

AIT53E: Management of Information Systems [MIS]

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GREEN IT



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EXECUTIVE SUMMARY

The businesses and governments are focusing nowadays on the environmental issues and realizing the importance of these issues which can gain a benefit through them besides the major aspect on the environment by adopting initiatives, several benefits also can be gained like saving money and utilizing the technology aspects in an effective way, which all resides in the IT field that has a high concern from the majority of the IT leaders, which at this point it will minimize the environmental impact of technology.

The origin of the term Green IT emerged just after the Energy Star program was initiated in 1992, the number of computers and computer based systems has been growing steadily, and the data centers are now an essential element of a society in which IT plays a key role.

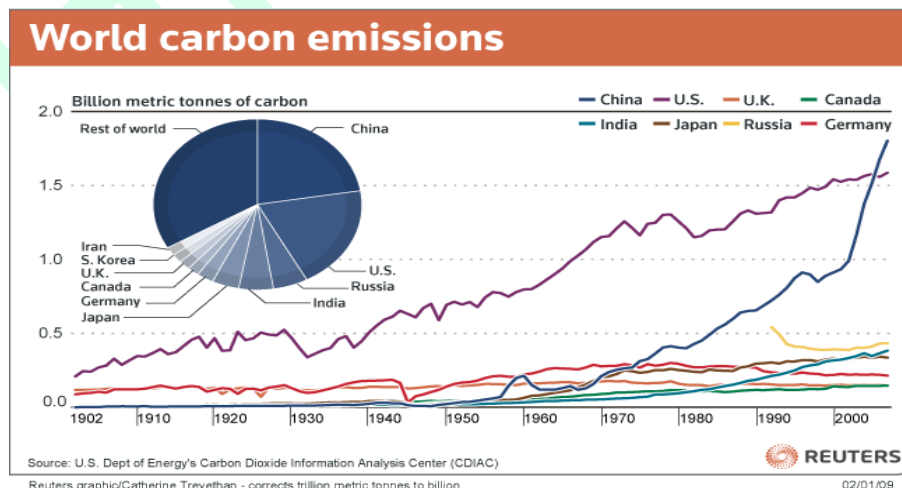
For instance the number of servers was less than 5 millions in 1996, and the projection for 2011 is right less than 40 millions, this brings us the problem of providing the energy required not only to keep data centers working but set up new installations, the Energy spending for the servers installed in 1996 was less than 100 \$ billions while the projection for 2011 is 250 \$ billions.

Energy needs are growing dramatically and the implications of this include a number of issues, one of which is environment.

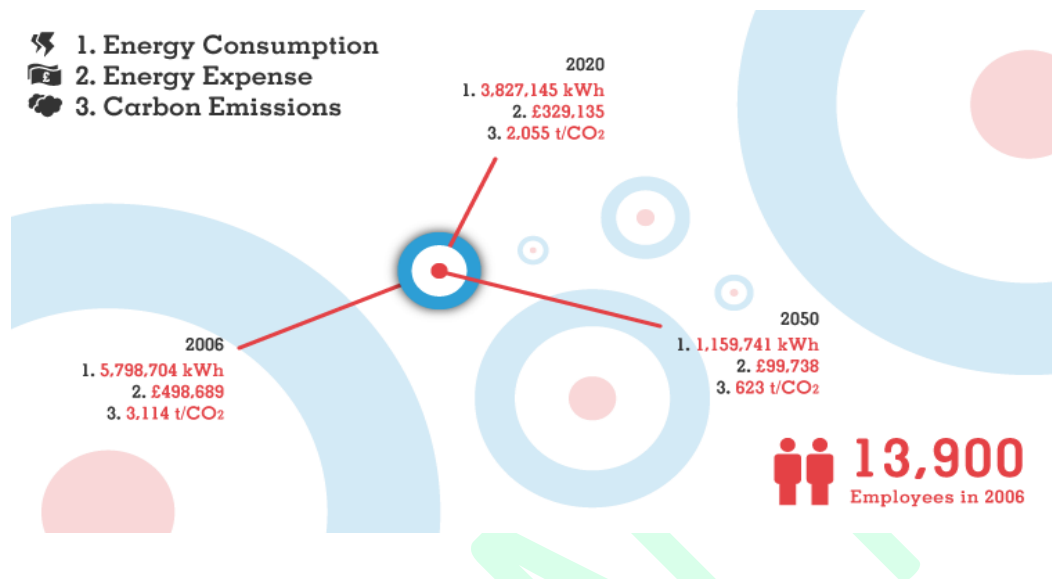
Also one of the things that having a high attention in the world is the CO₂ emissions, we burn fossil fuels to create energy. From keeping warm in our house, to fuelling our cars, to growing our food, to manufacturing, energy is used, and the CO₂ the effect of all this extra carbon dioxide in the atmosphere is that the overall temperature of the planet is increasing (global warming).

The global carbon emissions attributable to ICT have been estimated at 2% to 2.5% of world totals - about the same as the airline industry - and as high as 5-6% of developed nation totals.

