ENERGY CONSUMPTION AND THE ECOLOGICAL FOOTPRINT OF TOURISM IN AN ISLAND DESTINATION: THE CASE OF KOH SAMUI, THAILAND

Submitted by

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I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

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ABSTRACT

This thesis aims to apply the concept of the Ecological Footprint (EF) to examine the impact that the tourism industry has on the environment through energy consumption and also investigates patterns of energy-consuming behaviour among tourists and tourism businesses. EF is becoming an increasingly popular analytical tool in tourism studies. However, at present most attention has fallen on its value for studying tourism in international level. Moreover, very few studies have taken account of the influence of social factors when making EF calculations linked to tourism. As a consequence of these biases, there is currently a need for studies of tourism which take account of EFs at the destination level and how the behaviour of tourists and tourism businesses affects energy consumption at holiday destinations. This study addresses this gap by investigating the EF of energy-consuming behaviour linked to tourists and tourism businesses at a particular holiday destination, namely Koh Samui in Thailand, and also by exploring the factors which influence this kind of behaviour.

The findings of this study show that most tourists rely on modes of transport which release high levels of CO_2 (especially long haul flights). In the case of Thailand, a majority of tourists fly from Bangkok to Koh Samui and then use private cars to get around the island. Energy intensive electrical appliances such as air conditioning and tankless hot water heaters were widely used in accommodation, while beach activities, which generally have a low carbon footprint, attracted the largest numbers of tourists. It was also found that demographic factors, including travel behaviour and concern for the environment, influenced these kinds of behaviour in various ways.

As regards different types of tourism business, in the accommodation sector hotels used the largest quantities of electricity while tour operators used more diesel and petrol than any other type of tourism business. Furthermore, it was also found that even though respondents who stayed in five-star hotels expressed the greatest level of concern for climate change, they still considered their own convenience and satisfaction to be their highest priorities. Tourism on Koh Samui consumed about 54.55 PJ of energy in 2007 and thus needed 3.41 gha of forest land to absorb the resulting CO_2 emissions. Given that this figure exceeds the current world-average biocapacity of 1.8 gha, it can be stated that tourism on Koh Samui is currently unsustainable.

This study highlights the relationship between the EF of tourism at a particular holiday destination and the energy-consuming behaviour of both tourists and tourism businesses. In this way, it is shown here that excessive energy consumption combined with a lack of effective energy management in the business sector can lead to the development of an unsustainable EF. In response to this finding, practitioners and policy-makers should consider ways of mitigating EFs linked to tourism.

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TABLE OF CONTENTS

LIST OF APPENDICES

LISTS OF TABLES

LISTS OF FIGURES

LIST OF ABBREVIATIONS

ANOVA	=	Analysis of Variance
CO_2	=	Carbon Dioxide
DEDE	=	Department of Alternative Energy Development and Efficiency
EF	=	Ecological Footprint
EGAT	=	Electricity Generating Authority of Thailand
EIA	=	Environmental Impact Assessments
EIO	=	Environmental Input-Output Model
EPPO	=	Energy Policy and Planning Office, Ministry of Energy, Thailand
GHG	=	Green House Gas
IPCC	=	Intergovernmental Panel on Climate Change
Koh Samui	=	Koh Samui Island, Surattani, Thailand
KSMC	=	Koh Samui City Municipality
LAC	=	Limit of Acceptable Change System
LCA	=	Life Cycle Assessment Model
LPG	=	Liquid Petroleum Gas
PEA	=	Provincial Electricity Authority
PWA	=	Provincial Waterworks Authority
SMEs	=	Small and medium sized enterprises
SMTEs	=	Small and medium-sized tourism enterprises
SPI	=	Sustainable Process Index
TAT	=	Tourism Authority of Thailand
UNFCCC	=	United Nations Framework Convention on Climate Change
WWF	=	World Widelife Fund

UNITS OF MEASUREMENT AND CONVERSION FACTORS

Prefix	Symbol	Value	Example
Kilo	K	10^3	Kilowatt/ kW
Mega	M	10^6	Megajoule/ MJ
Giga	G	10^9	Gigajoule/ GJ
Tera	T	10^{12}	Terajoule/ TJ
Peta	P	10^{15}	Petajoule /PJ

Type	Unit Name	Symbol
Energy	joule	J
Power	watt	W
Time	hour	h
Energy (electricity use)	kilowatt-hour	kWh
Temperature degree	Celsius	°C
Fuel	litres	l
Distance	passenger-kilometre	pkm
Area	global hectare	gha

Type	Unit Name	Symbol	Value
Energy			
(Electricity use)	kilowatt-hour	kWh	3.6×10^6 J = 3.6 MJ
Energy	terawatt-hour	TWh	3.6×10^{15} J = 3.6 PJ
Energy	litre of petrol	L	3.2×10^7 J
Energy	m^3 of natural gas at STP		3.4×10^7 J
Power	kWh per year	kWh/y	0.114 W
CO_2	Tonnes	CO_2	1 tonnes = 1,000 Kg
Area	hectare	hectare	1 hectare = 10,000 m^2

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

“We no longer live within the sustainable limits of the planet. Ecosystems are suffering, the global climate is changing, and the further we continue down this path of unsustainable production and exploitation, the more difficult it will become to protect and restore the biodiversity that remains”

(Matthews, 2006: 5)

Changes to the global environment, the most serious problem faced by humanity today, are increasingly regarded as having a severe impact on public health as well as the natural environment. Recently, these changes have become a remarkable and serious issue at the centre of global public concern. They have been intensely studied over the last few decades as growing evidence of the reality of climate change has come to light; this work informs the views of the Intergovernmental Panel on Climate Change (hereafter; IPCC) which articles the consensus of the international scientific community and thus acts as the global authority on the science of climate change and its causes. The critical data from this research shows that humankind is largely responsible for the global temperature rise (IPCC, 2001; Oreskes, 2003). In order to deal with the challenges posed to humanity by climate change, effective policies and action are required from all sectors around the world, specifically for the purposes of reducing the greenhouse gases produced by human activities (Vitousek, 1994; Goudie, 2006; Gössling and Hall, 2006; Norcia, 2008).

A series of major steps have been taken since the 1990s in reducing global emissions of greenhouse gases (hereafter; GHG). The United Nations Framework Convention on Climate Change (hereafter; UNFCCC) was signed by 150 states in 1992 in order to encourage international countries to stabilise their green house gas emissions. Following this, in 1997 the Kyoto Protocol, an international agreement linked to the UNFCCC, the Kyoto stabilise Protocol, an international agreement linked to the UNFCCC, was signed by 37 industrialised nations (including all members of the EU at the time); these countries were collectively known as the Annex I party. This officially committed them to cutting their net GHG emissions by 5.2%, or back to 1990 levels, by 2012. Undoubtedly, there are substantial policy aspirations for reducing world GHG emissions; especially carbon dioxide (hereafter; CO_2) which accounts for the largest proportion of these trace gases. Therefore, tracking the global ecological footprint, reducing CO_2 emissions from production processes, and developing more friendly environmental policies are considered priorities both by businesses and governments across the world.

Like other developing nations, Thailand ratified the Kyoto Protocol in 2002, but not as an Annex I country, meaning that it has no formal commitment to reduce its CO_2 emission. Nevertheless, according to the United Nations Human Report (2007) on climate change, CO_2 emissions are rapidly increasing in the kingdom (they increased by 180% between 1990 and 2004). As a result, Thailand is now ranked as the world's 22nd largest producer of CO_2 emissions. This report also brought the scale of Thailand's CO_2 emissions to the attention of the Royal Thai Government, showing that the per capita emissions for Thailand were 4.2 tonnes per year; this compared to the 3.8 tonnes per capita in China which was then ranked the 2nd largest overall producer of CO_2 after the US in 2004. According to the most recent data, Thailand's per capita emissions of trace gases are still nearly equal to that of China which has now overtaken the United States to become the world's largest emitter of CO_2. The EF of Thailand will undoubtedly continue to rise steadily in the near future.

Accordingly, Thailand experienced that the energy-related CO_2 emissions in the country increased from 80 million tons in 1990 to 159 million tons in 2000 with 159% of those emissions rising (UNEP, 2007). CO_2 emissions profiles in Thailand also show the steady rise of the EF from energy which accounted for approximately 220 million tons of CO_2 in 2009 (DEDE, 2009). To improve CO_2 reduction performance in the kingdom, the Ministry of Natural Resources and Environment has declared that Thailand will continue to implement the UNFCCC recommendations by making significant reductions in GHG emissions, (Krairapanon, 2003). As one of the most releasing GHG emissions sector, the energy sector has been pressured to mitigate its impact toward global warming. In 2003, the energy sector was the biggest contributors to Thailand's annual GHG; it accounted for 56.1 % of the total GHG emissions in Thailand (Yoohoon, 2009). Furthermore, the EPPO's annual report illustrates an increasingly trend of those emissions during the period 2003-2009 (EPPO, 2010). The GHG emission is increasingly in political concern and Thailand has strengthened the legal and policy framework for decreasing an environmental impact from energy use. H.E Abhisit Vejjajiva, prime minister of Thailand declared to the United Nations Framework Convention on Climate Change at Copenhagen that:

> "Thailand is implementing the 15-year National Alternative Energy Development Plan (2008-2022), which aims to increase the share of alternative energy to 20 % of final

energy consumption in the country by the year 2022. Accordingly, the green house gasses emission will be substantially reduced from alternative energy and from more efficient use of energy as a whole. In addition, to increase our carbon sink, Thailand has set the ambitious target to increase the national forest cover from 30 % in 2006 up to 40% by 2020” (Vejjajiva, 2009: 10).

Consequently, Thai policy-makers are now drafting proposals for making Thailand into a low carbon economy by decreasing the use of fossil fuels and switching to renewable energy sources. The plenty programme , associated with energy saving, has also been launched by the Thai government, as well as the implementation of the Kyoto protocol’s Clean Development Mechanism (CDM) in order to improve the country’s emission profile.

However, maintaining growth in the country’s economy and providing a secure, affordable and environmentally sustainable supply of energy are now major challenges facing the Royal Thai governments. Ideally, the uses of fossil fuels are claimed as the main drivers behind global warming. However, there is the lack of energy options available for the production of Thailand’s domestic energy supply which is mostly derived from fossil fuels like natural gas, oil, and coal (Laosooksathit, 2009). Moreover, the rising price of imported natural gas, a major source of power, is a growing problem for the Thai government, while alternative cheaper energy sources, such as coal, are ineligible for environmental friendly policies. In other words, the security of Thailand’s energy supply and the reduction of CO_2 emissions are conflicting priorities for Thailand's political elite who need to balance the pressures of a managing a developing economy with the threats posed by climate change. Hence, more capacity building on research and implementation related with these problems are urgently needed for Thailand.

This study focuses on ecological footprint (hereafter; EF) analysis in order to track CO_2 emissions from energy consumption, and also deals with the behaviour of energy use in the tourism industry, which is widely regarded as one of the largest and fastest-growing industries in the country (TAT, 2010). To develop its economy, Thailand relies heavily on the tourism sector which plays a vital role in attracting foreign revenues (WTTC, 2009).

It is estimated by the Tourism Authority of Thailand (hereafter; TAT) that there were 14 million visitors to Thailand in 2009 and that they contributed £9,581 million to the Thai economy; this accounted for 6.5% gross domestic product (GDP) in 2009 (TAT, 2010). This economic growth has been highlighted and the traditional products of ‘Sea Sand Sun’ are becoming increasingly popular among tourists, causing a vast consumption in the resources related to the sector. There is no exception for energy as they are inextricably linked. The vast consumption of energy related to the tourism industry has led to it becoming a major contributor to global environmental change; the UNWTO (2007) estimates that the global tourism industry is responsible for about 5% of human-induced climate change.

In light of Thailand's ratification of the Kyoto Protocol and pressure from global environmental concern, tourism, energy use and climate change feature as a topic of discussion at a national level in Thai politics. The Thai government, and especially the Ministry of Energy, has played a leading role in shifting its policy focus away from economic benefits towards Thailand's environment assets.

However, there are concerns of mitigating climate change practices *e.g.* lacking a study in footprint measurement, a significant gap in addressing the environmental problem at a global scale, and so forth. In particular, there are only a limited number of publications, scenarios and perspectives about energy and climate change issues. Furthermore, most policies and planning for tourism (especially at a provincial level) show little concern for its impact in terms of energy use on global climate change. Research is therefore needed to fill these gaps as well as support more solutions which encourage the tourism industry to develop plans to significantly mitigate it's the EF. Therefore, this study addresses these concerns and views them as valuable for developing a mitigation policy.

For the purposes of this study, Koh Samui, has been chosen as a case study to assess the EF from energy use in Thailand's tourism industry. By using Koh Samui as an example, it is intend to shed light on patterns of energy-consuming behaviour among tourists and tourism businesses and thus provide decision-makers with useful information. Koh Samui is Thailand's third largest island. More than a million people from around the globe visited it in 2007, thus making it one of Thailand's most popular tourist destinations (TAT, 2009). The growing pressures placed on the natural-resources of the island by those seeking sun, a relaxing lifestyle, friendly atmosphere, and exotic environment, have recently become a serious concern for both the local authorities and the national government, the office of tourism development. The vital point of concern is not only the deterioration of existing natural resources in the major places of tourist attraction and a lack of co-ordination among various organisations involved in the management of those resources, but also the limitations of the island's energy supply. In 2000, the rapid growth of Koh Samui's economy led to the demand for electricity exceeding the island's supply. A submarine cable has since been installed to boost supply, but this is only expected to meet demand for the next couple of years (Thirakomen *et al*., 2006). This has resulted from a lack of development control and guidance.

As an international destination in the current era, Koh Samui needs to be mindful of the impact of its energy use on the rest of the world. Furthermore, robust data on the impact of energy consumption in tourism is needed in order to educate stakeholders about the impact of energy use and climate change on the local economy and also for facilitating decision-makers to develop more pro-active policies in the sustainable development frame.

1.2 RESEARCH AIMS AND OBJECTIVES

The primary goals for this study are to apply the concept of ecological footprint to tourism industry in order to examine its EF from energy use and also to investigate energy use behaviour of both tourists and businesses. This aim will be researched by the following objectives:

1. To analyse the energy consumption behaviour of tourists and its influential factors. In order to gain a more profound understanding of these relationships between the patterns of energy use of tourists at home and on vacation are also examined.

2. To investigate the energy consumption patterns in major components of the tourism sector (transport, accommodation and activities) in order to identify the key areas of energy use and to provide insights into the attitudes and behaviour of entrepreneurs in tourism business towards energy use.

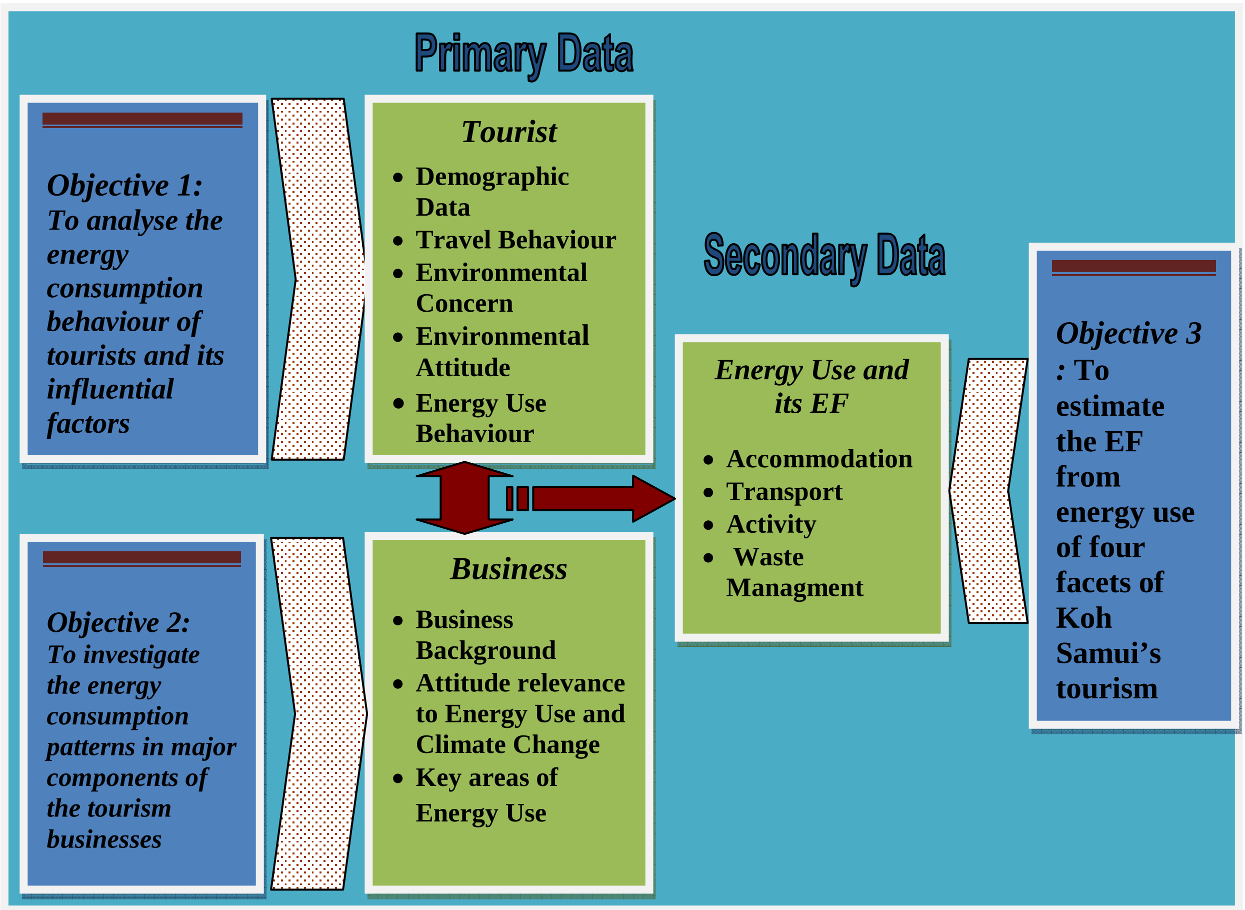
3. To estimate the ecological footprint from energy use of four facets of Koh Samui's tourism sector: namely transport, accommodation, activities, and waste management.

1.3 STUDY FRAMEWORK

A framework has been designed for this study in order to show how its objectives will be met (See Figure 1.1). This study seeks to explore the energy consumption patterns of the tourism industry and tourists, the key stakeholders in tourism. Businesses are mainly considered on their background such as operating time, size of organization, and type of business. Their attitudes toward energy use and climate change are also examined as well as their patterns of energy consumption which are mainly focused on electricity, fuel and water use.

Four aspects of variable groups associated with tourist behaviour are examined here: their information background, travel behaviour, attitudes, and energy consumption. This study compares the energy consumption behaviour of tourists when they are on vacation and in their everyday lives. Furthermore, it should be noted that the demographic characteristics of tourists taken into account by this study include age, gender, total household incomes, and educational level. The travel behaviour characteristics of tourists include whether or not they travelled as members of groups, length of stay, time spent in deciding to visit specific attractions and participating activities. In order to quantify the EF of tourists in Thailand, four major sources of energy are investigated using secondary data.

Figure 1.1: Study Framework



Source: Author

1.4 STRUCTURE OF THESIS

This study consists of nine chapters; these develop as follows:

The literature reviews are explored in three chapters (Chapter Two, Chapter Three, and Chapter Four). Chapter Two is the first section of the literature review. It mainly focuses on key studies which have demonstrated the connections between climate change, energy use, and tourism as well as dealing with the concepts of sustainable tourism and the EF analysis. The earlier work in this area is analysed here as well as the advantages and limitations of this model. This chapter also explores how the footprint framework can be used as a tool for measuring the sustainability of tourism.

Chapters Three and Four, the second parts of the review literature, discuss how the environmental impact of the behaviour of tourists and businesses, respectively. In order to gain an understanding of the reactions and behaviour of stakeholders toward the environment and climate change, both theory and related works are reviewed. Businesses and tourists are the key components associated directly with resource consumption; therefore the affects of their attitudes and behaviour on the environment and climate change are explored in this chapter.

Chapter Five discusses the research methods used in this study. This is developed by basing primarily on research objectives. This significant section of methods employs a mixed method in order to an answer the key questions posed by this study. It also explains the processes of data collection including the sampling plan for the former data. The last part of section explains the tools and statistics used in this study to analyse the research data. The methods used in this study to determine the energy usage and the EF of the different sectors of the tourism industry are also explained in this chapter.

Chapter Six analyses the energy consumption of tourists. It links directly with the first objective of this thesis by focusing on the energy consumption behaviour of tourists and its influential factors. Therefore, this chapter provides the results of tourist behaviour relevant to the energy-consuming behaviour in three main areas: accommodation, transport and tourism activities. In order to gain a more profound understanding of these relationships between the patterns of energy use of tourists at home and on vacation are also examined.

Chapter Seven explains the results of research and analysis result related with the second objective of research mainly on the patterns of business energy consumption. This section mainly discusses the data collected from questionnaires about energy consumption in the commercial sector (*i.e.* accommodation, restaurants, activities operation and key transport). The effects of the attitudes and behaviour of tourism providers on energy use, climate change and public policy are also addressed in this chapter because they are certainly recipients of much advice and regulation and can be key players in most initiatives designed to mitigate the impact of travel and tourism on the environment.

Chapter Eight discusses the impact of the EF and the energy use of the tourism sector in Koh Samui, Thailand. Using secondary data, the findings of total energy use for tourism and the EF produced by the tourism industry in Koh Samui are discussed in this chapter. The results of energy-use, carbon emissions, and the EF also estimated from secondary data for the main sources of energy-use in the tourism industry (namely, transport, accommodation, activities and waste management) as stated clearly in objective 3.

Chapter Nine concludes the thesis on the back of these findings. It provides a number of recommendations and the summary of this thesis which are intended to inform policy-makers and ensure that the Footprint Approach becomes an effective tool in the management of sustainable tourism.

CHAPTER TWO

THE ECOLOGICAL FOOTPRINT OF ENERGY CONSUMPTION IN TOURISM

2.1 INTRODUCTION

The negative effects of tourism have been widely discussed since the development of tourism studies and continue to be debated from various perspectives up to the present. Recent years have witnessed a rapid growth in concern for changes to the global environmental, particularly global warming and its effects. A point has now been reached where all nations and stakeholders should take action to prevent serious climate change. Given the contribution made to climate change by the travel industry, it is important for every company and individual traveler to take measures to reduce their respective carbon footprints and thereby help to preserve the future of the tourism sector and the planet (Becken, 2002a; Gössling *et al.*, 2002).

Research from various disciplines has centred on assessing the likely impact of anthropogenic climate change since it became widely recognized as a threat to life on earth in the 1980s. McCarthy *et al.* (2001) have estimated the probable effects of rising temperatures and sea levels, extreme weather patterns, and a breakdown in thermohaline circulation on global biodiversity and loss to property and human life. The growing body of evidence in support of these findings is increasingly becoming a major concern for governments, environmental organizations, and other relevant sectors.

Current studies of tourismindustry, in particular, are responding to concerns about CO_2 emissions, which are widely believed to be one of the principle causes of global environmental problems, by encouraging the development of carbon-accounting schemes. It is also generally accepted that the tourism industry is the one of the largest consumers of energy, mainly through the transportation of tourists and provision of amenities and supporting facilities at destinations (Becken and Simmons, 2002; Gössling, 2002).

This thesis focuses on how tourism places pressure on the global environment in terms of the EF. These estimations have been made from a sectoral perspective, assessing the contribution of air transport, the accommodation sector, or other tourism-related economic sectors. It also widely accepts that most of the carbon footprints are mainly produced from energy use and "[l]ikely vary greatly between destinations, reflecting climate, culture, energy sources, available technology and activities undertaken" (Sisman & Associates, 2007: 1).

This chapter aims to explore the ecological footprint framework which is increasingly being used to measure the sustainability of tourism and to evaluate the consumption of natural resources at tourist destinations. The EF has been applied in the context of tourism to assess the rates at which resources are consumed at different destinations. The data gathered by this kind of research can help to support policy-makers in developing plans for sustainable tourism. Thus, this chapter deals with the process and uses made of ecological footprint analysis in regard to tourism. However, there is a gap between the desired ecological-footprint levels required by the tourism industry to sustain itselves and the actual resources available for doing so. This in turn raises the critical issue of how resources can be effectively shared among different facets of tourism. Therefore, calls have been made for more research into this area as well as solutions to enhance the capacity of the tourism sector to monitor negative environmental changes and minimize its contribution towards them

This chapter begins by outlining the relationship between the tourism industry and climate change as well as why it is important to tourism scholars. This is followed by a discussion of how energy-consumption in the tourism industry has been approached by different research streams. The final section demonstrates the different models of EF calculation.

2.2 THE TOURISM INDUSTRY AND CLIMATE CHANGE

The global threats posed by climate change can be directly linked to human activities: especially production and consumption (Becken, 2004). The GHGs released into the atmosphere by humanity have resulted in annual increases in the global temperature (IPCC, 2007a). Moreover, the IPCC has predicted that the global temperature could increase, on average, from 1.4°C in 1990 to 5.8°C by 2100 (IPCC, 2007b). Many nations have responded to the negative impacts linked to climate change by seeking international agreements on how it can be tackled (two such examples being the United Nations Framework Convention on Climate Change of 1994 and the *Kyoto Protocol* of 1997 (UNFCCC, 2004)). The key aim of these agreements is to reduce GHGs, especially CO_2, by five percent on average in relation to 1990 levels (UNFCCC, 2004). A more recent gathering, the Copenhagen Climate Change Conference in 2010, was also intended to form an international consensus about dealing with climate change and global warming (Scott and Becken, 2010). This conference led to targets for reducing GHGs being extended to all levels of participating governments, non-governmental organisations (NGOs), the international business community, faith-groups, and scientists.

Although households and businesses have long been the targets of eco-friendly and energy-saving schemes and campaigns, the contribution made by the tourism industry to climate change has only recently been recognized by policy-makers and campaigners (Kelly and Williams, 2007; Neto, 2003; Gossling, 2000). The tourism industry is one among many facets of the global business community which accounts for a significant portion of global carbon emissions, especially through aviation which is becoming an increasingly popular mode of transport among tourists (Becken, 2007). Many studies have demonstrated the significance, with respect to global climate change, of the GHG emissions produced by different facets of the tourism industry: particularly accommodation, transport, and attractions / activities (*e.g.* Becken, 2002b; Becken and Patternson, 2006; Becken *et al.* 2003; Gössling, 2000, 2002; and Stohl, 2008). Furthemore, Becken and Patterson (2006) and Becken *et al.* (2003) have noted that tourists' travel choices make an important impact on how much energy they use. The main contributor of GHGs in the tourism industry is transport. This is mainly because of the increasingly long distances that tourists often travel between their home countries and holiday destinations and also the ways in which they travel around at their destinations (Dwyer *et al.*, 2010). It has been estimated that the mode of transport chosen to reach a destination account for between 59 % and 97 % of the carbon footprints produced by tourists (Dolnicar, Laesser, and Matus, 2010). Although a recent report by UNWTO-UNEP-WMO (2008) has found that the tourism industry contributes about 5% of global GHG emissions, this portion is currently increasing. Therefore, all stakeholders in the tourism industry, including countries bound by the Kyoto Protocol such as Thailand, need to take responsibility for reducing the carbon footprint of tourism within their borders.

