Assessing Green IT Readiness: Experience from an Indian ICT Organization

ISBN: 978-1-943295-02-9

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The application of green consciousness to Information and Communication Technology (ICT) is commonly referred to as Green Information Technology (IT).Understanding and leveraging Green IT principles and practices is therefore critical for businesses' continued progress. The Green IT-readiness is conceptualised as a measure of a company's IT preparedness to be environmentally responsible and competitive. This paper presents the experience in assessing the Green IT readiness of an Indian IT Firm. The assessment involves (i) understanding the existing measures for "Greening", (ii) quantitatively exploring the potential for energy saving through two main actions like shutting down the computers when not in use, use of power management techniques and conversion from desktop to laptop (iii) assessing the awareness among the employees through survey based on the Green IT- readiness framework proposed in Molla et.al, 2009 and (iv) identifying the actions to be taken to make the organization Green IT ready.

Keywords: Green IT, Green IT Readiness, Green Practices, Power Management

1. Introduction

"Green Information Technology" is a nascent initiative to the Green Movement among the businesses of today. Although the term "Green IT" is becoming a buzz, there is little consensus on the actual meaning of this term. In 2008, the Climate Group and the Global e-Sustainability Initiative (GeSI) issued a survey named SMART 2020: enabling the low carbon economy in the information age. The study highlighted the significant and rapidly growing footprint of the ICT industry and predicted that because of the rapid economic expansion in places like India and China, among other causes, demand for ICT services will quadruple by 2020.

The Smart 2020 study also made a compelling case for ICT's significant potential to deliver climate and energy solutions, estimating that ICT technologies could cut 7.8 GtCO2 (Gigatonne Carbon Dioxide Equivalent) of global greenhouse gas emissions by 2020, a 15% reduction over business-as-usual projections. The study shows that innovations from the ICT sector when combined with increased use of renewable energy can put the world on a more sustainable path and help keep global temperature increase below the 2°C threshold. Table1 shows the estimated values of the survey (Greenpeace international report, 2010). The digital revolution has increased the usage of ICTs in businesses and also helped in introducing these technologies in other sectors apart from IT. The large demands of IT systems and technologies have tremendous impact on the environment which is quantified in the Table 1 and thereby the need for environmentally sustainable technology can be estimated.

There are two schools of thought which forms the basis for Green IT. On one hand ICT is a part of the problem as explained above. Besides, ICTs have an undesired consequence of disposal of electronic-waste. These potentially hazardous materials if are improperly disposed of, can cause harm to public health and the environment. On the other hand, ICTs is part of the solution. ICTs can help enabling a carbon footprint analysis, monitoring and reporting capability through supplanting eco-unfriendly business practices to deploying computerized models to increase energy efficiency and reduce greenhouse gas emissions (Molla et al., 2009).

Table 1 *Results from Smart2020 study. MtCO2e = Metric Tonne Carbon Dioxide Equivalent.*

	Emissions 2007	**Percentage 2007**	**Emissions 2020**	**Percentage 2020**
	MtCO2e		MtCO2e	
World	830	100%	1430	100%
Server Farms/Data centers	116	14%	257	18%
Telecoms Infrastructure and devices	307	37%	358	25%
PCs and Peripherals	407	49%	815	57%

Green IT can be defined as a holistic and systematic approach to address the challenges surrounding the IT infrastructure such as data centre space and energy efficiency; IT's contribution to reducing the environmental impacts of business IT activities (such as through adopting green technologies), IT's support for environmentally sustainable business practices (such as in enabling green supply chain management through carbon foot print monitoring through building tools for energy management options) and IT's role (such as supplanting high CO2 emitting business practices) in the low-carbon economy (Molla et al.,2008).

1.1 Implementation of Green IT

The trend of "Going Green IT" is new in the business world and it narrows down to the IT department for its implementation. Green IT introduces a concept of being environment friendly that does not affect the day-to-day business operations but makes these operations more efficient and economical for the organisation. The goals of green IT include reduce the use of hazardous materials, increase energy efficiency, and follow the 4-R's- reduce, reuse, recycle and refurbish in the day to day businesses.

According to Gartner, "green IT" is a manifestation of keen interest of an organization to sustain both enterprise operations and environment (Gartner 2007). Such ecological sustainability refers to organizations being able to survive and profit over the long run in both economic and natural environments (Schmidheiny, 1992), where the organizational development can "meet the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987: 43). In a word, green IT requires an organization to seek an orchestrated effort that spans across people, IT process, and IT products.

The paper is organised into seven sections, Section II explains a brief introduction of the organisation under study, Section III explores a method of quantifying and monitoring the power consumption in the organisation, Section IV discusses the power management strategies that can be undertaken by the organisation, Section V provides an assessment of Green IT – readiness in the organisation under study, Recommendations to make the organisation are given in Section VI and Section VII presents the conclusion of the study.

2. Readiness of an Indian ICT Organization

A perpetual growth of any business can be through proper awareness and intention to leverage Green ICT practices. Without a clear understanding of Green IT -readiness, companies will approach Green IT initiatives on an ad hoc, somewhat reactive basis insufficiently supported by the structural requirements to execute competently (Molla et.al ,2011) . This may lead to sinking resources into Green IT initiatives without seeing results anywhere near expected returns. As green issues continue to impact strategy, business operations and IT itself (Gartner, 2008), lack of Green IT -readiness may translate to missed opportunities for competitiveness and success (Graaf, 2008; Porter and Linde, 1995).

