



# Green office, its features and importance for sustainable environmental management: A comparative review in search for similarities and differences

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## Abstract

In the recent decades, there is a growing importance of green office, a practical environmental management system for the offices, as it is an environmental service for offices with the main goal of bringing an environment, which is good for the health, for conservation of energy, diminishing emission of carbon dioxide in the atmosphere and the ecological footprint of the offices.

This article aimed to describe the purpose and principles of green office, features of green office as green building, steps to set up a green office and analysis of the green offices in some countries as Singapore, Hong Kong, Finland, UK, USA and Thailand so as to find out the similarities and differences in its practice, features and aims and objectives of the green offices. The article was carried out through review of available literatures in books, journals and internet sources.

The article concluded that green office in the work places can be promoted through behavioral changes and efficient office management practices, by reducing the consumption of natural resources, promoting sustainable lifestyles through enhanced employee environmental awareness.

**Keywords:** Green office, workplace, human factors, environmental management

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## 1. Introduction

The concept of green office was first defined, developed and managed by an organization in Finland. According to this organization, green office is a practical step or measures to solve the impact of daily office activities to the environment. Therefore, it is an environmental management program for the offices, which can be applicable to all kinds of organizations, large or small, public or private, having the ultimate aim of reducing the carbon dioxide emission, greenhouse gas emission and its footprint ecologically [1]. The U.S. Environmental Agency defined green office as a structure that is environmentally responsible with limited use of available resources. As a result, it can be said that green offices are built to have efficient energy system, thereby incorporating recycled content. Its ultimate goal is creation of an environment which is healthy to live in for mankind and all living beings along with conservation of energy and reduction in pollution. With green office, offices' impact on the environment will be reduced, achieved savings economically and at the same time will lessen the burden on

the environment, which will help to retard the effect of climate change in the environment.

## 2. Abbreviations

IEQ - Indoor Environment Quality  
IAQ - Indoor Air Quality  
IPCC - Intergovernmental Panel on Climate Change  
EPA - Environmental Protection Agency  
SEC - Singapore Environment council  
CDL - City Developments Limited  
WEEE - Waste Electrical and Electronic Equipment  
CFLs - Compact Fluorescent Light bulbs  
DEQP - Department of Environmental Quality Promotion  
FSC - Forest Stewardship Council  
PEFC - Programme for the Endorsement of Forest Certification

## 3. Methods and Objectives

The article was carried out through review of available literatures in books, journals and internet sources with objectives as:

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- to describe the purpose and principles of green office, features of green office as green building, steps to set up a green office
- to highlight climate change and the growing importance of green office
- to analyze through review of the green offices in some countries as Singapore, Hong Kong, Finland, UK, USA and Thailand
- to find out the similarities and differences in Green offices of the above mentioned countries.

### 3.1. Purpose of Green Office

There are many ways for the consumption of energy and among them, offices and its daily operations consume a lot of energy and therefore a sustainable solution lies in the organization of offices' management. This led to the creation of green office, which aims to motivate staff in an office to work in an environmentally friendly way with regard to daily office activities and to perform office tasks economically by means of environmental education. Green office management aims to bring awareness to the office staffs about the benefits of following green office standard. This will help to bring benefit to both the parties, that is, office and the environment [1]. The following are the purposes of green office standard as:

- Reduction in the consumption of natural resources by making the office to be environmentally efficient
- Promotion of the sustainable environmental practices in office by training and educating the employees so as to improve environmental awareness
- Bringing awareness on the effect of climate change and counter measures steps necessary to mitigate it with activities or practices such as energy saving measures and use of renewable energy sources [2, 3]

### 3.2. Green Office's principles and features

The following are the main basic principles of the Green Office initiatives as:

- To bring all round improvement in the working atmosphere and environment of the concerned organization
- To reduce the negative impact caused by office on the environment such as using office resources efficiently
- To motivate and inspire employees to practice environmentally good habits [4]

The following gives the main features of green office as:

#### *- Green office and reduction in energy consumption*

Following the green office's activities such as switching off unnecessary light will lead to less consumption of energy.