Tourism is obviously sensitive to changes in the environment at local and global levels because of its dependence on facets of the natural environment: *e.g.* beaches, wildlife, snow-based sports, predictable weather patterns. Despite national variations in how tourists perceive the negative environmental impact of the tourism industry, environmental problems at holiday destinations can affect the quality of their vacations (Baysan, 2001). Hence, there is a two-way relationship between tourism and climate change: namely, tourism is both a victim of, and a contributor to, climate change, as stated by the WTO (2003: 8):

> *[O]n the one hand, tourism has an obligation to minimise its adverse impact on the environment and thus on the emission of greenhouse gases which in turn contribute to climate change. On the other hand, it was recognised that changes to the world's climate will have a direct impact on many tourism destinations which could have far-reaching implications, not just for the tourism industry, but for other economic sectors.*

Thus, tourism seems to be particularly sensitive to environmental changes. More specifically, it is especially vulnerable to a number of the recognized effects of global climate change like extreme weather events and changes to the seasons and climate which, in turn, can affect the health of tourists at holiday destinations and influence their future holiday and spending decisions. There has been a growing number of studies on the adaptation from environmental impact focusing on the effects of climate change on tourist flows and patterns of consumption: for example, studies on sensitive activities like skiing, and specific regions or sensitive environments such as coastlines, mountains and the ice caps (see Gössling and Hall, 2005; Hall and Migham, 2005).

Scholars concerned with the environmental impact of tourism have highlighted developing countries as 'the most vulnerable regions', particularly because of the limited capacity of their populations to adapt to changes in the climate due to the usage of inefficient technologies and the higher rates at which they consume natural resources such as forests (see also Swart, Robinson, and Cohen, 2003). Nevertheless, very little research has been done so far into the links between changes to the global environment and tourism in developing nations. Furthermore, it can be seen from current research trends that there is a lack of research into tourism as a dynamic and holistic system. Thus, it needs to be stressed that understanding of all facets and aspects of the tourist industry needs to be developed in order to make it more sustainable in the future.

As noted above, tourism is a major contributor to global climate problems in the respect that it accounts for at least 5% of global anthropogenic CO_2 emissions (although this could be as high as 14% if radioactive forcing is also taken into account). Additionally, tourism is heavily reliant on transportation which contributes around 75% of its overall CO_2 emissions (Scott *et al.*, 2007).

According to Wackernagel *et al.* (2002), the current global EF is greater than the Earth can provide. Theoretically speaking, sustainable development can be reached (for the impacts covered by the EF) if the EF of human activities in general is reduced below the capacity of the Earth (Peeters and Schouten, 2006). In order to maintain the sustainability of the tourism industry, effective management tools are needed to reduce its EF and thus the potential effects of emissions linked to tourism destinations. As Kelly and Williams (2007: 68) state:

> *As awareness of tourism's energy impacts on global environments increase, and as knowledge of energy impacts on global environments increase, and as knowledge of energy consumption's effects on tourism destination sustainability grows, so does the need for destination planners to develop proactive energy management policies and srategies.*

Sustainable practices related with energy management in the tourism industry are mainly implemented in two ways: (1) developing and using clean technology because improving vehicle efficiency makes a contribution towards achieving the energy and environmental goals of different nations, including the reduction of energy-consumption from direct operations (Scott, 1992); (2) promoting more environmentally-friendly behaviour among key stakeholders, especially tourists and tourism businesses, by changing their energy-use behaviour which is derived from the demands of tourists (Tabatchnaia-Tamirisa *et al.*, 1997) and influenced by personal and social variables. Therefore, in order to obtain carbon emissions from energy-use in the tourism industry, data needs to be gathered about the travelling behaviour of tourists and general business practices.

Many tourism businesses have employed different strategies to persuade tourists to act in environmentally-friendly ways because they are the key contributors of carbon emissions. Therefore, tourism businesses, and especially tour operators, are potential stakeholders whose actions may be able to reduce the carbon footprint of the tourism industry (Budeanu, 2005). Moreover, tourism businesses can persuade tourists to mitigate their carbon emissions by increasing the knowledge of their staff and tourists about environmental impact as well as by developing environmentally-friendly products (Budeanu, 2005; Lee, 2001). By doing this, a code of conduct is required to develop and exhibit within the destination (Cole, 2007). These strategies are soft tools for managing and mitigating carbon emissions within the tourism industry.

However, tourists whose actions directly result in carbon being emitted into the environment need to change their habits and behaviour: particularly reducing wasteful consumption and being disciplined about how they use resources (*e.g.* changing the kinds of transport they use, turning off lights and air conditioning before going out, and cooperating with energy-saving practices encouraged by tourism businesses (Lee and Moscardo, 2005)). By making small changes to their behaviour, tourists can easily cooperate with the tourism industry to reduce its EF, especially since eco-friendly programmes are provided by many tourism businesses (Houdré, 2008).

2.3 THE ECOLOGICAL FOOTPRINT BACKGROUND

The EF is an indicator of sustainability which has been employed to monitor and manage sustainable development in different countries, industries, and products (van den Bergh and Verbruggen, 1999). It was first suggested by William Rees in his 1992 study, "Ecological Footprints and Appropriated Carrying Capacity: What Urban Economics Leaves Out". In this work related with urbanization consumption and sustainability, Rees demonstrates the need to taking account of how large a human population different land areas and their corresponding eco-systems can support, given the rates at which natural resources are being consumed, while also sustaining themselves.

The basic purpose of EF is to measure the environmental impacts of human activities, such as GHG emissions, which consume energy and natural resources. Furthermore, EF takes account of the need for sufficiently biologically productive areas on land and water to absorb human waste products and GHGs (especially CO_2) (van den Bergh and Verbruggen, 1999).

> "[T]he footprint expresses the area of land and sea that is required to feed us, provide resources, produce energy, assimilate waste, and to re-absorb the greenhouse gases produced by our use of fossil fuels. This approach uses land as its 'currency', and provides a notional figure – the global hectare (an area equivalent to a normal hectare but adjusted for average global productivity) – to quantify the area required to support an individual, a community or a nation's population at its present standard of living."
>
> (Ross, 2006: 5)

The threats mentioned above are the results of human activities which tend to have severely negative impacts on the future of the global environment. Therefore, EF has been developed as a managerial tool for monitoring the condition of the environment as well as to reduce the impact of humanity on the earth (Wackernagel, 1998). Hence EF is a model for analyzing the demands made by humanity on eco-systems and comparing human consumption in relation to ares of land and water (Ferng, 2002). Or in still different words, EF is a measure of the consumption of natural resources that indicates the extent to which current demand is overshooting the available bio-capacity of the earth. Thus, greater rates of economic growth make larger EFs on the Earth. This is because all human activities require a certain amount of natural resources such as land, water, plants, and so on. Accordingly, people need to be concerned about how much in the way of natural resources will be available for future generations. It is also noteworthy that economic systems play an important role in creating EFs in the respect that they are driven by the availability of natural resources for satisfying current levels of consumption.

EF functions as an indicator of sustainability in regard to two facts: (1) tracking most of the resources which people consume and the resulting waste products; and (2) most of these resources and waste can be recycled and reused for further production (Wackernagel, 1998). EF can be used as an indicator of sustainability and measured in terms of both consumption and production (Chen *et al.*, 2007). Finally, the results gathered by measuring EFs can be used to create awareness of the environment and climate change.

As a conceptual framework, EF can reflect the land area necessary to sustain current levels of resource-consumption and waste-discharge by a given human population. Furthermore, it can be used to reflect clearly in international footprint comparison. The World Widelife Fund (hereafter; WWF) has demonstrated that "[t]he average footprint of every citizen of the planet is greater than 1.8 gha, and then we are over-exploiting the earth's resources and thus jeopardizing the ability of future generations to lead a decent quality of life" (WWF, 2002: 8). In 2001, the global footprint averaged 2.2 gha per person, at which level it was already exceeding global carrying capacity by 21 percent. Moreover, most over-consumption of natural resources occurred in developed countries: the largest rate being in the United Arab Emirates (9.9 gha) closely followed by USA (9.5 gha), while the UK had a total EF of 5.4 gha per person. Crucially, if everybody in the world maintained consumption patterns equivalent to those of UK citizens, three planets would be needed to support their lives. However, evidence has shown that the over-use of resources is increasingly impacting on specific areas of developing countries which are vulnerable due to their limited access to both financial support and people skills.

Currently, EF is not only used to measure the impact of human activities on the natural environment: it is also widely used to support assessments of progress towards sustainable development. Moreover, it has been adapted and expanded so that it can be applied in various disciplines (Dietz, Rosa, and York, 2007; Mingquan *et al.*, 2010). It can also can be used at varying geographical scales (*i.e.* from local to global), by various sectors (*e.g.* governments and businesses), and across many time-scales since it can be used to evaluate sustainability in the present and to estimate future levels of environmental impact (Muñiz and Galindo, 2005; Wackernagel *et al.*, 2006; Wackernagel *et al.*, 2002).

2.4 APPLYING THE ECOLOGICAL FOOTPRINT IN TOURISM

In the tourism industry, EF has been employed to monitor and measure the environmental impact of the behaviour and activities of tourists in order to assess the sustainability of the tourism industry (see also Cole and Sinclair, 2002; Gössling *et al*, 2002; Kuo and Chen, 2009; Patterson, 2003; Sonak, 2004; Stoeglehner and Narodoslawsky, 2009). These studies focus on land, energy consumption, and their impacts on the environment. For example, Gössling *et al.* (2002) have employed EF to assess the sustainability of the tourism industry in the Seychelles. They analysed EF from the aggregation of built-up land (roads, airports, accommodations, and activities), the fossil energy land footprint, and the footprints for food and fibre consumption in order to calculate areas expressed as world average space equivalent. The major contribution of EF has been to demonstrate that travel is the most significant driving force behind negative changes to the global environment: in particular, air travel accounts for 97 % of the total EF of the tourism industry (Gössling *et al.*, 2002). Additionally, Cole and Sinclair (2002) have provided a retrospective study of EF by calculating how it changed over the period between 1971 and 1995. In this way, they have contributed a comparative analysis of two different periods and thereby demonstrated the growth of EF over that period.

2.4.1 Tourism and Global Environmental Problems

Nowadays, global environmental change is one of the most important international issues, particularly in regard to temperature changes and other issues associated with the vulnerability of the climate.

> "Public opinion and environmental associations have mainly focused attention on the most evident effects of the problem, such as glaciers melting, or the extinction of species with irreparable damage to biodiversity, in addition to the main cause of the problem: massive fuel consumption….to abate the proliferation of Greenhouse gas (GHGs) and thus stop global warming, it is necessary to investigate deeply the major sources of GHGs"
>
> (Bastianoni, Pulselli and Tiezzi, 2004: 253)

It is widely accepted that most of the GHGs trapped in the atmosphere are the result of the fuel burned to run various modes of transport: mainly airplanes, vehicles, and ships (Greene and Schfer, 2003; Woodcock *et al*, 2007; Park and Heo, 2007; Papathanasopoulou, 2010). With over 900 million people annually travelling abroad, the global tourism industry is undeniably one of the main sources of these emissions. Hence there is growing recognition that international tourism requires vast amounts of energy in order to meet the demands of its customers through products, services, and experiences (Kelly and Williams, 2007). In other words, prior studies have pointed out that energy is fundamentally required not only to transport visitors to and from and around holiday destinations, but also to support amenities at those destinations (Becken, 2002; Becken *et al.*, 2003; Becken and Simmons, 2002; Becken and Hey, 2007; Gossling, 2000, 2002; Høyer, 2000; Kelly and Williams, 2007). Attention is increasingly being drawn towards both global and local tourism because the energy demands at different destinations as well as the energy needed to bring tourists to them contribute towards global climate change. Therefore, it is widely considered that the tourism industry should share responsibility for global GHG emissions and work towards minimizing their production.

Another issue which stimulates significant concern for the global environment among stakeholders in the tourism industry is the impact of climate change on tourism itself and especially the natural resources upon which it relies. As explained in the previous section, there is a two way relationship between the tourism industry and global warming. As Scott explains, climate variability and environmental change "[a]ffects a wide range of the environmental resources that are critical attractions for tourism, such as snow condition, wildlife productivity and biodiversity, water levels and quality" (Scott *et al.*, 2007: 5). Therefore, the tourism sector needs to deal with both its impact on the environment and adapting itself to meet the challenges posed by climate change.

The tourism industry is becoming increasingly concerned about the negative contribution it makes to changes in the global environment. Global warming has become one of the keywords in recent debates within the tourism industry concerning how it can integrate concern for the environment with its own developmental needs and thereby make itself more sustainable while also helping to protect the global environment. Hence the tourism sector now incorporates concern for the climate into developmental and managerial policies and planning.

However, despite the shortcomings of climate change impact, which is already influencing decision-making in the tourism community, like other sectors tourism and its related businesses have called for more links to be made between environmental problems and the goal of 'sustainable development'. However, it is not clear how the contribution made to climate change by the tourism industry can be investigated in regard to the concept of sustainable development. Since sustainable tourism still seems to drive existing problems in much the same way as traditional tourism, the industry actually needs to clarify what it considers to be genuine sustainability. Furthermore, it needs to develop a framework whereby it can explore, analyze, and link its impact on the environment to the boundaries of 'sustainable tourism development' and in response formulate environmentally pro-active management policies. In short, tourism is regarded as an agent of global environmental change. Thus, given the rising evidence of the environmental impact of tourism, its stakeholders can no longer ignore the consequences of the environmental changes that tourism brings about which affect not only its future sustainability but also potentially threaten the survival of humanity.

2.4.2 Sustainable Tourism: the Key Debates

There is currently a substantial body of literature and various schemes in operation concerned with sustainable tourism: included among the latter group are frameworks designed to maintain the natural environment at tourist destinations. Nevertheless, there are still some debatable issues around the concept of sustainable tourism. The most contentious of these concerns how 'sustainable development' and 'sustainability in tourism' may be defined. These paradigms have been described by some authors as 'problematic' and 'unrealistic' in regard to the problems inherent in defining either and measuring whatever is meant by "sustainability", especially in third world contexts (McMinn, 1997: 141). Finding an adequate definition for the concept of sustainable tourism is important for many scholars. In particular, Mowforth and Munt (2003) have pointed out that vague interpretations of the goals and consequences of sustainable tourism and development have often led to reductions in the efficiency of tourism policies and practices. Thus, the challenge at present is to clarify the meaning of sustainable tourism for all stakeholders in the tourism industry in order to ensure that it does not harm 'tourism assets': economic, environmental, and social. However, according to Garrod and Fyall (1998) and White *et al.* (2006), attention needs to be shifted away from defining sustainable tourism towards implementing it according to available definitions. In short, greater consideration needs to be given to how definitions of sustainable tourism may be put into practice. Meanwhile, arguments about the validity of different definitions of this term can reflect new ideas about, and concepts of, sustainability which may in turn pave the way for future developments in sustainable tourism.

Theories, philosophies and even new paradigms concerning sustainable tourism may seem sound, not least because they form the basis of a substantial body of academic literature and also form an integral part of many managerial tools. However, many questions have been raised about the practicalities of sustainable tourism development. There is evidence that sustainable tourism is growing worldwide, not only under this definition, but also by way of other ideas which concentrate on sustainability: for example, ethics in tourism management and codes of conduct. However, the most widely regarded alternative approach to tourism management is alternative tourism. Developing alternative tourism in primitive areas seems to be a traditional commitment for many academics and practitioners. However, in their rush to escape from mass tourism and increasing numbers of international tourists, destination managers have not hesitated in developing new forms of tourism on a smaller-scale in order to assure that they fit under the umbrella of 'sustainable tourism'. Undoubtedly, "sustainable" and "alternative" forms of tourism are overly euphemistic since they rely heavily on buzz-words and phrases: *e.g.* sustainable nature-tourism, sustainable park tourism, sustainable eco-tourism, eco-tourism, green tourism, and so on. Many destinations which promote themselves as being at the forefront of alternative tourism in fact expose themselves to negative environmental impacts similar to those brought about by conventional mass tourism (Wheeller, 1999). Moreover, it can be seen recently that not all cases of alternative tourism achieve success because they depend heavily on a single circumstance and sound understanding of managerial process

In conclusion, the evidence reviewed above illustrates that throughout the long journey of sustainable tourism development, problems have arisen both in its theorization and implementation. As many academic researchers have pointed out, sustainable tourism development has not necessarily been a success in all its forms, particularly in the case of ecotourism (Wall, 1997; Miller and Twining-Ward, 2005). Hence there are calls within the tourism industry for more action to clarify and develop sustainable tourism both in theory and practice.

As explained above, the concept of EF has been developed for the purposes of measuring sustainability in tourism development (Gössling *et al*, 2002; Hunter and Shaw, 2007; Cole and Sinclair, 2002; Hunter, 2002; Patterson *et al.,* 2007). EF analyses the area necessary to support human consumption and to absorb waste discharged by human activities. Tourism is one among a number of industries which have adopted this concept to support policy and planning formulation. Interest in the EF of tourism is also growing among practitioners and local authorities who have conducted EF tests for their businesses and areas of authority. Moreover, EF is increasingly being used for educational and awareness-raising purposes. At the same time, many local authorities are keen to use make EF measurements on a regular basis to monitor the environmental impact and sustainability of their local authority area (Barrett and Simmons, 2003).

2.5 THE ECOLOGICAL FOOTPRINT: A TOOL FOR SUSTAINABLE TOURISM ASSESSMENT

In order to assess and measure the negative impact of tourism and its related development, policy-makers require frameworks and tools whereby they can efficiently gain precise data for the purposes of developing proactive forms of tourism and plans for long-term sustainability. Of all the existing ways of determining the sustainability and environmental consequences of tourism, EF has been employed most effectively. As Hunter (2002: 8) has pointed out that tourism is one of the largest single sectors of world trade it is important to understand the demands that it makes on natural resources. He also makes use of EF to clarify the status of sustainable tourism and finally suggests that "primary research should focus on calculating the touristic EF associated with individual tourism products, throughout the product's life-cycle". However, his idea of using EF to quantify the difference between 'light green' and 'dark green' types of sustainable tourism development has so far only been expanded upon in a very small amount of subsequent research. Moreover, some researchers have made the case for EF by comparing different aspects of tourism development. EF has also been appraised as a tool for assessing environmental-sustainability by Gössling (2003: 10), who states, 'it has proved to be a valuable instrument to assess the environmental impact of travel and thus to be used more widely.'

There is some available academic research which implements these ideas by using EF models to approach sustainable tourism measurement. The first of these deals with using the footprint framework to compare the rates of consumption of specific resources in different destinations , as can be seen from the work conducted by the WWF (2002) in Majorca and Cyprus. In this study, holiday footprint is defined as:

> "[A]practical tool that enables tour operators to calculate the environmental impact, or ecological 'footprint', that a holiday product has on the environment in terms of

resources used. It also gives an estimate of the relative environmental sustainability of a product, and helps to identify opportunities for footprint reduction and cost savings." WWF (2002:3)

In this way, this study found that the ecological resources used per bed night of a typical package holiday for 2 weeks on average accounted for 0.03 hectares in Majorca and 0.07 in Cyprus. The larger tourism footprint found for Cyprus was significantly influenced by longer distance air travel. The second group of research makes comparisons of the ecological resources used by different products made available to tourists by implementing and linking up with Hunter's work, as mentioned above. This is can be seen from a study by Johnson (2003) in which the various types of tourist choices, including accommodation, food, transport, and activities are quantified, assessed and compared.

There are other initial works available which explore EF in the tourism industry and also investigate changes to environmental consumption in different areas. In order to capture progress on sustainable tourism development, Gössling *et al.* (2002) have applied footprint analysis to measure the environmental consequences of tourism activities and assess tourism sustainability. Their study assesses the total footprint left by international tourists visiting the Seychelles in 2000. They analysed how this group of tourists consumed four types of resources as defined in Wackernagel's methodological framework. Also significant in this respect is Cole and Sinclair's study (2002) 'Measuring Footprint of a Himalayan Tourist Centre', which attempts to assess environmental changes in the context of the developing world: specifically in Manali, India. Despite using secondary data sources and focusing on a specific area, their study helps to depict the potential and limitations raised by the application of EF into tourism assessment frameworks. This study also offers a holistic perspective in that its authors highlight where action could be taken to develop long-term sustainability plans.

Furthermore, recent EF applications show that most scholars (*e.g.* Patterson, Niccolucci and Marchettini (2008), Peeters and Schouten (2006), Becken and Patterson (2006), Peng and Guihua (2007) who have used the footprint model to assess the sustainability of tourism development have made use of different methods and perspectives. Obviously, the research in this area tends to extend the concept of EF to specific products such as tour-operation or inbound tourism and also to resources used in tourism such as energy and water. Furthermore, some works were conducted in the more disciplinary context of 'the bottom-up analysis'. For example, this can be seen in a study by Becken and Patterson (2006). The bottom-up method makes use of EF to study a wider range of social dimensions "[in order to] examine the influence of the combined effects of energy efficiency of different industries and tourist behaviour" (Becken and Patterson, 2006: 325). Most of these studies call for more research to be done into a wider range of geopolitical contexts (particularly in developing countries), and also for more attention to be paid to the range of resources used in tourism, including different products. According to Hunter (2002: 12)

> "…the fundamental contribution of ecological footprinting, currently absent from the great majority of tourism impact studies, would be the ability to couch actual or potential tourism activities in terms of widely scoped ecological demand beyond the physical confines of any particular geographical setting (e.g. a destination area)."

There are very few attempts to study the EF in sustainable tourism, and Hunter and Shaw (2007) also call for further research to deal with the EFs of various modes of transport at holiday destinations. To this end they offer a simple methodology for exploring the EF of domestic tourism activities and also for creating a new method of "collect[ing] 'real world' primary data for the resources consumed during the life-cycle of a range of different tourism products, including low-impact, 'genuine' eco tourism holidays of various kinds, and very up-market, luxury hotel-type holiday resorts

Adopting EF to examine possible improvements to sustainability at holiday destinations is also widespread among policy-makers and other practitioners. A range of regional ecological footprint projects have been produced in order to help local authorities use EF as the key performance indicator for measuring the impact of changes to consumption activities as well as to assess the potential environmental impact of policies for monitoring the actual impact of policies over time.

> *"Regional and local governments within the UK have shown a strong interest in the issue of global responsibility and many organisations have ended up considering the use of the ecological footprint as a comprehensive indicator of sustainable consumption"* (Barrett *et al* 2004:234).

A growing number of local authorities have conducted studies of the ecological footprints of their areas and are now attempting to act on the results. For example, the English tourism body, South West Tourism (SWT), with the cooperation of the Stockholm Environment Institute (hereafter SEI), has employed the Resource, Energy, and Analysis Program, or 'REAP tourism', to manage the environment and the impact of tourism on it in the South

West of England by focusing on sustainable tourism (SEI, 2009). SEI has integrated the input-output of ecological footprint calculations into the software tool in order to monitor and calculate both direct and indirect CO_2 emissions. SEI (2009: 4) has mentioned that "[t]o distinguish between different consumers, bottom up consumer spend, travel and energy use data is incorporated into the model." In order to allow the user to explore evidence that can be used in the policy-making process, the REAP model contains baseline data on the greenhouse gases, air pollutants, and ecological footprints for every local authority area, governmental region, and nation in the UK (Paul *et al.*, 2010).

> *"To provide a consistent set of results at the national, regional and local level, REAP combines physical data on energy and fuel use with monetary data on household and government expenditure. Using this approach, REAP can account for the full supply chain impacts associated with the food people eat, the clothes they buy, the way they travel as well as how they heat and light their homes. This allows the user to look at the impacts of individual consumption activities in the context of lifestyles as a whole (Paul et al, 2010: 2).*

In other words, REAP's indicators assess the impact of the consumption activities of both individuals and households within specific geographical areas and take account of the domestic energy used by households, the ways in which people travel and consume food, and what people buy and use. Moreover SEI (2009) confirms that since its UK launch in February 2006, REAP has been used in a wide variety of policy domains and in more than 50 projects. Approximately 20 local authorities are using REAP in their policy process, with over two thirds of all local authorities using the footprint data REAP provides. There has also been interest in developing the REAP methodology in Europe, Thailand, China, Canada and Australia.

2.5.1 Critiques of EF in Measuring the Sustainability of Tourism

In order to discuss the strengths and weaknesses of the EF approach, it is necessary to turn back to typical frameworks available for use in the past since it has taken time to develop an understanding of their pros and cons. Compared to traditional frameworks for measuring environmental impact such as Environmental Impact Assessments (hereafte; EIA), the carrying capacity concept (CC), and the limit of acceptable change system (hereafter LAC), EF offers some great advantages but also significant limitations when it is applied to the context of sustainable tourism.

2.5.1.1 Advantages of the EF Framework

A major advantage of EF is that it is an efficient tool for monitoring the contribution made by the tourism industry to global warming.

Another major benefit of EF is that it plugs a gap between other frameworks by enabling comparisons to be made between environmental impact and different sources of consumption on local and more global scales. As a consequence, it offers a bridge between our understanding of sustainable development at local and global levels. Many tools are available for monitoring environmental impacts, such as EIA and LAC. However, these methods mainly provide a microcosmic perspective of the direct effects of human beings on the environment. They rarely pay attention to the macrocosmic and indirect effects of resource consumption (Peng and Guihua, 2007). Custom tools have traditionally abandoned global perspectives of the impact of tourism by instead mainly focusing on local environmental changes. As mentioned in most tourism research (see Gössling *et al.*, 2002; Johnson, 2003; Hunter and Shaw, 2007), EF compensates for a major weakness of traditional tools, namely that they only work on small scales where conditions such as the climate, land uses, and management efforts are the same, by allowing for global comparisons of the cumulative effects of local environmental changes and impacts to be made between results. It is very useful for policy-makers because it helps them to explore and compare the effects of a diverse range of factors at different destinations. In this way, EF facilitates more pro-active decision-making as part of the process of sustainable planning.

In addition to the advantages of using ecological methods in the business sector, Barrett and Scott (2001: 323) indicate that EF offers "its ability to compare the impact of different components on the same aggregated scale as it can possibly be applied to compare the impact of energy consumption and waste generation". It is very useful for policy-makers that they can explore and compare resource consumption among diverse types source of impact in destination and therefore, it addresses more pro-active decision making in sustainable planning formulation.

As Hunter (2002) indicates, touristic EF allows for direct comparisons to be made between different types of tourism product in terms of their overall ecological performance. As a result, EF provides a means for making comparative measurements of the various types of environmental impact brought about by major components of the tourism industry: particularly, transport, accommodation, and activities. Therefore, it can help a destination to focus its tourism policies towards increasing sustainability and prioritizing its efforts to reduce both its local and global impacts (Peters and Schouten, 2006: 169).

Another advantage of EF which makes it different from other frameworks is that it provides data which can be easily communicated to the general public. Accounting for environmental impact is fundamental to the sustainability of the tourism sector, as mentioned by Becken and Patterson (2006: 336). However, it is also essential that people are made aware of the enviromental impacts of tourism. Some sets of results gathered by traditional models have been difficult for tourists and people in general to understand. This is turn can directly affect their attitudes towards the protection of the environment and how they react in related with their consumption patterns in the future. Moreover, the footprint model facilitates the tourism sector by amplifying essential knowledge about the environmental impact of tourism operation. In this respect, EF provides a profound understanding of the theory of sustainable tourism. In short, presenting simple information and basic knowledge about the conditions of sustainability at local and global levels is a crucial step towards gaining public support for sustainable tourism development, including from tourists who are major stakeholders in the tourism industry and its impacts on the environment.

2.5.1.2 The Limitations of the EF Framework

Attention has recently been drawn to the limitations of EF when applied in the context of tourism. Given the complexity and non-linear dynamics of the tourism system, it is widely recognised that the overall EF of the tourism sector cannot always be precisely distinguished due to its close links with other sectors. As Hunter (2002) has pointed out, the tourism industry is highly diverse because it embraces many trades and businesses, including the transport, accommodation, and food service industries, tour operators, retailers, and various other kinds of private business. Thus, as with other tools, the EF framework can run into serious problems when attempting to define what factors need to be calculated as sources of a given tourism footprint. Missing and / or adding variables which are not related to tourism activities can lead to the footprint size being over- or underestimated.

