A STUDY OF ENERGY CONSERVATION BEST PRACTICES IN SERVICE SECTOR

Sohan Dutta and Prof. U.S. Rao

Department of Management Studies,
Sri Sathya Sai Institute of Higher Learning,
Puttaparthi, Andhra Pradesh -515134, India.

ABSTRACT

Escalating energy prices, depleting non-renewable energy resources and global warming is making business environment more volatile day by day. Energy conservation is a fundamental element in the progress towards a future low-carbon economy. Actions to decrease energy consumption can make a significant impact in squaring the circle between an increased demand for energy and environmental protection, ensuring a move towards a more sustainable energy future.

Energy saving is important and effective at all levels of human organizations – in the whole world, as a nation, as companies or individuals. Energy Conservation reduces the energy costs and improves the profitability of energy consumers. Energy Conservation is also closely related to the environmental issues, the less we consume the less we contribute to global warming.

The paper put-forth the energy conservation best practices followed across the globe in service organizations and then to list out guidelines for the aspiring organizations to emulate and make a difference to their organization and to the world.

The study enforces that focusing on energy efficiency and energy conservation as strategy organizations in services sector can enhance their image of global citizenship, reduce operational cost, address the uncertainty risk and get a competitive advantage as a whole. Energy Conservation can be instrumental in influencing the 'Triple Bottom-line', i.e. planet, people and profit. Energy Conservation is no more a concept to talk about; practicing it is the need of the hour!

Introduction

Energy security has become the biggest concern over the past decade, though it had made its mark strongly during the time of oil crisis in 1970 (Energy Efficiency Solutions Book, 2008). But, with the increase in population and scarcity of resources the future of the world is inconceivable. The increase in urbanization, industrialization, and the rise in the living standards have resulted in greater demand for energy (Joel N Swisher, 1997). It is estimated that the world energy consumption has risen up by 45% today since 1980, and is projected to be 70% higher by 2030 than 1980 (Energy Efficiency Solutions Book, 2008). Bridging the gap of the demand-supply is the biggest challenge mankind has before them, and to make the scenario more complex it is coupled with the issue of environmental security. Service sector is one of the major consumers of energy; they increase the energy consumption to a very high extent. The service sectors include hotels, education institutions, IT companies, and any such companies that provide services. The important task that lies ahead is to analyze the demand and supply vividly and then to put forth a set of recommendations that will provide energy sustainability and environment sustainability to the world.

Demand has been increasing at a stupendous pace; Increase in population and their standard of living have triggered the increase in numbers of skyscrapers, vehicles, industries, appliances, lighting, HVAC, and so on, with a corresponding increase in energy demand. But, when it comes to supply, it is just a handful of resources and that too each has its own unique constraints. Supply can be classified into two broader categories namely primary and secondary sources. Primary sources comprise of coal, oil and natural gas, and these three together caters to approximately 81% of energy need of the world (Environment and Energy (Discussion Paper), 2009). But these sources are fast depleting and moreover they are the main sources of carbon emissions, which in turn aggravate the global warming (Kim, 1997). Coal, gas and oil are either consumed directly or they are used to generate electricity to provide power. The secondary source mainly comprises of sustainable energy sources like: solar, wind, water, nuclear. The sources are also called clean energy sources except nuclear (as the nuclear waste harms the environment) as they don't emit any harmful gasses which can pollute the environment. Though they can be eternal sources of energy, it too has its limitations.

'Energy Efficiency' and 'Energy Conservation' are the quickest, cheapest and cleanest way to extend the world's energy supplies (Energy Efficiency Solutions Book, 2008). But to insure its effectiveness, intelligent pricing, pertinent policy and mass awareness becomes essential. Energy efficiency is defined by Swedish Energy Agency as 'to obtain an unchanged output value at reduced consumption level' (http://eippcb.jrc.es). In other words increased energy efficiency means producing goods, and services- such as comfortable buildings, lighting, food, transport, and manufactured goods for domestic or export sale- with less input (Alison Bailie, 2006). Energy efficiency plays a vital role for the advancement of the organizations, not only from the profit or savings point of view, but also it helps to get a competitive edge over others, as energy is becoming precious resource. Moreover every organization has its obligations to the society, by being more energy efficient it will be consuming less energy and thus will help in decreasing the demand-supply gap and which in turn will also reduce the carbon footprint. Energy savings can be attained in daily life not only by individuals but also by the organizations by setting a goal to reduce waste. Energy efficiency can be achieved by following best practices, using energy efficient products, optimum energy mix, process reengineering, etc. So,

focusing on improving energy efficiency and energy conservation helps organizations to increase their savings and also to secure the energy and environment at large.