2.1 About the Organization

The organization where the assessment is done is a design company that blends technology, creativity and engineering to help customers transform ideas into world-class products and solutions. It is a global engineering services organization with more than 20 years of expertise in electrical and electronics. It addresses the communications, consumer products, defence, healthcare, media & entertainment, semiconductor and transportation sectors. This is supported by a network of design studios, development centers and offices worldwide.

Headquartered in Bangalore, the organization is known to provide high quality, cost effective solutions across the product design spectrum. The company's passion for excellence is backed by SEI CMMi Level 5 and ISO 9001: 2008 accessed processes. It is a medium sized company and such companies are easily adaptable to the implementation of nascent initiatives when compared to smaller organisations reluctant to invest to the technology or large organisations where introduction of newer initiatives is a difficult task. Moreover this company was willing to invest to greening of their day to day business operations and wanted to seek suggestions to better the current processes followed by them. The facilities of the organisation considered in this study was Bangalore and Chennai, however there are many other facilities of the same organisation. Further details of the organisation are given in the Appendix.

2.2 Existing Activities on Green & Sustainable Computing in the Organization

The organization is into embedded product design engineering services and do not have manufacturing done internally. The projects do not consume non-renewal resources nor generate process waste and emissions on the scale compared to a manufacturing industry. Based on the directions from its parent organization and its code of conduct in 2008, it has started initiatives to improve its environmental performance. It is committed to optimize its resource consumption, minimize its ecological as well as carbon footprint with the ultimate objective of decoupling business growth and environmental impact.

The focused areas that has to become the guidelines to company's Green IT initiatives are reduce greenhouse gas emissions, 3-R systems and supplies, procurement of energy efficient hardware, increasing the resource efficiency, virtualisation, consolidate storage with SAN/NAS solutions, optimize data center design, use thin clients to reduce CPU power usage, use more efficient displays, encourage telecommuting .

The environment conservation targets in the organization are reduction in electricity consumption, green buildings, reduction in carbon footprint, reduction in water consumption, reduction in paper consumption, reduction in waste generation, increase waste conversion to manure, use of renewable sources of energy, rainwater harvesting, employee engagement-Create awareness in the organization.

3. Quantitative Analysis of Power Management

3.1 Quantifying and Monitoring the Power Consumption of LIVE Machines over the Weekend

"You can't manage or improve if you can't measure". Therefore, once Green IT solution is implemented, the organization needs to monitor its effectiveness and returns and tweak the Green IT strategy along the way. To do this, organizations need

to find out where the energy goes i.e. organizations need to derive how much electricity is consumed by IT.

The electricity that comes through the power cord of the computer is turned into heat and power conversion is wasted through the PC power supply. The PC needlessly are left ON even if they are not being used, unaware that it still uses electricity and heats up which requires additional cooling. In an enterprise the cost of electricity for hundred such computers becomes enormous.

The organisation under study has an innovative initiative of keeping track of machines that is in ON state over the weekends. This is done by executing a scheduler task across the network on Friday night to check the number of systems that are active across the facility. Mailers are sent to the users of these machines requesting the employees to switch off their machines when it is not in use, thereby reducing the energy consumption of unwanted machines.

3.1.1 Bangalore Facility

The data for Bangalore facility during the months Jan-Apr 2015 are tabulated as shown in the Table 2. The Table gives the number of machines that are in ON state over the weekend. It's a standard that the machine goes to stand-by mode after 20 minutes of inactivity, during this period the power consumption is 40% of the total power consumption of the machine. Considering this logic, the power consumed during this period is tabulated in the third column using the product of number of systems in ON state and 40% of the total power consumption of a machine. Energy consumed is the product of the power consumed during the period and the total number of hours the machine is kept ON, here over the weekend i.e. 48hrs (Saturday + Sunday) which forms the basis for the fourth column. To quantify the expenditure of the energy consumed over the weekend, industrial tariffs of the city electricity supply are considered i.e. the amount that is paid as electricity bill. According to the electricity tariff – 2015 of Bangalore Electricity Supply Company Ltd. (BESCOM), for the first 1 lakh units the tariff is Rs 5.7/unit and for the balance units Rs 6/unit. With reference to this data the fifth column is calculated. If the value of the fourth column exceeds 1lakh units the value is multiplied with Rs.6/unit else Rs. 5.7/ unit. The carbon foot print is calculated using electricity-specific emission factor for grid electricity. The emission factors for India is 1.333174843 kgCO2/kWh (Brander, M et al, 2011), the product of this factor with energy usage (4th column) gives the carbon footprint in metric tonnes (6th column).

Table 2 quantifies the energy consumption over the weekend by computer systems alone over the weekend in Bangalore facility. For an average of 6% of machines that were active in the four months, **Rs. 38003.04** could be saved with CO2 emissions of **8.8** metric tonnes considering the Bangalore campus alone.