The lack of an adequate method for accounting for the main sources of consumption within tourism, such as waste contribution and energy-consumption, raises serious issues for sustainability monitoring. The poor statistical database currently available for quantifying the EF of tourism is the main factor currently affecting research into actual cases of tourism operation. This problem has been mentioned in many works (see Cole and Sinclair, 2002, Johnson, 2003; Patterson *et al.*, 2008). The severe of this obstacle address mainly in developing country as. In regard to these issues Gössling *et al.* (2002: 209) have stated:

> "EF analysis is often difficult to apply because it requires a detailed database on consumption and biomass yield figures. Such data is often difficult to obtain due to insufficient statistical databases, lack of transparency or unwillingness to cooperate particularly, the application of model in developing countries".

However, as more research has been done into this area, a better understanding of the relevant issues has been developed. In this way, ongoing research into the EF of tourism can help, first, to establish better databases which can be used to demonstrate its efficacy as a means for measuring the environmental impact of tourism and, second, to educate tourism management institutions to deal with relevant data sets.

As discussed previously, the term, 'sustainable tourism', is ambiguous since it can be interpreted in a number of ways and also because many types of tourism products have been used to represent what this label means in practice: for example, ecotourism, green tourism, and alternative tourism. Additionally, Gössling *et al.* (2002: 200) have pointed out that existing concepts of sustainable tourism are insufficient to make clear statements about the sustainability of particular forms of travel or certain destinations. Thus, the vagueness of this concept can render the process of making EF measurements and analyzing sustainability more difficult.

It is noteworthy that instead of using EF, sustainable tourism development can also require all three main functions, environmental, social and economic demands, to quantify the area of units required for serving the tourism industry in any given cases. In this way, it solely measures multiple environmental impacts in terms of a single aggregated indicator. The most critical issue which has been raised against EF is that it focuses solely on environmental problems whereas there are three main components of sustainable tourism: namely the environment, economics, and social issues. Therefore, given the question, 'Why does this sustainability measurement framework focus only on the environmental dimension of tourism?', it is necessary to turn to the starting point of ecological concern: those global environmental changes are perceived as a vast threat affecting all humankind. Moreover, some critiques of EF studies have questioned how these tools can make a direct impact on tourism decision-making. For example, the WWF (2002: 7) has highlighted the main factors affecting the decisions made by tourists about their holidays:

> "[P]resent consumer behaviour suggests that people do not take environmental impacts into account when buying a holiday. They are influenced more by price, and health and safety issues, rather than by some notional limit informed by an equitable or available per capita earthshare".

However, this point of view lacks a profound understanding of the data provided by an EF analysis which can be made easily understandable for all groups. Moreover, obvious evidence of current changes to the global climate, such as rising daily temperatures in tropical zones, may stimulate concern among tourists for the effects of waste, CO_2, and other impacts that they produce during their holiday periods.

2.6 THE 'ENERGY CONSUMPTION' IN TOURISM

As mentioned above, energy-consumption is a major cause of CO_2 emissions in the tourism industry and has thus attracted the interest of many scholars (*e.g.* Becken and Patterson (2006), Becken and Simmons (2002), Becken *et al.* (2001, 2003), Deng and Burnett (2000), Dolnicar *et al.* (2010), and Dwyer *et al.* (2010)). These scholars have focused not only on tourist behaviour with regard to their travel choices, but also business practices toward saving-energy. The first stream of research, which took the demand-side approach, mostly focused on the effects of the behaviour, attitudes, and values of tourists, and other influential factors, on the environment and energy-consumption (Dolnicar *et al.*, 2010). This study also took the view that tourists are key consumers of energy in the tourism industry who need to be encouraged to reduce the amount of energy they consume and thereby their impact on the environment through effective planning and policy-making.

Becken *et al.* (2001) have studied energy-consumption in the accommodation sector of the New Zealand tourism industry. They found that hotels use the single largest portion of energy in the accommodation sector: 67 % in total with 1.18 PJ. Electricity is used at the highest level in all categories of the accommodation sector. Similarly, Becken *et al.* (2003) have attempted to develop a method for measuring the CO_2 emissions of different kinds of tourists, to which end they identified the following groups: coach tourists, soft comfort travellers, auto tourists, campers, backpackers, hikers, and those visiting friends or relatives. This study determined the energy-intensity of these different types of tourist by calculating how much energy they tended to use through activities, length of stay, modes of transport, and relative to group size. The results of this study show that coach tourists tended to be the most energy-intensive per day while those visiting friends / relatives tended to be the least so.

Other studies also in a similar vein have been done by Becken and various colleagues in order to monitor CO_2 emissions relative to the transport, accommodation, and activity choices made by tourists (see also Becken and Gnoth, 2004; Becken and Simmons, 2002; Becken *et al.*, 2001; also see Martín-Cejas and Ramírez Sánchez, 2010). These studies focus on calculating the carbon footprint and EF of different facets of the tourism industry (*i.e.* transport, accommodation, and activities/attractions) and also different types of fuel (fossil fuels and electricity). They have demonstrated that, in regard to transport, domestic cars, ferries, and camper vans are the most energy-intensive when compared with all other modes of transport, respectively. In contrast, backpacker buses, scheduled buses, and motorcycles produce the least CO_2, respectively. Meanwhile, in regard to accommodation and activities / attractions, hotels, bed and breakfasts, and air and motorised water activities were found to be the most harmful to the environment.

Additionally, Martín-Cejas and Ramírez Sánchez (2010) have focused on calculating road transport usage related to tourism activities on Lanzarote, one of the Canary Islands. Their work demonstrates that tourists must make a trade-off between their own comfort and tourism development in Lanzarote. Moreover, they recommended that EF analysis can help policy-makers to understand the environmental impacts made by different stakeholders in the tourism industry.

Meanwhile, some scholars have focused on understanding either socio-economic/demographic or socio-psychological factors in order to provide insights into energy-use behaviour (Dietz, Stern, and Guagnano, 1998; Dodds, Graci, and Holmes, 2010; Shaw and William, 2002). However, most of this research has been done in Oceania and Europe. There is less interest in conducting research of this sort in Thailand, especially on Koh Samui, which is one of the country's most popular tourist destinations.

Dolnicar *et al.* (2010) have focused on short-haul travel by tourists to Switzerland, specifically by investigating their travel choices and how destinations can be designed to reduce the negative environmental impacts from tourism. They have demonstrated that travel objectives and length of stay are highly influential factors in determining tourists' travel choices. In particular, they found that trains are the most popular mode of transport for tourists going to visit friends or relatives or just travelling to urban areas. Similar studies have been done by many scholars. For example, Becken (2007) has investigated how tourists perceive climate change and the policy of air travelers towards its policy from air travellers in order to judge how much knowledge and awareness tourists have of it. She found that even though tourists accept a degree of responsibility for reducing their GHG emissions both at home and on holiday, they did not agree that limits should be placed on their freedom to use air travel. Thus, it can be seen that there is a pressing need to change the attitudes and behaviour of tourists in order to deal with this issue.

The second stream of research focuses on energy management and sustainable tourism management in regard to tourism businesses: that is, the supply-side approach (Dolnicar *et al.*, 2010). As with the demand-side approach, scholars have calculated the GHG emissions produced by tourism businesses. For example, Byrnes and Warnken (2006) have measured the GHG emissions of tour boat operators in Australia by integrating several different research methods: *i.e.* secondary data, interviews, questionnaires, and site auditions. They found that tour boat operators produced 70,000 tons of CO_2 and accounted for 0.1 % of the transport sector in Australia.

A similar study has been conducted in New Zealand by Becken and Patterson (2006), who applied both bottom-up and top-down modes of analysis to data on tourist behaviour and tourism business analysis: accommodation, transport and activity/attraction. However, this research method tends to rely on bottom-up industry surveys for data about tourist behaviour. Furthermore, it seems to overlap with the manner of calculating GHGs in the demand-side approach, but with the key difference that scholars using the demand-side approach gather data directly from tourists about their behaviour and travel choices. Additionally, many scholars have recommended EF as a tool for assessing the environmental impact of tourism and energy-use (*e.g.* Gössling (2002), Rees (1992), Sonak (2004), Stöglehner (2003)). This issue will be discussed further in the following section.

Another way of conducting research through the supply-side approach, which has mostly been applied to sustainable tourism management, is to explore the behaviour of tourists and other factors influencing the environment and energy management. Many works have investigated business practices within the tourism industry towards water, recycling, and waste management (*e.g.* Li *et al.* (2003), Redmond *et al.* (2008), Trung and Kumar (2005)). These studies provide insights into how businesses can manage and reduce the environmental impacts of tourism. For example, Trung and Kumar (2005) have shown how the hotel industry in Vietnam can deal with the environmental issues caused by tourism through better management of energy, water, and waste. These studies tend to suggest good practices which tourism businesses can follow in order to deal with environmental issues and climate change.

Another area of study aims to understand attitudes, senses of social responsibility, and perspectives toward environmental issues, including climate change and global warming, among tourism stakeholders (Becken and Carboni, 2008; Budeanu, 2005; Hall, 2006; Dalton, Lockington, and Baldock, 2007; Warnken, Bradley, and Guiding, 2005).

For example, Becken and Carboni (2008) have conducted empirical investigations of energy-use in tourism businesses. They demonstrate that all components of the tourism industry (accommodation, attraction/activity, transport, and others) tend to have good understandings of how much energy they use and how to monitor it. However, Hall (2006) has demonstrated that even though tourism businesses in New Zealand realise the potential threats of climate change and global warming, they show little commitment to acting in environmentally-friendly ways for a variety of reasons: operating costs, government regulation, competition, inappropriate rural developments, and pollution, and the effects each of them have on all participations. These issues have the combined effect of discouraging positive action from the industry. In regard to regulations, Mycoo (2006) recommends that market mechanisms and green certification can be used to indirectly enforce environmentally-friendly business practices, even if they are not supported by binding legislation.

2.7 THE ECOLOGICAL FOOTPRINT CALCULATION

As mentioned above, the tourism industry has a significant negative impact on the global environment by producing large quantities of GHGs, the major cause of which is energy-use (Becken *et al.*, 2003; Becken and Patterson, 2006; Dolnicar *et al.*, 2010). The rate of GHG emissions is rising rapidly in correlation with the growth of the tourism industry (Gössling *et al.*, 2002; Kuo and Chen, 2009). Moreover, all stakeholders in the tourism industry, including international organisations (*e.g.* UNWTO, UNEP, WMO), have acknowledged the threats posed by this trend and the contribution that tourism activities make towards it.

Many concepts have been employed to make changes at holiday destinations which can help to mitigate the local effects of tourism on the environment (*e.g.* Environmental Impact Assessments (EIA), carrying capacity concept (CCC), and limits of acceptable change system (LAC) (Gössling *et al.*, 2002). A number of tourism management concepts (*e.g.* sustainable tourism management, eco-tourism, and green tourism) have been developed to reduce the environmental impact of tourism. However, most of them focus on qualitative demonstration (Kuo and Chen, 2009). Additionally, EF, developed by Wackernagel and Rees (1996), has been employed to monitor and manage the global environmental impacts of the tourism industry (Gössling *et al.*, 2002). Therefore his section focuses on how EF is calculated in order to demonstrate the EF of energy-consumption.

Generally for prior studies like Chen and Hsieh (2010) EF uses corresponding biological productive land to estimate the resource consumption and waste absorption area of a specific population or economy. This productive area has been classified into six major categories: built-up land, Fossil energy land, Arable land, Pasture land, Sea space and managed forest land. All these categories are self-explanatory (Table 2.1) and they are estimated in terms of equivalent land area (Gössling *et al.*, 2002; Wackernagel and Yount, 1998). In other words, they are converted into a normalised measure of land area expressed in 'global hectares' (gha). The calculation of EFs then can quantify the different types of this biological productive land which specific group of consumer requires for supporting their resource consumption.

Table 2.1: Components of Productive Areas

Components	Definitions
Built-up land	Space is not used or usable because it is covered by human artifacts *e.g.* road, building, theme park, and so on.
Fossil energy land	Planted forest areas for containing the CO_2 released by humans
Arable land	Agricultural area is used for growing fruits, vegetables, and grain for human consumption
Pasture land	Land used for grazing of livestock or animal farming area covering 3.35 billion hectares
Sea space	Space for fishery and sea food covering 36.3 billion hectares
Managed forest area	Wood land space for producing timber products

Sources: Gössling *et al.* (2002) and Wackernagel and Yount (1998)

However, when it comes to calculating the EF of fossil energy land, it can be estimated in various ways. Based directly on research aim and objectives, this study consider to adopt the calculation procedure which express 'the fossil energy land' in terms of 'the forest area for sequestering CO_2'. Drawing upon the work of Wackernagel (1999) and Ferng, (2002) this method applied to calculate the land needed for fossil energy consumption by assessing the equivalent planted forest area. This forest area represents the area which is necessary to absorb the CO_2 emissions generated by burning fossil fuels (Stöglehner, 2003; Cejas and Pablo Ramírez Sánchez, 2011).

From recent literature, there are two main approaches for quantifying energy and its EF: in current research: top-down (compound) and bottom up (component) approaches (Becken and Hay, 2007; Gössling *et al*., 2005; Peeters, 2005; Hunter and Shaw, 2007; Martín-Cejas and Ramírez Sánchez, 2010) as follows.

2.7.1 The Top-Down Approach

The top-down or compound approach is frequently applied at the national level, although it can also be applied on smaller and larger scales (Becken and Hay, 2007). This method began with EF data calculated in the National Footprint Accounts, from which sub-national Footprints were extrapolated by apportioning the total national Footprint to sub-national populations. The top-down method, which works very well for nations and geographical regions, allows us to say that certain areas generally consume more or less than their fair share of resources. We can also get a crude understanding of the kinds of activities that have the greatest impact, such as food production, transport or housing.

The EF of a nation can be calculated in one of two ways. The most simple is the mass balance approach originally developed by Wackernagel and Rees (1996). This involves collecting data on the consumption in tonnes (or metres cubed for forestry) of all resources used by a given nation which is then run through an EF calculation: in this way an EF is calculated. The more complex approach, the input-output model, takes economic data as a proxy for consumption levels. Different industrial sectors are matched up against the resources they use in a matrix so that the economic intensity of each sector can be converted into figure which represents their resource intensity (Patterson and McDonald, 2004). For example, the cotton textiles sector uses 1 hectare of cropland and 3 hectares of carbon land to produce $1 worth of goods, so we can multiply the total income of the sector by those figures to arrive at its resource-use. These resource consumption levels can then be used to calculate the footprint. Data comes mainly from the UN Food and Agriculture Organisation (FAO) and national statistics offices. For tourism, this model enables researchers to quantify the interactions between different sectors of the economy and thereby calculate total energy-use and CO_2 emissions (Becken and Patterson, 2006).

Wackernagel and Rees (1996) developed this top-down approach in order to assess the resources used by humans for the purposes of production and consumption and the resulting waste products in relation to the area of productive land available. In other words, this EF model helps to assess the impacts of human activities on bio-productive areas by determining the bio-capacity of an area required to absorb GHGs (Gössling *et al.,* 2002; van den Bergh and Verbruggen, 1999; Wackernagel and Rees, 1996). Therefore, this model takes account of the natural capacity of areas of land to offset the negative effects of resource-use and waste-production linked to human activities. According to the recommendations of Schaefer *et al*. (2006), these components can be divided into two groups: (1) non-renewable resources (built-up areas and fossil-energy land); and (2) renewable resources (arable, pasture, sea, and forest). The basic idea behind this model is that consumption should be evaluated according to different categories, as shown in Table 2.1, and also that the uses to which different areas of land are put should be assigned as different categories (van den Bergh and Verbruggen, 1999). In this way, the EF can be calculated by summing up CO_2 emissions from these components. As explained by Schaefer *et al.* (2006):

> [E]F expresses the consumption of renewable resources (crops, animal products, timber, and fish), the result of the consumption of energy and the use of built-up areas in standardized units of biologically productive area (in gha). It is a measure of how much biologically productive land and sea an individual, population or activity requires to produce the renewable resources it consumes and to absorb the waste.
>
> (Schaefer *et al*., 2006: 6)

Before aggregating all these categories into the total EF, the data needs to be multiplied with an 'equivalence factor' (Wackernagel *et al.,* 1999). The figure produced by this process represents the global average yield of a given space (arable, pasture or forest) by making comparisons with the global average yields of all spaces. It is used to quantify all spaces in terms of global hectares, which is necessary because the average yield of one space may be higher than that of another (Schaefer *et al.,* 2006). These equivalence factors are the same value in all countries, but they differ from year to year. Hence to calculate an EF, it is necessary to determine the area of land (in hectares) needed to absorb the GHG emissions produced.

In tourism area, Gössling *et al.* (2002) calculated the EF of international tourists in the Seychelles in 2000 by aggregating their CO_2 emissions into different categories: transport, accommodation, activities, and food and fibre consumption. They also suggested that the figure for transport should take account of how tourists travel to and from, and around, their destinations. However, in a series of studies Becken and her colleagues have excluded food and fibre consumption from their calculations of CO_2 because they do not consider it to be a real sector of the tourism industry (Becken and Patterson, 2006; Becken *et al.*, 2001, 2003). Gössling *et al.* (2002) found that each tourist's EF is 1.9 gha per year, 90 % of which can be accounted for by air travel.

Another study which has used this model to evaluate EFs in tourism was conducted by Cole and Sinclair (2002) at the Himalayan Tourist Center in order to analyse the sustainability of Manali, India. They demonstrate that the EF of the area, over the 14 year period between 1971 and 1995, grew by 450%. Much like Gössling *et al.* (2002), Cole and Sinclair (2002) employed secondary data to calculate the EF of the tourism industry. A similar study conducted in India by Sonak (2004) found that an area with a bio-capacity of 1.2 ha produces an income of 1,000 rupees for the tourism industry. Sonak adopted the EF method to assess the environmental impacts of tourism activity. However, there are some overlaps in his calculations between resource- and energy-use. Moreover, it seems that he is mainly concerned with ecological footprints at the local level because he does not include factors such as whether tourists used air travel to get to and from their destinations.

This model has been criticised by many scholars in the field who claim it is not able to guide environmental and energy policies (*e.g.* Ayres, 2000; Ferng, 2002; Moffat, 2000; Stöglehner, 2003; Stoeglehner and Narodoslawsky, 2009; van den Bergh and Verbruggen, 1999; Wood and Lenzen, 2003). Gössling *et al.* (2002) have noted the problems raised by unavailable data for calculating CO_2 emissions from energy-use. Moreover, this model is limited by the aggregation of all CO_2 emissions into a one dimensional indicator. Therefore, the quantity of CO_2 cannot be compared with different types of energy or EF categories (van den Bergh and Verbruggen, 1999).

2.7.2 The Bottom-Up Approach

The *bottom up* approach uses locally specific consumption data in order to generate a picture of consumption within a smaller area. As WWF-UK (2006) point out that the bottom up approach can provide some useful localised information, but one significant drawback is that in many instances data on local consumption patterns can be difficult to find. Using local data also does not take account of the resource requirements of the economy as a whole or of the indirect flows associated with consumption. It has been suggested by Goedkoop and Spriensma, (2001) that a 'bottom up' component analysis be utilised to estimate regional and personal ecological footprints. It is often argued that such 'bottom up' analyses are expressed in terms that are more easily understood by end-users – personal energy use, eating (food consumption), shopping behaviour (purchases of goods and services), travel behaviour, recycling and use of materials, and water usage.

In terms of accounting for energy use and carbon dioxide emission in typical tourism industries, the bottom-up analysis is integrated into a final model of energy-relevant travel behaviour. Becken and Patterson have mentioned that "[t]he model enables us to examine the influence of the combined effects of energy efficiency of different industries and tourist behaviour" (Becken and Patterson, 2006: 325).

In summary those two different models have different characteristics, for calculating EFs different ways and characteristics (Table 2.2) of models for calculating EFs: the top-down approach (Environmental Input-Output, hereafter EIO) and the bottom-up approach (Life Cycle Assessment, hereafter LCA) (Wiedmann and Minx, 2007). Although the calculation methods of each of these models may differ, they all focus on the conditions required by the lifecycle assessment. The EIO model concentrates on economic and environmental analysis in order to give an overall picture of economic activities (Pan and Kraines, 2001). Many scholars have claimed that EIO provides the most comprehensive and robust analysis of environmental impacts and sustainability (*e.g.* Druckman and Jackson (2008), Pan and Kraines (2001), and Wiedmann and Minx (2007)).

Table 2.2: Summary of Specific Characteristics of Model for Calculating EFs

Model	Main Characteristics	Sources
Top-down Approach	Economic accounts of overall economic activities Using EIO approach Only able to consider production processes from a macro-perspective Unavailable data Convenience Less time-consuming Less analysts	Druckman *et al.* (2007); Pan and Kranines (2001); Vringer and Blok (1995); Wiedmann and Minx (2008); Wiedmann *et al.* (2006); McDonald and Patterson (2004)
Bottom-up Approach	Able to analyse CO_2 emissions at the destination level Using LCA approach Providing an analysis of each tourism sector: accommodation, transport, activities, and food consumption Providing an understanding of the overall life cycle process of each particular sector	Becken *et al.* (2001), Gössling *et al.* (2002); Becken (2002a, b); Becken and Simmons (2002) ; Becken and Patterson (2006); Monfreda *et al.* (2004); Peng and Guihua, 2007; Kelly and Williams (2007); Kuo and Chen (2009); Lin (2010)

Source: Author

Moreover, EIO offers greater convenience since it is less time-consuming and requires fewer analysts (Pan and Kraines, 2001). Therefore, this model tends to be used to assess the EF of nations or regions by environmental economists.

In contrast, LCA, or the bottom-up approach, is popular for assessing EFs within the tourism industry because it can provide analysis of CO_2 emissions for particular destinations or facets of the industry: accommodation, transport, activities/attractions, and food/fibre consumption (Becken, 2002b; Backen and Simmons, 2002; Becken and Patterson, 2006; Becken *et al.*, 2001, 2003; and Gössling *et al.*, 2002). This model provides understanding of the overall life cycle processes of particular sectors or components (Wiedmann and Minx, 2007). However, it cannot provide macro-level analysis of the whole industry (Borland, Kaufmann, and Wallace, 1998; Pan and Kraines, 2001).

Kuo and Chen (2009) have employed LCA to analyse energy-use, CO_2 emissions, and environmental loads from the tourism industry in Taiwan. They found that each tourist, on average, uses 1,606 MJ of energy and 607 litres of water, and emits 109,034 g of CO_2 per trip. They conclude that LCA is useful because it takes account of the full extent of the tourism industry's impact on the environment and allows for comparisons to be made between the specific impacts of its different sectors. Moreover, LCA provides strategic tools aimed at reducing these environmental impacts. Nevertheless, it cannot be used to analyse all the indicators for every component of the tourism industry (*e.g.* it is unable to calculate water consumption from tour operations). Finally each method offers a different development perspective, and determining which is most appropriate is a case-by-case or application-by-application Therefore, in order to consider which models will be employed to analyse EFs, the research framework, available data, and the level of analysis need to be considered

Finally apart from the steady growth of the world tourist industry including the demand on tourist facilities, huge amounts of energy are required to meet the need of tourists. As discussed by numerous scholars, tourists' activities are heavily dependent on energy-consumption in various sources of those energy (*e.g.* Becken, 2002a; Backen and Simmons, 2002; Becken and Patterson, 2006; Becken *et al.*, 2001, 2003; Gössling *et al.*, 2002; Chen and Hsieh, 2011). As far as the awareness of *energy consumption* in tourism has been raised, the little attention has put on the EF of energy consumption. Most studies in recent years concentrate on either the energy consumption behaviour of tourism stakeholders or the EF calculation. There is a lack of attention given to evaluating EF together with investigating energy consumption behaviour and attitude toward environmental impact related with EF.

2.8 CONCLUSION

A number of existing studies analyzing the EF and the energy consumption have been reviewed in this chapter. The literature related to the EF in the tourism context and the general methods for EF calculation were also explored in order to develop the most suitable framework and methodological approach for this research, as revealed in Chapter Five. This chapter also addresses the discussion on the lack of adequate research with respect to integrating the EF concept into energy consumption behaviour.

Environmental problems have long been considered as the crucial issue in tourism management, particularly in the context of sustainable development which tourism has put much emphasis on to be an environmentally responsible industry. However, as the growing concern of global environmental change which calls for more action and planning from all industry, the destination environment is no longer serving solely as the significant factor in destination competitiveness. It also plays a crucial role in the global-integrity ecosystem and a clearer response is necessary regarding practice effort and for evaluating the environmental impacts contributed by tourism and related developments. Hence, as the most important task likely to confront policy makers and planners, in order to develop long-term strategies, the industry now needs a framework which can facilitate data for their decision-making. To assist them in assessing the relative impacts of tourism on resource consumption, the EF has emerged as a key concept and method for measuring sustainability of various levels from national to local, and even for single products.

EF is increasingly accepted as the potential tool in monitoring environmental change in sustainable tourism development and in the first part of this chapter, the fundamental and theoretical issues of this tool are demonstrated so as to pave the way for an application of the footprint concept to measure the sustainability of tourism development. Various points of view in applying EF to measure sustainability in the tourism context are explored in tourism research. Most research suggests that EF is an important tool in assessing tourism sustainability and it could be applied to all types of destination and could likewise account for travel-related impacts of single components and products of tourism.

The other important point as mentioned in the previous section is that EF has both limitation and strengths. However it is important to rectify those weaknesses and promote more strengths as it can answers the most basic question for sustainable tourism development 'how many resources do we have compared with how many we use to serve tourists and related operations?' Regarding the weaknesses, even through the EF of tourism can compare different components on the same aggregate scale; the tourism industry now should pay more consideration to the remaining limiting factors in EF application, particularly the major issues of a poor statistical database, and the limited research in dealing with the complexity factor of tourism operations. Moreover, as only the environmental dimension of the three main components in sustainable tourism development has been quantified, there is a call for more qualification of the social dimension. Hence this research aims to fill this gap by integrating the energy consumption behaviour of the demand and supply sides from the EF analysis.

So far, tourism researchers and industry have made few practical recommendations about how energy consumption and its EF can be quantified. Regarding approaches to data collection and the calculation of EF, there are two basic methods in current research: the top-down (compound) and the bottom up (component) approaches (Becken and Hay, 2007; Gössling *et al*., 2002; Peeters, 2005; Hunter and Shaw, 2007; Martín-Cejas and Ramírez Sánchez, 2010). The former uses national energy, aggregate economic input-output, and the expenditure data in terms of regional or national statistics in a top-bottom way to derive EF per capita. Using widely available national statistics is the main strengths of the top-down method but the overlooking of particular issues in this approach is its limitation. The latter approach is based on daily human consumption in a bottom-up way in which the data of per capita consumption can be acquired by questionnaires and statistics (Peng and Guihua, 2007:2955). According to this approach, providing useful localised information is the main advantage characteristic. However using local data is likely to be a disadvantage as it provides an incomplete picture as the resource requirements does not take account of the economy as a whole or of the indirect flows associated with consumption.

Finally based on a review of existing energy and EF literature, this research examines the principle concept of using bottom-up analysis integrated into estimating the EF with the energy-relevant travel behaviour. The methodology decisions are based directly on the research questions and research objectives. This study therefore considers a particular set of research questions: What is the demand for Koh Samui energy for supporting the tourism industry in terms of amount of energy and how it is used by tourists and businesses? The study also considers the area of biosphere that theoretically would be needed in order to absorb CO_2 emissions from this energy consumption? The bottom-up method will enable the researcher to examine the combined effects of energy demands of different sub-sectors in tourism and also can capture the energy consumption behaviour of both tourists and businesses. However due to the limitation of the bottom-up approach, identifying the components of energy use in tourism context and the access of data are important factors. This research also employs the methodology and related processes from earlier works (Becken, 2002a; Becken and Patterson, 2006; Hunter and Shaw, 2007; Chen and Hsieh, 2011) for quantifying amount of energy, the CO_2 emission and EF with the bottom-up analysis.

