

Greenhouse Gas Emissions Evaluation in the Hotel Establishment Case Study : Phuket

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ABSTRACT

The objectives of greenhouse gas emission evaluation in the hotel establishment: case study Phuket Province were to assess greenhouse gas emissions from the activities of hotel establishments and to obtain guidelines to reduce greenhouse gas emissions from the activities of hotel establishments in Phuket. Carbon footprint was assessed according to the guidelines of Thailand Greenhouse Gas Management Organization by purposive sampling. Hotel representatives in Phuket area were selected on a voluntary basis and a total of 2 hotels accepted to participate in this research.

Results of carbon footprint assessment from both hotels during the 1-year period from January to December 2020 indicated that the greenhouse gas emissions of hotel case study 1 were 1,883.64 t.CO₂-e and hotel case study 2 were 2,522.69 t.CO₂-e. The carbon footprint assessment of the hotels found that the type 2 emission of greenhouse gases, which was the indirect emission and absorption of greenhouse gases (the electricity type), was the highest value out of the 3 types.

Guidelines for reducing greenhouse gas emissions from hotel activities in Phuket Province included 1) reducing the amount of electricity consumed by replacing electrical equipment and energy-saving measures; 2) installing solar rooftops to reduce the amount of greenhouse gas emissions; 3) architectural improvement design in hotel building for energy saving; 4) participating in the green hotel or low carbon hotel project; 5) handling tax measures as an incentive to reduce greenhouse gas emissions for hotel establishments; and 6) supporting education on methods to reduce greenhouse gas emissions from the activities of hotel establishments. and best practices in pollution prevention and reduction for hotels.

Keywords: carbon footprint; greenhouse gas; hotel

INTRODUCTION

Currently, global warming is considered an important issue that affects human life which should be aware of the situation in order to adapt and be prepared to deal with the upcoming climate change. Global climate change and greenhouse gas reduction is an important issue that each country pays attention to and is the main topic that has been discussed to solve problems under the United Nations Framework Convention on Climate Change (UNFCCC) and many other world leaders' meetings. Continuous greenhouse gas emissions are from various human activities, including energy use, agriculture, expansion of industry, transportation, deforestation, tourism and the destruction of natural resources. These are the major causes of global warming leading to climate change. This is an important international problem that governments and private sectors are working to reduce greenhouse gas emissions in term of the monitoring, reporting, verification of greenhouse gas emissions. This is an important part of initiating a plan to limit the concentration of greenhouse gases in the atmosphere [1].

Carbon footprint for organization (Corporate Carbon Footprint: CCF) is a method that shows the amount of greenhouse gases emitted by an organization's operations from various activities in the production and service of the organization. It will lead to the determination of management guidelines to reduce greenhouse gas emissions effectively both in industrial and national level. It can also be used as a tool to estimate greenhouse gas emissions and strengthen the potential of Thai entrepreneurs and businesses to be able to compete in the world trade arena. Moreover, the government must report the number of emissions and absorbing greenhouse gases (Greenhouse Gas Reporting) of various organizations to be used as a guideline for managing greenhouse gas emissions in Thailand [2].

Thailand as a member of the Convention has responded to such problems from the policy level to concrete implementation, such as showing the intention to reduce greenhouse gas emissions in Thailand and to develop national strategies and national development plans that aim to shift the development paradigm towards a low-carbon economy and society as well as the preparation of the agency and various sectors to

support commitments to participate in reducing greenhouse gas emissions that will occur in the future. This causes Thailand to have policies, plans and operations to support the management of greenhouse gas information and reduce greenhouse gas emissions from various sectors in the country continuously. In addition to the energy sector, transportation, industrial sector which is a major source of greenhouse gas emissions, the waste and wastewater management sector is another route that Thailand is preparing for in reducing greenhouse gas emissions. Because waste and wastewater management in Thailand, in addition to helping to reduce greenhouse gases down, it also helps create many other mutual benefits, such as enhancing people's quality of life and health, creating a livable environment emergence of green employment and generating additional income for the people from participating in waste management [3].

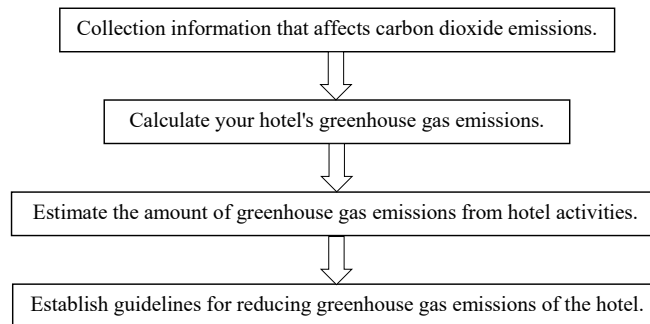
From the burning of coal and other fuels to obtain energy, the greenhouse gases rise to gather in the atmosphere of the earth. As a result, the sun's rays that are supposed to be reflected in just the right amount are trapped by these greenhouse gases, causing the global temperature gradually higher than before and global warming problems. In the future, it is expected that the effects of global warming will become more and more severe. For hotels and tourism businesses, it can help reduce global warming in many ways, such as reducing waste generation by promoting reduction, reuse, efficient water use or waste water reuse [4].