As for McKinsey which is a global consulting firm forecasts that the ICT sector's carbon footprint will triple during the period from 2002 to 2020.



In the following graph showing a study of 2006 in the city of Bristol in the United Kingdom, and its ICT footprint broken down by business sector, also depicting the impact of a 34% reduction by 2020, and 80% by 2050 in line with the UK Climate Change Act



The main incentive for proceeding with this trend, and the driver for using the Green IT initiatives is the Cost Controlling and saving, which has four main benefits under this term: decreasing the electricity use, decreasing the consumables use, decreasing the future operational expenses or investments and realizing the credits or rebates from local utilities and governments. Another Two additional benefits were quoted as key considerations by many businesses which are the ability to meet the customers' demands in a better approach, and increasing features and functionality for the business.

PART 1: GREEN IT

PART1.1: WHY IS GREEN IT

When we want to talk about the “Green IT” and to clarify why we need it for a business, and why this Megatrend has now a wide appreciation and concern from many countries and industries worldwide, in this report I will mention the main points about why to adopt this trend:

- 1) Growing public environmental awareness: First of all, we can see that focusing on the environmental issues is now, one of the most important attentions to the worldwide.
- 2) Increasing impacts on environmental and human health: The outcome of energy is the CO2 emissions that is a contributor to the global warming and this recycling processes may result in a negative effect on the environment and the human health.
- 3) Cost Saving: PC power management software can cut energy costs by \$20-60 dollars per PC, which can save a lot of money when considering large enterprises. For many organizations, this can mean a (5-15) % reduction in overall, organization-wide energy consumption; also energy sales are expected to grow 50 percent worldwide by 2030. So by reducing the amount of power required to operate your business, we can avoid those risks which are out of control.
- 4) Corporate Social Responsibility: as with following the rules of the Green IT, it will help the organization for self regulation, so to make a positive impact through its activities on the environment, consumers, employees, communities, stakeholders and all other members of the public sphere.

Obviously, there are many things that need to change and knowledge which needs to be shared. If we try to see the trends in the SMBs and from the data that we could extract from them, we can conclude that they need to buy more energy-efficient computers, and the energy saving is one of the main topics that is having a high priorities, which is already mandated in the federal government and in many enterprises.

PART 1.2: WHAT IS GREEN IT

Starting with a definition of Green IT which is the most standardized one, by which it clarify the terms in this trend, so it can be identified as The study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated with subsystems efficiently and effectively with minimal or no impact on the environment.

There is many initiatives related to the Green IT, but in my report I tried to summarize them into the 4 main points which are:

- 1) **Virtualization & Consolidation:** in this group, the server virtualization and consolidation, in addition to storage consolidation and desktop virtualization.
- 2) **Energy Efficiency:** Initiatives in this area include server room upgrades and new builds, IT energy measurement, printer consolidation, and PC power management.
- 3) **Travel Reduction:** Initiatives in this area include remote conferencing & collaboration and telecommuting.
- 4) **Asset Disposal:** this contains one single initiative which is IT equipment recycling.

Within this report, I will explain each term individually, and try to address the management, technology, and organizational issues

PART 2: CONSOLIDATION & VIRTUALIZATION

Starting from the consolidation and virtualization, and within describing this concept, I included the benefits that we can get and their effects on the business, also focusing on the term thin clients, the benefits and the future of it.

PART 2.1: WHAT IS CONSOLIDATION & VIRTUALIZATION?

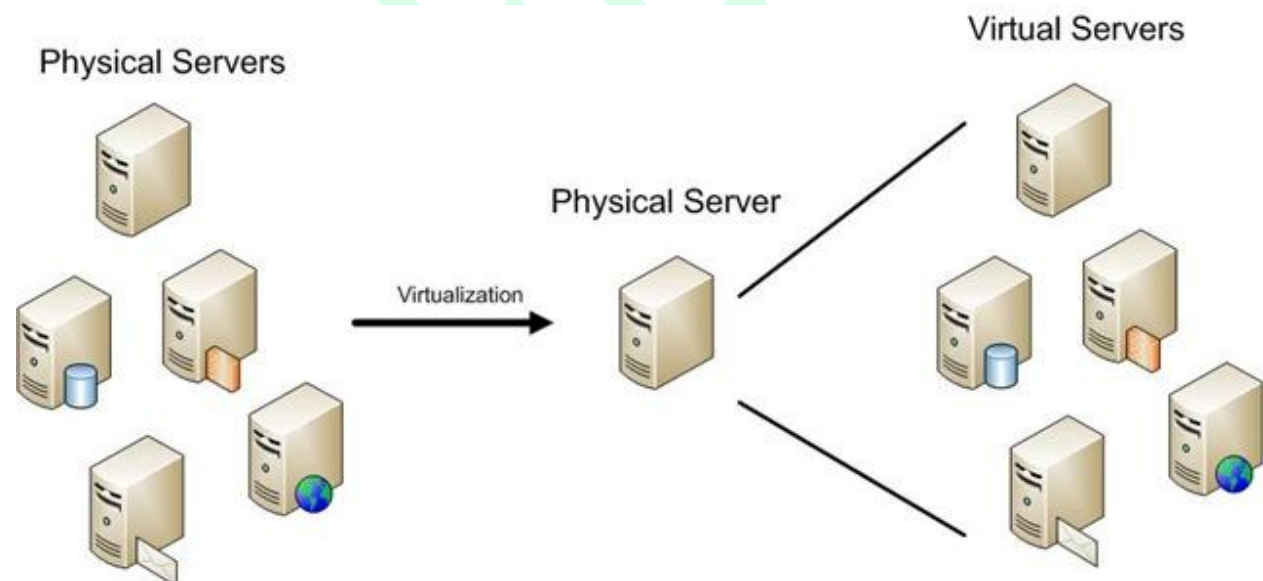
A lot of IT Administrators have seen that there is a superposition between consolidation and virtualization, and they tried to coincide these two terms in the datacenters environments.