Need and significance of the study:

Escalating energy prices, rising temperature and increasing carbon emissions make business environment even more volatile day by day. Energy efficiency is a fundamental element in the progression towards a future low-carbon economy. Actions to decrease energy consumption can make a significant impact in squaring the circle between an increased demand for energy and environmental protection, ensuring a move towards a more sustainable energy future. However, considering future trends in world energy use, increasing concerns about access to energy and energy security, significant challenges need to be addressed, for which energy efficiency will be part of the solution (Environment and Energy (Discussion Paper), 2009). Strategies and best practices for improving the energy efficiency are immediate need to respond to the complex challenges of energy security and climate security. Moreover considering triple bottom line, it captures an expanded spectrum of values and criteria for measuring organizational success: economic, ecological and social. From economic point of view energy efficiency will help in increasing the profit, or reduction in cost, from social and ecological point of view it will reduce the CGH emissions and also will reduce the demand-supply energy gap, thus helping contributing to the sustainability of the world. There is a strong business case for energy conservation, it enables companies to save costs, improve their competitiveness and overall productivity.

It is therefore appropriate to explore what improvements service companies have done and what are the best practices and technology available for improving energy efficiency and enhancing energy conservation. The study felt the need to analyze the strategies followed and to assimilate best practices, which will in turn be used to prepare a 'Business Case for Energy conservation' to be presented to CXO's of various organizations.

METHODOLOGY

Nature of the study:

Energy efficiency and energy conservation are fundamental elements in the progression towards a future low-carbon economy. Actions to increase energy efficiency can make a significant impact in squaring the circle between an increased demand for energy and environmental protection, ensuring a move towards a more sustainable energy future. The increase in energy consumption in service sector has augmented the importance of energy conservation for the organizations.

This section explores what companies are doing to address the energy sustainability issue - from both organization and societal point of view. How their strategies and best practices are helping in tackling the grave issue; how well it can be improved or implemented by the non-energy efficient entities. Is it impacting the triple-bottom line? Are they having any competitive advantage by strictly adhering to their best practices?

The study tries to find answer for all the questions posed above. The study is more of a qualitative research and exploratory in nature from variety of sources such as annual reports, sustainability reports, global citizenship reports, books, journals, articles, working papers, insights of experts in the field and field study in service organization.

Scope of the study:

- To study different tools, techniques, methods, technologies and its applications for improving energy conservation.
- Study cases where practically such cases were conducted and energy savings was achieved.
- Highlight the best practices and innovative initiatives taken by firms to reduce their energy usage and the carbon footprint.
- Identify the strategies that can serve as a competitive advantage to the firm.
- Conduct energy audit for an organization and suggest some methods for improving energy efficiency along-with cost-benefit analysis.

Sources of data:

The major chunk of data for this report is primarily based on secondary data collected from journals, business magazines, business newspapers, company websites, energy websites, sustainability reports, and annual reports. A part of the report is based on the insights and data shared by few company executives and consultants (energy and green buildings) during interview.

The data for energy audit was primary in nature, which was collected from the office, departments and also during the walkthrough.

Limitations of the study:

- The first part of the study is mainly dependent on secondary data and hence bound by its limitation of time of study and information available at the time of study conducted.
- The selection of companies is based on the data available and also as per the credibility expressed by the various energy websites.