#### *- Green office and reduction in transportation*

Most business also requires some traveling, but sustainable organizations having green office aims to avoid unnecessary travel by bringing an alternative solution such as through technological innovation in communication: telephone, email, Skype, video conferencing and other forms of internet communications.

This will save time, travel expenses as well as the reduction of carbon emission thereby helping to improve environmental situation.

#### *- Green office and reduction in paper consumption*

As paper is made from wood, the mass scale production of paper needs the destruction of the forest, thereby resulting to massive ecological impacts such as endangered species, water resources, climate and people. Reduction in its use saves its impact on the ecology.

#### *- Green office and reduction in water consumption*

Water footprint of human consumption has been exceeding at an increasing rate beyond the sustainable levels globally. As a result, steps should be taken care of to save water through the practice of green office at workplace.

#### *- Green office and reducing waste generation*

Another feature of green office is to reduce the generation of waste products in the office in order to save natural resources and minimized the effect of environmental pollution. Attempts were made by activities and management of green office to bring down the quantity of waste generation and because of it, the amount of waste generation per employee in the Green Offices decreased substantially by 17.5% in 2010 according to information received from 39 offices [4].

### 3.3. Climate change and the growing importance of Green Office

Climate changes have large impacts on the Earth's environmental system such as the rising temperature, chaotic and unpredictable weather condition, disintegration of wild animals, rising sea levels, occurrence of flood, drought, famine, deforestation, which are factors responsible to bring threat to the life of human beings, animals and other living beings [4]. The most recent report of the Intergovernmental Panel on Climate Change (IPCC) concludes that human beings are responsible for climate change. Therefore, climate changes can be mitigated through changing in ways of human behavior in the daily life style and at work. Hence lies the importance of having green office in the work places through sustainable behavioral changes and practices in the daily office work sphere. To achieve it, the first step is to launch green building [5].

#### **Green Building**

Nowadays, every country is demanding to push green building policy for a sustainable development due the present changes in the environment. Therefore, the main motive of green building is to bring multiple benefits as environmental, economic and social [6]. This made many designers, innovators, engineers and experts to bring solution through their design, idea, technology and innovation aiming to make building construction which is energy efficient [7, 8 and 9]. Studies have found a preference bias for "environmentally friendly" or "green" artifacts and buildings.

For example, indoor environments are more favorably viewed when the building is labeled/certified “green”, in comparison with one that is not labeled/certified, even though the two environments are actually identical [10]. In order to maintain green building, some steps should be taken care of as: Lighting, Cleaning, Decoration, Maintenance, Acoustic, Office Lay out, Thermal Comfort and Indoor Air Quality [11].

### 3.4. Steps for being Green Office

To be a green office, it is important for an organization to follow these steps which will help to enhance their performance for becoming a certified green office as:

- assemble a Green Office team
- complete the assessment form
- formulate an environmental program
- take decision and action on how to save energy
- consider the environmental aspects of procurement
- communicate
- instruct and train
- fill in the consumer habit questionnaire (voluntary)
- arrange for office inspection
- use a logo of green office
- formulate the aims and goals of the office in consultation with wwf [12].

## 4. Analysis of Green Office in various countries

### Green Office in Singapore

Organizations in Singapore having green office are Singapore Environment council (SEC) and City Developments Limited (CDL). Distribution of eco office kits, containing materials to bring awareness and nurtured habits, which were environmentally friendly was the first eco office project in Singapore. Among the key programs of this project, rating system is worth to mention as it helps offices to administer a self – audit based on variables as corporate environmental policy, commitment, purchasing practice, measures for waste minimization and recycling level. The green office in Singapore is established with the following objectives:

- incorporate environmental practices into the daily life of office employees in order to bring environmental awareness in offices;
- educate and inspire all staffs to help to preserve the environment;
- availability of environmental policy which are easy, convenient and cost effective to implement to office staff,
- share knowledge and experience so as to promote the principles and practices of environmental responsibility in the office;
- continuous overall improvement for development of a greener office;
- identify areas that needs environmental initiatives or environmental project [13]. The following are the eco office tips in Singapore [14].