Table 2 *Quantifying the Energy Consumption over the Weekend by Computer Systems alone over the Weekend in Bangalore Facility*

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Week	**No. of computers in ON state**	**Power usage for the weekend (kW)**	**Energy consumption for the weekend (kWh)**	**Electricity Bill(Rs)**	**Carbon foot print (metric tons)**
02-Jan-15	135	8.1	388.8	2216.16	0.52
09-Jan-15	112	6.72	322.56	1838.592	0.44
16-Jan-15	140	8.4	403.2	2298.24	0.54
23-Jan-15	149	8.94	429.12	2445.984	0.58
30-Jan-15	160	9.6	460.8	2626.56	0.62
06-Feb-15	156	9.36	449.28	2560.896	0.6
13-Feb-15	164	9.84	472.32	2692.224	0.63
20-Feb-15	120	7.2	345.6	1969.92	0.47
27-Feb-15	138	8.28	397.44	2265.408	0.53
06-Mar-15	146	8.76	420.48	2396.736	0.57
13-Mar-15	166	9.96	478.08	2725.056	0.64
20-Mar-15	154	9.24	443.52	2528.064	0.6
27-Mar-15	152	9.12	437.76	2495.232	0.59
03-Apr-15	100	6	288	1641.6	0.39
10-Apr-15	168	10.08	483.84	2757.888	0.65
17-Apr-15	155	9.3	446.4	2544.48	0.6

3.1.2 Chennai Facility

The data for the Chennai facility during the months Jan-Apr 2015 are tabulated as shown in the Table 3. The computation is similar to that of the Bangalore facility except for the calculation of the electricity bill. TamilNadu Electricity Board has different tariff rates; the tariff for high tension consumers for financial year 2014-15 in the industries sector is Rs. 7.22/unit. This value is considered for calculation of the electricity bill amount in the 5th column.

Table 3 quantifies the energy consumption over the weekend by computer systems alone over the weekend in Chennai

facility, for an average of 40 machines that were active in the four months, **Rs.13806.95** could be saved with CO2 emissions of **2.55** metric tonnes considering the Chennai campus alone.

Table 3 *Quantifying the Energy Consumption over the Weekend by Computer Systems alone over the Weekend in Chennai Facility.*

Column1	Column2	Column3	Column4	Column5	Column6
Week	**No of computers in ON state**	**Power usage for the weekend (kW)**	**Energy consumption for the weekend (kWh)**	**Electricity Bill(Rs)**	**Carbon foot print (metric tons)**
02-Jan-15	24	1.44	69.12	499.0464	0.1
09-Jan-15	19	1.14	54.72	395.0784	0.08
16-Jan-15	17	1.02	48.96	353.4912	0.07
23-Jan-15	19	1.14	54.72	395.0784	0.08
30-Jan-15	37	2.22	106.56	769.3632	0.15
06-Feb-15	28	1.68	80.64	582.2208	0.11
13-Feb-15	84	5.04	241.92	1746.6624	0.33
20-Feb-15	35	2.1	100.8	727.776	0.14
27-Feb-15	27	1.62	77.76	561.4272	0.11
06-Mar-15	97	5.82	279.36	2016.9792	0.38
13-Mar-15	36	2.16	103.68	748.5696	0.14
20-Mar-15	31	1.86	89.28	644.6016	0.12
27-Mar-15	27	1.62	77.76	561.4272	0.11
03-Apr-15	26	1.56	74.88	540.6336	0.1
10-Apr-15	31	1.86	89.28	644.6016	0.12
17-Apr-15	92	5.52	264.96	1913.0112	0.36
24-Apr-15	34	2.04	97.92	706.9824	0.14

This initiative by the organization to monitor the machines over the weekend started in the mid of the year 2013. The data was collected after more than a year of inception ensuring that the employees are not new to this process and thereby these numbers are legitimate. The number of machines in ON state consists of test PC for testing purposes and lab PCs which roughly contribute to 1% of the total PCs that are in ON state.

During the month of January the numbers are low and the reason might be due to low pressure of work in the beginning of the year, but however there are haphazard changes in the following months. At the Chennai facility, the number of systems increase in the mid of the month and reduce at the beginning or the end of the month, however no such pattern can be observed from the Bangalore facility data.

The amount of money that can be saved in the electricity bill and reduction in CO2 emissions is lesser in Chennai in comparison with that of Bangalore indicating that Chennai facility is more adaptive to this process than Bangalore facility. The reasons may be lesser work force in Chennai, better awareness among employees and attitude of the employees. These values are also dependent on the projects the two facilities handle. The mailers can contain the amount of money the company lost due to the machines in ON state or the emission of CO2 metric tonnes, will make aware of the loss such systems are causing to the organisation and society at large. Thereby, the number of systems in LIVE state during the weekend can be brought down. When every employee own this process, there need not be any monitoring of such kind and this can be done by increasing the awareness through mailers, posters or workshops. The amount of savings in power that could have been obtained during the weekend is shown in the Table4.

Table 4 *Percentage Savings if the Systems that are idle are Switched off During the Weekends*

(i) Total number of machines	2250
(ii) Average number of machines in ON state over the weekend	144
(iii) Average power/machine(W)	145
(iv) Total power consumption during weekday(kwh)	16312.5
(v)Total power consumption during weekends(kwh)	523.2
(vi) Savings (%)	3.11

From Table 4, the total number of machines is considered (i) of Table 4; the Table 2 gives number of systems that are in ON state over the weekend, an average value for four months is taken in (ii) of Table 4. A weighted average of the power

ratings and the number of machines are used to find the total power consumption over the weekdays ((iv) of Table 4). The total power consumption over the weekday is calculated using the product of *Total number of machines * Average power/machine*5days (working days of a week)* 10 hours (working hours)*. We are considering the worst case scenario where all the high power consumed systems are left ON over the weekend. The total power consumed per machine over the weekend is calculated using the product of *Average number of machines in ON state over the weekend * Average power consumed by the machines that are in ON state *48 hours (Saturday and Sunday) * 0.4 (40% utilisation of the power consumed by a machine)* ((v) of Table 4).Savings(%) is calculated by the ratio of *total power consumed per machine over the weekend/(total power consumed per machine over the weekend + total power consumed per machine over the weekday).* Thereby a power saving 3.11% can be obtained when 6% (144/2250) of systems remain idle over the weekend. Simpler power management strategies can help the organisation tackle these wastes of power.

