Energy Consumption Monitoring and Management in the IT sector

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Aims & Objectives

The aim of the current project is to present and inform us about the policy of IT Companies. Through this, it is offered a way to reduce CO_2 emission so as to monitor and manage the energy consumption which possesses the 2% of the global emissions. This percentage is expected to be increased by 6% in the next few years.
In order to achieve the aims of the project the below objectives have been set:

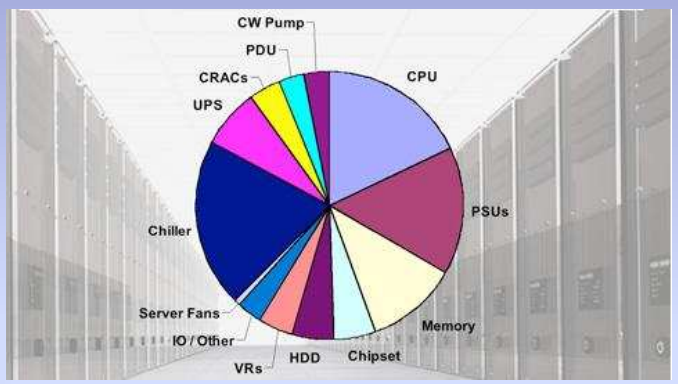
Estimate the present situation and the data that are obtained from IT companies about energy waste

Compare the IT energy consumption with the one of the aviation sector.

Investigate the difficulties for monitoring and management of energy in PCs and Data Centers

Indicate the procedure of the way in which we save up money for the consumers and companies after the precise selection of an appropriate innovation system.

Finally, the technical function of experimentation will be appraised and whether it would be useful to implement it to consumers and Data centers.



Project Description

The energy monitoring system has been designed to measure the consuming power in Informatics lab of TEI –Athens. It will especially calculate the energy consumption of PCs or Data center
The monitoring will be easy in use but the construction is a complex electronic system, although the main part of the system is the following. Initially the system includes a microcontroller AVR (ATmega328P) which is the 'heart' of the system. This is a low power 8-bit microcontroller which achieves throughputs by approaching 1 MIPS per MHz allowing the system designer to optimize the power consumption versus the processing speed.
The second part is an energy metering chip (ADE7757) which has a low cost, a single chip solution for electrical energy measurement. It also includes a direct drive availability for electromechanical counters and a high frequency pulse output for both the calibration and the system communication. The third part of the system is Ethernet controller (ENC28J60) a small chip with only 28 pins and has a SPI interface which is easy to use from any microcontroller. The energy monitoring system will be measured in watt. In addition it has limit until 8Kw and the monitor comprises 4 digits. The transmission of the counter power will be provided by Ethernet.
In this point the data of experimentation will be validated concerning the consuming power and any necessary reduction.