Energy Saving Practices of Service Organizations

Best Practices of Energy Conservation of 25 organizations belonging to different services industry across the globe studied are:

- Green Mountain Power
- Company: Orchid Hotel
- ITC Green Centre
- Batra Hospital and Research Center
- Apollo Hospitals
- Jehangir Hospital
- Kovai Medical Center
- Ruby Hall Clinic
- Sterling Hospital
- Post Graduate Institute for Medical Education & Research
- Chatrapati Shivaji Maharaj Hospital
- Moolchand Medcity
- North Western Railway hospital
- Copper India
- Siemens Limited
- Walmart Stores Incorporated
- EcoSpace (RMZ Corp. &Ambuja Realty)
- Taj Residency
- Wipro Limited
- Infosys Limited
- Lemon Tree Hotels
- Coles Supermarket
- Whitman-Hanson Regional High School
- San Jose State University
- Hyatt Regency

Best Practices and Technology

The study revealed the list of best practices and the related technolgies followed by the vanguard organizations.

Technology	Best Practices
• **Energy efficiency in architecture**	• AAC (autoclaved aerated concrete) • Natural Lighting in the atrium • Double/Triple-Glazed window • High Albedo roof coating • Optimum wall thickness • High-efficiency distribution center (DC) that has a solar power system on site which powers the building. • DC also features a "green wall" that uses plant growth to reflect heat and skylights in the roof to utilize natural light during working hours. • Green roof and green areas help cool the building, reducing the need for air-conditioning, which saves electricity and money. • Low U-value Glazing System by Saint Gobain with Dupont technology *Specialized Heat Recovery System* with VFD (Variable Frequency Drive) Helps minimize heat gain, reduces air-conditioning bills and lowers carbon footprint. • Use of low VOC paints, sealants, and adhesives. • South-west glass panes closed with thermocol to reduce the heat gain. • LEED – Gold rated campuses. • Day Lighting – maximum daylight without glare. Cabins and conference rooms have been moved to central zone and workstations are in the periphery of the building plan. • Usage of most efficient equipment to bring down the plug load to 1W/sq. ft • ASHRAE standard of 1W/sq. ft have been incorporated in the design for corridors and toilets. • Thermal Insulation - Increases room comfort and conserves energy. • Multi-zoning (internal space planning) - The different climatic needs of the main zones of a supermarket, from refrigerated goods and fresh produce to the bakery, etc. Physical barriers will be more effective and energy efficient than air pressure or large air curtains in lessening mixing between air from the different zones.
• **Lighting Technology**	• PL lamps , Fluorescent tubes and key card. • Installation of energy efficient lighting system.

	• CFL with electronic chokes for lighting. • Optimizing indoor and street lighting. • CFL lights have been installed. • Replacement of lightening fixtures in operation theatre. • Installation of energy saver control panel for area lighting. • Retrofitting of energy efficient lighting. • Factory overhead lights from 400 watts to 200 watts. • Replacement of tube lights and halogen lamps by energy efficient LED lights. • Commissioning of centralized panel with RTC for auto switching and of lights and AC units in certain offices. • Reducing the night-time lighting of stores and buildings • Installation of our first parking lot with LED lighting. • Installation of timers on street lights. • LEDs replace halogen lights at common areas. • Lux levels monitored on a regular basis to optimize the lighting load. • Building envelope - In addition to wall cavity insulation, TR-10 continuous insulation is on the outside face of the exterior wall. The roof has R-20 continuous insulation. The floors have under-slab insulation.
• **HVAC Technology**	• Fine-tuning and synchronizing building HVAC. • Electronic reduced voltage soft starter cum energy saver for A/C compressor. • Change of impellers in the pumping system for the air conditioning system. • Change of existing inefficient AHUs to new efficient AHUs. • Installation of VFDs for AHU blowers and CT fans. • Replaced reciprocating compressors with centrifugal and screw type compressors. • Installation of timers on AHUs. • Installation of AC VFD. • Installing energy savers on AC. • Inception of screw type compressors in AC. • Reducing the power consumption of AHU and pumps in ACs. • Utilizing waste heat recovery from air conditioning systems. • Checking the AC systems. • Building AC has 4 quadrants, where chillers are switched off when unoccupied. • Installation of screw chillers with variable speed pumping system. • Retrofitted split ACs with latest technology Digital scroll VRF. • Reduction in compressed air leakage. • Replacement of outdated split AC units and chiller plants. • Installation of energy savers in AC package units.

