs

ENERGY STAR program of EPA began the process of awareness of energy performance of equipment's in data centres by supporting development of energy performance measures for servers. [50]

United Kingdom

UK follows the data centre consolidation which reduces the cost increase security and reduce risk of disruption when we provide services private sector. Data consolidation minimizes power and energy consumption of cooling facilities.

Cabinet Office –led Joint Government /Industry Data Centre Strategy team define some rules which are implemented in 2010.Try to develop business case which consolidation the strategy. Use these approaches which benefit and consolidate benefits. Use information assurance community which gives confidentiality integrity and availability. Find strategy which consolidate data centre and make more effective. Avoid duplicity in data .Work with industry who we use consolidate data and apply on these models.

BRE Environmental Assessment Method (BREEAM) was developed by Building Research Establishment (BRE) and Digital Realty Trust in United Kingdom.

BREEAM Datacenters scheme for construction, design and operations of data centre. BREEAM and LEED and schemes are focusing on an environmental issues and impacts. [25] [41] [55]

India

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There has been a significant growth in the Information Technology industry in India. Major factors influencing the progress of Data Centres in India are:

a) Development in Banking, Financial Services & Insurance (BFSI)

b) Growth in Telecom Industry

c) Progress in Information Technology

d) Social Media Boom

e) Bandwidth cost reduction

India Government e-governance policies mentioned below have a huge influence in the growth of data centres.

State Wide Area Networks (SWAN): Advanced technology infrastructure utilized to communicate data between 2 or more geographical different locations. Swan is established to improve the efficiency, speed in the Government System.

National Informatics Centre (NIC): National Informatics Centre plays a vital role in proper functioning of e-governance applications around the country.

State Data Centre (SDC): State Data Centres are being proposed under e-governance scheme to collate services, applications and improve the services in States.

In India Data centre operators are categorized as follows:

Hosted Data Centres: Third party service providers who provide clients with infrastructure and maintenance at the data centres

Captive Data Centres: Majority of data centres in India come under this category.

In 1988, Indian Information Technology (IT) and Business Process Outsourcing (BPO) industry established a trade association called National Association of Software and Services Companies (NASSCOM).Ministry of Communications and Information Technology (Department of Electronics & Information Technology) provide guidelines for data centres such as:

Server Management: Monitoring critical resources of operational systems

Database Management: Monitoring critical resources and parameters of databases.

Help desk: Centralized help desk system

Web Management: Monitoring critical web servers

Backup: Providing centralized online backup for critical applications.

Storage Resource Management: Managing and monitoring storage resources effective disturbed on SAN or NAs storage. [56][58]

E. E-waste policies by Government Sector

United States of America

Business need to follow the E-waste regulations of state and federal level.

US federal government has established 2 legislation Acts.

National Computer Recycling Act Resource Conservation and Recovery Act (RCRA)

Resource Conservation and Recovery Act (RCRA) is the main act which regulates solid and hazardous waste.

Main goal of RCRA are as follows:

Protect human health and environment.

Energy conservation and use renewable resources

Reducing the amount of waste generated, by using 3 R'S.

Give the management of waste which protect environment.EPA gives waste management which is follow by all industry which is approved by EPA. It also follows state law for hazardous waste program.

CODE OF FEDERAL regulation defines 50 titles as per the subject area in an electronic waste and title 40 comes which is follows protection of environment. It defines solid waste base on RCRA. In United States 25 states define their own recycling project. These come under law which varies state to state. In California, progressive recycling fee model are generated which consumer pay $6 to $10 as a recycling fund at the time of purchase. This project introduced 2003.As per EPA electronic manufacturing sector 9% decreased co2e emission in 2012.In 2011 IT produced 5.9 million metric tons and 2012 it produced 5.1 million metric tons. [47]

EPA define the National Strategy for Electronics Stewardship (NSES) which is the collaboration of 16 federal departments and agencies, collectively known as the Interagency Task Force on Electronics Stewardship, as well as consultation with stakeholders from the electronics, retail, and recycling industries; environmental organizations; state and local governments; and concerned citizens. [52]

It has the following goals to build incentives for design of greener electronics and enhance science, research, and technology development in the United States.