3.2 Laptops Better than Desktops

The Table 5 shows the number of PCs and laptops and the respective power ratings being used at the Bangalore Facility.

Table 5 PCs *and Laptops used at the Bangalore Campus*

Configuration	Type1	Type2	Type3	Type4	Type5
Desktops	550	750	450	100	22
Laptops	15	315	200	140	8
Power Consumption in W (DT)	150	150	135	190	225
Power Consumption in W(LT)	50	60	65	90	90

To quantify the amount of energy that can be saved by using laptops we have considered the cost of laptops with a particular configuration as shown in the Table 6.

Table 6 *Cost of Laptops as on 25/5/15 at 14.30 at http://www.mysmartprice.com or http://www.amazon.in*

Configuration	Cost of laptops (Rs)
Type2	26000
Type3	37000
Type4	43900
Type5	50000

The Table 6 shows the total amount that can be saved in the monthly electricity bill in the organisation at the Bangalore facility. The total power consumption of the machines is calculated by the product of number of machines and the power consumption of each machine. If the desktop was a laptop, the power consumption is calculated by the product of number of desktop machines with the power consumption of a laptop. The total difference in the power consumption between a desktop and laptop is calculated in kW. Considering the machines are working for 9 hours daily i.e. (9.00-18.00) and 20 days per month i.e. (5days/week * 4 weeks/month) the energy consumption is calculated in kWh. As per the BESCOM guidelines the electricity bill amount is calculated. A total of **Rs.171311.22** could be saved and CO2 emissions of **40.06** metric tonnes can be revived.

Table 7 *Quantifying the Savings in Terms of Amount and Energy if Desktops were Replaced with Laptops*

Configuration	Power Consumption of the Machines			Difference in power consumption if D was L (kW)	Energy Consumption (kWh)	Electricity Bill(Rs)	Energy Consumption (kWh)	Electricity Bill(Rs)
	Desktop (D)	Laptop (L)	if D was L		Daily		Monthly	
Type1	82500	750	27500	55	495	2821.5	9900	56430
Type2	112500	18900	45000	67.5	607.5	3462.75	12150	69255
Type3	60750	13000	29250	31.5	283.5	1615.95	5670	32319
Type4	19000	12600	9000	10	90	513	1800	10260
Type5	4950	720	1980	2.97	26.73	152.361	534.6	3047.22
				Total amount that can be saved in the monthly bill (Rs)				171311.2

If the total amount that is saved is invested in laptops, with the monthly savings after the desktops are replaced by laptops, the numbers of laptops that can be procured are shown in the Table 8.

Table 8 *Number of Laptops of Specific Models can be Procured with the Monthly Savings*

No. of DELL laptops of Type5 processor	3
No. of HP Pavilion laptops of Type4 processor	3
No. of HP Pavilion laptops of Type3 processor	4
No. of HP Pavilion laptops of Type2 processor	6

Privacy, mobility, efficient space utilization, better price for good configuration, multitasking, better resale value, better display screens, easier keyboards are few benefits of laptop. The primary benefit from an environmental perspective is it saves more energy and lesser production of e-waste when compared to the desktop. Moreover, laptops also encourage telecommuting which can also be one of the Green IT initiative.

4. Assessment of Green IT-Readiness

The speed with which environmental sustainability impacts IT activities and economics requires a framework that not only accounts for factors enabling the spread and usage of Green IT but that also explicitly considers the roles played by key stakeholders such as IT and business. The Green IT-readiness framework is based on the premises, Green IT-readiness is conceptualised as an organisation's capacity to implement holistic Green IT, as defined above, principles and practices. Green IT -readiness framework is used for evaluating the readiness of individual organisation adopting the Green IT concept. It demonstrates the comparative levels of Green IT development among businesses and serves as a benchmark for measuring an enterprise's progress to participate in the global low-carbon e-economy. The five dimensions that make up Green IT -readiness are attitude, policy, practice, governance and technology. Each of these can be combined in a variety of permutations to separate organisations that are successful in building Green IT from those that are less successful (Molla et.al, 2008).

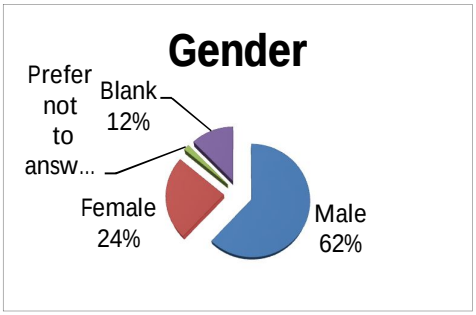
Green IT Attitude is an organization's IT people sentiment, values, and norms toward climate change and eco-sustainability and IT's role. Green IT Policy is the environmental criteria and frameworks an organization puts in place to guide the sourcing, use, and disposal of the IT technical infrastructure and the activities of IT people. Green IT Governance is the operating model that defines the administration of Green IT initiatives, the allocation of budget, and other resources and the metrics for assessing impacts. Green IT Practice pertains to the actual application and realization of eco-sustainability considerations in IT infrastructure sourcing, operation, and disposal. Green IT Technologies are technologies used for reducing the energy consumption of powering and cooling corporate IT assets, optimizing the energy efficiency of the IT technical infrastructure, reducing IT induced greenhouse gas emissions, supplanting carbon emitting business practices, and analysing a business's total environmental footprint(Molla et.al, 2008).