### Indoor Air Quality:

Printers and copiers should be kept in a ventilated room far away from the staff working area. Substances which emit volatile chemicals in the office as glues, sealants and paints should not be used. To freshen, purify and remove toxins from the air in the office room, indoor plants should be grown. This will add aesthetic attraction of the office room as well as purify the indoor air. Along with this, indoor air quality should be monitored on a routine basis with the option to check for untreated, natural carpeting and flooring.

### Tips for Waste Management & Recycling in green office of Singapore

- All recycling facilities should be placed in area which can be easily seen to all.
- The staff should be encouraged to reuse and recycle waste.
- The staff should be educated as how to distinguish and separate waste through display as graphs, posters and pictures on the office wall or notice board. They can also be notified or informed through e-mails.
- The contractor who is in charge of recycling should check and specify on what categories/kinds of plastic can be used for re-cycling.

### Water Conservation tips in green office of Singapore

The following gives the guidelines for water conservation:

- Posters and stickers should be pasted in the pantry and toilets as a reminder to the staff on saving water;
- Talks, seminar and field trips should be organized in order to create awareness to the staff about the necessities of conservation of water.

There should be water saving faucets in toilets and pantries;

- If there is any water leakage, it should be immediately informed to the responsible person of the office.

### Energy Conservation tips in green office of Singapore

The following gives the guidelines to conserve energy in Singapore as:

- All lights and electronic equipment should be switched off when not in use such as going out for lunch break, after office timing, holidays, weekends etc.
- Features which enable to save energy should be selected for all electrical equipment.
- The computer should be switched to sleep mode if it is inactive for more than ten minutes instead of switching to screen saving mode.
- Energy saving monitor screen should be used in the office.
- Cost effective multi-purpose machine designed to the needs of offices should be used for photocopying or printing.
- Outside doors and windows should be checked for

any hole in order to stop cool air from escaping.

- Compare and make optional for lower energy consumption when purchasing,
- Use of natural lighting should be maximized if there is availability and possibility.
- Adjustable switches which can be changed to dim light should be installed in the office.
- Meeting rooms and toilets should have sensors of occupancy.
- Lighting reflectors should be used in the office to increase the intensity of brightness with less energy consumption.
- Regular maintenance and annual servicing of the air conditioning system helps to ensure maximum energy efficiency and performance.

### **Organizational Awareness in the green office of Singapore**

- Commitment Guidelines.

In order to have commitment in the office, a green committee should be set up to make all colleagues involved together in the implementation of environmental decision. Along with the management support for the onward journey of green office, it is important to give staff encouragement, training and awareness through meeting, seminar and other group activities. This will provide an opportunity to increase the bond among the office staff. In addition, an environmental auditing is necessary for determining the deficit area or issue to be focused.

- Forms of Communication guidelines in the green office of Singapore.

Electronic methods of communication such as e-mails, online chat, video chat etc. should be encouraged. If using faxes, paper faxes should be replaced by computer linked faxes.

- Reference Material.

An electronic database, containing record of documents and reference which is easily assessable to staff should be maintained. In order to reduce waste disposal, staffs should be encouraged to use their own cups, plates and re-useable bags.

- Green Transport guidelines in the green office of Singapore.

Office staffs should be encouraged to use public transportation or bicycle when they go out for lunch or other places at work. They should have flexible working hours so as to avoid the peak hour and encourage them to use public transport or cycle to work.

### **Purchasing & Operation system in green office of Singapore**

- Procurement.

Accredited environmental level which indicate that the product has reduced environmental impact compared to other products should be used in the green office. Papers which uses less pulp in production process and which are recyclable should be used in green office. Used office furniture and other equipment which are no longer used should be donated or sell out to sec-

ond hand buyers. Re-useable towels should be used in the store room or pantry. Purchasing office food items such as milk, coffee powder or sugar should be bought in bulk rather than individual packaged item. Lastly, re-useable shopping bags made from clothes should be purchased for office supplies.

- Printing guidelines in the green office of Singapore.

