

GREEN TECHNOLOGY COMPLIANCE IN MALAYSIA FOR SUSTAINABLE BUSINESS DEVELOPMENT

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ABSTRACT

Economic growth, industrialization and growing population in developing countries such as Malaysia, demands a huge growth for renewable energy as global environmental problem call for drastic cuts on fossil fuel consumption. It has resulted in the promotion of green technology that presents the most viable way of meeting with the new green-related activities for environmental conservation. The Malaysian government has played a strong role in ensuring environmental sustainability by way of introducing necessary policies and implementing them. This research intends to explore the opportunities that green technology might bring to entrepreneurs by complying with new business success factors (BSF) particularly in term of the green demand and supply among the Malaysian companies. The research would also enhance some of the existing relevant literatures and discuss several practices useful for business consideration of the green technology adoption.

Field of Research: Environmental, Green Technology, Entrepreneurs, Demand and Supply, Business Success Factors.

1.0 GREEN AND SUSTAINABILITY

"Green Technology" is an initiative evolving various kinds of methodologies and materials enhancement, from techniques for generating energy to non-toxic cleaning products. The main goal to achieve in this rapidly growing field includes sustainability of the economic development. With many scientific studies pertaining to the green technology pointing to global warming and climate changes caused by greenhouse gases, there is an ever increasing societal push for environmental friendly mechanisms to help reduce the impact resulting from fossil fuel consumption, landfill and industrial sector wastages. Current researches by industry groups are pursuing and exploring the alternative for green energy sources and production. Governments and World Energy Council (WEC) are playing the key roles to develop and implement a wide-scale of green technology efforts that meet the needs of society through indefinite ways into the future without damaging or depleting natural resources. In short, meeting present needs without compromising the future generations ability to meet their own needs.

2.0 GREEN TECHNOLOGY OPPORTUNITIES

"The future of technology is most definitely green. With rising energy costs and the threat of global warming, many businesses are now recognizing the benefits of using technology to reduce their carbon footprint and to minimize waste, while having a positive impact on their business".

(Zainura, 2010)

"Global warming is the largest economic opportunity of the 21st century..."

(John, 2009)

"It is always ahead. It has recognized only too clearly that its competitiveness in the world can be secured through deployment of green technology. The country has a wealth of abundant resources to get there, the land mass, the biodiversity, the rainforest, water power, natural gas and biomass and the commitment of its leadership".

(Volker, 2010)

As greening of purchasing (demand) and supply management can be part of a transition to sustainability, rather than just an efficient way of ensuring the more rapid diffusion of conventional environmental management systems of environmentally friendly product and process innovation in supplier firms, then "sustainable" would mean to cover both at the general socio-economic level and at the level at which a particular firm operates (Green 1998). For the purpose of this research, the author(s) has observed and finally identified at least six green technology business success factors (BSF) for entrepreneurs in Malaysia to embark on that include (but not limited to) green energy, green building, green purchasing, green supply chain, green chemistry and green nanotechnology.

2.1 Green Energy

Energy is one of our most critical resources. Without it, life would cease. Currently, most industrialized country depends on oil and natural gas for most of their energy needs. Generally, these two energy resources supply more than sixty two percent of all energy consumed worldwide (WRER, 2008) but unfortunately both are depleting and non-recyclable sources of energy. Energy should be the ability of one system to do work or give support on another system or sub-system continuously. Conventional energy scarcity is the most urgent issue for green technology. This sparks the necessity to develop alternative fuels, new means of generating energy and energy efficiency requirements. There are many sources of renewable energy; such as chemical energy from fossil, electrical energy distribute by utility company, radiant energy from the sun and nuclear energy from a reactor (McGraw, 2007). However, most of recent technological breakthrough in energy is based on earlier scientific discoveries which may pose other serious effects to the world.

The world also depends on energy as the major input and catalyst for their economic development. In the case of developing countries, energy sector assumes a critical importance as the ever-increasing energy needs require enormous investments to provide them. As a result, globally, the per capita consumption of energy has been used as one of the indicator to measure the economic development level of a country. In other words, energy plays an important role in human life; such as to operate machineries and other equipments accordingly, to power things to change; and it is in fact the ability to produce work. Electricity is derived by burning coal, oil, gas, and even trash. Energy from the sun, the

wind, the falling water and from the earth to make electricity is made when the atoms are held together. For Malaysia, as the electricity demand is growing as the economy surges, the government expects an investment of \$9.7 billion for the electricity utility sector through 2010, cited from Malaysia Energy (2006).