	• Chiller operating temperature increased from 7oC to 8oC in the day time and 9oC in the evening (every degree increase in chiller temperature will decrease power consumption by 4%). • Airlocks at the main entrance and rear dock seals - Significantly reduce air ingress and energy used by heating, ventilation and air-conditioning (HVAC) and refrigeration systems. • 'Thermomass' insulated concrete panel to west and east walls - Reduces heating and cooling requirements through better insulation.
• **Appliances**	• Master Control Panel. • Conducting efficiency tests for all equipment.
• **Hot Water Technology**	• Installation of economizer in the boiler to recover the flue gas waste heat. • Use of steam from the boiler to meet the hot water requirement. • Minimized diesel generation by using steam generation. Waste steam used to pre-heat water. • Water source heat pumps to heat and cool the store via refrigeration waste heat recovery. • Coolers and Freezers fan cooled condensers are been replaced with water cooled condensers to recover the rejected heat to generate hot water also improve the Efficiency, 3 to 6 Deg. heat exchange is been achieved. 1470 litres of boiler fuel saved/ year approx. • Install meters to monitor air-conditioning chiller conditions.
• **Lift**	• Replaced old elevator machinery with variable frequency drive. • Installation of energy efficient variable voltage variable frequency drive in elevators.
• **Motors**	• Replacement of old boilers with an energy efficient one with economizer and air pre-heater. • Installation of centrifugal chillers with variable frequency drive. • Installation of FRP fan for cooling tower. • Installation of energy efficient luminary VVFD for water pumping & motors for central AC plant.
• **Green Computing**	• Connection of equipments with UPS to use optimum load. • All Desktop PCs have a screensaver of 2 minutes. • Energy Star 5 desktops and laptops.

	• Green Data Centres: Deliver 10-15% more energy efficiency. • Virtual meetings and Video Conferencing. • Green IT – Optimized power management configuration ensures that desktops enter in sleep mode after 1 hour of inactivity, which saves 50W/hr. • Installation of eco-friendly data centers.
• **Smart Meters**	• Installation of digital meters. • Installation of LPG Meter • Separate energy meter for each tower/vital monitoring point.
• **Energy Management System**	• Employ data driven energy management program. • Installation of building monitoring system. • BMS (Integrated Building Management System) monitors services like HVAC, electricity, water, enhancing efficiency. • Installation of Computerized Energy Management System. • IT-platform based remote energy management services.
• **Power Factor Controllers**	• Improving power factor. • Installation of power factor panels. • Power savings in HT connections by providing by automatic power factor control panels.
• **Power Savers**	• APFC fitted with harmonic suppression filters. • Replacing the electronic ballast. • Reduction in current Harmonics. • Addition of Capacitor bank.
• **Building Automation**	• Implementation of effective automation and control. • Regular monitoring and controlling temperatures and regulating chiller operations. • Commissioning of centralized panel with RTC for auto switching and of lights and AC units in certain offices. • Remote monitoring to reduce energy consumption of refrigeration and HVAC systems and improving refrigerant gas loss.
• **Carbon Footprint Monitoring**	• iSustain- an enterprise carbon energy and resource management tool with sustainability reporting and performance management capabilities. • LT Voltage Stabilizer for Energy Saving - Prevents damage to equipment due to sudden power fluctuations.

• **Alternate Sources of Energy**	• Use of Solar Voltaic. • Inception of solar water heating system. • Setting up the bio-gas plant. • Using bio-gas for waters. • Electric heaters replaced with solar heaters. • Installation of solar heating panels. • Solar lighting. • Harvesting of site energy- Windmills and Solar Panels atop the office towers provide energy to run the building management system.
• **Others**	• Mini Bars- Fuzzy Logic • On all electric panels, it has been requested to switch off light while leaving the room. • Awareness creation among employees on energy conservation. • ISO certification of sub-stations feeding electrical supply to the hospital. • Educating associates on how to save energy, including remembering to turn off lights or close doors on back-up refrigeration equipment • Chilled Water Cooling System with double skinned AHU and 134A refrigerant avoid depletion of the ozone layer and global warming. • Use of aero wind generator to power 10 street lights for 10 hours.Street lights are fitted with LED / CFL luminaries of 18 w. • Optimization of lab power consumption - Optimum utilization of equipment (servers, testing equipment, rectifiers). • Operation of A/C units in cafeteria as per time schedule. • Switching off A/C units according to occupancy, switching off lights according to the requirement • Eco campaign for the awareness of employees. • iSmart- An intelligent power strip that can only supply power from an electrical source to devices connected to it in the enterprise environments, but also monitor their consumption levels.
• **Sensors**	• Light sensors are installed in all patient areas. • Motion sensors installed in work stations and restrooms. • Daylight sensors and Motion sensors installed.