It is worth noting that there is difficult to quantify all types of GHG due to data availability and the practical issues in calculation. This study follows Becken and Patterson (2006: 325) which "focuses on CO_2 emissions as the main green house gas resulting from the combustion of fossil fuels, and does not consider the emission of other greenhouse gases such as methane and nitrous oxide". Therefore in this study the EF is an assessment of tourism dependence on energy expressed in gha of the forest area required for CO_2 absorption.The identification of components and process of measuring energy and its EF in this study are explained further in Chapter Five.

CHAPTER THREE

A REVIEW OF TOURISTS' BEHAVIOUR TOWARD ENERGY CONSUMPTION AND CLIMATE CHANGE

3.1 INTRODUCTION

The literature surveyed in Chapter Two on the EF framework provides this study with effective guidelines for quantifying the size of the tourism sector's energy footprint. Consequently, based on research objective 1, this chapter focuses on tourists as "energy users". In this respect, tourists are key stakeholders in the tourism sector whose activities produce CO_2 emissions both directly and indirectly. This kind of "consumer behavior" analysis is essential for the development of proactive policies and strategies which promote sustainable energy-use in the tourism industry. Relevant factors, such as tourists' attitudes toward climate change issue and energy crisis, behaviour, and sense of social responsibility also need to be considered in the process of developing policies and strategies which advocate more environmentally-friendly behaviour.

The basic premise behind successful planning implementation is that tourists—whether they are on a week long holiday or taking a year out —should be made aware of the consequences of their energy-use behaviour and to consider how they may voluntarily alter this behavior in order to reduce their environmental impact**.** Accordingly, this chapter aims to review current literature concerning the energy-use behavior of tourists and their sense of environmental responsibility. The factors that influence energy-use and environmentally friendly behavior are discussed in this chapter with the intention of developing a framework for investigating energy-use behaviour.

This chapter will be presented in four parts which are organised as follows. It begins with a brief overview of tourist behavior. This is followed by a discussion of studies which have focused on the relationship between consumer-behaviour and environmental and social concern among consumers. These studies have paved the way to a better understanding of environmental consumption hence their relevance here. This section also discusses the phenomenon of global environmental concern and shifts in the consumption patterns of the tourism industry. The second section of this chapter concentrates on the relationship between environmental concern and tourist behaviour. In order to monitor flows and patterns of consumption among tourists, this section aims to provide understanding of the interactions and current environmental issues affecting the tourism industry especially in terms of the behaviour of tourists. Therefore, this section also discusses definitions of environmentally responsible behaviour. It also classifies these behaviours and assesses theories of environmentalism, especially within the context of the global-environment.

The third section of this chapter deals with energy-use behaviour of tourists. Previous studies concerning energy-use behavior in the tourism industry are analysed in order to develop a research framework and questionnaire which suit the purposes of this study. The relevance factors which affect energy-use behaviour and specific theories which concern its relationship with feelings of environmental responsibility are examined in the fourth section. This section also summarizes the evidence gathered by previous studies of the factors that determine and alter environmentally friendly behaviour, in response to which some principles for guiding future research and informing the design of studies of environmental behavioural are outlined. Finally, the conclusion explains the variable framework which has been developed from relevance theory and prior studies.

3.2 TOURIST BEHAVIOUR AND THE GLOBAL ENVIRONMENT

This section provides understanding of general ideas related to the tourist consumption with relation to global environmental impact and also discusses tourist in terms of environmentally responsible behaviour: *e.g.* tourists' sense of responsibility towards the environment and environmental issues. These issues will be discussed below:

3.2.1 The Significance of the Relationship between Tourist Behaviour and the Environment

The potential threats posed by uncontrolled conventional tourism to various destinations around the world, especially due to the demands of tourists, have been widely recognized since the development of the tourism industry (Dodds *et al.*, 2010; Jackson, White and Schmierer, 1996; Tabatchnaia-Tamirisa *et al.*, 1997). Moreover, the environmental impact from alternative forms of tourism, which tend to emerge in vulnerable areas, are increasingly being mentioned in current tourism discourse (Baker and Coulter, 2007; Hemingway, 2004).

3.2.1.1 Tourists and the Responsibility of Environment Impact

The tourism sector, along with many other industries in the modern world, is undergoing a change with respect to its relationship with the environment. In recent years, tourism has come to be widely regarded as a significant contributing factor towards the development of negative environmental impact, including GHG, climate change, and global warming, all of which are now recognised as causes of unprecedented changes in the global climate (Becken and Hay, 2007; Gössling and Hall, 2005). Many scholars have investigated the impact of climate change on the tourism industry (*e.g.* Amelung, Nicholls, and Viner, 2007; Belle and Bramwell, 2005; Bigano, Hamilton, and Tol, 2006; Gössling, Peeters, and Scott, 2008; Lise and Tol, 2002; Perry, 2006; Scott *et al.*, 2006; Stegier and Mayer, 2008). Furthermore, there have been many studies of how the tourism industry contributes towards climate change and global warming (*e.g.* Becken, 2002b; Becken *et al.*, 2003; Ceron and Dubois, 2005; Dodds *et al.*, 2010; Dolnicar *et al.*, 2010; Dubois and Ceron, 2005, 2006; Gössling, 2000, 2002; Hamilton, Maddison, and Tol, 2005; Høyer, 2000, 2001; Patterson, Bastianoni, and Simpson, 2006).

Even though concern for the global environment is currently growing worldwide, demand for travel is also expected to increase. Therefore, studies of the impact of the behaviour of tourists and their patterns of consumption, especially of limited resources like energy, and also the negative impacts of tourism on the environment are becoming increasingly important. Consequently, the tourism sector is becoming increasingly aware of its own sustainability and responding to widespread concerns about the future of the global environment. However, across the tourism sector the highest expectations for reducing its environmental impact have been placed on the shoulders of tourists. The decisions made by tourists regarding what kinds of transport, accommodation, and activities they choose to undertake affect energy consumption and environmental degradation (Becken, 2007; Becken and Gnoth, 2004; Becken *et al.*, 2003; Dodds *et al.*, 2010; Hudson and Ritchie, 2001; Kelly and Williams, 2007; Woodside and MacDonald, 1993; Woodside and King, 2001). Furthermore, tourists are the main agents in the tourism system which makes the impact of their behaviour and attitudes towards the environment a central concern for tourism business and policy maker. On the other hand, many scholars do not count tourists as stakeholders who should take responsibility for the environmental impact of the tourism services they use (*e.g.* Kernel (2005); Sheehan and Ritchie (2005) and Pforr (2006)). These scholars argue that tourists are not able to directly control or manage the degradation of the environment. However, as mentioned above, this thesis considers tourists to be responsible stakeholders because their leisure demands have driven the tourism industry to supply them with services during their holiday.

In order to cope with the potential threats of global environmental change, tourists and businesses related to the tourism sector must be treated as key agents by policy makers. By taking account of the environmental impact of the attitudes and behaviour of tourists and tourism businesses, it is possible to gather bottom-up data which can help to close the current gap between policies and / or strategies designed to benefit and maintain the health of the environment.

3.2.1.2 The Relationship between the Environment and Tourist Behaviours

Greater attention needs to be paid to understanding and defining the environmental impact of the behaviour of tourists. The travels of tourists influence different facets of the tourism industry: *e.g.* economic, environmental, socio-cultural, and its relationship with local communities (Kontogeorgopoulos, 2003). Tourists may have positive affects on their destinations such as by generating tax revenue, using local businesses, and increasing the employment rate. On the other hand, they may have negative impacts such as encouraging criminality, damaging the local environment, bringing about cultural and social change (Becken and Hay, 2007; Fennell, 2006; Gössling, 2002; Hall and Higham, 2005), and generally contributing to climate change (Dodds *et al.*, 2010; Hamilton *et al.*, 2005). Kontogeorgopoulos (2003) has offered a critical perspective on tourism in Phuket, Thailand, by examining the dramatic growth of the tourism industry in the area and the negative impact which this has had locally. He found that socio-cultural influences on tourists can lead them to behave in different ways which may affect the rate at which energy and local resources are consumed.

Therefore, governmental organisations and the private sector need to work together to understand the behaviour of tourists for the purposes of developing effective and efficient plans for achieving their goals and reducing the negative effects of tourism. In order to achieve the latter goal, it is necessary to analyse both the behaviour of tourists (*e.g.* itineraries, purposes, modes of transport used, durations of stay, accommodation, destinations visited, expenditure, expectations and whether these have been satisfied (Becken and Hay, 2007; Swarbrooke and Horner, 2004)) and the factors which influence their behaviour (*e.g.* cultural backgrounds, attitudes, perceptions, motivations, income levels, and reference groups (Kontogeorgopoulos, 2003; Kotler, Bowen, and Makens, 1999; Swarbrooke and Horner, 2004).

These data may directly benefit tourism businesses (Swarbrooke and Horner, 2004) which can use them as bases for future plans and marketing strategies and programmes intended to satisfy the desires of tourists. However, this is not the purpose of this study, which is instead intended to provide understanding of how the backgrounds, attitudes, and behaviour of tourists affect the environment and energy consumption (Becken *et al.*, 2003; Van Middlekoop, Borgers, and Timmermans, 2003). Importantly, because tourists are one of the main causes of climate change (Becken and Patterson, 2006; Becken *et al.*, 2003; Hamilton *et al.*, 2005; Lise and Tol, 2002; Richardson and Loomis, 2003), data on their behaviour may potentially help other sectors of the tourism industry to develop strategies to lessen their impact on the environment and generally make tourism more sustainable.

3.2.2 Consumption Patterns and Social Concerns

The influence of globalisation on a dynamic system like the tourism industry has led to vast changes in the consumption patterns, behaviour, and decision-making tendencies of tourists. Since the nineteenth century expanding horizons, resulting from increased leisure time, wealth and technological advances like air travel, have allowed more people to travel further in search of pleasurable experiences (France, 2002). These changes have affected the socioeconomic profile of tourists and introduced wide variations in the ways that people plan holidays. In other words, not only has the size of the tourism market and the distances that tourists are prepared to travel grown tourists themselves have become more sophisticated, unpredictable, and non-linear in their behaviour and decision-making processes. A major trend in this regard has been a shift away from the predominance of traditional sun, sand and sea holidays towards more experiential vacations involving a much wider range of stimulation and activities (Goodwin and Francis, 2003: 271).

These new consumption patterns and the search for a different holiday experience among tourists have been dubbed ‘the new tourism’ or ‘post-fordist tourism’. They are perceived as a response to the emphasis placed on exploitation which has become associated with mass tourism, especially in developing countries (Burns and Holden, 1995). The expectations of ‘alternative’ consumers are fundamentally different to those associated with the old perspective of mass tourism. In regard to this trend, Poon (2002: 51) has mentioned about the new perspective that “[t]here is a growing ‘see and enjoy, but do not destroy’ attitude… and changing values are also generating demand for a more environmentally conscious and nature-oriented holiday”. However, at present the environmental impact of local and global issues still arise in various forms. As Poon mentions, the key characteristics of new tourists, among which can be counted a wider range of experiences, changed values and lifestyles, products of changed demographics, and greater flexibility and independence of mind, have made the tourism sector more complicated than ever. In short, there has been a general shift in the concerns of tourists away from the functionalities of mass tourism towards experience and hedonistic consumption (Shaw and Williams, 2004).

Changes in consumer consumption behaviour may be analysed in socio-economic terms (see Shaw and William, 2002). Increases in demand and changing patterns of consumption may be caused by socio-economic factors, particularly in relation to sensitive issues such as environmental impact (Economic and Social Research Council, 2001). Significant growth in the use of environmental resources can be related to increased use of motor vehicles. Better standards of living and rising incomes generally lead people to rely on personal forms of transport especially cars which in turn results in greater CO_2 emissions (Vlek and Steg, 2007). Moreover, Cohen, Pearlmutter and Schwartz (2010) have shown that socio-economic factors (especially lifestyle, income, and social status) exert a powerful influence on the travel and activity choices made by holiday-makers.

It is also important to take into account the extent to which the eco-friendliness of consumers' behaviour differs between when they are at home and on vacation. This is because tourists tend to require greater comfort and convenience when they are on vacation than when they are at home (Dolnicar, Crouch, and Long, 2008). As mentioned above, the travel choices and behaviour of tourists result in different levels of energy consumption and also pro-environmental behaviour. Numerous scholars have identified important factors which influence how environmental friendly the behaviour of tourists is: *e.g.* nationality (*i.e.* Hudson and Ritchie, 2001; Becken and Gnoth, 2004; Baysan, 2001, Carr, 2002, Hashimoto, 2000), lifestyle, home and everyday of life (*i.e.* Barr, 2003, Cohen *et al.*, 2010, Schipper, 1996, Shove, 2002; Bargeman and van der Poel, 2006). It can be concluded from these studies that origins and living-conditions of tourists tend to influence their behaviour. Dolnicar and Leisch (2008) have collected data on the behaviour of Australian tourists, both on vacation and at home, which shows that 92 % of them behave in more environmentally-friendly ways when they are at home than on vacation. They also find out that, only a quarter of tourists follow the sustainable practices on their vacation. It is congruent with Barr et al.'s (2010:480) study that home-based practices are not always transfered into tourism contexts and "for some individuals, being environmentally conscious at home could be used to justify, or 'trade off', their lack of commitments whilst on holiday".

Scholars in the field tend to focus on either the environmental impact of holiday behaviour (*e.g.* Becken *et al.*, 2003; Budeanu, 2007; Lee and Moscado, 2005; Scott *et al.*, 2003) or home life (see also Barr, 2003; Kalantari *et al.*, 2007; Shove, 2002). Apart from Dolnicar and Leisch

(2008) and Barr *et al.* (2010) study, there has been a very limited number of research studies focused on the relationship between environmentally respondsible behaviour at home and on vacation. Investigating the relationship between energy consumption behaviour and those environmentally respondsible behaviour of tourists receives less attention. Therefore, more research needs to be done to help us understanding how energy consumption behaviour and the environmentally-friendly behaviour at home and holiday of tourist are different.

3.2.3 The Link between Tourist Behaviour and Global Environmental Impact

There is a substantial body of material concerned with how the consumption habits of tourists and psychological factors such as perception, values, motivations and attitudes affect the quality of the environment. Becken *et al.* (2003) have studied how the travel choices made by tourists affect energy consumption and the environment. They provide the quantitative data which shows how much energy is used by different modes of transport, accommodation, and activities in the tourism sector. Moreover, the attitudes of tourists bear a strong influence on the kinds of travel choices they make. Becken and Patterson (2006) have calculated the carbon footprints for different modes of transport, of which their research shows that domestic air travel produces the greatest. However, the most critically important areas of study at present are the attitudes and level of concern shown by tourists towards the state of the environment (Vlek and Steg, 2007).

However, in general environmentally responsible behaviour can be strongly linked with personal profit and individual experience among tourists. Furthermore, environmental problems connected to specific holiday destinations weigh more heavily on their minds than changes to the global environment. For example, according to a study by Baysan (2001), German tourists, who tended to participate more frequently in swimming activities than people of other nationalities, showed greater concern for the protection of 'the sea and beaches'. By contrast, people of other nationalities tended to pay greater attention to the preservation of 'historical monuments'. In a similar study of skiers, Hudson and Ritchie (2001) showed that different environmental concerns and behaviour can be linked with gender and nationality.

Moreover, tourists tend to posses the positive attitude for supporting their behaviour and some studies have shown that the attitudes of tourists towards the environment are not always consistent with their behaviour. For example, Holden (2003) draws attention to the view expressed by some trekkers that rather than harming the local environment their pastime makes a positive contribution to the local economy. Furthermore, a significant portion of the trekkers surveyed by Holden (25.5%) acknowledged that trekking can be harmful to the environment even though they had no intention of changing their holiday choice. Similarly, Lee and Moscardo (2005) have found that although high levels of environmental concern have been reported by tourists, many do not participate in the environment management practices available at the resorts in which they stayed. Thus, in order to design strategies to deal with the environmental impact of tourism, policy makers need to gain more data and to fill the gap of between the attitudes and actual behaviour of tourists.

It is also worth considering how far the environmentally-friendly habits people maintain in their daily lives, such as domestic recycling and donating to environmental organisations, influence their consumption patterns on holiday. However, as stated above, many scholars investigate these areas of concern separately: *e.g.* Barr's (2003) study of citizens and environmentally-responsible behaviour or Roberts and Bacon's (1997) study of environmental concern and consumer behaviour; and alternatively, Becken *et al.*'s (2003) work on tourists' travel choices and energy consumption. There is currently very little interest in comparing environmentally-friendly behaviour at home and on holiday. Wearing *et al* (2002) have found that while tourists tend to participate in eco-friendly schemes and pay attention to environmental issues in their home countries, they do not necessarily continue to do so at their holiday destinations. When questioned about this conflict in their behaviour, many of them responded 'I don't' know'. Wearing *et al.* (2002) take this to be indicative of a lack of knowledge among tourists about environmentally-responsible tourism products and awareness of environmental issues associated with their behaviour.

This can be linked to Gössling *et al*'s (2006) finding that there is very little awareness among tourists of the environmental problems caused by the energy-intensive lifestyles of well-educated and wealthy people and spread among young. Therefore, given the complex characteristics of consumers, including their socio-economic backgrounds, more research is needed to clarify why people behave and consume environmental assets in the ways in which they do. In the following section, the environmentally-responsible behaviour of tourists will be discussed in order to provide understanding of how they respond to eco-friendly schemes or initiatives.

3.3 ENVIRONMENTALLY- RESPONSIBLE BEHAVIOUR AMONG TOURISTS

As mentioned above, the choices that tourists make while they are on holiday have a direct and often negative impact on the environment: *e.g.* carbon footprint, waste, degradation of natural resources. Therefore, tourists cannot deny that they carry some responsibility for acting in eco-friendly ways while on holiday in order to reduce their environmental impact (Becken, 2007; Kelly and Williams, 2007). Nevertheless, there are no compulsory responsibilities or laws which force tourists to lessen their impact on the environment. Tourism businesses and governments tend to adopt codes of conduct which request rather than demand that tourists act in ways that save energy, water, and electricity. That is, policy-makers prefer to invoke tourists' sense of social responsibility (Lee and Moscardo, 2005). The key aspects of environmentally-responsible behaviour will be discussed later in this chapter. For now, this section focuses on environmentally-responsible behaviour and the willingness of tourists to pay for environmental-friendly products.

An important threat to environmentally-friendly behaviour is the cost of supplying environmentally-friendly services for both tourism businesses and their customers to whom these costs carry over (Oines and Assenov, 2006; Tartaglia and de Grosbois, 2009). Therefore, problems arise in the market for these kinds of product which generally cost more than their less eco-friendly competitors. In the case of Phuket, Thailand, it has been found that higher income tourists tend to choose environmentally-friendly accommodation. Interestingly, however, a significant relationship has not been found between environmental awareness and willingness to pay more for environmentally-friendly products. This clashes with the finding of many scholars that awareness of environmental impact is directly linked to environmentally-friendly habits and behavior: *e.g.* Hudson and Ritchie (2001), Laroche, Bergeron, and Barbaro-Forleo (2001), Lee and Moscardo (2005), Mont (2004), Shove and Warde (2002). Hudson and Ritchie (2001), in particular, have studied the sense of social responsibility, environmental concern, and willingness to pay premium prices for environmentally-friendly products among skiers in Canada. They found that tourists in this group are generally willing to pay extra for environmentally-friendly products because they are aware of the negative impact of the skiing industry on the environment. This study shows that knowledge of environmental issues can influence the behaviour of tourists with regard to the environment. Commenting on Hungerford and Volk's (1990) ideas, Lee and Moscardo (2005: 548) suggest:

> "...[i]f people became more knowledgeable about the environment and its associated issues, they would in turn become more aware of the environment in more responsible ways."

Their empirical analysis also demonstrates that 'lack of awareness' is a reason for why tourists do not commit themselves to acting in environmentally-friendly ways (Lee and

Moscardo, 2005). It has also been found that tourists' awareness of the environmental practices of businesses may improve their attitudes toward environmental issues (Cottrell and Graefe, 1997; Firth and Hing, 1999; Lee and Moscardo, 2005). Accordingly, the interpretation system within the destinations or tourism businesses can increase the knowledge of tourists about the environment and thereby encourage them to behave in more environmentally-friendly ways (Moscardo, 1999; Tubb, 2003). As noted above, nationality also seems to influence tourists' behaviour towards the environment, as can be seen from many works: *e.g.* Budeanu (2007), Chafe (2005), CREM (2000), Hudson and Ritchie (2001), and Pizam and Sussmann (1995). Interestingly, it has been found that international tourists in Thailand are unwilling to pay for improving the quality of the environment, but that they are glad to pay for better services (Baddeley, 2004). Therefore, this thesis aims also to investigate environmental friendly behaviours at the tourists' home. It may contribute to our understanding of tourists' practice and habits toward environment.

It has been noted by both Budeanu (2007) and Manaktola and Jauhari (2007) that tourists who are concerned about environmental issues also tend to choose environmentally-friendly products, but that they do not want to pay extra for those products. It might be inferred from this finding that tourists who are concerned about the environment also believe that other stakeholders should take some responsibility to provide green-practice services. For example, tourists on Phi Phi Island (Thailand) and Gili Trawangan (Indonesia) express the view that provincial governments should take the lead responsibility, followed by tourists, in preserving the local environment (Dodds *et al.*, 2010). In contrast, Law and Cheung (2007) found that tourists who are not concerned about their environmental impacts are happy to pay more for environmentally-friendly products. This is in line with the finding of Scott *et al.* (2003) that the "feel-good factor" is more important than cost in encouraging tourists to pay more for environmentally-friendly services.

Tourist behaviour is an important factor in reducing the environmental impact of tourism activity and its CO_2 emissions. As mentioned above, people who are aware of their environmental impact and entertain positive attitudes toward the environment tend to behave in environmentally-responsible ways and be more willing to pay extra for environmentally-friendly products (see also Lee and Moscardo, 2005). Scholars have employed a range of different methods or models to study environmentally-friendly behaviour. For example, Uysal *et al.* (1994) have used the New Environmental Paradigm (NEP) to understand environmentally responsible attitudes and behaviour: Reiser and Simmons (2005) and Budeanu (2007) have employed Ajzen's (1991) Theory of Planned Behaviour (TPB) to measure tourists' attitudes to environmentally-friendly behaviour; and Stern, Dietz, and Guagnano (1995) employ the schematic model of environmental concern to demonstrate how beliefs and attitudes influence the behaviour of tourists toward the environment. All of these models and methods have led to similar findings: namely that tourists who are knowledgeable and hold positive beliefs and attitudes about the environment tend to act in environmentally-friendly ways.

As is now increasingly the case among all types of consumers, in recent years tourists have become increasingly aware of their environmental impact which has in turn encouraged them to choose or consume eco-friendly products (Budeanu, 2007; Lee and Moscardo, 2005; Laroche *et al.*, 2001). Tourists from European countries (*e.g.* Britain, Italy, Holland, Germany, and Denmark) tend to prefer environmentally-friendly products and act likewise (Chafe, 2005; CREM, 2000; Goodwin and Francis, 2003; Miller, 2003). For example, CREM (2000) has shown that the star system is requested by Dutch tourists to include the sustainable practice for rating how eco-friendly different products are. Meanwhile, in their study of environmentally-friendly behaviour among tourists in Phuket, Oines and Assenov (2006) found that about 70% of tourists choose eco-friendly hotels or presumably at least hotels that advertise themselves in this way. They also found that green habits like reusing towels and bed linen and turning off electrical appliances were common among tourists at the resort. This pattern is confirmed by Tartaglia and Grosbois (2009) whose results show that most tourists tend to save electricity by turning off lights or televisions when they go out and taking showers instead of baths. They also found that less than one third of tourists made constant use of air conditioning. However, taking an overall view, they found that most tourists do not act in environmentally-friendly ways.

However, conflicts can also be found between tourist' sense of responsibility towards the environment and their actual behaviour. Chafe (2005) has shown that even though about 80% of tourists express concern for environment, only 10% of them behave in environmentally-friendly ways. This issue is also discussed by Becken (2004) who notes that tourists need to experience pleasure and gain hedonistic benefits from their vacations. In other words, they tend to be most concerned or focused on themselves when they are on holiday which can lead them to ignore eco-friendly practices. Similarly, Dalton *et al.* (2008) have found that tourists tend to focus on comfort and convenience rather environmental impact when making choices or deciding how to behave: *e.g.* whether to use air conditioning instead of opening windows, changing towels daily, and so forth. Moreover, environmentally-friendly products tend to be more expensive than the alternatives; therefore, considerations of cost may lead tourists to choose cheaper less eco-friendly products (Pembroke, 1996). Moreover, many tourists believe that tourism businesses should cover the costs of reducing their environmental impact (Dodds *et al.*, 2010; Tartaglia and Grosbois, 2009). Furthermore, it has been found by Tartaglia and Grosbois (2009) and Stern (2000) that habits, which is to say everyday routines, exert an influence over whether tourists choose to act in environmentally-responsible ways or not. If people's everyday habits are not green then they are also likely to act as an obstruction to them behaving in environmentally-friendly ways when they are on holiday.

Therefore, the willingness of tourists to pay for eco-friendly products is influenced by, among other things, subjective (*e.g.* knowledge and awareness of environmental issues) and demographic (*e.g.* nationality) factors. In order to develop sustainable management policies in the tourism sector, it is necessary to research and thereby gain understanding of how these factors affect the behaviour of tourists at home and on vacation. However, as mentioned by Trudgill (1990) and Dickinson and Dickinson (2006), we should be aware that by directly asking tourists about how environmentally-friendly their behaviour is, we may lead them to be self-defensive in their answers. Tourists may give answers which give them a good image. Accordingly, this issue has been taken into account in the questionnaire development process in order to increase the reliability and validity of the results. These factors will be employed to develop questionnaires for gathering data from tourists.

3.4 ENERGY-USE BEHAVIOUR AMONG TOURISTS

Energy is not only a key part of our everyday lives in as far as we need to switch on the lights, drive to work, and so forth. It also affects us indirectly by contributing to major changes in the global environment (Becken and Patterson, 2006; Dolnicar *et al.*, 2010). In order to establish policy guidelines which promote more environmentally-friendly forms of energy-use behaviour among tourists, it is necessary to analyse their energy-consumption habits. Cao and Mokhtarian (2005) recommend that understanding the attitudes, personalities, and lifestyle choices of tourists can be helpful in developing policies and plans which address their environmental impact. In order to develop a framework and search for factors which are influential in reducing energy-consumption and CO_2 emissions, it is necessary to look back to prior research and relevant theories as shown in Table 3.1. Furthermore, it is important to gain understanding of the habits of tourists by investigating their behaviour at home. Table 3.1 gives a review of the literature on the energy-consuming behaviour of tourists: differences between behaviour at home and on vacation are addressed.