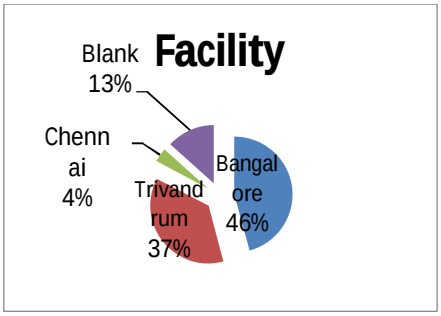
To understand the Green IT -readiness of the organization a survey was conducted across all the facilities, 179 responses were obtained of the demographics as shown in Figure 1. The questionnaire is adopted from the study of Green IT diffusion (Molla et.al, 2009). The reliability statistic of the questionnaire is measured using Cronbach's alpha which is around 0.761.

Of the 179 respondents there were 94 were interested in the survey indicating that the environmental consciousness in the company is high. The respondents were mostly male employees of the age group 25-34 from the Bangalore facility.

To study the understanding for the need for Green IT among employees of the organisation, questions such as "I believe that IT equipment and systems contribute to greenhouse gas emission" and "I believe that IT can be used to reduce a business's total carbon footprint" were asked to the respondents. 136 respondents believe the negative impact of the ICT equipment and 151 respondents agree that IT can be a solution to reduce the carbon footprint of the organisation. The results shown in Figure 2 indicate that the employees understand the urgency to go green and hence might cooperate with the initiatives considered by the organisation.

To understand the source of awareness of Green IT initiatives among the employees, the respondents were questioned about the frequency of the related articles and their willingness to gather more information on Green IT. The results shown in Figure 3 indicates that the respondents rarely read information on Green IT but are willing to gather more information. The reason for this might be because of their busy schedule at office.