GUIDELINES FOR ENERGY AUDIT

The objective of Energy Conservation in any organization is to achieve and maintain optimum energy utilization, minimize energy costs, waste and environmental impacts.

The objective of this section is to offer a summary of insightful industry-demonstrated steps that can act as a reference/guide for any organization that wants to improve their energy conservation. Energy audit is the key to achieve the goal of energy conservation.

Energy Audit = Savings in Money + Environmental protection + Sustainable Development (Energy Efficiency Office, 2007)

Energy audit is an examination of the system to ensure that the energy is consumed efficiently. An Energy auditor analyzes the way energy is being used by various components, checks for areas of inefficiency and identifies areas for improvement. During the energy audit, the auditor looks for opportunities to reduce the amount of energy input into the system without negatively affecting the output(s).

Purposes of Energy Audit

Energy audit is implemented for following purposes:

- Collecting energy bills and available data
- Analyzing energy use patterns
- Benchmarking and comparative analysis
- Create new ideas/ innovation
- Identifying energy efficiency potentials
- Finding realistic energy savings
- Cost-Benefit analysis
- Preparing action plans for implementation
- Develop staff training programs

Energy Audit Steps

Energy Audit has three main steps:

- Energy Audit preparation
- Audit execution
- Audit results reporting including – a defined set of limited post-audit activities.
    - Each of the steps has several sub-steps.