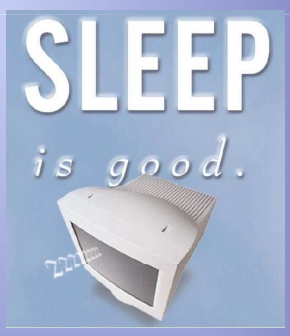
Background

It is estimated that the IT industry contributes 2% of global emissions. The percentage is close to that of the aviation sector. In one hand the proliferation of devices and on the other the developing economies are expected to increase rapidly. It is estimated by 6% per year. 'Green' initiatives are in their infancy in the sector, however IT companies start to take these issues into consideration such as Cisco 'Energy wise' technology which is oriented towards monitoring power consumption in network equipment. It should be mentioned that IT gave a new impulse to society but problems were created as well.
Gartner (2007) is referred two visible factors, the direct issue of electronic waste and the potential impact which is caused by the electricity consumed from computers and has an effect on global warming.
In addition the electricity power for Data center is not the only issue but also the power is needed for the storage devices, networking and controllers.
Nevertheless Gartner (2007) estimates that by 2011 a quarter of new Data center will be different than those of today with mechanical, electrical, thermal and design energy efficiency will be improved.
According to the European Commission Review (2008) Information and Communication Technologies (ICT) are extremely important because they reduce the energy intensity and increase the energy efficiency of ICT in the economy. In other words they reduce by 2% the global CO2 emissions and contribute to sustainable growth. It is also supported by intelligent equipment and services can reduce the emissions. For example British Telecom has achieved a 60% reduction in its UK carbon emission from 1996.
Cisco, adopts the same philosophy regarding the telepresence technology. All the issues above are thoughts which help the organization to go green.
NCC (2008) at the report of 'The green IT paradox' has referred that only 13.3% of responsible organizations have a green IT policy but an encouraging 45.8% of them claim that they will develop one in the future.
The most difficult part of energy consumption in the IT sector is to manage the energy.
Chase and Doyle (2001) allege that a developing system which handles server resources in order to cluster power demand scales with request throughput. This system can save significant energy due to server clusters and sized for peak load, while traces show that traffic varies from 3-6 or more through any day or week, with average load less than 50%. As a conclusion this system guarantees both economic and environmental benefits.
In 2006, Data Centre around the word managed 161 exabytes which are equal to 161 billion GB, this growth will presumably reach to 988 exabytes by 2010. The organizations have set the target to reduce factor energy and the cooling cost, with the appropriate schedule .Another appropriate solution would be to compare the blade with the rack servers.
It was observed that rack servers are more efficient. Furthermore, an appropriate monitor can save a lot of money, so as to inform and offers the opportunity to achieve it (Taylor 2008)
The reason why a new potential system for the measurement of the consumed energy has not been developed up to now is because there have not been found proper systems for energy efficiency. Noticing all the above is essential to be referred to how does the above mentioned system Cisco Energy Wise works.
Cisco demonstrated their plans for Cisco Energywise (2009) an innovative technology which gives solutions and can help everyone to proactive control rising operating cost while minimizing the carbon footprint by measuring, reporting and r educing energy consumption. This can happen potentially with devices connected to a Cisco network ranging from power over Ethernet (Poe) devices such as phones and wireless access equipment. Energy wise has the ability to monitor, optimize, manage and reduce electricity energy which consumed. In addition, this system can save energy by cutting the power off when the devices are not needed.
Up to now we were not concerned about the consumption of energy because the percentage of CO_2 emissions from IT was reduced the last years but it has increased according to numerous Data centres. This percentage has reached the 2% of global consumption. Moreover, according to Cisco's report Cisco GreenIT (2007) 'Why IT must take a lead in greening the enterprise' a typical data centre housing 1800 servers consume 5 Mw of electricity, that cost 5 million dollars per year. Beside this, 60% of power derives from coal release that is emitted from power station chimneys and 10% is lost in grid distribution. For the remaining 35%, half is consumed for cooling, 11% for the power conversion and 3% for the light. It has been approved that servers consume a quarter of the power and data centres 10% which correspond to 10.000 tonnes of coal per year and emit three times the amount of CO_2.
Cisco (2009) has defined four steps to evaluate the energy efficiency. First, the current energy of network should be measured, secondly we have to realize how the productive network works, the thirdly it is important to analyze the network architecture and their components lastly to evaluate and compare the energy efficiency.
In addition, the company wants to reduce GHG emissions by 25 percent by the year 2012. The main target is to achieve information on technology and the power of the network and the same time, to minimize their power consumption.
It is important to mention that these applications have risks in case we reduce the consumption of electricity. This would mean the increase of temperature and as a consequence the destruction of the servers. This might cause a lot of confusion to the companies and as a result to lose informative data.
Google (2009) refers that the answering of a question consumed 0.0003 Kwh of energy it should be mentioned that is less than we will use in our personal computers. The company has obtained a 'green' attitude in order to minimize electricity used by servers, data center which consume a great part of energy for the cooling. The company has proved that evaporation is a powerful tool, which can save a big part of consumption.
Hewlett – Packard (2009) assume that the main factor which is responsible for the great consuming of energy data centers is to cool the system.
Furthermore it represents a new 'Dynamic smart cooling system' which reduce the cooling cost up to 25 – 40%, prefer resilience and increase the efficiency. From the report of GeSi (2008) it is calculated what the data centers footprint in 2020 will be.
It is referred that 122 million severs in 2020 emit 259 Mt CO_{2e} in comparison that of 18 million server which emitted 76 Mt CO_{2e} in 2002.