Virtualization is about enabling multiple dominant workloads to run at the same time on larger servers, which is until now one of the main aspects in the consolidation, but the thing is that virtualization is offering a far-reaching opportunity to transform the operations in the datacenters.

If we want to talk about the server consolidation, it is about combining workloads from separate machines or applications into a fewer number of systems or applications, and there are many types of consolidation, and as a result reducing number of servers, OS images, systems and applications.

Storage virtualization and server virtualization are taken into consideration due to the benefits that they provide in term of ease of management and cost efficiency beside the reductions in energy use.

According to a study, around 25% medium sized companies have applied some form of storage consolidation or virtualization.

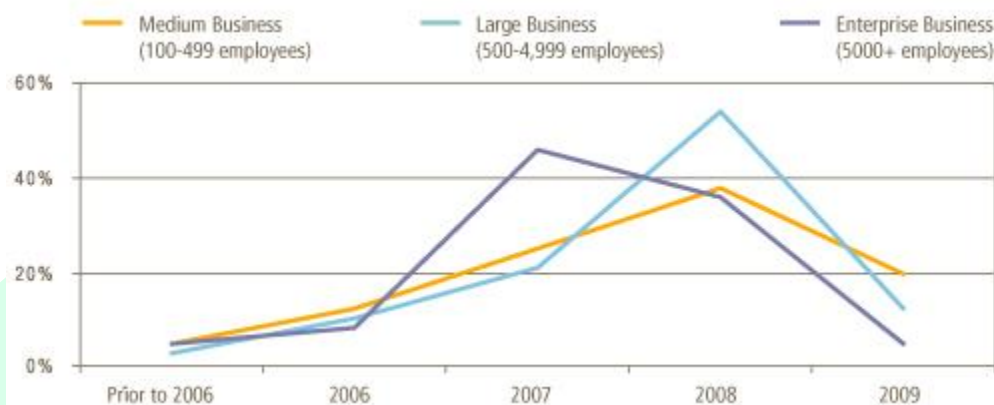


In this section I will introduce the most important aspects of virtualization which are:

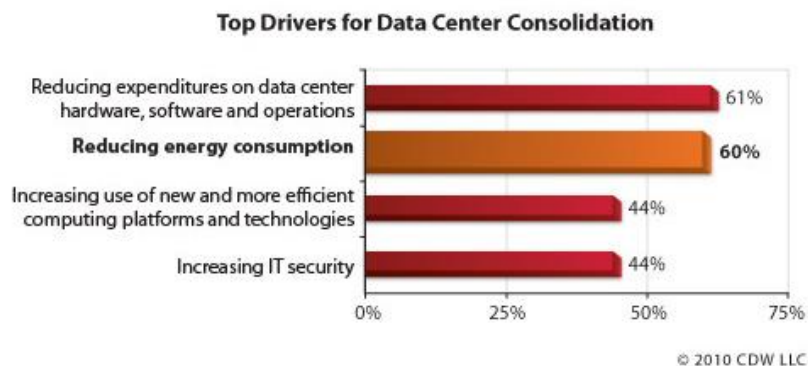
- 1) Decreasing the overall number of devices running in the server room, along with the square footage needed to house these devices.
- 2) Decreasing the energy required to run servers and storage, along with the associated cost and greenhouse gas emissions.
- 3) Decreasing the cost of future investments in physical servers and storage devices, by operating server room assets at higher utilization rates.
- 4) Reducing time needed for maintenance with the ease of change virtual server configurations, as a substitute for changing configuration of physical servers, and the management of storage space became simpler when the data is centralized on few systems rather than distributed ones.

These factors of decreasing energy consumption will let to a more cost-saving plus the ability to obtain more features than the ordinary PC.

With reference to a study, 59% of enterprise companies report they began deploying virtualization in or before 2007 vs. 34% of large and 42% of medium organizations



Many organizations now have or are developing programs to reduce IT energy use, and managing the consumption of energy. Since it has major effects on the cost and the budget, the importance of energy efficient technology use has increased, and the organizations are consolidating data centers and innovating to reduce the energy use, in the figure below, it shows the interest of organizations in the data center consolidation, and the top drivers for this technique.