Table 3.1: Influential Factors in the Environmentally-Responsible Behaviour of Tourists

Factors	Behaviour	Theorists
Awareness of Environmental Impact	Aware and willing to pay	Becken (2007); Dodds, Graci, and Holmes (2010); Firth and Hing (1999); Hudson and Ritchie (2001); Hungerford and Volk (1990); Laroche, Bergeron, and Barbaro-Forleo (2001); Law and Cheung (2007); Lee and Moscardor (2005); Lindsey and Holmes (2002); Mont (2004); Moscardo (1999); Shove and Warde (2002); Tubb (2003)
	Aware but unwilling to pay	Budeanu (2007), Manaktola and Jauhari (2007)
	Unaware but willing to pay – feel good	Law and Cheung (2007); Scott, Christie and Tench (2003)
	Environmentally responsible behaviour	Budeanu (2007); Chafe (2005); CREM, (2000); Lee and Moscardo (2005); Laroche, Bergeron, and Barbaro-Forleo (2001)
Price Concern	Unwilling to pay	Oines and Assenov (2006); Pembroke (1996); Tartaglia and Grosbois (2009)
Knowledge	Environmentally responsible behaviour	Budeanu (2007); Chafe (2005); CREM, (2000); Lee and Moscardo (2005); Laroche, Bergeron, and Barbaro-Forleo (2001); Mont (2004); Moscardo (1999); Shove and Warde (2002); Tubb (2003)
Attitude	Environmentally responsible behaviour	Baysan (2001); Chafe (2005); Firth and Hing (1999); Gössling, Bredbery, Randow, Svensson, and Swedlin (2006); Dodds, Graci, and Holmes (2010); Holden (2003); Hudson and Ritchie (2001); Lee and Moscardo (2005); Uysal, Jurowski, Noe, and McDonald (1994); Vlek and Steg (2007)
Environmental Concern	Environmentally responsible behaviour	Beaumont (2001); Becken (2004, 2007); Budeanu (2007); Kim, Borges, and Chon (2006); Lemelin, Fennell and Smale (2006); Luo and Deng (2008); Noe and Snow (1989); Wearing *et al*. (2002)
Demographic	Environmentally responsible behaviour	Agarwal (1992, 1997); Becken and Knoth (2004); Brandon and Lewis (1999); Chafe (2005); CREM (2000); Dietz, Stern, and Guagnano (1998); Dodds, Graci, and Holmes (2010); Hanke and Athanasiou (1970); Heslop, Moran and Cousineau (1981); Hudson and Ritchie (2001); Hung, Shang, and Wang (2009); Kalinkara (1997); Lindén (2007); Mutsukawa (2004); Oines and Assenov (2006); Tartaglia and de Grosbois (2009)
Travel Characteristics	Environmentally responsible behaviour	Anable and Gatersleben (2005); Becken and Patterson (2006); Becken, Simmons, and Frampton (2003); Bromberek (1999); Dolnicar, Laesser, and Matus (2010); Peeters and Dubois (2010); Peeters and Schouten (2006); Van Middlekoop, Borgers, and Timmermans (2003);

Source: Author

3.4.1 Patterns of Energy-Use in Tourists' Home Countries

Previous studies have investigated how people use and save energy in their everyday lives in order to provide data which can inform the development of energy-saving policies and plans: *e.g.* Barr, Gilg, and Ford (2005); Carlsson-Kanyama and Lindén (2007); Carlsson-Kanyama *et al.* (2005); Desmedt *et al.* (2009); Gyberg and Palm (2009); Lindén, Carlsson-Kanyama, and Eriksson (2006); and Steg (2008). These scholars tend to deal with energy-saving in the household and thus focus on factors which influence how people use and save energy at home. Interestingly, Kalinkara (1997), and Lindén (2007) have identified gender as being of relevance to the development of energy policies and plans and thus investigated how it affects energy-use in several aspects of people's everyday lives (*e.g.* work, family, length of marriage, and so forth). However, these studies tend to focus only on the electricity consumption.

Studies of household energy-consumption have tended to focus on energy-saving behaviour. Furthermore, a number of studies have been conducted to find out how householders can use energy more efficiently through smart consumption patterns, sustainable social practices, and better energy-saving behaviour (Gyberg and Palm, 2009; Lindén *et al.*, 2006). The findings of these studies may be beneficial in encouraging householders to change their behaviour. It can contribute towards future phases of the organisation's commitment to improving its energy-efficiency and related policies. Moreover, these findings help us to understand that consumption plays an important role in influencing how energy is used and saved (See also Gyberg and Palm, 2009). Therefore, behaviour tends to be the focal point of research into energy consumption. However, it is important to study not only how residents consume energy, but also how we can change their behaviour in this respect (Carlsson *et al.*, 2002; IPCC, 2007; Steg, 2008). Additionally, some scholars (*e.g.* Barr *et al.* (2005) and Gilg and Barr (2005)) have concentrated on the relationship between habits and behaviour in order to highlight effective ways of saving energy.

Several methods have been proposed for investigating patterns of energy-consumption in households and developing more efficient instruments which can facilitate and promote energy-saving behaviour among residents. These include the 'energy diary' developed by Brohmann and Cames of the Öko-Institut, the energy advice procedure (EAP), and the electrical audit (Desmedt *et al.*, 2009). The energy diary records daily energy-consumption behaviour in households and recommends changes which can be made to improve energy-efficiency. Meanwhile the EAP can represent the energy performance of a building. And furthermore, the electrical audit tends to be used in conjunction with the EAP in order to measure the rates of energy-consumption in households by connecting meters to all appliances (Desmedt *et al.*, 2009). Some researchers have employed an alternative method for evaluating household energy-use whereby a monitor is installed in people's homes which graphically displays information about the rates at which energy is used over different timescales (*i.e.* hours, days, and months) and the costs thereby incurred (see also Matsukawa, 2004; Ueno *et al.*, 2005; Van Raaij and Verhallen, 1989). For example, Matsukawa (2004) gave a computer monitor to 113 Japanese households for three months. Consumers could see graphs and tables of their energy-use on an hourly basis, as well as graphic comparisons with their historical performance. It is assumed, based on the theory and field research, that if residential consumers had more detailed and/or frequent information about the rates at which they consumed energy, they would have a better understanding of how they can improve the ways in which they use energy and thus act accordingly (Darby 2000; Van Raaij and Verhallen, 1983).

On the one hand, scholars can measure 'energy-intensity' by calculating the level of energy-consumption. For example, the intensity of electrical use, calculated in terms of kilowatt-hours per person per square meter of built area, can be taken as a measure of energy efficiency (Cohen *et al.*, 2010). On the other hand, survey techniques may be employed to gather understanding of how energy is used and saved in households. For example, Barr *et al.* (2005) have used questionnaires to investigate the purchasing behaviour of households toward environmentally-friendly products and their habits of using and saving energy. Similar work has been conducted by Kalinkara (1997) who analyzed the influence of attitudes, norms, experiences, and behavioural intentions on actual energy-using behaviour. Both of these studies took account of the influence of behavioural intentions on how people actually use energy. However, they differ in that Kalinkara investigated the relationship between personality factors (*i.e.* attitudes, norms, and experiences) and behavioural intentions whereas Barr *et al.* (2005) focused on the relationship between external (*i.e.* situation) and internal factors (*i.e.* environmental values and psychological variables) and behavioural intentions.

Energy-use behaviour in households typically varies according to the meteorological conditions of different geographical areas: *e.g.* weather and temperature (Carlsson-Kanyama *et al.*, 2005; Martiskainen, 2007). For example, in low temperature regions, most energy-use can be accounted for by heating while in tropical areas most energy is used for air conditioning. Moreover, the energy backgrounds, available technologies and energy policies of each country may influence the energy-consumption behaviour and habits of their respective populations (Bode, Hapke, and Zisler, 2003; Cohen *et al.*, 2010; Hudson and Ritchie, 2001; Parshall *et al.*, 2010). Thus, lifestyles and attitudes toward the environment are viewed as important factors in influencing how households use and save energy (Carlsson-Kanyama *et al.*, 2005; Cohen *et al.*, 2010; Gyberg and Palm, 2009). Global patterns of energy-use in residential households tend to be driven by fossil fuels (*c.*28 % of total energy consumption) which are a major cause of pollution (IEA, 2009). Global citizens share the same threat: damage to the global environment caused by extravagant energy consumption. Therefore, we should develop an understanding of how more environmentally-friendly patterns of energy-consumption may be promoted globally in the domestic sphere and on holiday period. The following section discusses patterns of energy-consumption in the tourism sector.

3.4.2 Patterns of Energy-Use in Tourism

In recent years, tourism has come to be widely regarded as making a significant contribution to negative changes to the global environment including through GHGs emissions (Becken and Hay, 2007; Gössling and Hall, 2005). As a result, the tourism sector is responding to widespread concerns over the future of the global environment and becoming increasingly aware of its own sustainability. Tourists have been recognized, both by the tourism industry and governments, as key agents who drive tourism and thus directly contribute to its negative environmental impacts. By developing an understanding of the attitudes and behaviour of tourists towards the environment, it is possible to gather bottom-up data which can be used to close the current gap between designing green policies aimed at making tourism more environmentally-friendly and delivering the desired outcomes (Becken, 2002a).

Concern for the global environment is growing alongside demand for leisure travel and changing patterns of resource consumption in the tourism industry. Accordingly, studies of the behaviour and consumption patterns of tourists, especially of limited-resources such as energy and water, are becoming increasingly important (Becken and Patterson, 2006; Becken *et al.*, 2003; Bode *et al*, 2003). This section focuses on the attitudes and behaviour of tourists towards energy-use. This section takes into account the literature from various academic perspectives concerned with consumption patterns among tourists and the extent to which they express concern for the environment, both at their holiday destinations and on a global scale.

According to Becken *et al.* (2003) and Becken and Patterson (2006), accommodation, transport, and attractions/activities are the main sources of energy-use in the tourism industry. Therefore, this thesis investigates how tourists use energy through these facets of the tourism industry in order to provide understanding of their attitudes and behaviour toward the environment. The findings of this study may prove helpful to policy-makers and stakeholders in developing effective plans for dealing with the amount of energy used in tourism and the environmental impact therein. As explained above, whereas a good deal of research has been done to date on energy-consumption behaviour in households, less attention has been paid to the same behaviour in the context of tourism. Furthermore, the research which has been done on energy-consumption behaviour in the tourism sector has tended to focus on either its effects on the environment (*e.g.* through CO_2 emissions) or factors which influence the behaviour of tourists and in turn how this behaviour affects the environment. By contrast, this thesis integrates both of these perspectives specifically by focusing on how much water, electricity, and fossil fuels are used by tourists in the contexts of accommodation, transport and attractions/activities and the amount of CO_2 emissions produced as a result.

Three main research perspectives can be taken when monitoring and measuring energy-use in tourism industry: (1) focusing on different facets of the tourism industry in order to understand how they influence the behaviour of tourists: *e.g.* energy-use in hotels (Bromberek, 1999; Deng and Burnett, 2000; Trung and Kumar), shopping behaviour (Lam and Li, 2003; Moscardo, 2004; Snepenger *et al.*, 2003; Yoon-Jung Oh *et al.*, 2004), tourism activities (Hudson and Ritchies, 2001), and transport (Dickinson and Dickinson, 2006); (2) focusing on factors which influence the overall behaviour of tourists: *e.g.* Dodds *et al.* (2010), Dolnicar and Leisch (2007), Dolnicar *et al.* (2008), Kitpipat (2007), Lee and Moscardo (2005); and (3) integrating these two perspectives above and calculating the environmental impact of tourism as a whole sector through the EF (Becken, 2002a; Becken and Patterson, 2006; Becken *et al.*, 2003; Dolnicar *et al*, 2010; Dwyer *et al.*, 2010; Kelly and Williams, 2007). Based on these useful literatures, it is therefore theses three perspectives are integrated in this thesis through the data collection process.

By making policy-makers aware of what factors influence the energy-use behaviour of tourists, it is possible to help them devise schemes or policies which can effectively promote more green behaviour among tourists and thereby reduce their environmental impact. For example, the European Commission (2003) has demonstrated that nearly 70% of tourists in the EU travel by car even though the most preferable mode of transport is by train (specifically because railway networks produce less pollution than other forms of transport). Indeed, British, French, Italian, Finnish and Swedish tourists tend to be more environmentally-friendly by using public transport: *e.g.* trains, buses, coaches, and so on (CREM, 2000; Hudson and Ritchie, 2001; Schmidt, 2002). Interestingly, most tourists from those countries, including those from Australia and the USA, tend to choose environmentally-friendly products (Goodwin and Francis, 2003). Most research which has been done on the environmental impact of tourism focuses on developed nations or tourists from them. Thus even when the focus is on tourism in developing nations, greatest emphasis is usually placed on the activities and behaviour of tourists from developed nations. Considerably less information is available about tourism within the developing world.

Research on the behaviour of tourists shows both positive and negative tendencies with respect to the environment. Thus, on the one hand it has been shown that many tourists do not commit themselves to environmentally-friendly behaviour because they tend to value their own pleasure most highly (Bargeman and van der Poel, 2006; Carr, 2002). On the other hand, meanwhile, many scholars have found certain kinds of environmentally-friendly behaviour to be common among tourists: *e.g.* saving electricity and water, recycling waste, using less energy-intensive forms of transport, and being willing to pay more for green services and products (*e.g.* Lee and Moscardo, 2005; Tartaglia and de Grosbois, 2009). Furthermore, it is noteworthy that Lee and Moscardo (2005) have made a comparison of the behaviour of tourists at home and on vacation in order to consider how everyday habits relate to holiday behaviour.

Becken, with various colleagues (Becken, 2002, 2007; Becken and Gnoth, 2004; Becken and Patterson, 2006; Becken *et al.*, 2003), has studied the environmental impact of the tourism industry by investigating the EF from the energy-use of tourists. She has employed secondary data in these studies: *e.g.* the number of tourists staying in accommodation, and transport and activity choices reported by the tourism authority in New Zealand. This illustrates one of the limitations of collecting data about energy-consumption and its environmental impact. The quantity of energy used by tourists cannot be calculated because of the limitations of data collected on the energy-using behaviour of tourists: *e.g.* transport, accommodation, and activities (see also Becken and Patterson, 2006). For example, tourists may not know how much energy they have used during their vacations, but they are usually able to tell how long on average they stayed in hotel rooms, how often they took showers or baths, how high they set the temperature, and so forth. Thus, many scholars, as mentioned above, have used questionnaires and qualitative techniques (*e.g.* interviews or observation) to collect data about the energy-use behaviour of tourists. This kind of information can be useful for policy-makers who need to develop strategies to promote eco-friendly behaviour among a majority of tourists. However, as is discussed in the next chapter, data about tourists needs to be integrated with data about tourism businesses.

3.4.3 Factors Influencing Environmentally-Friendly Behaviour

In order to analyse the ways in which tourists travel and consume energy, as well as their attitudes towards these things and the environment in general, this chapter concentrates on studies concerned with what factors influence environmentally-friendly behaviour. In this way, we may gain an understanding of the relationship between the ways in which people use energy when they are at home and on vacation. Furthermore, we can gain understanding of the habits, sense of social responsibility, and ways in which tourists try to act towards the benefit of the environment during their vacations by focusing on the choices they make with regard to accommodation, transport and activities. Burgess *et al*'s (1998) 'early model of pro-environmental behaviour' also highlights several aspects to green behaviour: cognitive (knowledge), affective (attitude), and behavioural (pro-environmental behaviour), respectively. As mentioned above, scholars who are concerned with household energy-consumption tend to focus on how psycho-social factors (attitudes, beliefs, values and worldviews) lead people to behave in environmentally-friendly ways. Furthermore, Dietz *et al.* (1998) have suggested that socio-economic and demographic factors also affect the ways in which people use energy. Therefore, this section examines how far these factors (*i.e.* dependent variables) promote or discourage environmentally-friendly behavior among tourists.

3.4.3.1 Demographic Profile

Dietz *et al.* (1998) have stressed that demographic data needs to form part of any adequate account of environmentally-friendly behaviour. Demographic data is crucial to most studies of tourists. The relationship between gender and environmentally-friendly behavior among tourists has been widely studied, often alongside other aspects of people's everyday lives such as marital status, employment, and family size (*e.g.* Agarwal, 1992, 1997; Hudson and Ritchie, 2001; Lindén, 2007; Kalinkara, 1997). These studies have found that women tend to be more concerned and behave in more environmentally-friendly ways than men both at home and on vacation. Income is another important demographic factor which affects how far tourists act in environmentally-friendly ways or not, particularly because it strongly influences their travel choices (Hung, Shang, and Wang, 2009; Oines and Assenov, 2006). Income has consistently been found to be a major determinant of baseline energy-use (Hanke and Athanasiou, 1970; Brandon and Lewis, 1999; Heslop, Moran and Cousineau, 1981; Matsukawa, 2004). Higher-income consumers tend to be more environmentally conscious, but this general concern does not necessarily translate into greater consciousness of the amount of energy they consume (Heslop *et al.*, 1981). Likewise, Dodds *et al* (2010), Hudson and Ritchie (2001), and Tartaglia and de Grosbois (2009) that tourists with higher incomes at their disposal tended act in less green ways, the larger numbers of tourists behave environmental-friendly.

As illustrated above in Table 3.1, the degree to which the behavior of tourists is green or not can be linked to their nationality. For instance, Tartaglia and de Grosbois (2009) have found that American tourists are generally more environmentally-friendly than their Canadian counterparts. Similarly, Becken and Gnoth (2004) have shown a correlation between the nationality and travel choices made by tourists and thus the levels of their energy consumption. Moreover, they found that older tourists are often more concerned about the environment and hence act in more eco-friendly ways than younger tourists. This finding is corroborated by Dodds *et al.* (2010) who report that older tourists are usually more committed to environmentally-friendly kinds of behavior: – *e.g.* cleaning destinations and environmental practices (waste, energy, and water). Finally, Oines and Assenov (2006) have found that education can influence to what extent people behave in environmentally-friendly ways or not. More specifically, they reportthat more highly-educated tourists tend to be more committed to environmentally-friendly practices than less-well educated tourists.

3.4.3.2 Travel Characteristics

Previous studies have noted the influence of travel characteristics on the eco-friendliness of tourist behaviour (see also Becken and Patterson, 2006; Becken *et al.*, 2003; Bromberek, 1999; Peeters and Schouten, 2006). Travel characteristics affect the transport, accommodation, and activity choices made by tourists in important ways and thereby determine how much energy they use during their holidays. Becken *et al.* (2003) have calculated the energy-intensity of the various forms of transport, accommodation, and activities linked with the tourism industry. Similar studies have been carried out by Becken and Patterson (2006), Becken *et al.* (2003), Peeters and Dubois (2010), and Peeters and Schouten (2006), all of whom focused on travel characteristics, including modes of transport, in order to calculate the energy-intensity and EF. Although it was stated above that all relevant data cannot be obtained from tourists' empirical data, information also needs to be collected about the travel characteristics of tourists in which in turn needs to be crosschecked with tourism reports conducted by local authorities.

Peeters and Schouten (2006) have asserted that travel characteristics (*i.e.* transport, distance of travelling, length of stay, accommodation, activity) directly influence the rate of energy-consumption and thus EF. They also mention that tourists who stay longer at their holiday destinations tend to act in more environmentally-friendly ways, such as by choosing less power-hungry modes of transport, because they are more relaxed. Meanwhile, Van Middlekoop *et al.* (2003) have noted a number of other factors that affect the travel choices made by tourists: *i.e.* distance to their destination, the number of people travelling, and the type of accommodation in which they plan to stay. They also mention that tourists' past holiday experiences play an important role in determining their future travel choices. Anable and Gatersleben (2005) have pointed out that the travel decisions made by tourists are often determined by considerations of convenience and flexibility. As Dolnicar *et al.* points out, tourists' travel choices are often determined by how they fit in with other objectives (*i.e.* whether they offer convenience or not). Support for this has been provided by Dolnicar *et al* (2010) who have found that tourists' objectives strongly influence which modes of transport they use: *e.g.* tourists tend to travel by train when they are going to visit their friends or relatives or travelling to urban areas. Moreover, Becken *et al.* (2003) have stressed that certain aspects of travel characteristics must be taken into account when calculating how energy-efficient different modes of transport are or can be: *e.g.* the number of people carried, the energy-intensity of different vehicle types, and travelling distance.

Meanwhile, in regard to accommodation CREM (2000) found a significant relationship between the nationality of tourists and accommodation preferences. For example, Italians tended to choose environmentally-friendly accommodation. Some important factors which have been found by Oines and Assenov (2006) to affect the types of accommodation chosen by tourists in Phuket, Thailand, are location, services, and prices. Furthermore, these authors note that higher-income tourists may prefer accommodation which is advertised as being eco-friendly regardless of cost. Another work conducted in Thailand, this time at the resort of Koh Samui, has found that tourists make decisions about accommodation based on cleanliness, value-for-money, and proximity to beaches (Vieregge *et al*, 2007). However, many other scholars who have found that hotel prices are the most important factor in determining where tourists choose to stay: *e.g.* Hung *et al.* (2009), Lewis and Shoemaker (1997), Lockyer (2005), and Oh (2000).

Accommodation choices have a direct impact on how much energy tourists consume during their holidays (see also Becken and Patterson, 2006). Therefore, gathering information about where tourists choose to stay can provide us with understanding of the link between eco-friendly behavior and accommodation. This data can in turn be used to develop policies and plans which aim to change tourists' attitudes and behaviour. However, Becken and Patterson (2006: 328) have warned about the limitations of data on energy-use in holiday accommodation: "[It is] usually not readily available, and therefore this information has to be collected from businesses."

In order to calculate the energy-efficiency of different tourism activities it is necessary to account for the average amount of energy used people undertaking them (Becken and Patterson, 2006). For example, shopping may require a large amount of energy, but it is more efficient than sightseeing because the energy used by shopping malls is shared by a large number of visitors whereas small sightseeing tours require more energy per visitor. However, the holiday destination is an important factor in determining what kinds of activities tourists choose to do (Becken *et al.*, 2003). Therefore, information about the activity and attraction choices made by tourists can help stakeholders to develop policies and plans which reduce the environmental impact of tourists and persuade them to participate in less energy-intensive activities.

3.4.3.3 Environmental Concerns

Some work has recently been done on environmental concern among have so-called "eco-tourists", which is to say tourist whose holiday-making decisions are determined by senses of social and environmental-responsibility (*e.g.* Beaumont, 2001; Lemelin *et al.*, 2006). Moreover, Lemelin *et al.* (2006) have demonstrated that experienced tourists tend to be more concerned for the environment than their less-experienced counterparts. Becken (2004) has investigated how environmental-concern translates into environmentally-friendly behaviour by looking into the practice undertaken by some tourists of planting trees to offset the environmental impact of their holidays. She found that even though approximately half of the tourists she surveyed expressed concern for the environment, only 36.1% of them committed themselves to planting trees: conversely, about 15.6% chose not to. Therefore, in spite of the discrepancy between the attitudes expressed by some tourists towards the environment and their actual behaviour, it can be inferred from Becken's study that environmental concerns play an important role in driving environmental-responsibility. This view is also supported by Budeanu (2007) who has demonstrated that the success of sustainable tourism is dependent on the level of environmental concern expressed by tourists and how far this translates into green behaviour.

Becken extended her study in 2007, this time classifying tourists into five groups according to the level of their awareness of environmental issues and how far they accept responsibility for their own environmental impact: green tourists, skeptics, resisters, uninformed but willing, and undecided (Becken, 2007). A similar study has been conducted by Kim *et al.* (2006) who classified tourists into three groups according to their level of concern for the environment: low, middle, and high. They found that tourists who expressed greater concern for the environment tended to participate in greener activities. This is corroborated by Noe and Snow (1989) who found that environmentally-concerned tourists are more easily persuaded to partake in activities linked to nature and the natural world: *e.g.* nature parks. Similarly, Luo and Deng (2008) have found that tourists who are more concerned for the environmental tend to stay closer to nature. Thus, it can be inferred from these studies that level of concern for the environment influences how far people behave in environmentally-friendly ways. However, as Wearing *et al.* (2002) have shown, the behaviour of tourists who express high levels of concern for the environmental as Dolnicar *et al.* (2010) points out, tourists' travel choices are often determinied by how they fit in with other objectives (*i.e.* whether they offer convenience or not) is not necessarily eco-friendly.

Therefore, although the behaviour of tourists who express concern for the environment may not always be environmentally-friendly, a clear link can be drawn between this concern and a desire to be close to nature (Luo and Deng, 2008). In turn, this information is of value to policy makers who aim to promote green practices among tourists.

3.4.3.4 The Attitudes of Tourists towards the Environment

Since the development of the tourism industry, the threats posed by uncontrolled conventional tourism to many destinations around the world have been widely recognized by many scholars *e.g.* Lee and Moscardo (2005), Vlek and Steg (2007), Wearing *et al.* (2002), and so forth. Moreover, the environmental impact of substantial forms of alternative tourism, which tends to emerge in vulnerable areas, is becoming increasingly acknowledged in the current discourse of tourism studies. However, the greatest expectations for reducing the environmental impact of tourism, right across the industry, have traditionally been placed on the shoulders of tourists. Furthermore, tourists are the main agents in the tourism system which is why their attitudes and behaviour towards the environment are of utmost concern. The relationship between their attitudes and behaviour towards the environment need to be investigated, particularly in light of studies such as Chafe (2005) which found that only 5% of tourists who expressed positive attitudes towards the environment act in correspondingly eco-friendly ways while on vacation.

As discussed above, there is a substantial body of literature which pays attention to the ways in which patterns of consumption among tourists and psychological factors such as perceptions, values, motives, and attitudes affect the quality of environment. At present, the most critically important areas for consideration are the attitudes of tourists towards the environment and level of concern they express for its health (Vlek and Steg, 2007). However, it should be noted that environmentally-responsible behaviour among tourists can be strongly linked to personal profit and individual experience. Moreover, tourists have generally been found to show more concern for localized environmental problems associated with specific holiday destinations than for issues affecting the global environment. For example, according to study by Baysan (2001), German tourists, who tended to participate in swimming activities more often than people of other nationalities, also tended to show greater concern for the protection of the 'sea and beaches'. Meanwhile, other national groups expressed greater concern about the need to preserve 'historical monuments'.

Another significant finding in the literature discussed above is that many tourists who claim to behave in environmentally-responsible ways do not necessarily do so. For example, as discussed above, Holden (2003) reports that many trekkers expressed the view that their pastime does not harm the environment while stating instead that it makes a positive contribution to the local economy. Some evidences in the conflict of attitude and behaviour toward environment can be seen from the group of some trekkers, 25.5%, they agree that trekking can harm environmental condition but they still asserted to consume this product. Similarly, Lee and Moscardo (2005) have found out that although many tourists report high levels of environmental concern, many of them do not participate in green management practices promoted by local authorities or businesses in resorts. These studies and others all suggest that policy makers urgently need to gain a better understanding of how attitudes correspond to behaviour in order to create more effective strategies for promoting environmentally-friendly tourism.

As noted above, a further area of study which is worthy of consideration is the relationship between home and holiday behaviour: especially how far areas of daily life such as domestic recycling and support for environmental charities may be taken as indicators of consumption patterns on holiday. For example, Wearing *et al.* (2002) have shown that tourists who show a preference for buying green products in their home countries do not necessarily shop in the same ways at their holiday destinations. As noted above, when asked about the reasons for this discrepancy in their behaviour, many responded 'I don't' know'. Wearing *et al.* (2002) took this to be indicative of a lack of knowledge about green holiday products and also limited awareness of the environmental issues associated with tourism. Another relevant issue, discussed by Gössling *et al.* (2006), is that many young, well-educated, and wealthy tourists are insensitive to the environmental problems caused by their energy-intensive lifestyles. Therefore, given the complicated characteristics of consumers, including their socio-economic profiles, more research is needed to clarify and understand why they behave and consume natural resources in the ways they have been shown to do.

Dodds *et al.* (2010) have recently studied the attitudes and behaviour towards the environment of tourists travelling in Thailand and Indonesia. The subjects surveyed in both destinations expressed willingness to pay taxes to fund sustainable tourism and also that as stakeholders in the tourism industry they should take responsibility for making it more sustainable. Furthermore, they were able to suggest ways in which they could help to reduce their environmental impact at holiday destinations: *e.g.* helping to recycle or properly dispose of waste and garbage. However, as noted above, many other studies have found that demographic factors do not significantly influence how tourists view the environment (*e.g.* Formica and Uysal, 2002; Jurowski, Uysal, and Noe, 1993; Uysal *et al.*, 1994; Zografos and Allcroff, 2007).