In order to save paper and ink consumption, printing option should be adjusted to grayscale. Another important guideline is to get accustomed with the use on multi -purpose copier, such as the printing area adjustment, printing double sided and reduction in paper margins. To reduce consumption of printing material, paperless culture should be encouraged such as making online reports, sending file electronically through e-mail. Before printing out a draft document, the documents should be re-checked and edited on the screen so as to avoid useless consumption of papers. A tray to collect one sided used paper should be placed near the printer and the office staff should be encouraged to nurture the habit of re- using one sided paper before sending it to the recycle bin. If the printer or fax machine is to be moved, the cartridges should be removed in order to prevent the toner powder or ink from spilling and thereby spoiling the internal mechanism of the printer.

### **Hong Kong**

Related Organization in Hong Kong are the Government of the Hong Kong Special Administrative Region and Environmental Protection Department [15].

### **The Green Office Objectives of Hong Kong**

- Business & Environmental Protection
- Energy Efficiency & Conservation
- Environmental Assessment & Planning
- Global Environment
- Nature Conservation
- Noise reduction
- Sustainable Development
- Waste & Recycling
- Water saving

### **The Eco-Office Tips in Hong Kong**

The following is the eco office tips in Hong Kong.

### **Waste Reduction tips in Hong Kong Green Office**

The following points explain the waste reduction tips as:

### **Paper Saving Tips in Hong Kong office**

The following instructions are the instructions that should be followed in green office in Hong Kong. The paper consumption can be reduced through innovation and use of computer technology such as using electronic mail instead of using printed paper, printing both sides of the paper and printing when required, recollecting one sided used paper by collecting it in a tray and recycling both sided used papers. The setting of the printer and printing task should be adjusted so that it is economical and thus save unnecessary consumption of paper. In addition, the staff should

be trained and encouraged to reuse stationery items as used envelope or folder. Instead of sending paper cards, e-cards should be sent.

#### **Waste Electrical and Electronic Equipment (WEEE) usage**

Waste electrical and electronic equipment should be donated to charity organizations or send them to recyclers for processing.

#### **Promoting a “food wise” culture in the office of Hong Kong**

For promoting a food wise culture, only sufficient quantity should be selected to avoid left over or wastage. If have leftovers, it can be packed and taken at home or give to someone. Use of disposable cutlery and utensils should be avoided.

#### **Clean Recycling**

The following give the step wise instruction for recycling as: While installing recycling bins, it should be categorized to collect items that are recyclables as waste paper, glass bottles, plastics, batteries etc. To inform the staff of clean recycling, there should be display, notice or poster in the office. Hazardous recyclable items as fluorescent lamps should be disposed off with care by wrapping them up properly.

#### **Energy Saving**

Here are some of the energy saving measures in the green office of Hong Kong. The electrical appliances should be turned off when not in use. In order to save energy even in summer time, the average indoor temperature of air conditioner should be set at 24 o to 26o Celsius. Thermometers should be installed in different area of the office to check the current temperature and at the same time, encouraging the staff to use staircase in place of elevator. Light bulbs which save energy should be used in lighting the room. In addition, the computer should be set at energy saving mode along with the regular auditing of energy consumption by the management department of the concerned office.

#### **Indoor Air Quality (IAQ)**

[16] There should be adequate air ventilation in the room. The room air ventilation system should be regularly checked for any blockade or presence of dust particles in the air filter. Used food products should be disposed-off properly to prevent unpleasant odor. If there is any problem in the office building such as leakage of water, it should be reported immediately to the concerned manager to repair it and check the indoor air quality before it causes the growth of micro-organism that affects the environmental hygiene. Lastly, aerosol products which contaminates air quality such as air freshener, pesticide should be avoided.

#### **Green Procurement**

While purchasing stationery items as paper, ball pens, pencils, ink etc. certified green label products which can be recycled should be selected. At the same time, while purchasing of office equipment as photo copier and printer, care should be taken to select those

which are labelled as energy efficient along with the selection of office furniture which are recyclable.