“Energy is essential for development; yet two billion people currently go without, condemning them to remain in the poverty trap. We need to make clean energy supplies accessible and affordable. We need to increase the use of renewable energy sources and improve energy efficiency. And we must not flinch from addressing the issue of over consumption - the fact that people in the developed countries use far more energy per capita than those in the developing world”.

(Kofi, 2002)

2.2 Future of Green Building

Green building is the practice of creating structures and using processes that are environmental and resource efficient throughout a building's life-cycle. It covers from sitting to design, construction, operation, maintenance, renovation, demolition; and everything from the choice of building materials to where a building is located. The operation of buildings has a tremendous impact on the world's natural resources and the environment. In the United States, buildings consume more than one-third of all the energy and two-thirds of all electricity used by the 76 million residential and commercial buildings, as reported by the U.S. Green Building Council (2010). It contributes to major air pollution of the urban air quality and ended up with the climate change, as mentioned in Building Materials (2006). Traditional buildings usually consume more energy resources than what necessary, and give negative impact to the environment by generating a large amount of waste.

Smart green building practices offer an opportunity to create environmental friendly and resource efficient buildings through using of integrated approach in its design and operation, says Boyle (2005). This practice improves the classical building design concerns in term of its economy, utility, durability, and comfortability. Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is to ensure green buildings designs reduce the overall impact on human health and the natural environment. Efficient use of energy, water, and other resources; protect occupants health, improve employees productivity, and reduce waste, pollution and degradation of the environment, (Wikipedia, 2010).

2.3 Green Purchasing

Environmentally Preferred Purchasing (EPP), often referred to as “green purchasing,” is the affirmative selection and acquisition of products and services that are most effective to minimize negative environmental impacts over their life cycle of manufacturing, transporting, using and recycling or disposing. Examples of environmentally preferable characteristics for products and services that conserve energy and water include minimize generation of waste and release of pollutants; products made from recycled materials and that can be reused or recycled; energy from renewable resources such as fuels, biogases, solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials and bio-hazardous agents. This evolves the search for products whose contents and methods of production have the smallest possible impact on the environment, and have been given mandates that these be the preferred products for government purchasing.

Earlier research on the forces driving environmental management, identifying the major factors such as compliance with regulation and legislation and cost savings encouraged further research on the nature of firms' response to environmental pressures that has led to a much more meaningful and central role for purchasing and supply chain management than the function has experienced before (Green, 1995). As a result, these critical roles have provided a significant influence on the firms' environmental performance. The extent of involvement by purchasing managers in Germany, the UK and the USA have on environmental issues (hazardous materials, investment recovery, product design, and supply chain relationships) versus the level they believe they should be, suggests that purchasing managers are ready for greater levels of participation in these environmental issues (George, 1998).

2.4 Green Supply Chain

Another type of modern managerial mode is the environmentally conscious supply chain that comprehensively considers environmental influence and resource efficiency in the entire business network. The new enterprise's strategic management mode places more importance on government, enterprises and even for academics purposes. With the increase of environmental pressure and resource restriction, many developed regions or countries such as Europe, America and Japan have issued some environmental protection policies and thus creating an urgency to establish green environmental enterprises and manufacturing companies. Manufacturing enterprises must carry out strategic reform and make good use of the opportunity brought by green supply chain since this is the only way to make a living and develop in the new competitive environment.

Some analysis on green supply chain management practice under the theory of innovative diffusion have proven that there were some differences among different type of companies in the aspect of the environmental running and the economic performance of green supply chain management (Zhu et al., 2007). On the other hand, it was successfully recognized and analyzed the dynamic and pressure factors that influenced China's entrepreneurs in implementing green supply chain management (Qu et al., 2007). It looked at the readiness evaluation index system of companies' green supply chain under the resource based view by conducting some empirical study on its promotion and cultivation strategy. In fact, the green supply chain management concept is a sincere demonstration of commitment to sustainability by many South East Asian organizations. Rao (2005) has also successfully conducted an empirical analysis and identified the greening link in different phases of the supply chain that leads to an integrated green supply chain, which ultimately leads to competitiveness and economic performance.