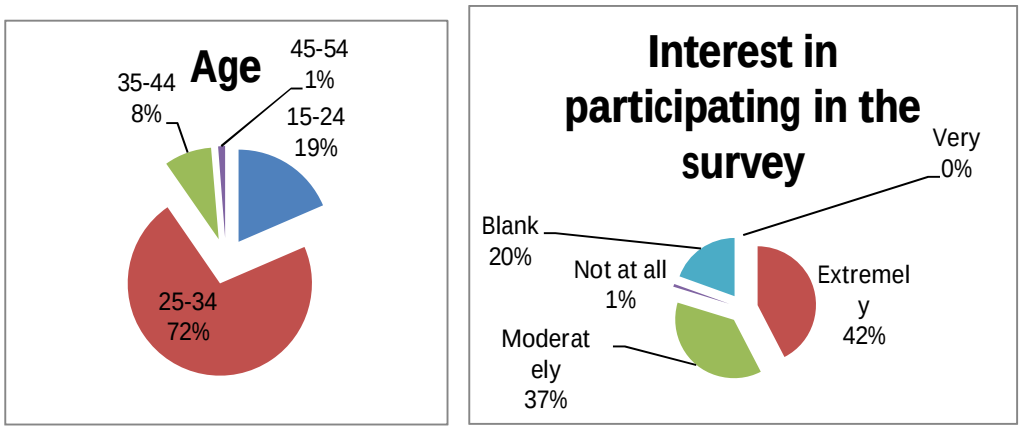


Figure 1 *Demographics of the Survey Conducted*

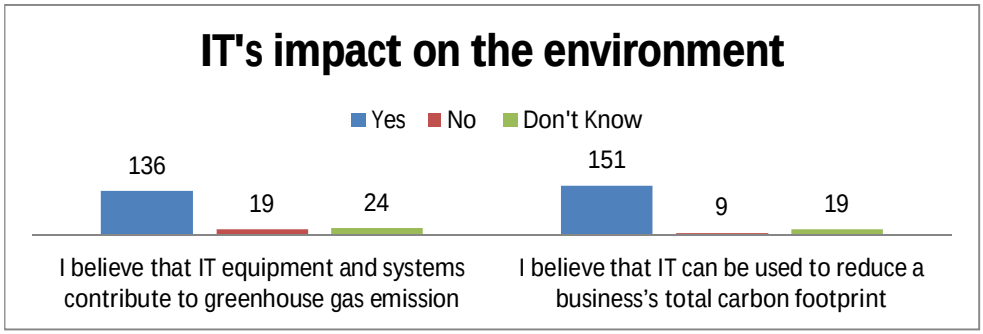


Figure2 *Survey results for its Impact on the Environment*

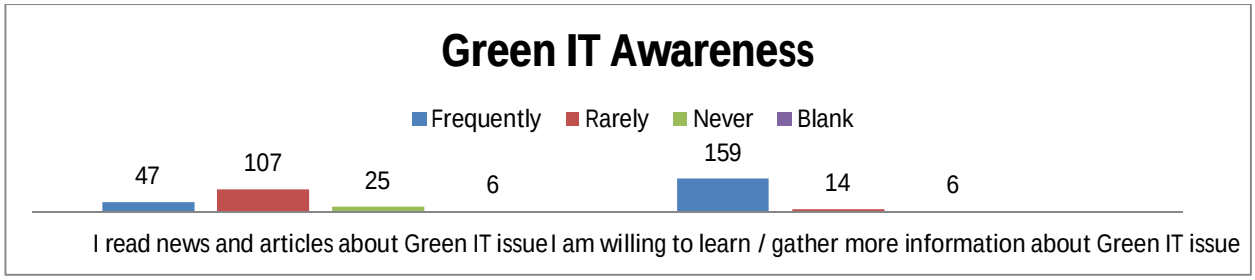


Figure 3 *Survey results for Green IT awareness*

To understand the green attitude of the organisation, questions such as "I believe that IT management should be responsible for reducing organization's carbon footprint", "I believe that every IT professional can play a significant role in helping reduce business's carbon footprint", "I believe that tackling the carbon foot print of IT systems should be a core part of a green business strategy", "I am very concerned about reducing IT's power consumption" and "Environmental consideration in planning IT operations is important" were asked to the respondents to understand their opinion. The results are shown in figure 4 that the company is high on attitude as most of them were affirmative on their duties as a professional or the organisations duties to reduce the carbon foot print. The reasons for such high values for green attitude can be associated with the high awareness levels the employees share on Green IT.

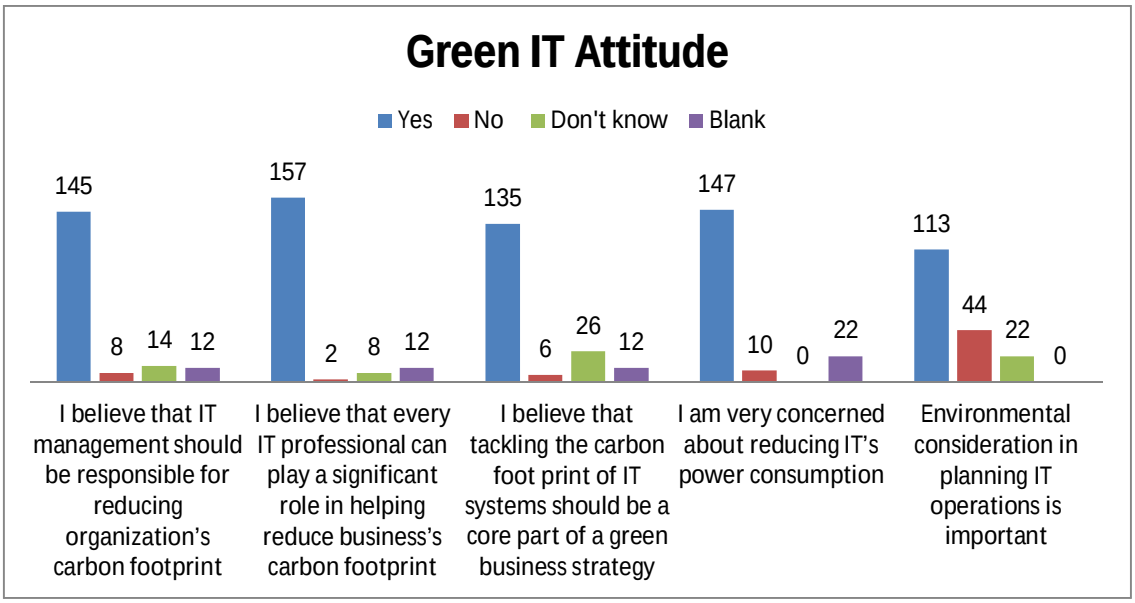


Figure 4 *Survey Evidence on Green IT Attitude*

To understand the Green IT Policy in the organisation questions such as "My company has executed Green IT initiatives", "My company has a policy that states staff should turn off computers when they are not in use", "My company advocates the use of green technology by potential IT suppliers" and "My company has investigated ways to reduce IT's power consumption" were asked to the respondents to understand their opinion. The results show that the employees are not fully aware of the policies of the organisation and there by the company has a scope for improvement here. The survey results are shown in Figure 5.