The hotel business is important in terms of tourism and service. It is one business that affects global warming. The increasing number of tourists every year results in more consumption of natural resources such as water, food and electricity consumption, power consumption for various vehicles in tourism and transporting, waste and paper use for hotel marketing. These processes all contribute to increasing greenhouse gas emissions in tourism and hotel industry. The study found that carbon emissions from accommodation was as high as 21%. The global hotel sector was estimated to consume 97.5 kWh of energy, and emitted 55.7 metric tons of carbon dioxide per person. Taiwan reported that the top 50 energy consumers in Taiwan's hospitality industry in 2008 were hotel sectors with 363,810 tons of carbon dioxide emissions [5].

From 2012 to 2015, the number of tourists in Phuket Province had increased every year, from 10 million in 2012 to 13 million in 2015, except in 2014 when the number decreased by only 0.25 percent [6]. Consequently, Phuket needed to have rooms to accommodate the increasing number of tourists. This may add to the amount of electricity, fuel, waste and wastewater generated in each hotel. The results of a survey of hotels and rooms in Phuket found that there were 1,591 hotels and 70,177 rooms [7]. Hotels essentially understand how electricity, fuel, solid waste and waste water should be managed. As this linked to the problem of global climate change.

For that reason, hotel establishment is one organization that has the potential to reduce greenhouse gas emissions by working with researchers to find effective ways to reduce the emissions of carbon dioxide and other gases from activities in the hotel. The cooperation from hotel establishments can lead to appropriate technology and innovation improvements to reduce the impact of climate change on global resources and environment in the future on the basis of sustainable development.

METHODOLOGY



1. Select the hotels by purposive sampling. They must be interested in environmental conservation and want to use the results from this study in setting guidelines for a reduction in greenhouse gas emissions. It is the starting point of the organization's direction for becoming a green hotel. Two hotels in Phuket area were selected on a voluntary basis as the sample hotels in the research by holding a small group meeting and clarifying the objectives of the research.

2. Determine the scope of study by collecting data on hotel activities that directly and indirectly cause greenhouse gas emissions. Data was collected using data-filled forms and interviews.

3. Assess the greenhouse gas emissions and calculate the amount of greenhouse gas emissions from activities by method in accordance with the standards of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 5 Waste [8].

4. Estimate the amount of greenhouse gas emissions from hotel activities. The calculated values were evaluated and interpreted.

5. Use the data obtained from the calculation and evaluation to prepare guidelines for reducing greenhouse gas emissions from the activities of hotel establishments in Phuket.

Note:

Limitations for the research project “Greenhouse Gas Emission Assessment of Hotel Types: Case Study, Phuket Province”

1) Lack of cooperation from the hotel establishment

2) Opportunity to reach hotel owners. The hotel establishment was not willing to give complete details during the past 1 year, especially about expenses and activities incurred in relation to greenhouse gas emissions.

3) Situation of the outbreak of the Covid-19 disease. The hotel establishment was ordered to close during March – June 2020, as a result, these were obstacles in data collection and information request.

RESULTS AND DISCUSSIONS

The result of carbon footprint assessment during the period from January to December 2019 was found that the amount of greenhouse gas emissions of the hotel case study 1 was 1,883.64 t.CO₂-e, and divided into 3 types of boundaries as follows:

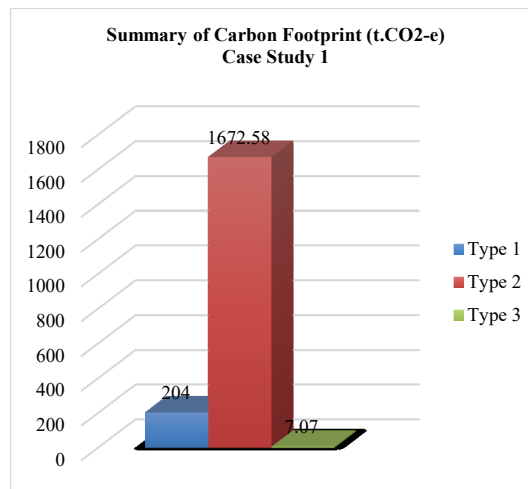


Figure 1 The proportion of greenhouse gas emissions of the organization classified by the scope of Hotel Case Study 1

1) Type 1, the amount of emission and absorption of greenhouse gases directly from the organization. The use of LPG in cooking had the highest emission of greenhouse gases with the amount of 140.2289 t.CO₂-e, accounting for 7.44% of the emission. Greenhouses CO₂-e of 52.8722 t.CO₂-e (2.81%), and 10.8988 t.CO₂-e (0.58 %) were generated from the mobile combustion of automobile diesel and benzine, respectively which was the lowest emission of a Type 1 greenhouse gas.