2.5 Green Chemistry

The chemical industry plays a key role in sustaining the world economy and underpinning future technologies, yet is under unprecedented pressure from the effects of globalization and change in many of its traditional markets (Martyn et al., 2002). Green chemistry is a major component of the science underlying the "responsible care" program of the chemical industry (Watkins, 2002) and of sustainable development (Eissen et al., 2002). The U.S. Environmental Protection Agency (2010) refers green chemistry to the design, invention and application of chemical products and processes to reduce or eliminate the use and generation of hazardous substances. While this short definition appears straightforward, it marks a significant departure from the manner in which environmental issues have been considered or ignored in the upfront design of the chemicals molecules and molecular transformations that are at the heart of the enterprise.

Another aspect of the definition of green chemistry is found in the phrase “use and generation”. Rather than focusing only on those undesirable substances that might be inadvertently produced in a chemical process, green chemistry also includes all substances that are part of the process. So, green chemistry is a tool to minimize those negative impacts and aimed at optimizing the process efficiency, that legitimate and complement the objectives of the subject. It also recognizes the significant consequences of the hazardous substances use, ranging from regulatory, handling and transporting, and liability issues.

2.6 Green Nanotechnology

Green nanotechnology refers to the use of nanotechnology to enhance the environmental sustainability from negative externalities. Nanotechnology involves the manipulation of materials at the scale of nanometer, one billionth of a meter (10^{-9}), (McGraw, 1997). Green nano science-technology can provide three additional benefits (Hutchison, 2008). It can spur innovation through the exploration of new materials and properties, enable commercialization by reducing uncertainty about material safety and providing more efficient manufacturing approaches, and protect entrepreneurs’ investment in nanotechnology from the threats of public (consumer) fears about the uncertain risks of the technology. Some scientists believe that mastery of this subject is forthcoming that will transform the way that everything in the world is manufactured. Green nanotechnology is the application of green chemistry and green engineering principles at the tiniest level. Environmental degradation is a serious problem causing by greenhouses effects but however the nano implementation greatly reduce water, and land usage; plus, topsoil runoff and loss. In mining, when most structures and functions can be built by molecular manufacturing, there will be far less use for minerals resulting in the manufacturing technologies pollution to be scaled back.

Green technology that benefits the environment could use nanotechnology to boost performance. Nanotechnology could make every atom count to create ultra-efficient catalyst, detoxify wastes, assemble useful molecular machines and efficiently convert sunlight into energy. It could potentially contribute to long-term sustainability for future generations, as more green products and green manufacturing processes the old harmful and wasteful ones (Schmidt, 2007). With greater ability to manipulate matters and tailor properties, it should be possible to make materials and products with reduce toxicity, increased durability and improved energy efficiency. Lux Research (2006) estimates that by 2014, nanotechnology will be incorporated in manufactured goods worth \$2.6 trillion and will provide 10 million jobs.

3.0 ENERGY DEMAND

Climate change is forcing the world’s economies to embark on a new industrial revolution. The majority of greenhouse gases emissions come from the use of fossil fuels to power a growing world economy. For this reason many countries around the world have promulgated policies, regulations and framework to increase the usage of green energy in a move toward carbon free and greener economy. Green energies include renewable resources, energy conservation/energy efficiency and any form of energy that are more sustainable from the environmental perspective by means of reducing pollution and overall energy consumption.

Today, the energy sources used to create electricity differ in many ways, including in their environmental impacts. In developed countries such as the United States, electricity is most often generated using fossil or nuclear fuels as the power generating forms detrimental effects on human health and the environment through air emissions and other problems. Despite advances in pollution

controls over the last 30 years, this conventional power generation is still the nation's single largest source of industrial air pollution and is a major contributor to greenhouse gas emissions.