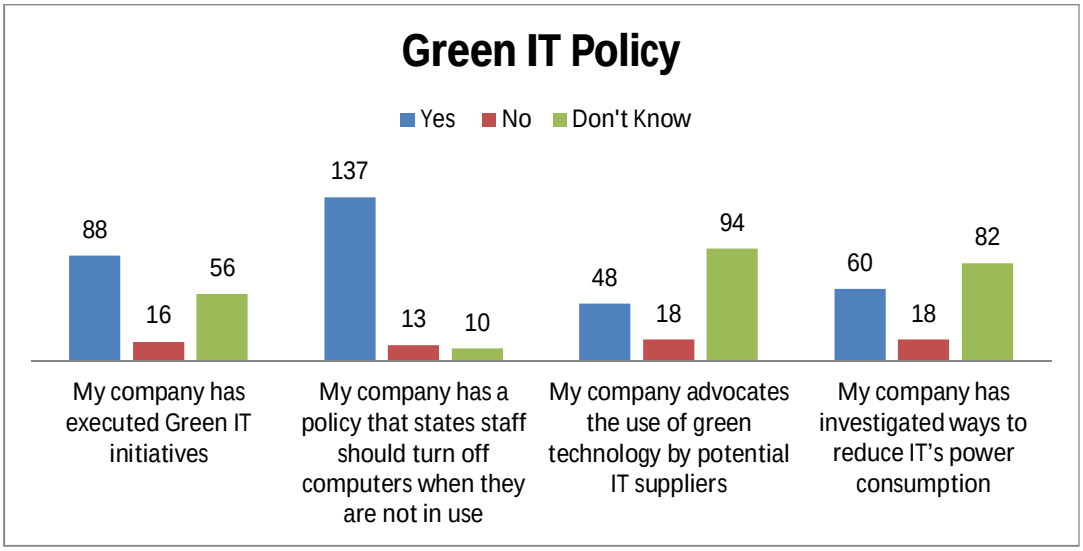


Figure 5 *Survey results for Green IT Policy*

To understand the Green IT Practice in the organisation questions such as "I prefer to print on both sides of paper" and "I turn off my computers when I am not using it" were asked to the respondents to understand their opinion. The results show that the employees follow green IT practices but the company has to implement green IT initiatives at the broader level to attain economic, environmental and societal sustainability. The survey results are shown in Figure 6.

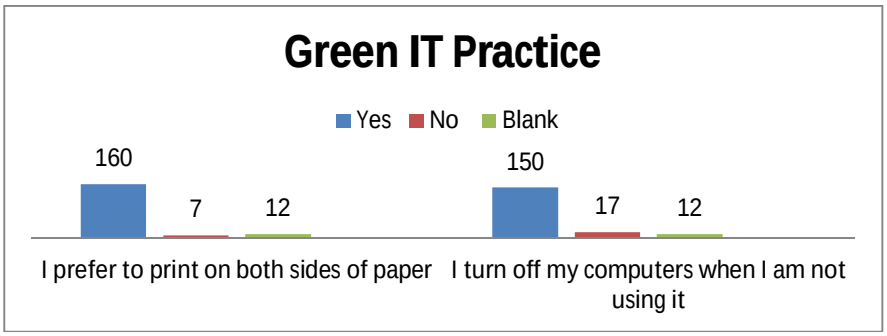


Figure 6: *Survey results for Green IT Practice*

To understand the Green Technology questions such as "Do you have screen savers on your machines?" and "Server Virtualization part of the company's Green IT Policy" were asked to the respondents to understand their opinion. The results show that the employees are not aware that using screen savers consume more power and more over there is no power management software that is implemented in the organisation there by scoring a low in the technology perspective, however employees are not aware of most of the practices or initiatives followed by the company because server virtualization is being implemented in the organisation. The survey results are shown in Figure 7.

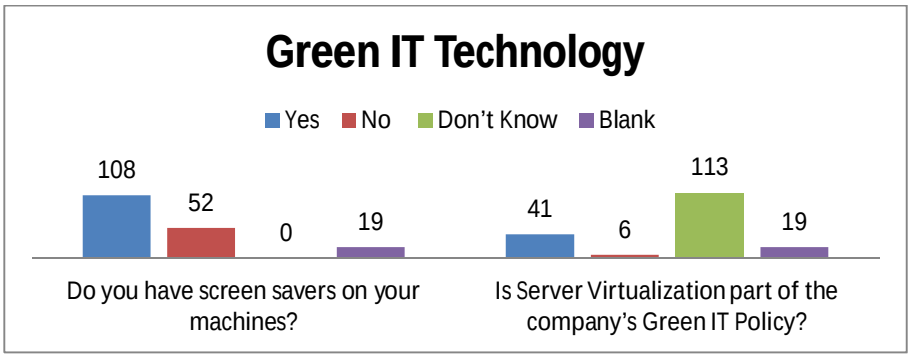


Figure.7 *Survey results for Green IT Technology*

To understand the penetration of governance in Green IT initiatives questions such as "My company has taken steps to reduce its carbon footprint" and "The issue of Green IT is on my company's radar" were asked to the respondents to understand their opinion. The results show that employees are not sure if the company is taking any initiatives forward for a greener company. The survey results are shown in Figure 8.

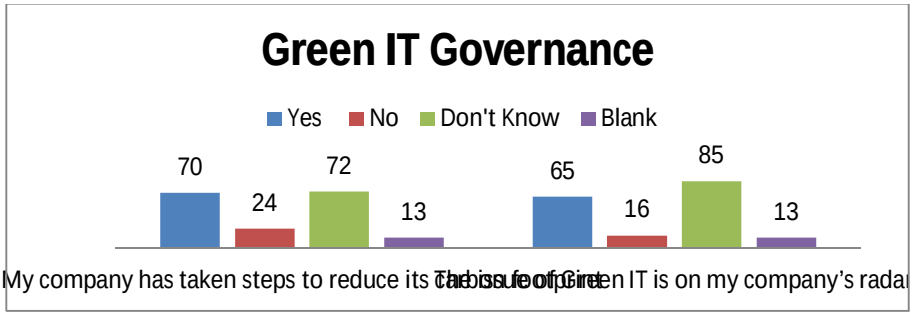


Figure 8 *Survey results for Green IT Governance*

5. Proposal to Make the Organisation a Green-IT Ready Organization

(i) Data centre power optimization: Data centres can be made green by controlling the carbon emissions through server consolidation, virtualization and high density rack utilization. The number of physical servers within the data-center can be drastically reduced, thus reducing direct power consumption as well as the cooling requirements of the data centre and the space required to house it. In addition, motion-sensing lighting which turns off when there is no activity is installed. The usage of blade servers can also reduce the power consumed.