#### **Others**

Beside this, a Green Manager should be appointed responsible for the implementation and promotion of green practices. For cleaning of the room accessories as carpets, only environmentally friendly products should be used. Finally, training program and workshop should be organized from time to time to provide knowledge on green office maintenance.

#### **United Kingdom, UK (England)**

Related Organization in United Kingdom (UK) is the British Assessment Bureau. There are many easy steps created for making the working environment to be congenial and that helps the staffs to promote greener office.

#### **The Eco-Office tips in United Kingdom, UK (England)**

The eco office tips in UK are; firstly, to get everyone in an office to be involved in the office affairs through regular meeting and communication with the office staff members. The objectives of communication is to encourage and make the staff to be aware as how to save the environment in the daily office practices; secondly, it is the creation of an environmentally action plan by designating responsibilities between team members; thirdly eco office tip in UK is the realization of the concept of reuse and recycle in the office affairs, such as using both sides of the paper for printing, buying office stationery items which are labelled as green and recyclable; fourthly, the reduction on the use of stationery and equipment, that is, to encourage staff to share together office equipment and other stationeries, to print double sided paper etc.; fifthly, it is related to the use of office infrastructure such as using water wisely for making tea, coffee, installing water saving toilet flushing devices etc.; sixthly, it is related to reduction on electricity consumption and expenditure, by switching on light only when it is needed, encouraging staffs to turn the monitor to sleeping mode when they were away from the desks, Seventhly, the reduction in expenses of unnecessary travels such as car share, using public transport, cycling, walking etc. for commuting to work. Along with this is the availability of the option of using video conferencing technology instead of travelling by car or train for attending offsite meeting; lastly, selecting eco office suppliers and products for office uses will help to control the carbon footprint and its environmental impact [17].

#### **Finland**

Related Organization in Finland with regard to green office is WWF Finland (World Wide Fund for Nature Finland).

#### **The Green Office Objectives in Finland**

Following are the green office objectives in Finland as reduction in the consumption of natural resources, awareness to mitigate climate change and promotion of a sustainable lifestyle. Lastly, its aim is to help en-

environmental management system by reducing the environmental effects of offices.

#### **The Eco-office topics in Finland**

- Energy
- Transportation
- Procurement
- Food
- Waste and Recycling
- Water
- Biodiversity
- People

#### **Green Office Tools in Finland**

The Green Office Tools in Finland consist of three things as compass, climate calculator and consumer habit questionnaire [3]. The function of compass is to provide information of green office and its network, while the function of climate calculator is to calculate emissions. Lastly, the administration of consumer habit questionnaire will help to evaluate environmental awareness of employees, green offices and overall result summary.

#### **The Green Office Criteria in Finland**

The green office in Finland has the following criteria: firstly, it is the selection of green office coordinator to work with its team, secondly, it is the planning procedure of environmental program; thirdly, it is improvement of energy efficiency in a continuous process so as to solve the problem associated with greenhouse gas emission; fourthly, it is the reduction of waste and classifying waste into recyclable and non-recyclable in accordance to law and local requirements; fifthly, it is the priority of giving green issues at the time of procurement, sixthly, it is education and information of office personnel about green office practices; sixthly, it is the instillation or education to the staff for aspiring them for a continuous innovation and improvement in matters of the environment; seventhly, it relates to updating annual environmental program; lastly, it is choosing appropriate indicators for setting numeric objectives and to monitor as how the objectives can be fulfilled.

#### **United States of America (USA)**

Related Organizations in United States of America are the US Department of Energy and the Green America (National not-for-profit Co-op America). According to a report made in 2001 by the US Department of Energy, certain factors as equipment and appliances used in the office are responsible for increasing energy consumption both at home and in the office [18].