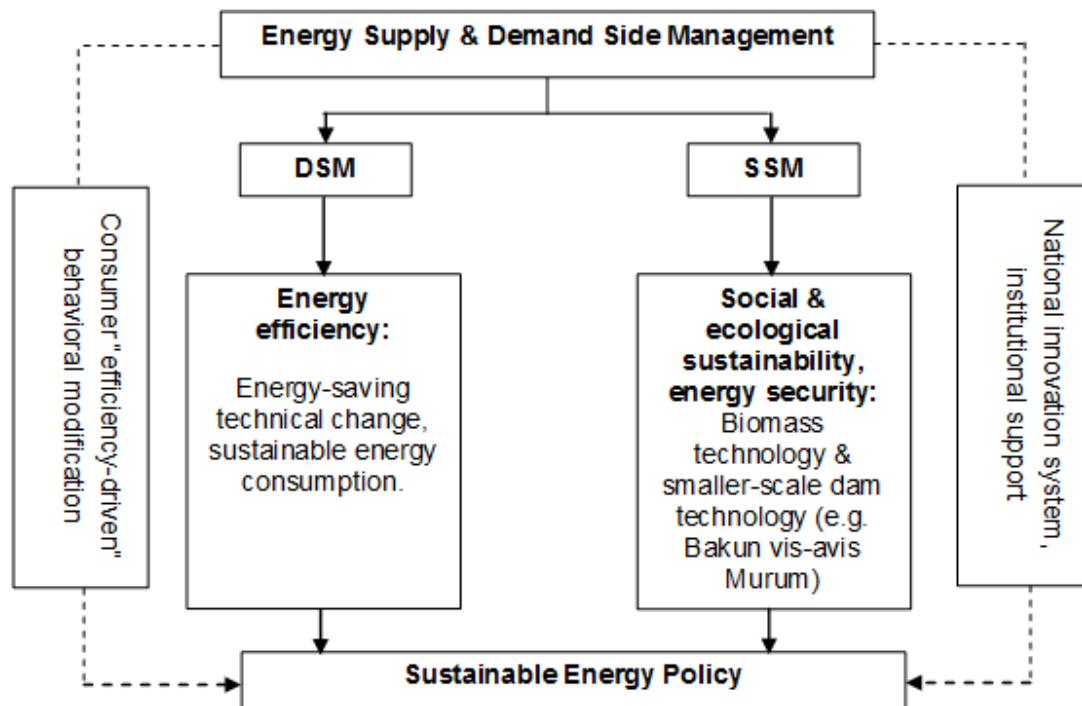
Realizing its importance as a vital component in economic and social development, the government of Malaysia has continuously reviewed its energy policy to ensure long term reliability and security of energy supply (Mohamed, 2006). As oil is still in used for power generation, the contribution of renewable energy (RE) to generate electricity is still insignificant and far below the target set under the 9th Malaysia Plan (2000-2010). In future, oil will no longer be a viable option for electricity generation due to the diminishing national resources and Malaysia become a net oil importer by the year 2030 (Oh et al., 2010). Other means to orchestrate a sustainable energy system in Malaysia include the implementable of demand and supply initiatives; the development of energy saving technology that influences the behavior change towards a sustainable energy consumption pattern (Keong, 2003).

3.1 Energy Issues

As Green Technology must be developed fast from indigenous resources and conserve its use via measure on energy efficiency, further researches might be needed to look at how these companies readiness are, towards accepting their share of the green agenda. Multiple challenges need to be tackled to achieve green product development for business sustainable. Any deterrent factor that are causing dilemma in its adoption can also be studied to compliment the National Green Technology Policy (as further input). With these efforts, it would be clear that energy demand is not only closely related to the growth of gross domestic products (GDP), but also the shift of industrial structure as well as the necessary improvement through addressing the appropriate energy intensity issues (Keong, 2003).

3.2 Sustainable Green Model

The sustainable green model on next page as suggested by Keong (2003) and readdressed by this research is related to the energy policy that clearly defines the components of green technology management (demand and supply) for business success (compliance to the energy policy). In the course of promoting a truly sustainable energy policy, the model requires them to place greater emphasis on the implementation of demand and supply management measures. Demand management measures fundamentally involved the deployment of energy-saving equipment or technical change. From the supply management side, however, it involves harnessing renewable energy sources, which are environmentally, ecologically and socially sustainable (Keong, 2003). The model summarizes all the necessary components through the needs for behavioral modification and support systems that should entice the entrepreneurs compliance for sustainable business development; in relation to energy efficiency (energy saving, change and consumption) associated with social & ecological sustainability, plus energy security development being the resources for change.



(Source: Keong, 2003)

This research study has therefore been limited to the authors(s)'s perceptions on the business opportunities created by green technology for companies in Malaysia. In this view, the author(s) has attempted to investigate and generalize the relation of the business success factors and their state of compliance (adoption and implementation) among the entrepreneurs. For the final outcome, two research propositions were inferred and briefly discussed below.

Proposition (1):

Malaysian companies' readiness for green technology implementation is dependent on the energy demand factors (leading to the green supplies or business success factors including green energy, green building, green purchasing, green supply chain, green chemistry and green nanotechnology).