Ensure that the federal government leads by example.

Increase safety and efficient management and handling of used electronics in the United States.

Reduce harm from U.S. exports of electronics waste (e-waste) and upgrade handling of used electronics in developing countries.

November 2010, U.S. President Barack Obama announced federal community would lead by example and government task force "to prepare a national strategy products. "In July 2011 NSES had established innovative pragmatic and framework to involve electronic stewardship.

The main goal of NSES to build electronic product, design which project human health and environment.

And reduce the harmful impact of e-waste. Product are registered with EPEAT is called green electronic. [14][15] [17] [19] [21] [22] [47] [57]

United Kingdom

Waste Electrical and Electronic Equipment (WEEE) recycling is an integral part of the waste and recycling industry. On 1st January 2014, Waste Electrical and Electronic Equipment Regulations 2013 were established

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as law by United Kingdom Government to replace the 2006 Regulations which were followed by Information Technology sector. [34] [36] [37]

Hazardous wastes are materials having harmful effects on the environment and also to human.

Below material can be considered as hazardous waste:
i) Asbestos ii) Print toner iii) Batteries
iv) Solvents v) Pesticides vi) Oils (Except Edible Oils)
vii) Equipment with Ozone depleting substances
viii) Hazardous waste containers

ROHS linked with Waste Electrical and Electronic Equipment Directive (WEEE) 2002/96/EC which define amount toxic electronic waste. [31]
ROHS define law which stopped harmful product EU market of the new EEE contain defines: -Lead (Pb) Cadmium (Cd) Mercury (Hg) Hexavalent chromium (Cr6+) Polybrominated biphenyls (PBB) Polybrominated diphenyl ethers (PBDE) [32] [33] [35]

India
E-waste (Management & Handling) Rules, 2011 came into effect from 1st May 2012 under powers conferred under Environment Protection Act, 1986 section 6, 8 and 25.
E-waste (Management & Handling) Rules, 2011 shall apply to every consumer or bulk consumer manufacturing, sales, purchasing and processing electronic and electrical components/equipment as specified in Schedule I, Environment Protection Act, 1986, producer, dismantler, collection centre and e-waste recyclers.

Consumers or Bulk Consumers Responsibilities: E-waste generated by Consumers or Bulk Consumers of electronic and electrical equipment must diverted to authorized collection centre / registered dismantler / recycler/ take back or return pick up services provided by producers. Maintaining records of e-waste generated is mandatory for bulk consumers, as records should be available for scrutiny with concerned Pollution Control Committee or State Pollution Control.

Producers Responsibilities: Collection of e-waste generated during manufacturing of electrical and electronic equipment and ensuring recycling and disposal. Producers also need to ensure collection of e-waste generated during the life cycle of a product in sync with the principle of "Extended Producers Responsibility" and channelizing e-waste by authorized collection agencies with proper setup of tack back system and collection centres. Providing transparency on information regarding hazardous constituents in electrical and electronic equipment, hazards caused due to improper handling, accidental breakage, damage/improper recycling of e-waste. Maintain records of e-waste generated and authorization from State Pollution Control Board or Pollution Control Committee.

Recycler Responsibilities: Authorization and registration with State Pollution Control Board is compulsory for recycler and maintaining facilities and recycling processes as per standards. Records to be maintained for inspection with Central/State Pollution Control Board or Pollution Control Committee of Union Territories. Residue generated is properly disposed in hazardous waste treatment storage disposal facilities.

Authorization and registration with State Pollution Control Board or Pollution Control Committee of Union Territories is mandatory for every producer of electronic and electrical components/equipment, dismantler, collection centre and e-waste recyclers for handling e-wastes. State Pollution Control Board or Pollution Control Committee of Union Territories has powers to suspend or cancel the authorization /registration if the authorized holders fail to comply with the conditions/ provision of Act or rules. Reduction in usage of hazardous substances for manufacturing electronic and electrical equipment. Producers shall ensure lead, mercury, hexavalent, cadmium, chromium; polybrominated diphenyl or polybrominated biphenyls ethers are utilized in new electrical and electronic equipment.