3.5 CONCLUSION

Since the rising interest in and concern about global environmental changes, and ecological footprint framework has become a key measurement tool of tourism studies (Becken, 2002a; Gössling *et al*., 2002; Hunter and Shaw, 2007). However, the context has often referred to individual circumstance and most of related studies focus on either estimating EF or resource consumption behaviour without considering integrating both issues together. In other words, non of single tool can bring tourism success perfectly and basically, tourism management rely on the art of academic solution as it need both natural science and social science to promote its sustainability. In order to link the EF analysis (in Chapter two) with the consumer context, this chapter attempted to emphasis the significance of tourist consumption behaviour toward energy use and explored the influential factors of that behaviour. The findings in this chapter then pave the way to developing research framework and methodology in Chapter five.

This chapter has briefly discussed tourist attitude and behaviour toward environment. As awareness of tourism's environment impacts on global environments increases, and as knowledge of tourist consumption's effects on tourism destination sustainability grows, so does the need for destination planners to develop proactive environmental management policies and strategies. As the result, the tourists themselves are at the centre of the bottom-up analysis, because they are the source of the environmental impact resulting from their travel behaviour.

As tourists have a close relationship with environment in that their holiday depend heavily on environmental factor such as the weather, sea, beach including the biodiversity of natural ecosystem as an appealing natural attractions, while most of impact affected environmental health are contribute visitor activities. However, there is a positive relationship between holiday-maker and environment in that tourist can support environment protection by providing the profit to local economy. From this point, it shows the importance of tourist behaviour which is essential to design efficient policy and maintain sustainability of a sector which is greatly influenced by the qualities of the environment at the destination.

Another main challenge in visitor management for reducing environmental impact is the changing of consumption patterns, due to the globalisation and other socioeconomic factors. Concern for the environment in which tourists travel does not necessarily translate into environmentally friendly behaviours, particularly those that are consistent with high environmental standards (Fairweather *et al*., 2005). With limitation from physical factors to psychological factors, it is impractical to stop people flying to long-distance destinations or using a car in the social of consumerism but we need for the way to decrease the over-consumption for example, a high demand placing upon limited- resources to meet the high expectations tourists *e.g.* proper heating, hot water, and so on).

CHAPTER FOUR

A REVIEW OF ENERGY-CONSUMING BEHAVIOUR AND ENVIRONMNETALLY-FRIENDLY PRACTICES AMONG BUSINESSES

4.1 INTRODUCTION

> "[O]f all the players in the activity of tourism, those in the tourism industry itself have traditionally faced more blame than all others. They have been the target for some much deserved criticism; and they have also been the easy scapegoat for many negative impacts of tourism developments"
>
> (Mowforth and Munt, 2003:165)

In recent years, tourism businesses have come under pressure not only to maximize their profits in an increasingly dynamic industry, but also to respond to growing pressure to reduce their impact on the environment. A number of key issues have arisen in this regard which tourism businesses are now expected to address, including waste and sewage management, limited water availability at many destinations, and climate change.

Given the wealth of examples of good environmental practice and publications giving advice on matters such as 'how to make your business more efficient and environmentally friendly', many observers have criticized the lethargic response of tourism businesses to calls for them to reduce their impact on the environment. Yet the tourism industry needs to deal with both the effects of climate change on holiday destinations and the changing demands of tourists who are showing increasing concern for the environment and climate change (Hall, 2006; Lynes and Dredge, 2006; Becken and Hay, 2007).

In order to develop a research path towards tourism businesses, this chapter discusses the key challenges posed for them by environmental management. This chapter proceeds in five parts. The first section demonstrates the environmental impact of tourism businesses in relation to the industry as a whole as well as energy consumption in three of its key components (*i.e.* accommodation, transport, and attractions and / or activities). This section also looks at the specific contributions of some major businesses. The following section deals with the level of concern among businesses towards climate change and global warming, and also how tourism businesses have attempted to reduce their environmental impact. The next section examines the attitudes and behaviour of tourism businesses towards the environment and climate change in order to demonstrate the main factors which encourage them to accept some responsibility for managing these issues. The final section deals with some critical issues concerning how the private sector has attempted to manage the environment at holiday destinations as well as global environmental changes.

4.2 THE ENVIRONMENT AND TOURISM BUSINESSES

As mentioned in Chapter Two, the environment is one of the most important issues for sustainable tourism management. The quality of the environment is important to the tourism industry because it directly affects the quality of tourism products (Budeanu, 2005). Therefore, different concepts (*e.g.* sustainable tourism, ecotourism, corporate social responsibility, global warming management, climate change management, and so on) have been developed by all stakeholders in tourism, including businesses, to lessen their environmental impact. On a practical level, tourism businesses have tried to implement these concepts in a variety of ways: *e.g.* eco-friendly programmes, reducing energy consumption, and encouraging eco-friendly behaviour among staff and tourists (Dief and Font, 2010).

Businesses are a major driving force behind growth in the tourism industry because they deliver the products and services consumed by tourists and also advocate a partnership approach to development at local and national levels. However, variations in the type, size, structure, and ownership of tourism businesses can lead to the differences of environmental impact. Those impacts likely expose varying in geography, time, pattern of land use and type of product or service providing to tourist and as a result, it will affect to entrepreneurs' behaviour in the way they deal with those impacts.

The products and services provided by tourism businesses can put immense pressure on local environments at holiday destinations and also have a cumulative effect on the global environment. The tourism industry can seriously affect the environment when it is allowed to develop in an uncontrolled manner, as pointed out in a UNEP (2002:1) report:

> "[T]he Construction activities and the development of tourism facilities such as accommodation, water supplies, restaurants and recreation facilities can involve sand mining, beach and sand dune erosion, soil erosion and extensive paving. In addition, road and airport construction can lead to land degradation and loss of wildlife habitats and deterioration of scenery".

In order to provide tourism services, many businesses rely directly on limited resources such as water, fossil fuel and other energy sources. Furthermore, various types of pollution are generated by investment in tourism and the decision-making which goes along with it: they include water pollution, air pollution, land pollution and visual pollution. Several important factors, including geography, level of consumption, target customer and patterns of consumption, influence how much of these different types of pollution are produced by tourism activities.

Even though tourism businesses benefit from nature and the environment, their operations often have negative effects on these things. One such way in which tourism businesses damage the environment is by releasing high levels of CO_2 through energy consumption (Becken, 2005; Scott and Becken, 2010). Becken *et al* (2003) have recently demonstrated that the energy intensity of tourism activities has a direct impact on the environment. The demands of tourists can be discerned from the kinds of products and services supplied by tourism businesses: *e.g.* cars, air conditioning, water, waste management, food, and so forth (Tabatchnaia-Tamirisa *et al.*, 1997). These services require large supplies of energy in forms such as electricity and fossil fuels from which CO_2 is released at both the production and consumption stages. Therefore, many tourism businesses have become concerned with the environmental impact of energy consumption and begun to focus on reducing the amount of energy they use. Such action helps businesses to reduce not only their impact on the environment, but also their operation costs. Nevertheless, they should still strike a balance between environmental concern and maintaining customer satisfaction.

According to Becken and Cavanagh (2003), reducing energy consumption within businesses requires no special techniques, but rather good internal management (*i.e.* attitudes, understanding, and organisational policies). In the other words, tourism businesses are eligible and capable to work towards reducing their negative effects on the environment. For example, in a recent study of tour operators, Budeanu (2005) has demonstrated that tourism businesses play an important role in both developing policies and taking actions which encourage all stakeholders in their industry to act in more eco-friendly ways. Moreover, in a study of energy consumption in the accommodation and transport sub-sectors of New Zealand's tourism industry, Becken and Cavanagh (2003) have shown how efficient plans can be developed to reduce energy consumption within those kinds of business.

As noted above, the tourism industry is linked to the environment in two crucially important ways. First, the environment is often a major attraction in the products sold by the tourism industry. Yet in spite of this fact, tourism businesses have generally shown far less commitment to reducing their environmental impact than other types of business (Mowforth and Munt, 2003). This discrepancy highlights a gap in our understanding of the practices of tourism businesses which needs further study. Second, by reducing their impact on the environment, tourism businesses can decrease their operational costs: *e.g.* fuel, electricity, water and so forth (Becken and Cavanagh, 2003). However, it is very difficult for tourism businesses to reduce energy consumption because it is considered a derived demand from tourists (Tabatchnaia-Tamirisa *et al.*, 1997). Hence some tourism businesses may neglect the importance of reducing energy consumption because they believe doing so would reduce their service quality and thus their profitability. Therefore, there is currently a need to explore how tourism businesses view their impact on the environment and how it can be reduced. In this way, relevant data can be provided for developing sustainable tourism management policies.

4.3 PATTERNS OF ENERGY CONSUMPTION AMONG BUSINESSES

Conducting an "industry analysis" of energy consumption in the tourism sector, it generally focuses on three of the main types of tourism business: accommodation, transport, and attractions / activities (Becken, 2002a). In this way, Becken and Patterson (2006) found that the study provides detailed information about energy consumption and CO_2 emissions for each of these facets of the tourism sector as well as of the industry as a whole. Moreover, information is provided about the amounts of different types of energy used by tourism businesses (*e.g.* electricity and fossil fuels).

4.3.1 Accommodation

Accommodation is one component of the tourism industry which derives its energy demands from those of its customers. It has been demonstrated in many works (Becken, 2000; Becken and Hay, 2007; Becken *et al.*, 2003; Becken and Patterson, 2006; Kelly and Williams, 2007) that there are different levels of energy consumption in different types of accommodation (*i.e.* hotels, bed & breakfasts, motels, backpacker hostels, and camp sites). Hotels use the most energy among the different types of accommodation business whereas camp sites use the least. It can be assumed that the level of service demand placed upon hotels by tourists leads to higher levels of energy consumption within them. Moreover, the energy costs of businesses are passed onto their customers, this being one of the reasons why hotels are considerably more expensive than camp sites. This, in turn, may have the knock-on effect of encouraging tourists who pay more for holiday accommodation to consume energy more heavily.

Becken and Hall (2007) have noted that the holiday accommodation sector traditionally ranges from luxury hotels, all-inclusive resorts, guesthouses, and chalets to camp sites and huts. They also explored energy consumption and GHGs emissions in different sectors of the tourism industry, noting that the diversity in the type and size of tourism businesses places limitations on the data collection process. This study confirms that it is harder to find useful information about energy consumption and GHG emissions linked to small and medium-sized businesses which are often overlooked in official records.

Electricity is the main source of energy used in holiday accommodation (Becken, 2000; Deng and Burnett, 2000; Kitpipat, 2007; Sisman & Associates, 2007). It is used to operate air conditioning, lighting, lifts and escalators, and various small electrical appliances (Deng and Burnett, 2000; Kitpipat, 2007). It has also been demonstrated that air conditioning accounts for one third of the electricity used in holiday accommodation (Deng and Burnett, 2000; Kitpipat, 2007). However, given that this figure is based on studies conducted in tropical regions, it is likely to be different for destinations where the temperature is lower in winter such as Europe or New Zealand.

Therefore, the different types of holiday accommodation and the appliances typically used within them tend to correspond to the level of energy consumption. Reducing energy consumption in holiday accommodation is problematic because doing so may lead to a reduction in the quality of the service provided. As mentioned earlier, energy consumption in accommodation is derived from the demands of tourists. Thus, in managing energy consumption, accommodation businesses must also deal with external factors relating to the socio-cultural and economic backgrounds of their customers. For example, Bromberek (1999) has demonstrated that cultural factors influence the ways in which tourists use air conditioning in holiday accommodation.

4.3.2 Transport

Transport, which is among the most important components of the tourism industry, uses huge amounts of energy from fossil fuels and thus has a large of carbon footprint (Becken, 2005; Becken *et al.*, 2003). Indeed, transport to and from holiday destinations accounts for nearly all the energy consumed by the tourism sector, at nearly 90 % (Gössling, 2002; Peeters and Schouten, 2006). Furthermore, in regard to the domestic transport used by tourists in New Zealand, Becken et al. (2003) have found that domestic air travel, ferries, and camper vans are respectively the most energy intensive. Gössling *et al* (2002) have suggested that when calculating the EF of tourist transport, everything should be taken into account, including travel to and from holiday destinations and around resorts or host countries.

Interest in the carbon footprint of tourist transport is currently growing (Peeters and Schouten, 2006; Peeters, Szimba and Duijinisveld, 2007; Becken, 2007, Martíin-Cejas and Sánchez, 2010). Most of the attention has fallen on transport in developed countries: the work of Susanne Becken on transport in New Zealand is particularly significant in this respect. By contrast, there has been far less interest in the carbon footprint of tourist transport in developing countries, including Thailand where tourism is a major industry. However, many ways of calculating the carbon footprints of tourist transport have been suggested. Peeters and Schouten (2006) argue that we should focus on distance travelled, modes of transport used, and lengths of stay because each of these factors can generate different levels of CO_2 emissions. For example, longer trips may put less pressure on tourists to travel around their holiday destinations and thus lead them to act in more eco-friendly ways. Moreover, as Becken and Patterson (2006) have mentioned, some modes of transport are more energy intensive and produce more GHG emissions than others.

On a global scale, most concern about the environmental impact of tourism is currently reserved for transport which accounts for approximately 75% - 90% of all of the GHGs emitted by the tourism sector and which contributes about one quarter of total worldwide CO_2 emissions. Meanwhile, leisure-related travel accounts for about 50% of the GHG emissions of industrialized countries (Gössling, 2002; Becken and Hay, 2007). Thus, the greatest challenge for policy-makers and practitioners of the tourism sector in fighting climate change is to reduce the GHG emissions linked to transport, particularly in the tourism sector where car and air travel are common. Moveover, Peeters *et al* (2006) have argued that a minor share of aviation-based tourism and a number of the “hypermobile” lifestyles of modern consumers accounts for most of the environmental problems associated with the aviation business in the tourism sector. Undoubtedly, these factors need to be confronted in order to reduce the EF of tourism industry. Evidence shows that the high impact of tourist travel may reflect a lack of environmental regulation, especially in regard to the fuel efficiency of air travel. However, the current upwards trend in air travel means that there are limits to the contribution that technology can make in reducing its GHG emissions. On the demand side, “poor transport infrastructure in the destination country” is a major problem for the tourism industry that influences product quality and customer satisfaction (Swarbrooke and Horner, 2004: 245). It is likely that encouraging people to minimize their environmental impact by changing the modes of transport they use is a difficult task. Moreover, maintaining customer satisfaction is a crucial mission for all tourism businesses.

Regarding transport at holiday destinations, most tourists tend to rely on cars (Anable and Gatersleben, 2005; Bieger and Laesser, 2005; Dolnicar *et al.*, 2010; Van Middlekoop *et al.*, 2003). Convenience, freedom, and flexibility are among the main reasons for why tourists prefer using cars during their vacations (Anable and Gatersleben, 2005). Travelling distance is also a major factor which influences the transport choices made by tourists. For example, Bohler *et al* (2005) have demonstrated that tourists tend to avoid using cars for longer trips. Importantly, as noted above, of all the different forms of tourist transport air travel makes the largest impact on the environment (Dolnicar *et al.*, 2010; Becken and Patterson, 2006; Becken *et al.*, 2003). Finally, since this thesis was conducted in Thailand, a variety of forms of domestic transport were included in the analysis: these include planes, trains, coaches, ferries, boats, minibuses, taxis, private and hire cars, and motorcycles.

4.3.3 Attractions and Activities

As with accommodation and transport, the demand for attractions and activities is derived from tourists. Hu and Wall (2005) have pointed out that attractions and activities give tourists important reasons for travelling long and short distances to reach them. However, they have also mentioned that there is no adequate definition of a tourism attraction. By contrast, Becken and Simmons (2002) have suggested that distinctions be made between attractions (*e.g.* visitor centres, temples, *etc.*), entertainment (*e.g.* cinemas, bars, shopping, *etc.*), and sporting activities (*e.g.* diving, jet skiing, golfing, sightseeing, *etc.*), all of which may be defined as things that tourists visit or do when they are on holiday.

The energy intensity of attractions and activities differs according to a wide range of factors. For example, air and motorised water activities consume the most energy per visit because they consume large amounts of fossil fuels (Becken and Patterson, 2006). In contrast, buildings and natural attractions are the least energy intensive types of tourism activity (Becken and Patterson, 2006). In spite of the fact that building attractions (*e.g.* museums, shopping malls, and so forth) require a large amount of energy to continue operating, their energy intensity is low because it is shared per capita across all the tourists who visit them. Thus even though air and motorised water activities may require as much energy in total as building attractions, they are more energy intensive because they are used by only individual or small numbers of tourists.

However, in addition to energy consumption and energy intensity within the tourism industry, some scholars also focus on knowledge and attitudes towards measuring and monitoring energy consumption. For example, in 2008 Becken and Carboni conducted a survey on energy consumption across a range of tourism businesses: 243 in the accommodation sector, 40 in transport, and 76 in attractions and activities. The respondents were asked about their knowledge and attitudes towards energy consumption and monitoring. As Becken and Cavanagh (2003) have noted, data of this type can help tourism businesses to develop policies and plans for tackling their environmental impact through energy consumption.

4.4 GLOBAL ENVIRONMENTAL CONCERN AND MANAGING ENERGY CONSUMPTION IN THE TOURISM BUSINESSES

Many scholars have provided insights into the environmental impact of tourism and how it can be managed sustainably at different holiday destinations. Nevertheless, environmental issues such as climate change and global warming are international problems and thus not limited to local areas or individual nations (*e.g.* Buzinde *et al.*, 2009; Dolnicar *et al.*, 2010; Dwyer *et al.*, 2010; McKercher *et al.*, 2010). There are many international organisations concerned with managing and tackling climate change and global warming: *e.g.* the Intergovernmental Panel on Climate Change (IPCC), the United Nations World Tourism Organization (UNWTO), the United Nations Environment Programme (UNEP), and the World Meteorological Organization (WMO). In 2008, international specialists and experts from UNWTO, UNEP and WMO fused their resources and knowledge of the environmental impact of tourism across the world in order to provide guidelines for managing and developing policies aimed at tackling climate change and global warming (UNWTO- UNEP-WMO, 2008).

The GHGs emitted by the tourism industry have serious negative consequences for the global environment. Awareness of this fact has raised the level of concern about the environmental costs of tourism beyond local destinations and countries to the world at large. Furthermore, the increasingly international character of the tourism industry makes it a global concern. All activities related to the tourism industry to greater or lesser degrees have negative effects on the environment (Becken, 2002a; Becken and Patterson, 2006). Therefore, the environmental impact of tourism should be viewed as a global phenomenon, the effects of which cannot only be measured at particular holiday destinations (Dolnicar *et al.*, 2010). However, the concept of EF (Becken, 2002a) can help scholars to determine to what extent different destinations contribute towards climate change and global warming.

It has been estimated that GHGs accumulating in the atmosphere will result in an average increase in the global temperature of about 4.4 ^{o} C over the next century (IPCC, 2007). Tourism is a major producer of GHGs and thus an important player in this issue. As mentioned above, all components of the tourism industry (*e.g.* accommodation, transport, and attractions and activities) consume huge amounts of energy, especially from fossil fuels (Dwyer *et al.*, 2010), and contribute about 5 % of total global CO_2 emissions and14 % of total global GHG emissions from human activities (UNWTO-UNEP-WMO, 2008). Accordingly, the rising GHG emissions linked to worldwide growth in the tourism industry is a global concern. Air travel is a major contributor of GHGs, especially through long-haul flights which are often used by tourists for travelling to holiday destinations (Becken, 2002). Long-haul flights account for only 2 % of all trips, but contribute 17 % of GHGs (Simpson *et al.*, 2008).

International concern about climate change and global warming has been growing for some time. In 1997 a major international agreement, the Kyoto Protocol, was made between with the aim of tackling these issues. The Kyoto Protocol is linked to the United Nations Framework Convention on Climate Change. It has been signed by 37 industrialised countries and the European Community and thus holds those countries to reducing their GHG emissions by 5.2 % relative to 1990 levels by 2012 (UNFCCC, 2005). This action contributes not only to reducing the global impact of GHG emissions, but also promotes responsibility among nations. More recently, in 2009 Copenhagen hosted the United Nations Climate Change Conference (officially known as the Conference of the Parties 15), the aim of which was to strengthen international cooperation on climate change and to replace the Kyoto Protocol (Scott and Becken, 2010).

In order to achieve the goals of reducing the output of GHGs from human consumption, the concept of EF, first introduced by Wackernagel and Rees (1996), has been employed to measure the CO_2 emissions of different industries including tourism. More specifically, EF has been adapted to measure CO_2 emissions from four components of the tourism industry: accommodation, transport, activities and food consumption (Gössling *et al.*, 2002). However, UNWTO-UNEP-WMO (2008) and Becken and Patterson (2006) do not include food consumption in their calculations. Instead, they focus on transport, accommodation and attractions / activities. Becken and Patterson (2006) justify this omission by arguing that food consumption is a tourism-related industry rather than a main component of the tourism industry. Furthermore, UNWTO-UNEP-WMO (2008) has divided transport into three main categories: air travel, cars, and other forms of transport.

Although measuring EFs at holiday destinations can increase awareness of climate change and global warming among stakeholders, it is merely a reactive way of developing policies and plans aimed at reducing the negative effects of tourism on the environment. In order to effectively and sustainably reduce its environmental impact, the tourism industry needs to develop proactive ways of reducing its CO_2 emissions. Tourism businesses are among the stakeholders who must take responsibility for finding proactive ways of reducing their CO_2 emissions (Becken and Cavanagh, 2003). Scott and Becken (2010) recommend that tourism businesses can achieve this end if they cooperate with sustainable practice scheme. By taking such action, they can help not just to reduce their environmental impact, but also to decrease their operational costs and thereby increase their profitability (Becken and Hay, 2007; Scott *et al.*, 2008).

Recent work by Coles *et al* (2010) on the influence of networks on innovation has demonstrated the kinds of action that can be taken between members and non-members of tourism networks to reduce their CO_2 emissions. The authors found no significant differences in innovations for reducing climate change between member and non-member businesses. However, they did demonstrate a positive relationship between the level of membership and the extent of innovation. Support for this finding is provided by Scott and Becken (2010) who found in discussions with representatives of the tourism business community at the Copenhagen Climate Conference that participation in climate changes schemes can help businesses to encourage and motivate tourists to adopt more eco-friendly behaviour.

It has also been shown by a series of studies that commitment to environmental schemes benefits businesses not only in terms of cost efficiency, as mentioned above, but also reputation (Dief and Font, 2010; Kärnä, Hansen, and Juslin, 2003). That is, by adopting such schemes, tourism businesses, especially hotels, can employ the “green” concept to reduce their CO_2 emissions and strengthen their business image (Dief and Font, 2010). However, in their study of perception and adaptation among tourism businesses in Finland, Saarinen and Tervo (2006) found that even though businesses are generally aware of climate change as a global issue, around half of them have not adopted eco-friendly programmes in response.

An important means of tackling climate change and global warming is through legislation aimed at controlling business practices, as highlighted by Carter *et al* (2004). Nevertheless, the same authors also pointed out a lack of any such legislation enacted at the time of publication. Moreover, the Copenhagen Climate Conference drew attention to widespread uncertainty among business communities about climate change and global warming policies as well as a lack of legislation holding businesses to deadlines for mitigating the environmental impact of their operations (Scott and Becken, 2010). Hence environmental issues, including climate change and global warming, are global concerns for which all nations and stakeholders in the tourism industry must share responsibility and thus try to reduce their CO_2 emissions. These issues are specified in the Kyoto Protocol and extended in the Copenhagen Climate Conference in order to encourage cooperation in reducing global CO_2 emissions. Furthermore, the relationship between tourism and climate change can be considered in terms of either climate change affecting the tourism industry or the tourism industry contributing to climate change (Dolnicar *et al.*, 2010). Therefore, tourism businesses should not deny their responsibility for managing and reducing their environmental impact. However, there is a critical discussion to be had over whether tourism businesses should be self-regulated or bound by environmental laws.

4.5 THE ATTITUDES AND BEHAVIOUR OF BUSINESSES TOWARDS THE ENVIRONMENT AND CLIMATE CHANGE

In order to deal with the environmental impact of tourism, it is important to take account of how tourism businesses respond to issues such as climate change and global warming and policies and planning aimed at addressing them. Importantly, climate change is increasingly coming to be seen as a stimulus for change in the tourism industry particularly as its effects on the weather at tourism destinations begins to become apparent. As Elsasser and Bürki have recently put it, climate change is ‘a catalyst that is reinforcing and accelerating the pace of structural changes in tourism’ (2002: 253). Accordingly, this section examines how tourism businesses perceive climate change and other environmental issues and also how they regard their own responsibility for managing their impact on the environment.

Therefore, the first part of this section discusses the motives for tourism businesses to adopt better environmental management practices as well as greener image. The second part deals with the attitudes and behaviour of tourism businesses towards the environment and climate change and the main factors that can encourage them to take responsibility for managing their impact on the environment.

4.5.1 Factors Influencing Environmentally-Friendly Business Operations

In recent years, tourism businesses have had to face not only significant changes in the consumption patterns of their customers but also to deal with the global environmental changes being brought about by global warming. Given that tourism businesses make a significant contribution to global environmental problems, it is imperative that they take responsibility both for reducing their immediate impact on the environment and promoting greener patterns of consumption among tourists. One way by which tourism businesses can be made to do this is through laws and legislation demanding compliance. However, they can also be encouraged to self-regulate on this matter by developing their own policies and practices for reducing their environmental impact. The main factors driving businesses to become more environmentally responsible and willing to adopt green initiatives are tourist demand, cost reduction, competitiveness, and reputation (Hu and Wall, 2005). Hence most attention tends to fall on tourist demand and reputation regarding to the key factor promoting more sustainable practices among tourism businesses.

The tourism industry has long been seen as demand-driven and since demand is liable to change, tourism businesses must therefore respond to shifts in the consumption habits of their customers. As people across the world become more aware of global environmental problems they have begun to alter their attitudes to the things they consume, and increasingly demand more ‘environmentally friendly’ and ‘ethically correct’ products (Holden, 2000). Thus, there is now growing demand in the tourism sector for businesses which offer their customers environmentally-friendly products or services. In turn, this trend is encouraging tourism businesses to change how they operate, such as by adopting energy efficiency measures to reduce their GHG emissions (Ayala, 1995). Many tourism businesses have also grasped this trend by participating in the proliferation of emission reduction schemes aimed at improving their environmental performance. One such scheme, namely ecolabels, was introduced as a way of providing consumers with information about how green businesses, products, or services are so that they can make informed decisions about whether to buy them or not. However, there is little evidence to date that consumers recognise tourism ecolabels or base their decisions on them (Font, 2002). A potential problem with such schemes is that some tourism businesses may use them as propaganda to attract tourists who are concerned about the environmental issues.

As consumers become more concerned about the environment, companies and industries will show greater willingness to protect it because they recognise the potential benefits to be gained by responding to this market trend (Hu and Wall, 2005: 622). Likewise, some businesses will treat labels like “green” or “environmentally-friendly” as means of improving their brand image rather than ethical goals to be achieved. Therefore, they may employ these terms to promote themselves in the marketplace with little or no intention of reducing their environmental impact (Sustainable Tourism Steward Council; STSC, 2005).

4.5.2 Attitudes and Behaviours

Tourism businesses are coming under increasing pressure to take account of worldwide concern for changes to the global environment and the need to move towards more sustainable development within the tourism industry. Setting aside for now the complexity of the worldwide tourism industry as a whole, individual tourism businesses are also highly complex and differ in many respects. In particular, the socio-economic contexts in which tourism businesses are situated can lead to various levels of environmental awareness among their owners, management, and staff and thus a wide range of responses to environmental issues.