The World Energy Outlook (WEO, 2009) suggested that it is not an exaggeration to claim that the future of human prosperity depends on how successful our global tackles the two central energy challenges facing us today: (i) securing the supply of reliable and affordable energy; and, (ii) effecting a rapid transformation to a low carbon, efficient and environmentally caring system of energy supply. According to the International Energy Outlook (2010) projection, total world consumption of marketed energy increases by 49 percent from 2007 to 2035. The largest projected increases in energy demand are for non-OECD (Organization for Economic Cooperative Development) economies. Energy provides several indispensable business success factors to continuous development and economic growth (WEO, 2009). Hence, energy is an important input to all sectors of the economy, fueling transport to move goods and people and providing electricity to industry, commerce, agriculture, and important social services such as education and health (World Bank, 2009). As faster devices always consume more power than the

slower ones, the increase in performance has caused a substantial increase in power consumption. Current estimates in the United States reveals that around 2% or 74 TWh/year of the total electricity consumed is used to power the Internet (Kawamoto et al., 2001). The venture into these business success factors is also becoming vital for Malaysian entrepreneurs' sustainable development or else they would be left behind with non-competitive products and services.

Proposition (2):

The viability of green technology is built-in around Malaysian business (complimentary from national innovation system, institutional support and consumer "efficiency-driven" behavioral modification).

On 9th April 2009, the Prime Minister, Y.A.B Datuk Sri Najib Tun Razak has pushed forward Green Technology to the mainstream portfolio. According to the Minister of Energy, Green Technology and Water (2009), Malaysia should be moving along the continuum of fossil fuel towards renewable energy (RE) through indigenous technology and energy efficiency (EE) that calls for paradigm shift among entrepreneurs to embrace green technology in their businesses. Commercial and industrial business entities in Malaysia which may opt to implement green products and services are the result from renewable energy resources such as biomass, biogas, hydropower and solar power for the future. But despite all the system and support in place they are still slow in their response although many incentives are being introduced by the government. If not properly planned, the rising of the conventional energy prices worldwide due to its uncertain future will make it even critical for local industries to sustain their business competitiveness globally. Paradigm change has emerged as very important and most critical motivating factors in the entrepreneurs' moving forward strategies for adopting the green technology opportunities.

4.0 CONCLUSION

The Ministry of Energy, Green Technology and Water of Malaysia has been taking a holistic approach to advocate green technology in the country. Since the launching of National Green Technology Policy by the Prime Minister on 24th July 2009, our government has constantly introduced various programs and incentives. The establishment of the Green Technology Financing Scheme (GTFS) amounting to RM1.5 Billion in the 2010 Budget was hoped to provide soft loans to companies to supply and utilize this technology. The active promotion of green technology and its spreading awareness has promised that the green agendas will reach all Malaysians with the expectation that everyone would adopt a green culture and leave a 'green' Malaysia for the generations to come. It was surprising that within a short span of time there have been many eco-preneurs born to nurture the green economy, and it was also viable as can be seen in many products being demonstrated during the IGEM2010. The research finding is hoped to further enhance the body of knowledge in sustainable development of the energy sector in the country which is not very profound. And the author(s) also suggests that more empirical research on the green issues should be carried out to exactly determine whether Malaysians are ready to adopt these strategic changes from the conventional economy to the green economy despite knowing the business potential prospered from the demand and supply of the green technology and for our nation sustainable development.

ACKNOWLEDGEMENT

The author(s) would like to thank the Centre for Research and Innovation Management (CRIM) of the Universiti Teknikal Malaysia Melaka (UTeM) for all the support given in ensuring the research work is successful done. The research has been carried out under UTeM's Research Vote: PJP/2010/FPTT(2F) S722.

REFERENCES

- Oh, T.H., Pang, S.Y., & Shing, C.C. (2010). Energy Policy And Alternative Energy In Malaysia: Issues And Challenges For Sustainable Growth. *Renewable and Sustainable Energy Reviews*. 14, 1241-1252.
- Zainura, Z.N. (2010). Embracing New Economy with Community-Based Innovation. In 2nd International University Social Responsibility: Conference & Exhibition.
- Volker, U.F. (2010, November 3). Malaysia Taking Right Step in Green Technology. Retrieved from <http://www.Bernama.com>
- U.S. Environmental Protection Agency. (2010, November 28). Retrieved from <http://www.epa.gov/greenchemistry/>
- International Energy Outlook (2010, November 28). World Energy Demand & Economic Outlook. U.S. Energy Information Administration: Independent Statistic Analysis. Retrieved from <http://www.eia.doe.gov/oiaf/ieo/world.html>
- John, D. (2009). Greentech: The Largest Economic Opportunity of the 21st Century. Speaking at Venue Beat's in San Mateo California, ERIC WESOPF.
- World Energy Outlook (2009, December 1). Sustainable Development Network. Energy Strategy Approach Paper, International Energy Agency (OECD/IEA).
- Retrieved from http://www.worldenergyoutlook.org/docs/weo2009/WEO2009_es_english.pdf/
- World Bank Group Report (2009). Energy Strategy Approach Paper: Sustainable Development Network.
- Hutchison, J.E. (2008). Greener Nanoscience: A Proactive Approach to Advancing Applications and Reducing Implications of Nanotechnology. *American Chemical Society Nano*, 2(3), 395-402.
- Schmidt, K. (2007), Green Nanotechnology: It's Easier Than You Think. Technical Report: Project on Emerging Nanotechnologies. National Science Foundation.
- Qu, Y., Zhu, Q., & Wu, C. (2007). An Empirical Study on Drivers/Pressures Affecting GSCM Implementation. *Forecasting*. 26(5), 1-6.
- Arizona State University (2006). Building Materials. Retrieved from <http://asusmart.com/buildingmat.php>