2) Type 2, the amount of indirect emission and absorption of greenhouse gases from the organization's energy use. This type occurred from the electricity consumption of the hotel purchased from the Electricity Authority with an amount of 1,672.5780 t.CO₂-e, equivalent to 88.79 % of total greenhouse gas emissions.

3) Type 3, the amount of indirect GHG emissions and absorption other than the first 2 types. This type was caused by the hotel's use of general paper (3.6785 t.CO₂-e), the use of hotel toilet paper. (2.4333 t.CO₂-e) and the water supply of the hotel (0.9537 t.CO₂-e). The proportion of GHG emissions from general paper use activities was the highest at 0.20%, followed by the use of hotel toilet paper (0.13 %) and the use of tap water (0.05%), respectively.

For the hotel case study 2, the amount of greenhouse gas emissions was 2,522.69 t.CO₂-e, and divided into 3 types of boundaries as follows.

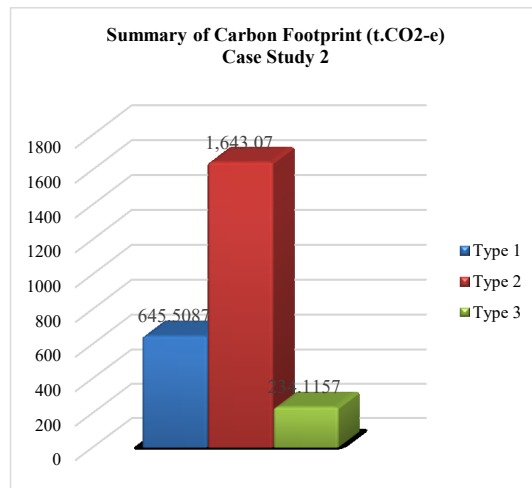


Figure 2 The proportion of greenhouse gas emissions of the organization classified by the scope of Hotel Case Study 2

1) Category 1, the amount of direct emission and absorption of greenhouse gases from the organization. This was caused by the use of refrigerant R-22 with the highest greenhouse gas emissions 641.8544 t.CO₂-e, accounting for 25.44% of total greenhouse gas emissions.

The combustion by using gasoline. (motorcycle) emitted 2.7787 t.CO₂-e of greenhouse gases, equivalent to 0.11 % of total greenhouse gas emissions.

The combustion by using gasoline. (personal car) emitted 0.8756 t.CO₂-e, equivalent to 0.04%, which was the lowest greenhouse gas emission of the scope of type 1. 0.04 %

2) Type 2, the amount of indirect emission and absorption of greenhouse gases from the organization's energy use. This occurred from the electricity consumption of the hotel purchased from the Electricity Authority with an amount of 1,643.0703 t.CO₂-e, equivalent to 65.14 % of total greenhouse gas emissions.

3) Type 3, the amount of indirect emission and absorption of greenhouse gases other than the first 2 types. General solid waste had the highest emission of greenhouse gases with 80.8134 t.CO₂-e, equivalent to 3.20 %.

The greenhouse gas emissions were as follows

- Drinking water consumption with 35.9019 t.CO₂-e (1.42 %)
- Use of HDPE black bags with 34.2036 t.CO₂-e (1.36 %)
- Tap water consumption with 30.1738 t.CO₂-e (1.196 %)
- Use of paper with 16.4536 t.CO₂-e, (0.65 %)
- Use of drinking water bottle with 3.7240 t.CO₂-e (0.15 %)
- Use of hotel toilet paper rolls with 27.7356 t.CO₂-e (1.099 %)
- Use of shampoo bottle with 1.8590 t.CO₂-e (0.07 %)
- Use of hotel soap with 1.2376 t.CO₂-e (1.36 %)
- Use of plastic bags with 1.0484 t.CO₂-e (0.04 %)
- Use of A4 paper with 0.4216 t.CO₂-e (0.02 %)
- Use of inks with 0.1106 t.CO₂-e (0.00 %)
- Use of shampoo with 0.0154 t.CO₂-e (0.00 %) which was the lowest emission of type 3 greenhouse

gases.