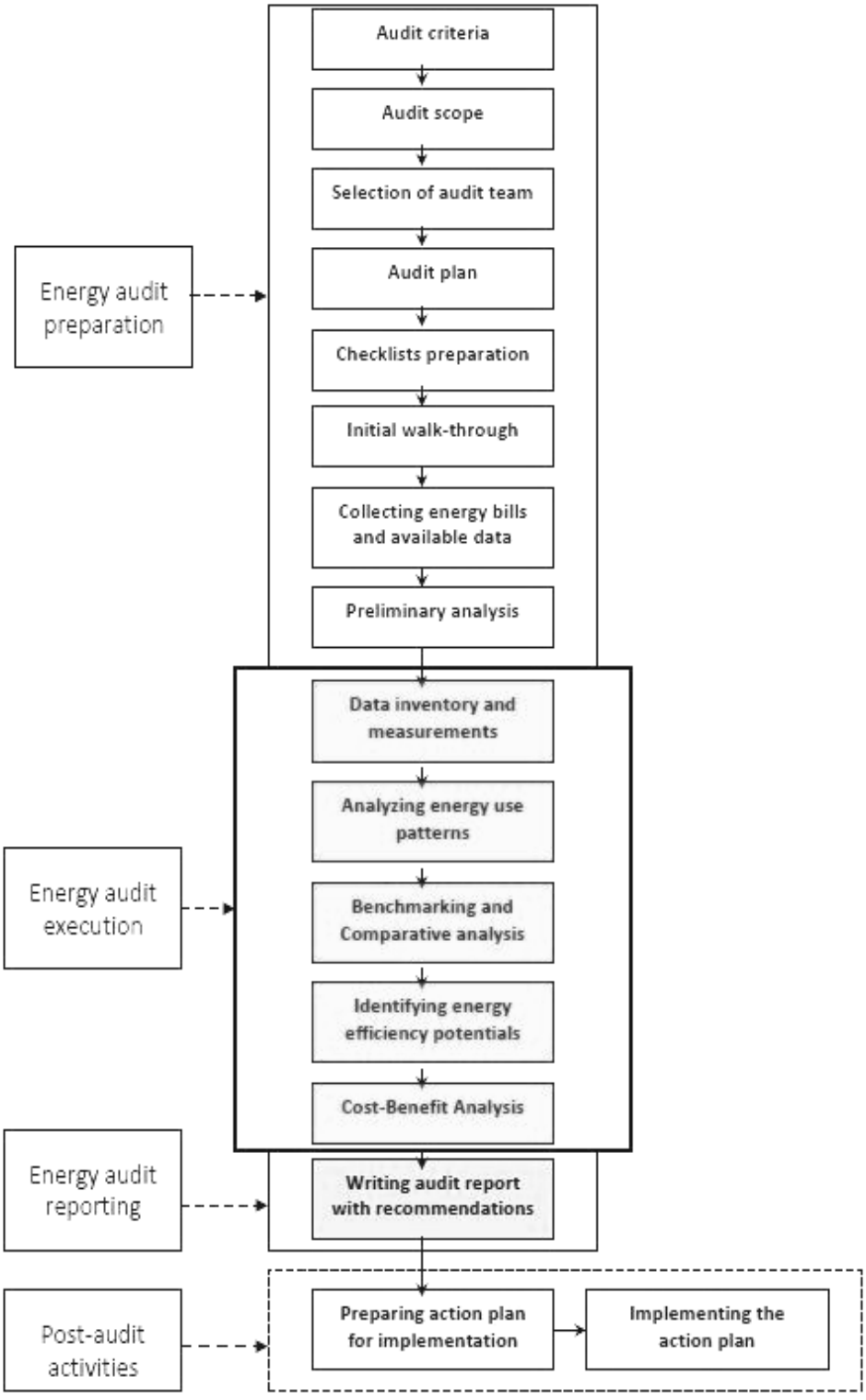

Figure: Energy Audit Steps

(Source: http://www.energy-wise.eu/node/254)

Energy Audit is a best practice followed by the service industry energy performance leaders without fail – this is also done on a continuous, regular basis. The grasp of the current energy use and management of energy intensity is a very important action, which can help in energy conservation and in turn reduce the expenses of the organization and its guilt of environmental impact.

Energy Audit at Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilyam Campus.

On the basis of the understanding from the study, an energy audit was performed at Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilyam Campus. The audit performed at the Campus was an eye-opener for it showed the numerous avenues available for energy conservation. Due to scarcity of time and resources the audit had a limited boundary, but still it yielded opportunities, which if tapped can save energy in thousands of KWh and couple of Lacs(Rs.) in terms of money (about 20% savings without capital investment), and create awareness to consciously reduce the energy consumption and reduce little bit of burden from the shoulders of Mother Earth.

A report containing the details of the energy audit and key recommendations for energy conservation was prepared and handed over to the concerned authorities for implementation.

Conclusions

One of the major problems the world is facing today is Energy security - which has become one of the biggest concerns over the past decade. The Service sector is one of the major contributors to the increasing energy consumption in the world. Energy conservation and energy efficiency have become the key issues for the service organizations as the energy consumption has increased in leaps and bounds whereas there is threat of sustainability as major sources of power are non-renewable in nature and are fast depleting.

The energy conservation of an organization can be improved by auditing the energy consumption of present practices/equipments, finding the gaps, and then improving the energy performance of buildings, appliances, and equipments through technical investments, emulating best practices and efficient management. Energy efficiency and energy conservation are fundamental elements in the progression towards a future low-carbon economy. By focusing on energy efficiency and energy conservation as strategy, organizations can enhance their image of global citizenship, reduce operational cost, address the uncertainty risk and get a competitive advantage as a whole.

Energy Conservation can be instrumental in influencing the ‘Triple Bottom-line’, i.e. planet, people and profit. Energy Conservation is no more a concept to talk about; practicing it is the need of the hour!

References & Bibliography

1. (n.d.). Retrieved November 2010, from http://eippcb.jrc.es.

2. Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology* .

3. Alison Bailie, R. P. (2006). *Successful Strategies for Energy Efficiency(Recommendation for Canada).* Alberta: Pembina Institute.

4. Anderson, M., & Jessen, B. (2005). Creating Lasting Energy Efficiency Behavior Change through Education and Training. *ACEEE Summer Study on Energy Efficiency in Industry*, (pp. 3-8).

5. Bala, V. (2011, May 12). 'Otis' Gen2 elevator systems reduce energy consumption by up to 75%. *Business Line* , p. 11.