- Zhu, Q., & Geng, Y. (2006). Statistics Analysis on Types of Chinese Manufacturers Based on Practice of Green Supply Chain Management and Their Performance. *Application of Statistics & Management*. 25(4), 392-399.
- Mohamed, A.R., & Lee, K.T. (2006). Energy for Sustainable Development in Malaysia: Energy Policy and Alternative Energy. *Energy Policy*. 34, 2388-2397.
- Lux Research Inc. (2006). Investment Overview and Market Research for Nanotechnology. *The Nanotech Report*. 4(1).
- Pusat Tenaga Malaysia (2006). Energy Information Bureau. Malaysia Energy. Retrieved from <http://eib.org.my/>
- Boyle, C.A. (2005). Sustainable Buildings. *Proceeding of the Institution of Civil Engineers Engineering Sustainability*. 158, 41-48.
- Rao, P., & Diane, H. (2005). Do Green Supply Chains Lead To Competitiveness And Economic Performance? *International Journal of Operations & Production Management*, 25(9), 898-916.
- Keong, C.Y. (2003). Energy Demand, Economic Growth, and Energy Efficiency - The Bakun Dam-Induced Sustainable Energy Policy Revisited. *Energy Policy*. 33, 679-689.
- Koffi, A. (2002). Both Rich and Poor Have Clear Interest in Protecting Environment, Promoting Sustainable Development. Secretary General Says. Press Release: SG/SM/8329/ENV/DEV/637. Retrieved from <http://www.un.org>
- U.S. Green Building Council (2002, April). Building Momentum: National Trends and Prospects for High-Performance Green Buildings. Green Building Roundtable and Prepared for the U.S. Senate Committee on Environment and Public Works.
- Watkins, K. J. (2002). Responsible Care. *Chem. Eng. News*. 80(16), 15. Retrieved from www.cia.org.uk/industry/care.htm
- Eissen, M., Metzger, J. O., Schmidt, E., & Schneidewind, U. (2002). *Angew. Chem. Int.*, 41: 414.
- Martyn, P., Michael, F.J., Trevor, R.F., Paul, T.A. (2002). Green Chemistry: Science and Politics of Change. 297. Retrieved from <http://www.sciencemag.org/cgi/content/full/297/5582/807>
- Kawamoto, K., Koomey, J., Nordman, B., Brown, R., Piette, M., Ting, M. & Meier, A. (2001). Electricity Used by Office Equipment and Network Equipment in the US: Detailed Report And Appendices. Technical Report: LBNL-45917. Energy Analysis Department, Lawrence Berkeley National Laboratory.
- Green, K., Morton, B., & New, S. (1998). Green Purchasing And Supply Policies: Do They Improve Companies' Environmental Performance? *Supply Chain Management*. 3(2), 89-95. MCB University Press.
- George, A.Z., & Thomas, E.H. (1998), Purchasing's Involvement in Environmental Issues: A Multi-Country Perspective. *Industrial Management & Data Systems*. 98(7), 313-320.

McGraw Hill (1997). Encyclopedia of Science and Technology (8th ed.).

Green, K., Morton, B., & New, S. (1995, November). Environmental Impact of Purchasing in Organisations. Paper presented to the 4th Greening of Industry Conference, Toronto.

Spector, P. (1992), Summated rating Scale Construction: An Introduction. Sage University Paper series on Quantitative Application in the Social Sciences (pp. 07-082). Newbury Park, CA: Sage.