The market for green data centers in the United States will more than triple to \$13.81 billion dollars by 2015 from today's \$3.82 billion, according to a forecast from Environmental Leader Insights. So it will be tough for IT vendors and data center power and cooling equipment firms to avoid aligning their product portfolios to this growing trend.



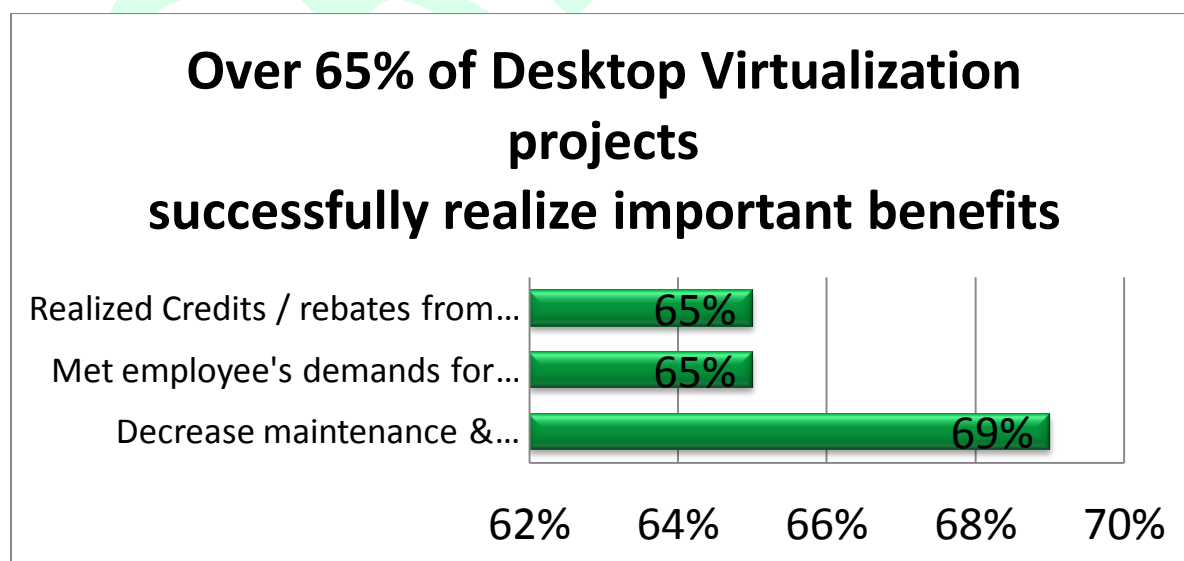
PART 2.2: DESKTOP VIRTUALIZATION

The term Desktop Virtualization is substituting the normal desktop PCs by thin clients, so as to reduce the energy consumption, besides some other advantages that I will mention later on, as the normal PC is consuming too much relatively, the thin clients doesn't contain many parts which are consuming more energy, this factor makes thin-client devices even more attractive than PCs by using significantly less power.



As one senior partner at a 100-employee services firm reports, “[Thin clients have] no CPU, no RAM, no moving parts, and connect to the virtual desktop environment. Our typical computer used up to a 250-watt power supply; our thin client uses a 4.8-watt power supply, so the reduction in electricity usage is 97, 98 percent, with all the functionality.”

In this figure, showing the successfully realized important benefits in the desktop virtualization from a recent study

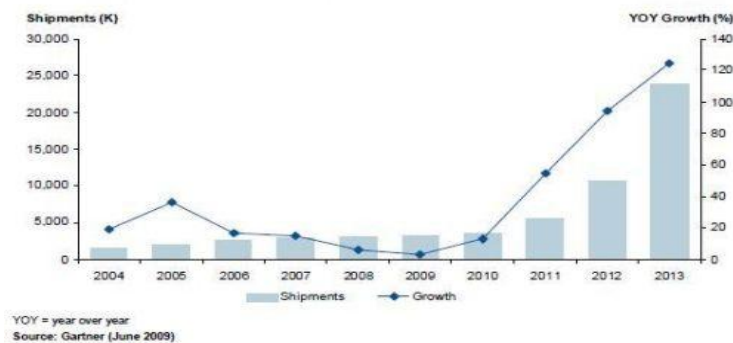


PART 2.3: THE FUTURE OF THIN CLIENTS

What the thin clients Promise to the businesses in term of Energy consumption by continuing to drive the use of CPUs at the lowest power envelope. This is because thin clients do not need to do as much processing compared to a traditional PC, and the Security and management since actual data is stored and processed on servers, the risk of data theft or loss is greatly reduced, in addition to Manageability, and Scalability which Each thin client is centrally managed and is accessible from anywhere on the network, those benefits besides reducing the carbon footprint, is the reason IT personnel in various industries are exploring and switching to alternative desktop computing.

This figure is taken from Gartner site which shows the projection of the thin client shipments and growth 2009-2013.