6. Can energy savings from operations promoting energy efficient behaviours in office buildings be accounted for? (2008). *Improving Energy Efficiency in Commercial Buildings Conference.* Frankfurt.

7. Chung, W., Hui, Y., & Lam, Y. M. (2006). Benchmarking the energy efficiency of commercial buildings. *Applied Energy* .

8. *Coles.com*. (n.d.). Retrieved May 2011, from http://www.coles.com.au/;http://www.ret.gov.au/energy/efficiency/best_prac/Pages/default.aspx: http://www.coles.com.au/;http://www.ret.gov.au/energy/efficiency/best_prac/Pages/default.aspx

9. DataMonitor. (2011, January 25). *1. http://www.energycentral.com/enduse/energyefficiency/news/en/18545272/Green-Mountain-Power-announces-energy-savings-at-Colchester-facility.* Retrieved May 2011, from 1. http://www.energycentral.com/enduse/energyefficiency/news/en/18545272/Green-Mountain-Power-announces-energy-savings-at-Colchester-facility: 1. http://www.energycentral.com/enduse/energyefficiency/news/en/18545272/Green-Mountain-Power-announces-energy-savings-at-Colchester-facility

10. Eijadi, D. A., McDougall, T., Leaf, K., Douglas, J., Steinbock, J., & Reimer, a. P. (2005). Energy savings: persuasion and persistence. *ECEEE 2005 Summer Study*, (pp. 571-582).

11. (2008). *Energy Efficiency In Hospitals.* New Delhi: Alliance for Energy Efficient Economy (http://www.eco3.org/downloads/Project%20Level%20Doc.%20&%20Presentation/International%20Energy%20Efficiency%20Building%20Conference%20%28Public%29.pdf).

12. Energy Efficiency Office. (2007). *Guidelines on Energy Audit.* Hong Kong: Electrical and Mechanical Services Department .

13. *Energy Efficiency Solutions Book.* (2008, April). Retrieved November 2010, from www.sneider-electric.com.

14. (2009). *Environment and Energy (Discussion Paper).* Paris: International Chamber of Commerce comission.

15. Farell, D., & Remes, J. K. (2008, July). How the world should invest in energy efficiency. *The McKinsey Quarterly* .

16. Gruber, E., & Brand, M. (1991, April). Promoting Energy Conservation in Small and medium sized companies. *Energy Policy* , pp. 279-287.

17. Hannon, B. (1975). Energy Conservation and the Consumer. *Science* .

18. Henryson, J., Hakansson, T., & Pyrko, J. (August,1999). Energy efficiency in buildings through information - Swedish perspective. *Energy Policy* .

19. (2010). *http://wipro.com/Wipro_Sustainability_Report/index.html.* Bangalore: Wipro Limited.

20. *http://www.eere.energy.gov/topics/buildings.html*. (n.d.). Retrieved June 2011, from http://www.eere.energy.gov: http://www.eere.energy.gov/topics/buildings.html

21. (2009). *http://www.infosys.com/sustainability/Documents/infosys-sustainability-report-2009-10.pdf.* Bangalore: Infosys.

22. *http://www.orchidhotel.com/mumbai_hotels/enviroconstruction.htm.* (n.d.). Retrieved May 2011, from Orchid Hotel: http://www.orchidhotel.com/mumbai_hotels/enviroconstruction.htm

23. *http://www.siemens.com/.* (2010). Retrieved May 2011, from Siemens: http://www.siemens.com/entry/cc/en/

24. *http://www1.eere.energy.gov/informationcenter/*. (n.d.). Retrieved 2011, from http://www1.eere.energy.gov/informationcenter/: http://www1.eere.energy.gov/informationcenter/

25. IBM Corporation . (2009). *ROI:Extending the benefits of energy efficiency.* ibm.com/expressadvantage/forwardview.

26. *ITC GREEN CENTRE.* (n.d.). Retrieved May 2011, from http://www.itchotels.in/custom/ITC_GREEN.pdf: http://www.itchotels.in/custom/ITC_GREEN.pdf

27. Jean-Sébastien, B., Bertrand, C., Sandrine, H., Bernard, B., Marie-Isabelle, F., & Jérôme, A. (2006). Raising awareness for energy efficiency in the service sector:learning from success stories to disseminate good practices. *Improving Energy Efficiency in Commercial Buildings.* frankfurt.