A number of studies (*e.g.* Becken and Carboni, 2009; Becken and Cavanagh, 2003; El Dief and Font, 2010; Hashimoto, 2000; and so forth) suggest that attitudes are one of the most significant factors shaping environmentally-friendly business operation. Additionally, a number of other important factors influencing how far tourism businesses go towards reducing their environmental impact have been highlighted, the most influential of which is socio-economic context. For example, businesses which actively seek more environmentally-friendly business outcomes possess supply-side tourism development values and so have more business experience. In turn, these businesses will have developed more sophisticated environmental management systems (EMS) which they will find more useful in ensuring good environmental performance (Herremans, Reid and Wilson, 2005) .

One stream of consideration focuses on the crucial factors which dominate environmental management in tourism businesses. Herremans *et al.* (2005) have found that tourism businesses can be encouraged to adopt greener values and to use more environmental management systems by providing them with training and orientation programmes, and also by partnering them with similar businesses which are more experienced in these respects.

However, it is still questionable in that the most important problem derives from their lacking of knowledge or less of environment awareness (Herremans *et al.*, 2005). Among accommodation businesses, the failure of environmentally-responsible programmes is not due to ‘a lack of concern’ or understanding of their environmental impact (Jurowski, 2005). Rather, there is a conflict between attitudes and actual behaviour, since accommodation businesses may often understand the importance of environmental protection programmes while being influenced by other factors which for them outweigh protecting the environment. However, some business owners expect other stakeholders to manage the environment for them. For example, Hashimoto (2000: 142) has found that managerial staffs in the tourism industry in parts of East Asia (*i.e.* China, Japan and Taiwan) tend to take the view that "the responsibility for solving environmental problems is basically either that of government or society". The government is usually expected by 'day to day' practitioners to be the primary actor in environmental management. This is especially the case in developing countries where people are still struggling to fulfil their basic needs and where environmental problems linked to tourism are likely to grow in the near future.

However, in recent years many tourism businesses in the accommodation, transport, and touring sectors have begun to alter their strategies and practices to improve how they manage their effects on the environment. Thus, in order to offset negative changes to the environment while continuing to meet consumer demand, many of them have developed and operate environmentally friendly business strategies. For example, proactive energy management strategies and resource programmes have been employed by tourism businesses to encourage their customers to consume less energy and recycle waste where possible (Li *et al.*, 2002)

Technology is another important factor which influences the behaviour of tourism businesses towards the environment. In light of the gathering pace of globalization and technological improvements, some private companies are becoming more confident that the undesirable effects of tourism on the environment can be controlled by advances in technology. As Hashimoto (2000) has found, tourism businesses frequently hold the view that people can maximise the utility of natural resources with technological assistance, and that impacts on nature over a long time-scale are minimal. Thus, in some cases, such as the aviation industry, the most popular way of demonstrating environmental concern is by investing in better technology: for example, "purchasing a new fleet of aircraft that are more expensive but have superior environmental performance" (Lynes and Dredge, 2006: 134). Furthermore, some individual business owners or managers may try to make up for discrepancies between their concern for the environment and their actual business practices by giving financial support to environmental protection schemes.

Finally, it is worth noting that the complexity structure in various types of businesses and in differently managerial resources in tourism industry, including the socio-economic factors, shape divers attitude and behaviour toward their environmental management. Given the example evidence of critical viewpoint which obviously different in attitude and operation in environmental management, consideration would to pay for the SMEs behaviour (see in 4.7) which increase in volume and play a vast majority in tourism industry movement. Given the lack of action currently being taken by businesses to address the effects they have on the environment, more research is needed to improve current understanding of the factors which promote better environmental management among them. In turn, these variations suggest that greater attention should be paid to how businesses perceive the environment and behave towards it.

4.6 THE TOURISM INDUSTRY: ADAPTING TO CHANGES IN THE GLOBAL ENVIRONMENT

> "[T]he scientific evidence is now overwhelming: climate change presents very serious global risks, and it demands an urgent global response. The business community must also consider these risks and determine its response, and the tourism industry is likely to be impacted more than most."
>
> (Gibson, 2007: 1)

In recent years, the tourism industry has come to be recognised as a major driver of damaging changes to the global environment. Tourism has traditionally depended heavily on a stable and predictable climate and healthy environments at holiday destinations. However, these things can be affected by the results of changes to global climatic conditions, such as sudden seasonal shifts, which can potentially harm the quality of the products offered by the tourism industry and so affect the consumption patterns of tourists. In this way, global environmental problems pose risks but also some opportunities for investors in tourism, depending on various factors such as geographical location. For example, due to site-specific circumstances, small islands, such as those in the Pacific region, and most locations linked to the winter tourism industry will suffer from environmental changes and face challenging climatic conditions in the future (Craig-Smith and Ruhanen, 2005; Aall and Høyer, 2005). Accordingly, critiques of tourism have increasingly placed the responsibility for reducing damaging changes to the global environment and so maintaining the tourism sector into the future on all stakeholders: that is, businesses, tourists and policy-makers.

There is a strong relationship between the tourism industry and climate change. As Becken and Hay (2007: 279) have pointed out, climate change will increasingly influence investment in tourism. For example, hotel developers will need to consider investing in energy-efficient building designs and new green technologies. Moreover, as it is likely to lead to changes to the conditions and resources available for tourism, climate change will cause shifts in tourist demand. For example, Perry (2005) has found that over 80% of UK holiday-makers who travel abroad do so in search of better weather. What is more, in an earlier study Giles and

Perry (1998) found that during an exceptionally warm summer in the UK in 1995, there was a substantial drop in the number of holiday-makers who went abroad as well as demand for peak summer season package holidays to the Mediterranean. Such shifts in the travel behaviour of tourists can lead to opportunities and risks for tourism businesses. On the one hand, in some locations global warming can open up new markets by creating better weather conditions and thus possibilities for new activities. But on the other hand, the pressures from environmental changes can lead to worse weather conditions at established holiday destinations and thereby damage existing businesses.

However, other viewpoints draw attention to the responsibility of businesses for reducing their GHG emissions. For example, Becken and Hart (2004: 200) have pointed out that often no single stakeholder feels it is their responsibility to implement their own strategies for reducing GHG emissions. However, the attitudes and behavioural tendencies which influence environmental-responsibility are often linked to geographical location and local weather patterns. Variations in the effects that climate change has on different types of business in different locations around the world lead to a very wide range of attitudes and behaviour towards climate change among the global business community (Hall, 2006).

Moreover, a critical concern in this area is the adaptive behaviour of the tourism industry in vulnerable areas: especially the third world where financial resources, technology and skills are frequently limited. Although climate change adaptation strategies and supporting technology already exist, such as snowmaking equipment developed for the skiing industry in North America (Scott, 2006), very little progress has been made along similar lines in the developing world.

Finally, in order to ameliorate the consequences of global consumption trends, existing data can help tourism businesses to respond to changing weather patterns by exploiting new market opportunities for tourism products as well as preparing them to confront the potential threats posed by climate change for their industry and the natural resources on which they depend. Furthermore, more research needs to be done into the ways in which tourism businesses in the third world are responding to global environmental changes in order to help them to adapt to those changes in the future. The tourism industry requires further information not only about local weather conditions but a range of other environmental issues such as water scarcity and the damage caused by sewage discharged into the sea.

4.7 SMEs AND THE ADOPTION OF SUSTAINABLE PRACTICES

It is undeniable that sustainable practices are one of the main commitments and strategies of the global business community for tackling climate change. However, the attention in this regard has mostly fallen on large business enterprises in spite of the fact that small and medium size enterprises (hearafter SMEs) account for approximately 95 % of all businesses (Schaper, 2002). Hillary (2000) has noted that SMEs are responsible for most of the pollution on this planet. The tourism industry accounts for about 11% of total gross domestic product (TGDP) in the world and generates several million jobs globally (OECD, 2010). Thus, given its size and contribution to the world economy, it is important to consider how tourism businesses, especially small and medium-sized tourism enterprises (SMTEs), respond to environmental problems. More specifically, it is necessary to define what constitute sustainable practices among stakeholders in tourism and to explore these practices further. As mentioned above, most tourism businesses are SMTEs (European Commission, 2002; Nodder *et al.*, 2002). Furthermore, Hillary (2000) has noted that SMEs place much pressure on the environment. Therefore, it is necessary for both practitioners and academics to collaborate in the development of strategies and policies aimed at mitigating the global environmental impact of tourism. It is also necessary to build understanding of how far tourism businesses should be held responsible for mitigating their environmental impact given that it is partly driven by tourists' demands (see also Hu and Wall, 2005).

Thus, to mitigate impacts on environment, Schaper (2002) recommends that research needs to be done into the environmental impact of SMTEs and also on any green businesses practices (or "ecopreneurship" as he puts it) which they may operate. He also demonstrates that some SMTEs have responded to environmental impacts reactively: *i.e.* by reusing or recycling resources. Meanwhile, Budeanu (2005) has drawn attention to sustainable practices employed by SMTEs in a specific area of the industry, namely tour operation. In this way, she has studied the environmental impact of tour operators and discussed their responsibility for developing more sustainable business practices. By contrast, Becken and Carboni (2008) have focused on different sectors of the tourism industry, but without considering how tourism businesses manage their own energy consumption habits: *i.e.* by monitoring energy consumption within tourism businesses and their attitudes towards it. Farsari *et al* (2007) have pointed out that SMTEs have a poor record of adopting sustainable practices in spite of the fact that they have high qualifications of sustainable practice adoption: flexible management and strong commitment labours.

The main problems for SMTEs in adopting sustainable practices relate to their structure and conflicting policies (Farsari *et al.*, 2007). Structural problems are caused by internal and external factors. Internally, SMTEs lack resources (*e.g.* finance, professional management, and so on) to manage sustainable practices (Buhalis, 1999). Importantly, the adoption of sustainable practices by SMTEs is closely tied to the attitudes of their owners, partners, and / or management towards sustainability and environmental issues (Berry and Ladkin, 1997). On the other hand, they face pressure from tour operators on whose support they strongly depend (Buhalis, 1999), as well as high levels of competition in the tourism industry (Sastre and Benito, 2001). As Weaver (2006) has noted, dependence on tour operators frequently results in SMTEs cutting their prices or losing profits. As a consequence, SMTEs need to reduce their operating costs which they may do by such means as shedding jobs or dropping environmental commitments. Ioannides (2001) has also highlighted how concerns about profitability can threaten the adoption of sustainable practices among SMTEs. Indeed, given the highly competitive nature of the tourism industry as well as the constraints of short seasonal operation, SMTEs cannot afford to neglect the issue of profitability. Therefore, the environment will invariably be a subordinate concern for this type of business.

4.8 CONCLUSION

There is growing recognition and rising evidence to show that the tourism industry needs to accept more responsibility for managing its environmental impact. A variety of environmental problems have recently come to bear on the tourism industry, including climate change and the carbon footprint from energy consumption. Tourism businesses have come in for particular criticism for not taking enough action to limit their impact on the environment and reduce the amount of resources they consume. As a consequence of these issues, tourism businesses are being placed under pressure not just to adopt more environmentally-friendly business practices but also to remain profitable in the face of the problems caused for them by climate change and the strain on resources. This chapter has provided a critical response to these issues by focusing on the attitudes and behaviour of tourism businesses towards the environment and climate change.

Most concern is currently directed to the issues which are considered to be the most pressing environmental problems, namely climate change and energy consumption. As regards the tourism industry, it is generally accepted that the aviation sector makes the largest environmental impact while accommodation providers are seen as having a major role to play in reducing the consumption of energy and other resources by adopting greener business practices.

It is worth noting that the owners or managers of tourism businesses are frequently unaware of the far-reaching effects of changes to the global environment and also overly-optimistic about the potential of technological advances to solve environmental problems. Moreover, as Hüttche *et al* have stated, "[g]reen technologies are only as good as the people who implement them daily, therefore managerial staff awareness and training are of great importance to make tourism more sustain" (Hüttche *et al* 2002: 137). However, the awareness of global environmental problems which is currently growing places us in a better position to deal with the threats they pose and also puts pressure on tourism operators to accept a share of the responsibility for tackling these problems. Therefore, a holistic plan is now needed which encompasses all factors and promotes long-term maintenance of the global environment. Furthermore, it is important to address the current lack of studies into the sustainability of tourism in developing countries by undertaking future research in those areas.

Finally, the pressure put on environmental management by imbalances between availability and demand in tourism sector is becoming one of the main challenges in tourism businesses. In recent years, this issue has led researchers to consider, first, how to raise consciousness of environmental problems among tourism businesses in order to promote more responsible business practices, and second, how to manage the risks to tourism businesses posed by environmental changes. Above all else, these questions require a response from the tourism industry. As Becken and Hart (2004: 205) have pointed out, tourism businesses can play a crucial role in improving energy efficiency, adopting renewable energy sources, investing in CO_2 sinks to offset emissions that cannot be eliminated, and promoting more environmentally-friendly behaviour among tourists. It is also worth noting that the complexity and diversity of businesses in the tourism industry can lead to their responding in a very wide range of ways to environmental issues. More research is also needed to evaluate current consumption patterns in the tourism industry and to assess how individual businesses respond to initiatives intended to help them to adopt greener business practices. This kind of bottom-up data can help to provide planners with more robust and useful tools for developing tourism destinations in environmentally-responsible ways.

CHAPTER 5

RESEARCH FRAMEWORK AND METHODOLOGY

5.1 INTRODUCTION

To demonstrate the application of systematic techniques and methods in pursuit of answers to the research objectives, this chapter illustrates and justifies the specific components of the methodology approach selected, with driving largely by theoretical reviews and the research aims. In other words, this chapter explains the methodological techniques which have been selected for the purposes of achieving the research objectives of this study**.** The concept of EF is used here to analyze energy consumption linked to tourism on the island resort of Koh Samui in Thailand. More specifically, this study focuses on the energy consumption behaviour of both demand and supply side, tourists and tourism businesses, the amount of energy consumed and its EF as a result of tourism on Koh Samui. In order to fulfil the objectives of the study, as stated in Chapter One, a mixed-method approach and a wide range of data sources have been adopted.

This chapter proceeds in eight sections. The first section outlines the main methods employed in this thesis in terms of research design and approaches in this study. In this way, the first section provides a rationale for research design, research approach and the study area of Koh Samui. The research framework has been also developed in this section by focusing on research process flow which link with the aims and relevant data requirements of this research. The second section is concerned with the practicalities of the data collection methods used for the purposes of this study. It is also important to choose the right data analysis method as shows the third section of this chapter that will allow data to be analyzed to meet the objectives of this research. The sampling method is in the fourth section which demonstrates the appropriateness of using sampling strategies for conducting this research. The remaining sections deal with the reliability and validity of the data and ethical issues, while the final section of this chapter draws and briefly summarises the research methodology of this thesis.

5.2 RESEARCH METHODOLOGICAL APPROACHES

This section clarifies the key methodological approaches used here to investigate energy-consuming behaviour linked to tourism on Koh Samui and the resulting EF. In order to gather valid and reliable data it is important to select an appropriate data collection method while also taking account of a variety of restrictions on this study: *e.g.* timing, budget, accessibility, response rate, the amount of data, bias, and research ethics. Therefore, this section reviews the research design, approach, and framework as well as the study area in order to provide understanding of the research methodology and select the best approach to conducting this study.

5.2.1 Research Design

In order to obtain relevant and accurate data, researchers must consider how they approach research problems. Research design bears an important influence on how research methods and data collection are planned as well as how research questions are answered and objectives followed (McDaniel and Gates, 2001). On the one hand, research design helps scholars to develop a framework or structure which guides their methodology, data collection procedures, instruments of analysis, sampling plans, and data classification systems. On the other hand, research design determines how data will be collected

Research design can be categorised in different ways depending on the researchers' perspectives (Yin, 2003; McDaniel and Gates, 2001; Chisnall, 2001). In this study, the research design takes three forms: exploratory, descriptive, and causal. Each of these three kinds of research are employed in this study to help to identify factors which influence the behaviour of tourists (Chisnall, 2001). On the other hand, research design determines how data will be collected. Descriptive and causal researches are used at an early stage in this study to examine the relationship between two kinds of variable: the dependent variable and the independent variable (McDaniel and Gates, 2001). Meanwhile, exploratory research contributes to this study by employing qualitative methods to provide insights into the operation of tourism businesses. To ensure quality of research, researchers must be concerned with validity and reliability during the research design process: especially internal validity which is absolutely necessary for casual research (Yin, 2003). The following discussion summarises each of the three kinds of research design used in this study.

Exploratory research tends to be used for identifying research problems, especially when there is a lack of relevant theory linked to those problems. Exploratory research is suitable for small research projects. It helps to provide better understanding of the nature of research problems and to determine the research hypotheses (Chisnall, 2001; McDaniel and Gates, 2001). Furthermore, exploratory research is suitable for qualitative investigations of specific contexts in which a strong emphasis is placed on the depth and richness of the data being gathered.

Descriptive research is used to describe specific issues and to clarify specific phenomena. It tends to be favoured in studies that focus on consumers' buying habits and it may take a variety of forms such as polls, market surveys, consensuses, or market reports (Chisnall, 2001). However, this type of research cannot identify the relationship between behaviour and variables.

Causal research is used to identify causal relationships between two variables: that is, the dependent and independent variables. Chisnall (2001: 36) suggests that "[c]ausal research attempts to identify factors which underlie marketing behaviour and to evaluate the relationships and interactions." This type of research can examine the effects of one or more variables (independent variables) on another variable (dependent variable). Thus, it is used to analyse cause-effect relationships.

This study makes use of all three of these types of research. Firstly, descriptive research is used to identify independent variables (*i.e.* different forms of tourist behaviour) and dependent variables (*i.e.* the factors which influence tourist behaviour). However, thesedata cannot provide proof of correlation or a causal relationship between the independent and dependent variables. Therefore, causal research is needed to examine the cause-effect relationships highlighted by the descriptive research. Thus, causal research is conducted to determine whether the independent variables cause the dependent variables. Finally, an exploratory approach is conducted in the form of semi-structural interviews to provide insights into the behaviour of tourists and stakeholders in the tourism industry and their attitudes towards the natural environment.

5.2.2 Research Approach

This study makes use of EF analysis to provide understanding of the environmental impact of the tourism industry. As mentioned in the literature review, there is a significant relationship between the behaviour and attitudes of stakeholders, tourists and businesses, in the tourism industry and EF. Accordingly, the factors which influence this relationship need to be included in the unit of analysis. A mixed-method approach is most suitable for this study because it allows for the employment of both quantitative and qualitative research methods which can identify the factors that influence the behaviour of tourists and stakeholders and thus shed light on the attitudes of both groups towards the environmental impact of tourism.

The quantitative approach involves systematic inquiries into quantitative data which allow researchers to analyse, interpret, and present their work in numerical forms. For example, statistical methods, such as graphs and tabulation presentations, can be used to explore data from descriptive studies. Moreover, the quantitative approach can be applied to causal studies to test hypotheses about the relationship between the dependent and independent variables. Researchers who use the quantitative approach believe that facts are a single reality and that research findings can be generalised (Carson *et al.*, 2001). Therefore, this approach requires the validity and reliability aspects which relate to the creditability of the study (Chisnall, 2001). As Johnson and Onwuegbuzie (2004: 18) have stated, "[the q]uantitative approach focuses on deduction, confirmation, theory/hypotheses testing, explanation, prediction, standardized data collection, and statistical analysis." Quantitative data were collected in this study for both statistical tests and in order to calculate the EF from energy consumption on Koh Samui.

In contrast to the quantitative approach, the *qualitative approach* is based on the belief that there is no single reality and that generalisations are impossible (Johnson and Onwuegbuzie, 2004). Therefore, this approach is suitable for investigating specific contexts (Carson *et al.*, 2001). Only a small number of informants are needed in the qualitative approach in order to build up a rich body of information which can give understanding of specific phenomena or issues. This approach is also suitable for answering "why" and "how" questions which require non-numerical answer (Yin, 2003).

The qualitative approach provides the best way of understanding semi-structural informant insights (McDaniel and Gates, 2001) because it requires multiple inquiry techniques such as observation and interviews. As Johnson and Onwuegbuzie (2004: 18) put it, "[the q]ualitative approach focuses on induction, discovery, exploration, theory/hypothesis generation, the researcher as the primary instrument of data collection, and qualitative analysis." Furthermore, the qualitative approach provides data which cannot be gathered from quantitative techniques or questionnaires such as, in the case of this study, specific reasons for ignoring energy conservation.

The mixed methods approach which combines qualitative and quantitative methods is becoming increasingly popular among scholars (Creswell, 2003; Johnson and Onwuegbuzie, 2004). This approach has developed in response to controversies about the respective merits of the quantitative and qualitative research paradigms. Some researchers have tried to capitalize on the advantages of both methods in order to produce higher quality findings and better answers to their research questions. Johnson and Onwuegbuzie (2004: 17) state that "[t]he mixed methods approach is the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study." Instead of limiting the scope of studies with one instrument or method, the mixed methods approach employs the most effective and efficient ways to answer research questions. Therefore, in one research project, researchers can apply different methods and approaches in order to obtain the best results.

Taking account of all the research approaches mentioned above, this study employs the mixed methods approach to investigate the factors which influence the behaviour of tourists and stakeholders in the tourism industry on Koh Samui. The research objectives of this study require statistical analysis to determine the factors that influence the behaviour of tourists and tourism businesses [semi-structural data of stakeholders' insights] (see also Table 5.1).

Moreover, independent research approaches cannot gather effective research findings. For example, the qualitative approach—semi-structural interviews—is employed to explore how tourism businesses view and respond to the issues of climate change and global warming. On the other hand, the quantitative approach—questionnaires—is employed to understand the energy consumption behaviour of tourists and tourism businesses and their attitudes towards their impact on the environment through energy consumption. Moreover, these data will be used together with secondary data on energy consumption to calculate the EF.

The mixed methods approach is most suitable for this study because it integrates different methods and instruments which allow for the collection of valid and reliable data. Thus, quantitative research in the form of questionnaires is used here to summarise and prove the relationship between the factors which influence the behaviour of tourists while qualitative research in the form of semi-structural interviews is conducted to gather insights into the attitudes of stakeholders towards energy consumption and their impact on the environment.

Table 5.1: Link between Research Objectives and Approaches

Research Objectives	Approach
To analyse the energy consumption behaviour of tourists and its influential factors. In order to gain a more profound understanding of these relationships between the patterns of energy use of tourists at home and on vacation are also examined.	*Quantitative approach:* to identify the factors affecting the behaviour and attitudes tourists as regards the energy they consume and also to provide understanding of the sources of demand for energy. Quantitative data enable this research to find out the influential factors that affect the tourist behaviour on energy demand and also to test the relationship between energy consuming behaviours at home and on vacation.
To investigate the energy consumption patterns in major components of the tourism sector (transport, accommodation and activities) in order to identify the key areas of energy use and to provide insights into the attitudes and behaviour of entrepreneurs in tourism business towards energy use.	*Quantitative approach:* to identify the key areas of energy consumption linked to tourism businesses and their attitudes and behaviour toward energy consumption with the aim of understanding how and why they respond to environmental impacts: *e.g.* climate change and global warming from energy consumption
	Qualitative approach: to understand the insights which tourism businesses can provide into their attitudes and behaviour in regard to energy consumption.
To estimate the ecological footprint from energy use of four facets of Koh Samui's tourism sector: namely transport, accommodation, activities, and waste management.	*Quantitative approach:* to employ secondary data (*e.g.* number of visitors or electricity usage) about the behaviour and attitudes of tourists and tourism businesses in regard to energy consumption in order to calculate the relevant EFs

Source: Author

5.2.3 Research Framework

Researchers tend to think in two key ways when they are carrying out studies: deduction and induction (Trochim, 2006). *Deductive thinking* is more prevalent in quantitative research (Johnson and Onwuegbuzie, 2004) which progresses from general ideas or theories to specific issues. In other words, this way of thinking is the process of working from the broad to the more precise and moves from theories and hypotheses to confirm the theory's validity. In contrast, *inductive thinking* is strongest in qualitative research (Johnson and Onwuegbuzie, 2004) and progresses from specific issues to more general theories and thus provides insights into specific contexts. Although these ways of thinking develop in opposite ways, they both make use of theory in varied ways (Creswell, 2003).

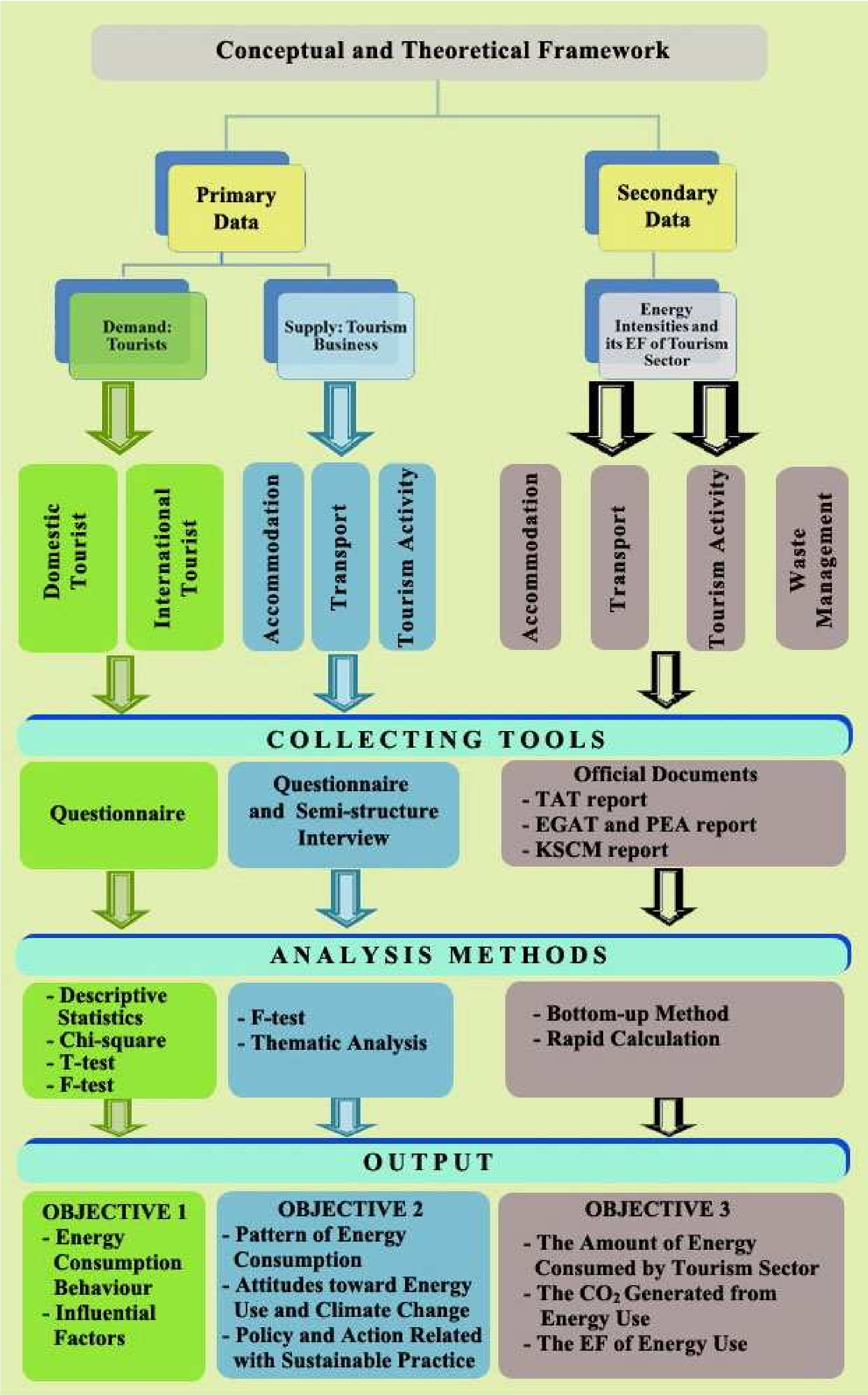
Accordingly, the validity and reliability of research depends on both primary and secondary data. The theories used in this study have helped to formulate research questions and objectives which have in turn contributed towards the development of a framework for collecting, analyzing, and interpreting data. Moreover, the theories used here have contributed to the collection of qualitative data in the semi-structural interview. Thus, in order to obtain relevant data, this section will outline the flow of the research framework as shown in Figure 5.1.