Task Name	Duration	Start	Finish
Research Methods Module	**27 days**	**Tue 17/2/09**	**Tue 24/3/09**
Portfolio Preparation	31 days?	Tue 17/2/09	Mon 30/3/09
Literature Review	16 days?	Wed 18/2/09	Tue 10/3/09
Project Management and Risk	4 days?	Tue 10/3/09	Sat 14/3/09
Hand in Portfolio	0 days	Tue 24/3/09	Tue 24/3/09
Poster Preparation	4 days?	Wed 25/3/09	Mon 30/3/09
Poster Preparation	0 days	Mon 30/3/09	Mon 30/3/09
Data Processing	**9 days?**	**Wed 1/4/09**	**Fri 10/4/09**
Data Evaluation of Global CO2 emissions	4 days?	Wed 1/4/09	Sat 4/4/09
Data Comparison (aviation-IT sector)	2 days?	Sat 4/4/09	Mon 6/4/09
Data Collections about Footprint in 2020	5 days?	Mon 6/4/09	Fri 10/4/09
Data Analysis	**8 days?**	**Fri 10/4/09**	**Mon 20/4/09**
Evaluation about the consumption	3 days?	Fri 10/4/09	Tue 14/4/09
Strategy of the companies	3 days?	Wed 15/4/09	Fri 17/4/09
Technical Description of CISCO	2 days?	Sat 18/4/09	Mon 20/4/09
Experimentation	**15 days?**	**Wed 22/4/09**	**Sun 10/5/09**
Current Situation of IT lab	3 days?	Wed 22/4/09	Sat 25/4/09
Project technical description & measurements	5 days?	Sun 26/4/09	Thu 30/4/09
Data analysis of experimentation	7 days?	Fri 1/5/09	Sun 10/5/09
Data Evaluation	**14 days?**	**Mon 11/5/09**	**Thu 28/5/09**
Results evaluation	8 days?	Sun 10/5/09	Tue 19/5/09
Proposed improvements	7 days?	Wed 20/5/09	Thu 28/5/09
Personal Opinion and Assessment	**4 days?**	**Fri 29/5/09**	**Wed 3/6/09**
Writing up	**17 days?**	**Thu 4/6/09**	**Thu 25/6/09**
Concluding the writing	12 days?	Thu 4/6/09	Thu 18/6/09
Possible additional work	5 days?	Fri 19/6/09	Thu 25/6/09
Evaluation of the Dissertation	**58 days?**	**Fri 26/6/09**	**Thu 10/9/09**
Presentation Preparation	10 days?	Fri 26/6/09	Thu 9/7/09
Oral Presentation	0 days	Fri 10/7/09	Fri 10/7/09
Final Corrections	8 days?	Sat 11/7/09	Tue 21/7/09
Hand in Dissertation	0 days	Thu 10/9/09	Thu 10/9/09

Conclusions

A brief introduction to the policies followed by the companies for the saving of energy in the field of Information Technology.
The aims and objectives have been clarified.
The social, ethical and legal issues have been specified.
In the literature review all the preliminary sources have been presented.
These sources will be improved in the dissertation.
In the project, it is included the description of the Project Management plan and a provisional timescale (Gantt chart) of the task that will be carried out. At the same time, any possible risks during the project are referred to the section of the Risk Management.



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