From the carbon footprint results of the hotel in case study 1 and 2, it was found that type 2 emissions, which were the indirect emission and absorption of greenhouse gases, were the highest out of the 3 types.

Procedures to reduce greenhouse gas emissions from the activities of hotel establishments in Phuket Province include

Guideline 1: Reduction of electricity consumption by changing electrical equipment according to energy-saving measures. It can substitute electrical equipment that is the main cause of greenhouse gas emissions. It can be modified and reduce greenhouse gas emissions as follows

1.1 Air conditioner 40,000 BTU (No. 5), increasing 1 degree temperature can reduce greenhouse gas by 0.5 t.CO₂-e.

1.2 Reduction of greenhouse gas emissions from refrigerants. The study found that the hotel case study 2 used refrigerant type R-22 (CHClF₂) which has a greenhouse gas emission coefficient of 1,760 kg CO₂-eq per unit. If the refrigerant is changed from R-22 to R-32 (CH₂F₂), it will decrease the amount of greenhouse gas emissions. Based on such information, it can be recommended to hotel case study 2 to change the refrigerant from the use of R-22 to R-32, which will reduce the amount of greenhouse gas emissions in the hotel.

1.3 Use of 50 lamps LED 20 W for the period of 1 year can reduce greenhouse gas 1 t.CO₂-e. LED lamp saves energy and has a longer service life. Therefore, the efficiency of LED lamp is more efficient than fluorescent lamps in terms of saving energy for the same amount of light. For the safety reason, the light obtained from LED bulb has no harm from infrared and ultraviolet radiation, mercury and light flashing, which is harmful to the eyes. In addition, the LED emits very little heat causing the reduction of electrical energy in the air conditioning section. This helps to save even more energy.

1.4 Reduction of electricity consumption according to the energy saving measures. Reducing electricity 2,000 units can lower greenhouse gas 1 t.CO₂-e (Thailand Greenhouse Gas Management Organization, 2019)

Guideline 2: Solar rooftop installation to reduce greenhouse gas emissions

Guideline 3: Hotel architectural improvement for energy saving renovation and sustainable architectural design criteria for energy savings Consider the architectural elements, including the design of ventilation openings, use of insulating glass, use of light colors for walls and roofs, adding a shading device to the opening area and designing an environment that is consistent with the building by taking advantage of natural lighting and ventilation.

Guideline 4: Participating in the green hotel or low carbon hotel project. The short-term and long-term impact mitigation plans can be applied directly to the greenhouse gas emissions for the case study hotels. This will raise awareness about climate change and energy conservation. A long-term impact mitigation plan has been recommended for "Green Hotel" that are successful in reducing greenhouse gas emissions. These plans can be tied into Thai government policies to mitigate the impact of climate change on the hotel industry.

Guideline 5: The use of tax measures as an incentive to reduce greenhouse gas emissions for hotel establishments. The reduction of greenhouse gas emissions from the hotel business can reduce environmental taxes.

Guideline 6: Promote, support, educate, enhance employees and personnel involved in sustainable tourism with low-carbon hotels. It will help improve the energy efficiency and environmental quality of tourism and hotel business.

The transfer of environmental management knowledge by creating brochures in the form of QR codes, attaching files and sending information to relevant people in the hotel establishment can also reduce greenhouse gas emissions.

CONCLUSION

Carbon footprint assessment of both hotel case studies during the 1-year period from January to December 2019 was found that the greenhouse gas emissions of Hotel Case Study 1 were 1,883.64 t.CO₂-e and Hotel Case Study 2 were 2,522.69 t.CO₂-e. The emission of type 2 greenhouse gases, which is the indirect emission and absorption of greenhouse gases (electricity type), was the highest level out of the 3 types.

Guidelines for reducing greenhouse gas emissions from hotel activities in Phuket Province include

Guideline 1: reducing the consumed amount of electricity by replacing electrical equipment according to energy-saving measures

Guideline 2: installing solar rooftops

Guideline 3: improving architectural design

Guideline 4: participating in the green hotel or low carbon hotel project

Guideline 5: using tax measures as an incentive to reduce greenhouse gas emissions for hotel establishments

Guideline 6: supporting education on how to reduce greenhouse gas emissions from the activities of hotel establishments, and best practices in pollution prevention and reduction for hotels

Remark: Due to the situation of the COVID-19 disease in the year 2020-2022, the data collection could not be carried out as planned. Data on services, stays and operations in the hotel has been interrupted, causing no information to be processed. The researcher has tried to work with the best of his ability, but only received information to create data for 2 hotels despite coordinating and operating more than 5 hotels. This is because the COVID-19 disease caused the hotel to stop operating. Therefore, there is no supporting information to complete this research as planned.

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