Duties performed by Authorities:
Annual Report: State Pollution Control Boards and Pollution Control Committees prepare annual report on the implementation of these rules and submit to Central Pollution Control Board by 30th September each year.

Central Pollution Control Board consolidates and prepares an annual review report on management of e-waste along with recommendations and forwards the same to Central Government prior to 30th December every year.

E-waste Transportation: No Objection Certificate from the concerned State Pollution Control Board and intimation to State Pollution Control Board of the state of transit is to be obtained by transporter for transportation of e-waste for final disposal to facility/dismantling/recycling in the State other than the State from where e-waste was generated/ collected.

Categories of Electronic and Electrical Equipment covered under E-waste (Management & Handling) Rules:
Information Technology Equipment - Centralized Data Processing: Mainframes, MinicomputersPersonal Computing: Personal Computers, Laptop Computers, Notebook Computers, Printers, Copying Equipment, Electronic Typewriters, User terminals and systems, Cellular phones, Telephone, Cordless phones, Telex, Answering systems. [12]

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Table 2: Three Countries government sector policies related to Greenhouse Gas (GHG) Emissions, Energy Consumption, Datacenters, and E-Waste.

Sr. No.	Category	Country Name		
		United States of America	United Kingdom	India
1	Greenhouse Gas (GHG) Emissions	United States has established U.S. Environmental Protection Agency (EPA) to monitor GHG emission.	Climate Change Act is established by government of United Kingdom to regulate GHG emission.	National Action Plan on Climate Change was introduced to reduce impacts of climate change.
2	Energy Consumption	Renewable Energy utilization to fulfil energy required and reduction of GHG impact.	Energy Companies Obligation (ECO) and Green Deal energy efficiency schema to reduce energy consumption.	National Mission for Enhanced Energy Efficiency established to enhance energy efficiency.
3	Data Centre	Data Centres efficiency upgrading by energy services performance contracts (ESPCs) and utility energy Service Contracts (UESCs).	Data Centre Consolidation is policy implemented to reduce energy consumed for cooling facilities.	Department of Electronics & Information Technology guides Data centre sustainability.
4	E-Waste	National Computer Recycling Act and Resource Conservation and Recovery Act are legislative acts to regulate E-waste.	Waste Electrical and Electronic Equipment (WEEE) regulations 2014 is the law regulating e-waste.	E-waste (Management & Handling) Rules, 2011 over see the E-waste.

IV. CONCLUSION

The aim of this research study is to analyze government sector (National governments) efforts towards green computing and environmental sustainability. We have conducted survey on ICT companies compliance with four major environment impact factors. The four important factors are energy consumption, e-waste, GHG emission, data centers

This research study portrays GHG emission parameters set up by the government to regulate the GHG emission of various sectors. Private sector companies are defining their policies to comply with government regulation. Analysis on the policies established by Government of various countries for reduction of energy consumption indicates the government are introducing various scheme to encourage private sector companies to reduce energy consumption and also purchasing of renewable energy from local government to minimize the impacts. Governments have set rules and regulation for datacenters to monitor energy efficiency of datacenters. Both government and private companies are moving towards virtualization to improve datacenter energy efficiency. This paper shows policies and regulations for reduction e-waste generated, recycling of e-waste and also disposal of e-waste. Private sector companies are disposing the e-waste as per the parameters set by local authorities. United Kingdom, India and the United States of America federal governments have defined goals for the year 2020 which are to be achieved by all sector companies.

In future, we can research on the technical aspects of the parameters to identify faults in the currently technologies used by various sectors, this may help us to identify the various methods of improvement. In future endeavors, we can research on the various technologies used in datacenters to reduce energy consumption such as in depth research on virtualization of servers and latest infrastructures which improve datacenter energy efficiency. Research on green computing is an ongoing process, collaboration of ideas and research is required to improve the computing in such a way that the impact will be minimal on the environment. In our future publications, our research target is to study the research conducted by information technology companies on green computing and to identify technologies used to make computing more efficient and providing a detailed research on the best technologies which we used in computing reduces the impacts on the environment.

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