Figure 3. Global Thin-Client Shipments and Growth Projections, 2009-2013



PART 2.4: GREEN EFFECTS OF VIRTUALIZATION

There are many remarks from an organizations that tells about the big use of this technology, and its results on the corporate expenses, in the beginning, starting with an equation to check how much we can save by reducing servers in an organization, now the power to run a small Data Center can be calculated by considering an average that one server might use 400 W, In 24 hours it would use 9.6 kWh, so it will need \$.10/kWh per \$1/day, by considering a small data center of 500 servers and that's equal to \$500 per day plus \$500 for cooling which is equal to \$30K/month

I will provide examples of companies that implement virtualization in their corporations;

The first one is the United States department of agriculture (USDA) which used virtualization to reduce or consolidate 255 servers into 22.



Another one is the Los Alamos National Laboratories undertook a virtualization project that decommissioned 100 servers, resulting in the use of only 13. This has resulted in a savings of almost \$1.5 Million dollars.



PART 3: ENERGY EFFICIENCY

Another major contributor to Green the business is the energy efficiency approaches, which I can mention them one by one, explaining how to exploit them in a way to take benefit by these ways.

PART 3.1: SERVER ROOM UPGRADES & NEW SERVER ROOM BUILDS

Computer servers must be kept under constant environmental conditions to prevent failures and shutdowns. The cold storage monitoring can provide temperature and humidity logging services to server rooms as well as staff workspace to ensure that all personal and private data is safe from server malfunctions.



The upgrading in the server room, or building new one may has a high priority because of some reasons that already needed, and others that emerged recently, the following can clarify these reasons:

- Decrease cost and increase effectiveness of cooling and ventilation systems. Many existing HVAC systems cannot keep up with smaller, more powerful servers that throw off more heat than older, low-density equipment. Most server rooms were not designed to keep pace with the modern complement of fully virtualized servers and consolidated storage.
- Increase server and computing capacity. Server room spaces are simply maxed out; they are either too small to house needed servers, or inadequately equipped to deal with a high rate of virtualization on fewer devices that run hotter.
- The server room design of yesterday no longer supports business needs of today, in terms of uptime and availability.
- Mounting maintenance and management costs for older facilities, which may not affordably handle growth of computing and storage.
- The need to decrease real estate costs, through server room infrastructure that supports denser, smaller footprints of new servers and storage.

PART 3.2: I.T ENERGY MEASUREMENT

From a recent study, they found that 28% of mid-sized enterprises are piloting or implementing IT energy measurement, and 25% plan to implement in the next 12 months.

The adoption is driven by rising electricity costs, a need for data and guidance in planning future initiatives involving energy efficiency, and greater awareness of the impact of carbon emissions on energy consumption.

Businesses consider energy measurement most useful for the following:

- 1) Many organizations seek to understand, roughly, the level of energy efficiency at which they currently operate and how they can begin to improve.
- 2) Measure server room consumption.
- 3) Due to the limitation of the Electricity supply, IT forced to create energy capacity through more efficient use of energy.
- 4) Finally, 43% of businesses expect to feel regulatory pressure, relating to energy efficiency, within a year.



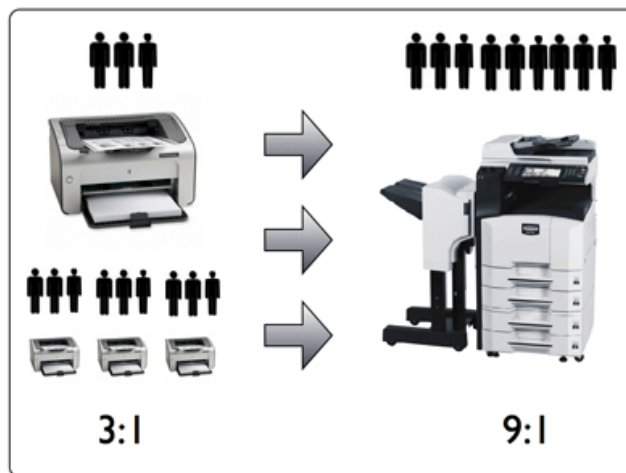
The measurement of data center efficiency is for the purpose of managing the use of electricity, at the same time making an action to manage and control the electricity usage requires knowledge of the source of inefficiency, and the expected benefits of efficiency improvements.

PART 3.3: PRINTER CONSOLIDATION

Printer consolidation is a good step in cost savings, the emergence of network - high speed printers is really helpful to the organizations where each computer is attached to a different type of printers. In addition to the cost savings this helps us to reduce the direct and indirect costs & administrative efforts associated with the maintenance of the local printers.

For more than 65% of companies, decreasing consumables such as paper, toner, ink and energy are driving forces behind printer consolidation and reduction, mentioning an example of a manager of a 1000-employee insurance firm said, "We eliminated 300,000 pages of output a year by moving to print-on-demand . . . with [savings of] six to nine cents per page". The firm realized operational savings of nearly \$30,000 year-over-year.