(ii) Green Procurement: Procurement of new PC's with upgradeable features so that the PC can be used for more than 5 years. Desktops can be converted to laptops for easier maintenance and lower energy consumption. Also adopt

Green product engineering solutions that address choice of materials, weight optimization and packaging for lower carbon footprint of the procured and the delivered products.

(iii) Buy energy efficient hardware: EPA's Energy Star guidelines for lower power consumption rate major hardware products, these ratings are called EPEAT ratings (www.epeat.net). Also look for high efficiency (80%) power supplies, variable speed temperature controlled fans, small form factor hard drives, and low voltage processors.

(iv) Use power management technology; consolidate storage with SAN/NAS solutions and virtualization technology to consolidate servers. Power management is one of the easiest ways to contribute to Green IT and achieve demonstrable savings for the organization. The number of physical servers, and thus the energy consumption can be reduced by using virtualization technology to run multiple virtual machines on a single physical server

According to (Nanath, K et. al, 2014) assessment of sustainability in the context of Green IT initiatives is done using the four indicators continued benefits, program continuation, community and values. However the initiatives at the organization is nascent and thereby a comment on sustainability is inappropriate at this juncture. This model can serve as a foundation for the Green IT initiatives at the organization instilling the beans of a green and sustainable culture in the organisation.

(v) Compliance to the following directives - restriction of Hazardous Substances (RoHS) directive, the Waste Electrical and Electronic Equipment (WEEE) directive, the Registration ,Evaluation and Authorisation of Chemicals (REACh) regulation and the Eco-Design for Energy Using Products (EuP) Directive. These laws have large implications for all electrical¸ electronics and IT manufacturers.

(vi) The suggestions provided can be incorporated in business for increasing efficiency of the operations in environment friendly manner are usage of blank screensavers , applications can be used to chat with employees worldwide. This will ensure face-to-face communication without travel costs. A study done by Eva Kern et.al (2011) identifies certain search engines consume more energy than the other and moreover taking an example of word processing tool they have made quantified the energy levels. Green IT concentrates on the hardware part but focus on the green software can ensure more conservation of power. Some software tools called "Sustainable Software Support Center" (S3C) has the objective to support developers, administrators and users in realizing sustainable software engineering. This comprises modules for metering and visualizing resource and energy consumption, modules for a context sensitive provisioning of guidelines, checklists, and tips (e.g. in integrated development environments) as well as modules for regulating and controlling the resource consumption of software products.(http://www.green-software-engineering.de).Usage Wi-Fi will reduce physical network cabling, "Reusability" of codes, in software development, develop with minimum possible lines of code, so that the software will run using minimum power.

Other Aspects of Greening the Organization Green awareness among employees, water conservation, waste re-use , usage of renewable resources, 3 R's of going Green –reuse, refurbish, recycle and conducting energy audits to look out for possible improvement in performance .(Tony, K, 2013)

6. Conclusion

This paper is an attempt to understand Green IT initiatives in an Indian ICT Organisation. Four dimensions of greening IT was identified – IT infrastructure efficiency, green technologies; support tools and supplanting tools in the organisation under study (Molla ,2008). The Green IT initiatives undertaken by the organisation was quantified to understand the feasibility of power conservation in terms of the amount being paid as electricity bill. Power management strategies such as a power management software, benefits of replacement of desktops with laptops and automated power saver mode in computer systems was dealt in brief to give an understanding of savings that can be obtained. For any business to operate successful in one or all of these dimensions it needs to demonstrate Green IT -readiness. The five framework concerns can relate to implementing green business practice in general (Molla ,2008). The study considered Green IT readiness, future scope of study can be related to Green IT life cycle of the organisation. Moreover, the similar studies can be conducted across various other sectors. This paper emphasised the need for Green IT and has quantified the energy conservation achieved by the company due to certain initiatives. Blooming and failure points are focussed and suggestions are provided for the company to become greener. This paper can serve as a guide for the organization and other companies towards a greener future.

7. Acknowledgement

We would like to acknowledge the tireless efforts, contribution and cooperation of the IT Infrastructure team at the organisation considered for the study. If not for them, the study would not have taken this shape.

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10. Appendix

The organisation was established in 1989, it is a design company that blends technology, creativity and engineering to help customers transform ideas into world-class products and solutions. It has a global presence across US, Europe, APAC and

Japan. A part of the $100 billion parent group and is a listed company, the organisation addresses the communications, consumer products, defence, health care, media and entertainment, semiconductor and transportation sectors. It is supported by a talent pool of over 4,000 employees and a network of design studios, development centres and offices worldwide. Headquartered in Bangalore, the organisation is known to provide high quality, cost effective solutions across the product design spectrum. The primary verticals served are Automotive, Networking &communications, Consumer electronics, Media & entertainment, Semiconductors and Scientific instrumentation. The organisation provides expertise in VLSI design, embedded software, networking, telecom, multi-media, storage, visual and high performance computing, mechanical product design, and digital content creation. They believe in conducting our affairs with the highest levels of integrity, with proper authorizations, accountability, and transparency. The base for the strong corporate sustainability at the organisation stems from the elements such as a fair, transparent and value-driven corporate governance, a strong strategy for longer-term business growth, best-in-class HR processes, initiatives for community betterment, stewardship of the environment.