#### **The Green Office Objectives in USA**

- Followings are the green office objectives as to
- Reduce Energy Use
  - Eliminate Wastes

#### **Reduce Energy Use**

The followings are the instructions to be maintained in the green office of USA for energy use as buying office equipment and accessories which are labelled

as “Energy Star” because ‘Energy star’ is a model program managed by the Environmental Protection Agency, (EPA), which indicates that it uses less energy than others, which are standard models. In addition, products that are labelled as “Energy Stars” means it have eco- friendly features, such as innovative printers which enable to print on both sides or a fax machine which can scan and send double side. Thus, an office using Energy Star equipment in the office as computer, monitor, printer, fax and other accessories saves power consumption expenditures. Similarly, to be eco-efficiency, lighting system which consumes less energy should be used. This should be added by reduction in power consumption by switching off unnecessary light or power in the office when not in use such as setting the office desktop monitor to sleep mode when away from the desk. Along with this is offsetting carbon dioxide emissions because of business travel by joining a “green tags” program. This program is made for generating renewable energy facilities that brings benefits to the environment by means of green power generation. In addition, minimizing business travel by using green business travel, or green office’s daily travel as bicycling or telecommunication tools, public transportation in place of private conveyance saves a lot of energy.

#### **Eliminate Waste**

The recycling initiatives in the green offices in USA are as:

Buy recycled: To use the paper made from recycled post-consumer and also use envelopes, calendars, planners and stationery made from recycled paper. Remanufactured ink and laser toner for printers and fax machines can also save the money and at the same time save the Earth. Waste loop should be closed by turning in old toner cartridge for recycling. To reduce paper consumption, there needs changes in the habit of the staffs in using office equipment such as setting the printer to print the documents on both sides, adjusting the length and margin to be printed, using smaller fonts to capacitate more texts on a single page, editing documents on screen before printing out to save paper for draft copies and circulation of mail, memo, report etc. electronically. In addition, selection of a responsible union printer, that can use recycled paper and vegetable-based inks and reusing or donating surplus or obsolete office infrastructure or equipment, saves a lot and this brings tremendous benefits to the environment. Finally, there should be a program of waste management auditing to help to find out the strategies, output and elimination of an office municipal waste in the form of a written waste report, thereby enhancing to track the office’s success at reducing waste.

#### **Thailand**

Related Organizations in Thailand are Ministry of Natural Resources and Environment, Department of Environmental Quality Promotion (DEQP) and Pollution Control Department. Green Office in Thailand

**Table 1.** Summary and conclusions (similarities and differences among countries)

	SP	HK	EN	F	USA	TH
Organization Awareness	X					X
Energy and Resources	X	X	X	X	X	X
Waste and Wastewater Management	X	X	X	X	X	X
Indoor & Outdoor Environmental	X	X				X
Green Procurement	X	X	X	X		X
Continual Improvement						X
Staff communication/ Participation			X	X		X
Transportation			X	X		X

**Note:** SP is Singapore, HK is Hong Kong, EN is England, F is Finland, USA is the united state of America, and TH is Thailand.

refers to the office or activities in the organization by using resources efficiently for a green environment and reduction in carbon emission [19].

#### The Green Office Objectives in Thailand

The green office of Thailand has the following objectives as:

- To bring or apply the Green Office principles in organization and offices for reducing resources used and being green.
- To promote to reuse and recycle in the office for reducing office expenses
- To reduce the emission released by activities in the offices.

The Green Office Management Topic in Thailand

- Organization Management
- Organization Awareness
- Energy and Resource
- Waste and wastewater Management
- Indoor & Outdoor Environmental
- Green Procurement
- Continual Improvement [20]

## 5. Conclusion

From the table 1, it can be seen that the first 3 major concerns in Green offices among the countries are Energy & Resources, Waste & Wastewater Management and Green Procurement. Thailand and Singapore are the only countries having focus on organization management. Thailand is the only country which practices all the mentioned variables as organization management, energy and resources waste and wastewater management, indoor and outdoor environmental, green procurement, continual improvement, staff communication/participation and transportation.

From the review of the above mentioned countries and their green offices, it can be concluded that the main goal of the green office management system is to apply the Green Office principles in organization and offices so as to reduce the consumption of natural resources by improving offices' environmental efficiency. It can be concluded that green office in the work places can be promoted through behavioral

changes and efficient management practices in order to combat climate change through energy efficiency and the renewables, reduce natural resource use, and promote sustainable lifestyles through enhanced employee awareness.

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