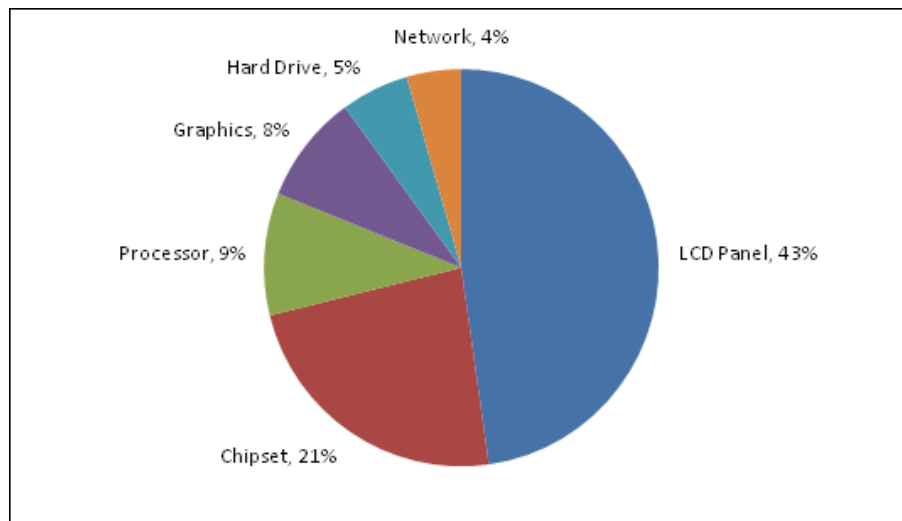
So by reducing the total cost of office output devices by using MFPs, reduce the total number of office devices, right-sizing the equipment to an enterprise organization, then all of these reflect a large saving when we are talking about a mid-to-large organizations that consume so much in the electricity, and the papers used, fixing the office devices besides the time lost in managing these resources, for examples the multi-function-printers are reducing the number of a distributed small ones, then having less consumption in term of electricity, and the maintenance, also the ability to centralize this device among different people and even departments, which at the end our goal is to have a green effect of not harming the environment and the cost-savings.



PART 3.4: PC POWER MANAGEMENT

When talking about PCs, the computer energy is often wasteful, not used all the time for the work, leaving the computer on, without doing tasks is wasting of this device which consumed a lot of energy when we count it for a large number of PCs working in an organization.

This is a graph representing the PC power consumption, claiming that it is the same for the laptop, which shows the consumption in the PC's components power utilization beside the Screen.



For instance, PCs can use up to 250 watts, while Laptops use 15-45 watts, so it's good in some situations to use the laptop instead of the PCs and it's recommended, On the screensaver mode the computer use 60-250 watts, while Less than 8 watts during sleep, standby modes so using software that centrally manages energy settings of PCs and monitors, or by enforcing standardized power settings on all PCs before distributing to end users



Another thing is procuring energy-efficient equipment, such as Energy Star certified devices, which will save more energy than the devices without this slogan, Using LCDs instead of CRT monitors as they are more power efficient and less leaded, which has better effect on the environment.

At the end, we can say that power management strategies can achieve prominent result in energy and maintenance cost savings, many enterprises had adopted some initiatives and others are piloting and implementing these initiatives.

PART 4: TRAVEL REDUCTION

Some initiatives in this report are related to travel reduction by considering the saving in fuel costs besides the greater awareness of harm caused by greenhouse gas emissions, many companies wish to reduce travel, so to cut costs and decrease negative impact on the environment. The initiatives in this report consist of the following:



PART 4.1: REMOTE CONFERENCING

Remote conference & collaboration allows people to participate in the same conference at the same time even though they are physically not in the same place, this initiative can be characterized by:

- 1) Video-conferencing and teleconferencing implementations between facilities or between office and client sites.
- 2) Online collaboration environments.