28. Joel N Swisher, G. J. (1997). *Integrated Resource Plannning:Improving energy efficiency and protecting the environment.* UNEP Collaborating Centre on Energy and Environment.

29. Kim, K. H. (1997). Global Warming: What is your business strategy?

30. Klotz, L., Mack, D., Klapthor, B., Tunstall, C., & Harrison, J. (July,2010). Building rating systems and energy performance goals for U.S. buildings. *Energy Policy* .

31. Kundu, M. (2009). *Energy Conservation Case Study for Mini Office.* Mumbai: copperindia.org.

32. Kunkle, R., Beamish, T. D., Lutzenhiser, L., Biggart, N. W., & Burr, T. (2001). *MARKET STRUCTURE AND ENERGY EFFICIENCY: The Case of New Commercial Buildings.* California Institute for Energy Efficiency.

33. Lebot, B., Bertoldi, P., Moezzi, M., & Eide, A. (2005). The myths of technology and efficiency: A few thoughts for a sustainable energy future. *ECEEE 2005 Summer Study*, (pp. 195-203).

34. *Lemontree hotels*. (n.d.). Retrieved May 2011, from http://www.lemontreehotels.com: http://www.lemontreehotels.com/about-us/lemontree-hotel-eco-friendly-practices.aspx

35. Lincoln, G. (1973, April). Energy Conservation. *Science* , pp. 155-162.

36. Majumdar, M. (2002). *Energy-Efficient Buildings in India.* Tata Energy Research Institute.

37. Margrethe, A., & Robert, B. (2005). Buildings that learn – the role of building operators. *ECEEE 2005 Summer Study*, (pp. 415-423).

38. Markus, D., & Dominik, S. (2005). Energy efficiency of office equipment – Proposal for a policy mix for Germany with an in-depth analysis of labelling strategies. *ECEEE 2005 Summer*, (pp. 745-753).

39. Merlin Gerin,Schneider Electric. (2010). *Unlocking Energy Efficiency(White paper).* Schneider Electric.

40. Neuman, K. (1986, January). Personal Values and Commitment to Energy Conservation. *Environment and Behavior* , pp. 53-74.

41. Nordman, B., Meier, A., & Piette, M. A. (1999). PC and Monitor Night Status: Power Management Enabling and Manual Turn-off. *Information and Electronic Technologies* .

42. Ottinger, R. L. (2006). Energy Efficiency: The best immediate option for a secure, clean, healthy future. *Natural Resources Forum* , 318-327.

43. Pachauri, R., Srivastava, L., Mathur, R., Kumar, A., Dadhich, P., Gupta, I., et al. (2008). *Mitigation options for India – the role of the international community.* TERI.

44. Pal, A. (2011, May). http://www.bengalambuja.com. (S. Dutta, Interviewer)

45. Pallak, M. S., & Cummings, W. (1976). Commitment and Voluntary Energy Conservation. *Pers Soc Psychol Bull* .

46. Rafael Friedmann. (2008). *Energy Efficiency Best Practices: What's New?* Oakland: ITRON Inc.

47. Reddy, A. K. (1990). Barriers To Energy Efficiency. *Energy and Global Climate Change,USA.*

48. Smith, W., & Pett, J. (2005). Energy efficiency refurbishment programmes help, but are the end-users doing their bit? *ECEEE 2005 Summer Study*, (pp. 957-968).

49. *Taj Residency*. (n.d.). Retrieved May 2011, from http://www.emt-india.net: http://www.emt-india.net/eca2006/Award2006_CD/37Hotels&Hospital/TajResidencyBangalore.pdf

50. *Walmart Global Sustainability Report 2010.* (2010). Retrieved May 2011, from walmartstores.com: http://walmartstores.com/sustainability/7951.aspx

51. WEBER, L. (1997). *Beyond Energy Conservation: Energy-Relevant Decisions within Office Buildings.* Energy Analysis Research Group(Swiss Federal Institute of Technology Zurich (ETH)).