PART 4.2: TELECOMMUTING STRATEGY

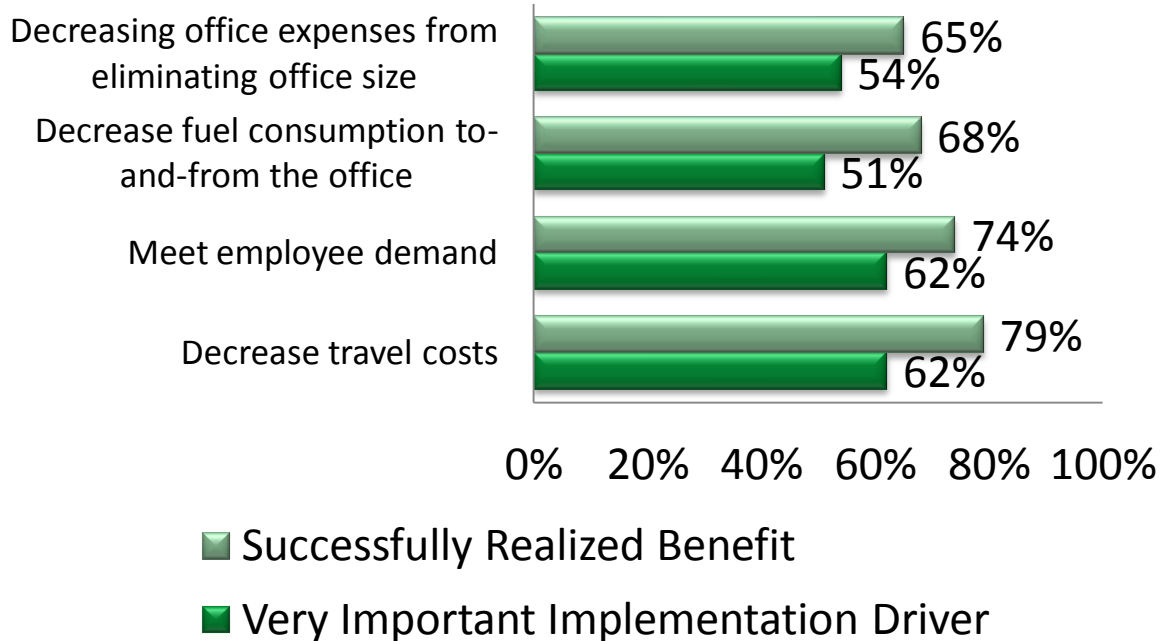
Telecommuting is also known as Tele-working, which is the act of working from a remote location, usually from home. This initiative is made simple with the use of diverse telecommunications technologies such as a telephone, fax machine and the internet. many telecommuters are set up with web conferencing capabilities allowing for office meetings, this also can be characterized by:

- 1) Virtual Private Network (VPN), remote access, and unified or voice communications capabilities to enable access from home and other remote locations.
- 2) Policies and strategies allowing or encouraging employees to work from home.
- 3) Policies allowing or enforcing employees to work "Four-Tens" (4 days a week, 10 hours a day).

These initiatives have some advantages, below is the main benefits:

- 1) Cutting travel costs where it counts: Decreasing the travel and fuel consumption costs associated with driving or flying between office locations and to client sites, hotels and related expenses.
- 2) Keeping your people happy: Satisfying the employees is pushing the companies to implement these initiatives, specially the telecommuting strategies.
- 3) Gaining access to remote talent for the organizations: sometimes the organization does not find an affordable way to get professionals from outside, but with the use of web conferencing, it became easier.
- 4) At the end, it will decrease the negative impact on the environment due to less consumption of fuel.

With reference to a study conducted to see the realized benefits and the most important driver for travel reduction initiatives, the remarks are presented by this graph.



Case Study: Over the last several years, AT&T has developed Alternative Office, a comprehensive program that currently allows 30,000 employees nationally to telecommute on a regular basis from home. This project is particularly interesting because it includes a rigorous cost/benefit analysis of their North Central New Jersey site. AT&T conducted a five year study of 600 telecommuters and concluded the following:

- 1) The most substantial savings were in reduced real estate costs. By allowing employees to telecommute, AT&T was able to close an entire office complex.
Annual Real Estate Savings: \$6,333,124
- 2) In addition to hard cost savings, there were substantial productivity gains. AT&T, based on employee interviews, estimates a conservative gain of two and a half hours per employee per week in time worked.
Annual gain due to increased productivity: \$5,112,841
- 3) Also, employees state almost without exception that they were able to be more productive during the hours they worked, due primarily to fewer interruptions.
Annual gain due to increased efficiency: \$3,127,617
- 4) There were, of course, start-up costs associated with setting up employees to work at home. Office alterations averaged \$3,000 per employee and computer/phone installations averaged \$4,000 per employee. These costs were depreciated over five years and \$1,250 per employee per year was added for phone, fax, copy and postage bills.
Annual costs: \$3,205,507.

PART 5: ASSET DISPOSAL

The success of IT equipment recycling relies on a combination of environmental responsibility and regulatory pressures and not the cost savings, which makes it different from the other initiatives.



The factors leading to implement this initiative which is the “products recycling” are:

- 1) Decreasing the waste sent to landfills, which is the most important factor in adopting recycling
- 2) Ensuring equipment is responsibly discarded at end of life.
- 3) Many IT departments are simply running out of closets and crannies to store old equipment, which results to the lack of space.



These pictures are for the ICT waste, which are exist mostly in Asian countries like china, as for the developed countries like the U.S and Europe, are sending these waste to the emerging countries to make a recycle operations for these assets.

PART 6: KEY SUCCESS FACTORS WITH GREEN IT

There are many factors assisting the “Green IT” implementation, but in this report I included the four main factors that affect the success likelihood of green IT implementations within an organization:

- 1) Stakeholder Support and Sponsorship from CEO and his executive team. Particularly for Green IT initiatives as they require education and a shift in attitude.
- 2) Lack of Implementation Barriers like the inadequate funding, misalignment with physical facilities, lack of resources, such as IT staff.
- 3) Motivation and rationale for adoption.
- 4) Urgency to comply with environmental laws and policies.

PART 7: THE INDUSTRY OF GREEN IT

- Climate Savers Computing Initiative (CSCI) is an effort to reduce the electric power consumption of PCs in active and inactive states, which provides a catalog of green products from its member organizations, and information for reducing PC power consumption.
- The Green Electronics Council offers the Electronic Product Environmental Assessment Tool (EPEAT) to assist in the purchase of "greener" computing systems. An evaluation of computing equipment on 51 criteria - 23 required and 28 optional – by the Council that measure a product's efficiency and sustainability attributes. Products are rated Gold, Silver or Bronze depending on how many optional criteria they meet.
- The Green Grid is a global consortium dedicated to advancing energy efficiency in data centers and business computing ecosystems. It was founded in February 2007 by several key companies in the industry – AMD, APC, Dell, HP, IBM, Intel, Microsoft, Rackable-Systems, SprayCool, Sun Microsystems and VMware.
- The Green500 list rates supercomputers by energy efficiency.
- Green Comm Challenge is an organization that promotes the development of energy conservation technology and practices in the field of Information and Communications Technology (ICT).
- The Transaction Processing Performance Council (TPC) Energy specification augments the existing TPC benchmarks by allowing for optional publications of energy metrics alongside their performance results.
- The SPEC Power is the first industry standard benchmark that measures power consumption in relation to performance for server-class computers.

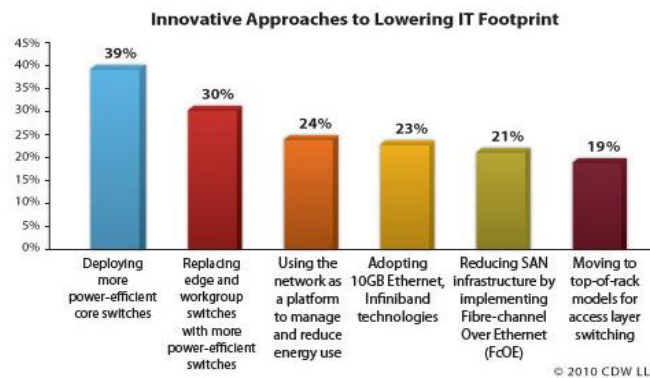
PART 8: THE CERTIFICATES OF GREEN IT

There are degrees and certifications provided from some academic institutions, I included the following:

- Degree programs that provide training in a range of information technology concentrations along with sustainable strategies in an effort to educate students how to build and maintain systems while reducing its negative impact on the environment. Metropolitan Community College (Omaha) has an associate's degree available in managing green data centers
- Information Systems Examination Board (ISEB) Foundation Certificate in Green IT is appropriate for showing on overall understanding and awareness of green computing and where its implementation can be beneficial.

CONCLUSION

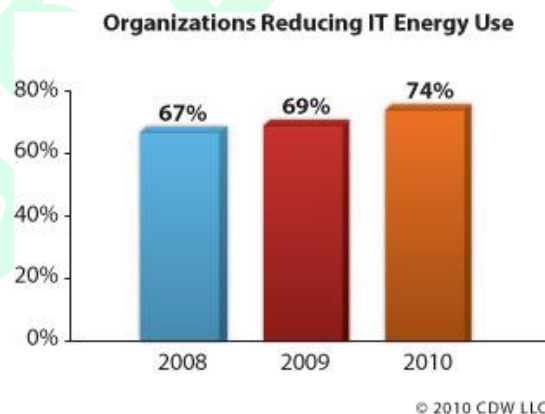
Due to the major contribution in saving money by energy-saving approaches, organizations are increasingly use an innovative tactics for reducing energy consumption and lowering IT footprint, for example 76% of organizations are adding at least one of the following innovative approaches to their energy efficiency tool kits, represented by the following graph:



Furthermore, Businesses around the world have discovered that going green isn't just good for the planet; it's good for their bottom lines.

And many governments are pressing business for action on the environment, through both regulatory regimes and international treaties, and this trend will surely continue.

IT decision-makers show significant interest in adopting most of the initiatives, to increase energy-saving and more focus on energy efficient IT.



Leading IT departments have embraced the cost savings opportunities inherent to increased energy efficiency and reduced consumption, and many others have now recognized these same benefits.

In the future, corporate environmental responsibility will become the norm rather than the exception as pressure from stakeholders and governments continues.

At the end, by summarizing the initiatives that I mentioned in this report, this table below shows the main benefits realized by each initiative:

		Decreased Energy	Decreased Consumables	Increased features & Functionality	Decreased Other Expenses/ Future Investment
Virtualization & Consolidation	Storage Consolidation				
	Server Virtualization & Consolidation				
	Desktop Virtualization & Thin Clients				
	Existing Server Room Upgrades				
Energy Efficiency	New Server Room Build				
	IT Energy Measurement				
	PC Power Management				
	Printer Consolidation & Reduction				
Travel Reduction	Remote Conferencing & Collaboration				
	Telecommute strategies & Capabilities				
Asset Disposal	IT Equipment Recycling				

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