In order to conduct effective and credible research, researchers require basic information relevant their research projects such as theories, facts, and evidence. Therefore, this study employs both primary and secondary data as suggested by Bryman and Bell (2007). The primary data is the information that is collected by the researcher specifically for the study at hand and for achieving the specific purposes of the research (Collis and Hussey, 2003). The primary data can be done by various methods; survey, observation, experimentation, focus group, interview which depend on the research problem, design and approach (Saunders, Lewis and Thornhill, 2007). Due to collecting data for achieving the specific purpose as an original work, primary research provides more validity, reliability, and relevance than secondary data, but it requires more costs, time, and people than secondary data (Bryman and Bell 2007). Moreover, pursuing primary research, the researchers have to concern and strict about the research methodology which may effect to the quality of the research project.

Firstly, using the mixed methods approach primary data was gathered about the factors which influence the energy-consuming behaviour of tourists and the attitudes of all stakeholders in the tourism industry towards the environment and energy consumption. Questionnaires were used to gather quantitative data and to identify the influence factors which are essential to the qualitative approach. Furthermore, semi-structural interviews were employed to give a better understanding of the energy-consuming habits of tourists and stakeholders in a local context as well as the attitudes of both towards energy consumption and the environment.

Questionnaires and semi-structural interviews were used in this study to collect data about the energy-consuming behaviour of tourists and the views of all stakeholders about the environment and energy-related issues. According to Leedy and Ormrod (2005: 145) “[q]uestionnaires can be sent to a large number of people and the respondents can respond to questions with assurance that their responses will be anonymous.” The questionnaires use open-ended and closed questions which give a better understanding about the energy-consuming behaviour of tourists and their attitudes towards energy consumption and the

Figure 5.1: Research Framework and Research Process Flow Chart



Source: Author

environment during their holidays. Moreover, semi-structural interviews were conducted with businesses in order to investigate how much energy they consume and their views on the environment, energy consumption, and sustainability in their industry. Different tools were used to analyse data and the outcome of data collection process. These issues are discussed in section 5.5 below.

Meanwhile, the secondary data gathered from texts, journals, energy situation reports, articles, and online archives were used to identify and analyse the factors influencing the energy-consuming behaviour of tourists and other stakeholders. In this respect, secondary research is defined as:

> "…information that has been gathered and that only might be relevant to the problem at hand."
>
> (McDaniel and Gates, 2001: 76)

Therefore, this data may help to clarify the research objectives, the outline of the primary research, and other contextual information. Furthermore, secondary research provides hypotheses and fundamental structures for exploratory research processes (McDaniel and Gates, 2001). Secondary data is very useful to this research because: (1) it is less consuming time than conducting primary research; (2) it is less expansive; (3) it can yield a large amount of information; and (4), it provides a lot of basic information for this study. However, secondary data also has a lot of potential drawbacks including a lack of immediate relevance to the research problem being addressed by this study (McDaniel and Gates, 2001). Furthermore, secondary data is often out of date hence researchers must either search for the most up-to-date secondary data from credible sources or conduct their own primary research.

Most of the data used in this study come from secondary sources including publications available from research libraries and belonging to the researcher. These sources have furnished this study with a general theory of tourist behaviour, including factors influencing energy consumption, and a research methodology. Moreover, relevant research articles in the field of tourism studies, especially those concerned with the environment and energy consumption, most of which are recent, have contributed to the development of the theoretical framework, research questions, design, instruments, and general progression of this study. Furthermore, the internet has played a crucial role in the secondary research conducted for this study: electronic journals and other academic resources provided by the University of Exeter and the search engines, Google.com and Scholar.google.com, have been particularly helpful.

For the purposes of this study, secondary data about the amount of energy consumed by tourists and businesses through transport, accommodation, activities and waste management were used to calculate the CO_2 emissions and EFs linked to tourism on Koh Samui. Secondary data were also used to plan the data collection process. Important secondary data was gathered from reports commissioned by the Thai government into electricity consumption in tourism industry, Koh Samui Municipality into waste management linked to tourism on the island, and TAT into the energy consumption habits of tourists in terms of travel behaviour of tourist such as type of transport and accommodation in Koh Samui. Taken together, these reports provide a comprehensive body of data on energy consumption connected with tourism on Koh Samui. These sources, combined with previous studies of EFs and energy consumption, are employed here to calculate the EF of Koh Samui's tourism industry as shown in Table 5.3. The data analysis method and the process used in this study to estimate the EFs linked to tourism on Koh Samui are discussed in more detail in section 5.5.3.

5.2.4 The Rationale for a Case Study of Koh Samui

The concept of EF was originally applied on national and international scales. It has recently come to be applied to a wider variety of settings, ranging from the manufacture and transit of individual products to organizations, cities, regions, nations and humanity as a whole (Wackernagel et al, 2002). The implications of EF for policy-making and planning are now recognized to the extent that to it is being used by several countries and local municipalities to implement and monitor their sustainable development agendas. EF has been proven to be a useful research tool for exploring the environmental impact of particular industries including tourism in certain geographical areas. For example, in the UK the REAP model, which was explained in chapter 2, has been employed to calculate the EF of the South West of England's tourism sector (SEI, 2009). The sustainability of certain holiday destinations is increasingly of interest to central government as a means of promoting sustainable consumption in other holiday destinations. Despite a lack of relevant data accounting for different consumption items in specific geographical areas, previous efforts at applying EF to tourism have proven that small-scale EF-based studies of cities and even single products are valuable hence there has been a call for more work in this area (Cole and Sinclair, 2002; Gössling et al, 2002; Sonak, 2004; Hunter and Shaw, 2005; Peeters and Schouten, 2006).

Therefore, in light of these trends in EF application and the theoretical backdrop of the EF framework including the pioneering efforts and research objectives, this thesis then has been decided to focus on single holiday destination, namely Koh Samui. Tourism is a key sector in the Thai economy, the growth of which relies in no small measure on the richness and diversity of Thailand's natural environment. While many people travel to and within Thailand to experience different cultural environments, for a great many people, especially international visitors, the main attraction is in its pristine beaches, marine environments and tropical landscapes. Thus, Thailand's natural environment is a major, perhaps even the main, asset of its tourism industry without which tourism would not continue to flourish in the future.

The environment is crucial to the long-term sustainability of tourism in Thailand and elsewhere. If we do not gain a better understanding of the importance of the natural environment to the tourism industry both now and in the future, we are putting ourselves at a disadvantage in terms of our ability to understand and maintain the success of Thailand's tourism industry for the benefit of future generations. Hence there is a clear need to understand how tourism puts pressure on the environment which sustains it and how this pressure can be lessened in order to secure the future of this important part of Thailand's economy, culture, and society.

The existing body of international research on tourism, especially in regard to Thailand, has overlooked the environmental impact of tourists at established holiday destinations such as coastal resorts and how the environment in general can be managed as a resource and asset (that is setting aside special cases such as ecological reserves and parks). So-called 'sun, sea and sand' visitors use large quantities of water and electricity every day, and they also produce large amounts of waste which needs to be disposed of in land fill or by incineration. Each of these factors places pressure on finite resources which must be effectively and appropriately managed.

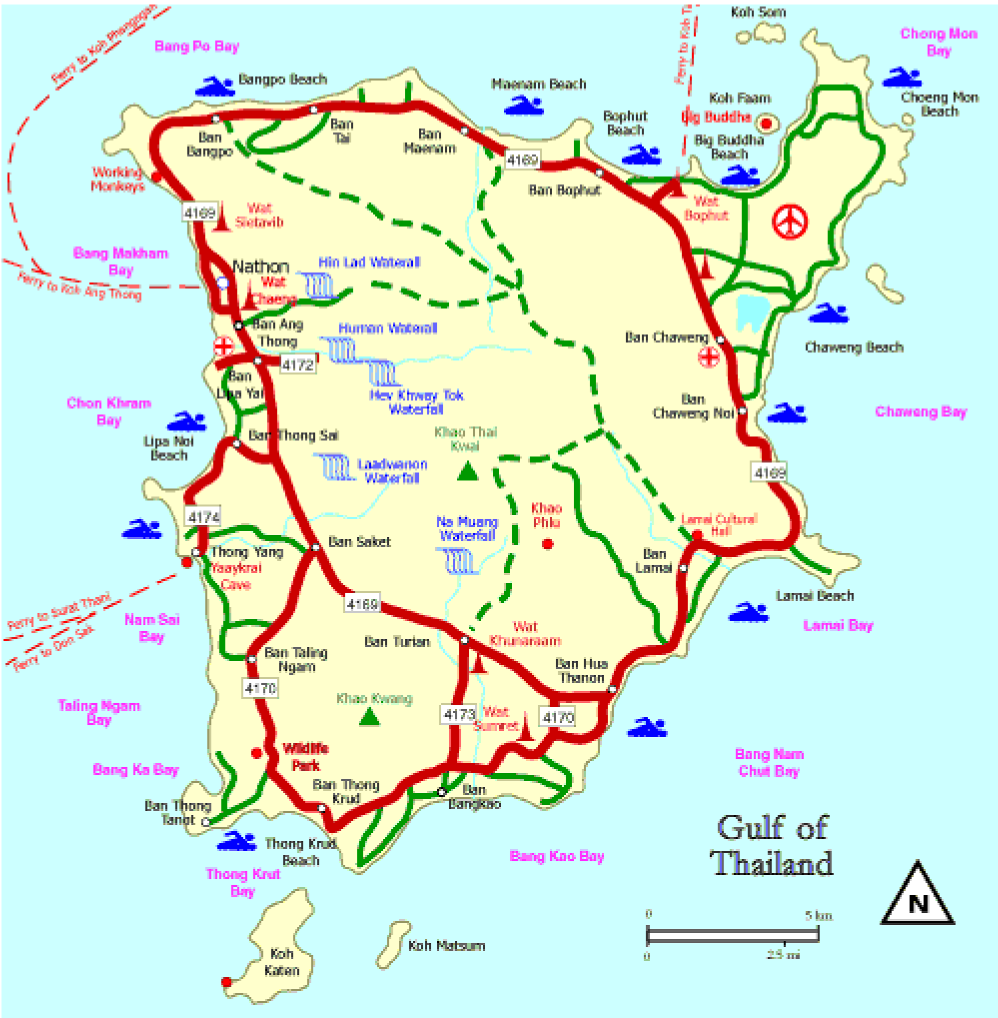
Koh Samui is one of the most prominent islands in southern Thailand (Figure 5.2 and 5.3). It has global brand recognition and is popular among international visitors who have a positive economic impact on tourism in Thailand. However, the research literature suggests that people in this group are also concerned with their impact on the environment as consumers. In response to such findings, TAT has chosen to promote Koh Samui as a sustainable holiday destination and as such a variety of sustainability initiatives which respond to the concept of EF have been put into practice on the island. For example, a collaborative scheme of working between primary schools and hotel businesses on Koh Samui focus on encouraging young children to learn how to reduce their EF.

Figure 5.2: Location of Koh Samui, Thailand

Source: http://www.lonelyplanet.com

Koh Samui shares many common features with other holiday destinations in Thailand, including infrastructure, energy supply, and government services. However, Koh Samui is peculiar among Thai resorts in the respect that there is a wide range of transport options available for getting to the island from within Thailand among which can be included air travel, public transport (*e.g.* coaches and trains), personal cars, and ferries. Accordingly, this study takes account of the different ways in which tourists get to the island and the resulting energy consumption. Similarly, the wide range of holiday accommodation available on Koh Samui (ranging from small bungalows to international hotel brands) supports the aim of this project to shed light on how energy-consuming behaviour among tourists differs in different types of accommodation.

Figure 5.3: Distribution of Key Attractions on Koh Samui



Source: http://samuiontour.com/About-Samui/Samui-General/koh-samui-map.html

5.3 DATA COLLECTION PROCEDURE

This section discusses the data collection procedures used to gather information for this study about the energy-consuming behaviour of tourists and tourism businesses. In particular, the following issues are addressed here: what kind of data collection instruments and units of measurement should be used.

Table 5.2 lists the different data collection methods used to meet each research objective of this study. Questionnaires were of particular importance since they were used to collect the data relevant to objectives 1 and 2. This study relied on several other data collection methods including semi-structural interviews which were used to get qualitative data about the attitudes and behaviour of tourism business owners and managers towards energy consumption and carbon emissions.

Table 5.2: Data Collection Techniques Related to Research Objectives

Objectives of Study (see also in Chapter One, page 16)	Data Collection Methods	Data Collection Tool	Type of Data	Sources
1	Using questionnaire	Questionnaire	Primary Data	Tourist
2	Using questionnaire	Questionnaire	Primary Data	Business
	Interviewing (semi-structured interview)	Interview schedule	Primary Data	Business
3	Using available information	Checklist and data compilation form	Secondary Data	TAT, PEA and Koh Samui Municipality

Source: Author

In order to meet objective 3 it was necessary to collect secondary data about energy-consumption in four facets of Koh Samui's tourism industry, namely transport, accommodation, activities, and waste management, from which their respective EFs could be estimated. This data was collected in spreadsheet form from a number of local government offices: the Provincial Electricity Authority (PEA), Koh Samui City Municipality, and TAT's local offices on Koh Samui.

The secondary data was collected before the fieldwork started. Firstly, figures for the number of tourists who visit Koh Samui, their personal characteristics, and behaviour (*e.g.* lengths of stay, transport used, expenses, country of origin) were gathered from TAT as well as a list of businesses linked to tourism on the island (TAT Southern Office Region 5 (2008)). It is noteworthy that these data included some errors in contact names and addresses. Therefore, these lists needed to be revised and updated before the fieldwork was conducted. Finally, secondary data about energy policy on Koh Samui was obtained from several local government offices: namely the PEA, Koh Samui District, and Koh Samui City Municipality.

The secondary data helped to plan the collection process for primary data and contributed to the design of the questionnaires and semi-structural interviews discussed above. The secondary data were also used to calculate the EF generated through energy consumption by Koh Samui's tourism industry. Accordingly, the rationale for choosing these data collection methods and developing the aforesaid collection tools will now be discussed. Moreover, these theories discussed in Chapter Four have contributed towards the development of the semi-structural interview and thus the collection of qualitative data.

5.3.1 Designing the Questionnaires

As stated previously, questionnaires were the main data collection method used for the purposes of this study. Questionnaires can be defined as self-report data collection tools which consist of formalized sets of questions intended to obtain useful information from people. Collis and Hussey (2009:191-2) define questionnaires as:

> [A] list of carefully structured questions, which have been chosen after considerable testing with a view to eliciting reliable responses from a particular group of people. The aim is to find out what they think, do or feel.

The questionnaires developed for this study were designed to gather data about energy-consuming behaviour on the supply and demand sides of the tourism industry. Questionnaires allow for the collection of data which can be subjected to statistical analysis. They can be completed in several different ways: face-to-face or over the telephone with an interviewer, or self-administered (Roberts, 2007). Modes vary in the extent to which they provide access to different questionnaire respondents and in other words each of these ways may yield different responses. Furthermore, self-administered questionnaires can be distributed through a variety of channels: *e.g.* by post, over the internet, or hand delivery. The questionnaires developed for this study were designed to be completed by respondents on their own.

5.3.1.1 Tourist Questionnaire

The final stage of designing the questionnaires for this study was a pretest which had already been undertaken in a pilot study. Before finalizing the questionnaire developed for this study, a pilot study was carried out and the questions were improved with the aim of testing whether respondents could understand the words, terms, and concepts used in them. The questions then were improved. For example, the test run showed that questions about types of energy and patterns of energy consumption where it was felt the respondents need assistance to articulate answers or provide answers on a preferred dimension determined by the researcher. Accordingly those opened-end questions were changed to closed questions. In other words, these open-end questions needed to be simplified so that respondents could answer them without any assistance from the researchers. The test run also highlighted the need for the questionnaires to be easily understandable and not too time-consuming since these factors can affect the participation rate. Accordingly, the questionnaires were edited before collecting data.

Thus, in the final form the questionnaires distributed to the respondents were self-administered and could be filled in with pens or pencils. As regards the plan for this study, the tourist questionnaires were developed in response to research objective 1 and the study framework (see also Figure 1.1) and consisted of four sections (see Appendix 1 for a copy of the questionnaire).

Section I: Personal Background - collected data on age, gender, marital status, number of adults and children in households, working status, education and country of origin.

Section II: Travel Behaviour Characteristics - gathered data on length of stay, type and number of people in travel groups, transport choices, main purposes for coming to Koh Samui and type of accommodation.

Section III: Attitudes towards Energy Consumption and Climate Change - measured attitudes towards environmental issues via a series of questions. Respondents were asked to rate the level of their concern for the environmental impact of their holiday and the level of their commitment to saving energy. This section measured attitudes by using the Likert scale.

Section IV: Energy Consumption Behaviour - asked respondents about the extent and patterns of their energy consumption in accommodation and when participating in activities and travelling on all modes of transport. Respondents were also asked to provide data about their energy consumption patterns at home for comparison with the data they had given about their energy consumption patterns on vacation.

They were also asked about how far they were influenced by state-sponsored energy-saving campaigns, and whether they supported alternative energy sources and had any commitments to environmentalist groups.

5.3.1.2 Business Questionnaire

A second questionnaire was developed to collect data from tourism businesses. More specifically, they were designed to respond to objective 2 of this study: namely, to investigate patterns of energy consumption in major components of the tourism industry (transport, accommodation, and activities) in order to identify the key areas of energy consumption and provide insights into the attitudes and behaviour of business owners and managers towards energy and the environment. As with the tourist questionnaire, the business questionnaire was self-administered and contained four parts (see Appendix 2 for a copy of the questionnaire): business characteristics, energy consumption and sources, environmental management related with energy consumption, and attitudes toward energy consumption and climate change.

Each of these four parts respond to research objective 2 by inquiring into patterns of energy consumption among tourism businesses, their attitudes towards energy consumption and climate change, and any policies or action they have taken towards becoming more sustainable. The first section asked for background information: i.e. name and type of business, year of establishment, number of staff, and, for accommodation businesses, number of visitor rooms and occupancy rate. These data aided the interpretation process and gave understanding of the relevant study issues (Morrison and Teixeira, 2004): that is, the environment and climate change. Questions were asked about the different energy sources used by businesses (gas, fuel, electricity, and others) so that their energy consumption behaviour could be classified according to the quantity and cost of each type of energy used per month. Businesses were also asked about the number of cars they used for the triangulated propose.

The next section asked businesses about their rates of water consumption and waste management including sewage water. Data about waste and sewage management are important components in the EF figures presented in this study (see Chapter 8) and also provide understanding of the level of environmental concern among tourism businesses. Finally, as recommended by Ritchie and Goeldner (1994), Likert scale questions were used to measure the attitudes of businesses towards energy consumption and climate change (e.g. their sense of responsibility and environmental, and interest in saving energy and environmental management).

5.3.2 Interview Schedule

In response to objective 2, tourism businesses were also asked to participate in semi-structural interviews which provide researchers with a better chance of dealing with specific contexts and gathering data that cannot be gained from questionnaires. Therefore, this section outlines the design of the semi-structural interviews which were used by this study to provide additional understanding of the behaviour and attitudes of tourism businesses towards the environment and energy consumption (see Appendix 3 for a copy of the interview schedule)

It has been noted that semi-structural interviews provide researchers with richer data than questionnaires (Denzin and Lincoln, 1994). Many scholars (*e.g.* Davis and Morais (2004), Peterson (1994), Riley and Love (2000)) have highlighted the advantages of semi-structural interviews: *e.g.* a natural setting and face-to-face conversation give a better understanding of the research context, not least in the case of tourism research. Additionally, this kind of interview provides for the triangulation of data and so ensures the relevance and validity of the research project (Cresswell, 2007; Decrop, 1999). The key advantage of semi-structured questions is that researchers can adapt them or add further relevant questions during the interview process (Cresswell, 2007). This flexibility in the interview process allows researchers to respond quickly to insights which emerge in the research environment. However, researchers must also have a degree of experience in order for them to effectively conduct semi-structural interviews.

To begin, the first question asked tourism businesses about their attitudes towards CO_2 emissions: “How do you respond to the view that “almost half of Thailand's carbon dioxide emissions come from the energy we use every day - at home and when we travel? By saving energy we can all help prevent climate change. Please explain your view.” The purpose of this question was to uncover whether tourism businesses perceived domestic activities or tourism activities as the chief causes of CO_2 emissions in Thailand. As mentioned in Chapter Four, businesses are among the stakeholders in the tourism industry who must take responsibility for their CO_2emissions (UNAP, 2001). Therefore, respondents were also asked about their views on this matter. The answers given to this question can help to inform policies aimed at reducing CO_2 emissions within the tourism industry. Moreover, they can help researchers to investigate how tourism businesses understand issues linked to the environment and climate change.

The second question asked businesses about how they manage and save energy: “Have you taken any type of initiatives to reduce the amount of energy consumption by this establishment, for instance, using technologies to increase the efficiency of the air conditioning system, environmentally friendly policy etc.? Please describe.” Answers to this question provide insights into the views of tourism businesses about reducing CO_2 emissions and climate change. Following from this question, respondents were also asked about any steps they might have taken to lessen their energy consumption.

The third question asked businesses if they felt there is a need for the government to enact legislation aimed at managing and controlling them or not: “Do you think that more legislation is needed for more responsible towards the environment in business operation? Why?”

Finally, as Dief and Font (2010) have commented, many tourism businesses promote themselves as being committed to fighting climate change and saving energy in order to strengthen their image and reputation. Accordingly, respondents to this study were asked: “To what extent do you believe that demonstrating a commitment to saving energy will increase your appeal in the market and attract a wider customer base?” Additionally, respondents were asked how they can employ environmental concern and energy saving schemes to improve their image and reputation.

Table 5.3: Sources of Data Necessary for Measuring Energy, CO_2 Emission and EF

Source of Energy Counsumption	*Energy Consumption*	*Unit from Sources*	*Unit for calculation*	*Source*
Accommodation				
- Electronic Appliances	Electricity	Kilowatt Hour (kWh)	kWh	PEA (2009)
- Desalination	Electricity	kWh	kWh	PEA (2009)
Transportation				
- Airplane	Fuel	Original Country/province, A number of Tourists	Distance, km and number of tourists	TAT (2008)
- Train	Fuel	A number of Tourists	Distance, km and number of tourists	TAT (2008)
- Bus	Fuel	A number of Tourists	Distance, km and number of tourists	TAT (2008)
- Private car	Fuel	A number of Tourists	Distance, km and number of tourists	TAT (2008)
- Ferry	Fuel	A number of Tourists	Distance, km and number of tourists	TAT (2008)
- Boat	Fuel	A number of Tourists	Distance, km	TAT (2008)
Activity	Fuel	A number of Tourists	number of tourists	TAT (2008)
Waste management	Electricity & Fuel	Kg and kWh	Kg and kWh	PEA (2009) & Koh Samui City Municipality (2009)

Source: Author

5.3.3 The Collection Tool for EF Assessment

There are various sources of data relevant to each of the tourism sub-sectors covered by this study as illustrated above in Table 5.3. The EF analysis conducted in this study mainly relies on secondary data about visitor numbers to Koh Samui in 2007 (1,059,642 in total) provided by TAT (TAT, 2008). The main advantage of using data about the amount of energy consumed by the tourist population in 2007 is that it enhances the accuracy of the estimation processes for both energy consumption and CO_2 emissions. The data available from TAT contain details of tourists' backgrounds and holidays which are necessary for estimating how much energy they consumed: *e.g.* demographic characteristics, modes of transport, accommodation and activities. These variables were combined with information provided by

TAT and previous studies about the routes taken by tourists and mileage relative to different kinds of vehicle they used for activities. These data were then applied to conversion factors in order to determine how much energy tourists consumed and CO_2 emissions they released during their holidays, and thus their overall EF.

However, it is worth noting that it is difficult to collect energy consumption data from TAT in the same unit of calculation. Therefore these figures (*i.e.* tourists' journey times in total hours and type of attending activities) need to be converted into a relevant format that can be interpreted in terms of energy consumption by multiplying it with the respective energy efficiencies of each type of energy. This study takes its figures about the amount of electricity used by tourism businesses from the PEA which is in charge of power distribution and customer services on Koh Samui. The latest carbon emission figures from the Electricity Generating Authority of Thailand (EGAT, 2009) were also used as a baseline for carbon emission calculations. However, there is still a lack of data available about energy consumption and carbon emissions in Thailand as well as an established conversion rate. Therefore, the calculation methods employed in studies similar to this one were also taken into account in the estimates made here of the overall level of energy consumption and the carbon footprint of Koh Samui's tourism sector.

Table 5.3 demonstrates that energy consumption in this study was broken down into four typical CO_2 footprint components: transportation, accommodation, activities and waste management. The details of each area will now be briefly discussed:

◆ **Accommodation:** Accommodation is the main sub-sector of the tourism industry since most tourists rely on it in one way or another. Most recent studies have confirmed that holiday accommodation, particularly hotels, have a substantial impact on the environment (Becken *et al.*, 2001; Becken and Cavanagh, 2003; WWF, 2002). This study uses statistics on electricity consumption provided by the PEA to account for the amount of energy used in holiday accommodation through electrical equipment such as air conditioners, lights, refrigerators and laundry facilities. Bearing this in mind, it is noteworthy that recent studies by Trung and Kumar (2005) and Becken (2002b) have found that around 75% of energy consumed by the hotel industry comes from electricity, which is above average for the whole commercial sector. These studies also found that the amount of fuel used by hotels for transportation is very small when compared with other areas of the tourism industry and so is discounted here.

Furthermore, given the high demand for water and limited supply on Koh Samui, electricity used in desalination plants was also considered in this research. Those data of electricity consumption obtained from the PEA which found that 60% of water product was supplied to accommodation industry. An independent body, Environmental Engineering Consultants Co. Ltd (EEC), and the EC-ASEAN Energy Facility (EAEF) (2008) have also provided this study with information showing that due to a lack of water resources, especially in heavily populated areas such as Chaweng beach, the Provincial Waterworks Authority (hereafter PWA) has brought in a private water supply management company, East Waters Co. Ltd, to construct a treatment plant in Bo Phut district. This project involves harvesting seawater and filtering it through a fine membrane which sifts out the salt. The rate of production is presently 2,500 cubic metres per day. This treatment process is necessary to prevent any knock-on effects it may have on the tourism industry and contributes towards improvements to the island's water supply system.

It should be noted that energy used for the construction and maintenance of holiday accommodation was excluded from this analysis. Additionally, fuel used for transport by the accommodation sector was not considered in that category in order to avoid the risk of double counting in the accommodation and transportation categories. Instead, energy consumed in vehicles operated by the accommodation sector was counted in the transportation category.

◆ **Transportation:** Most previous studies have shown that transportation, especially aviation, consumes the largest proportion of energy in the tourism industry as well as exhaust emissions (Gössling, 2000; Becken and Patterson, 2006).This study focuses on the CO_2 emissions released through the various forms of transportation used by tourists to get to and from their holiday destinations and to facilitate activities while they are on holiday. In order to avoid double counting in this area, emissions from transportation were calculated separately in terms of the total amount of energy consumed by trips to and from Koh Samui, including transfer within Thailand and by any subsequent transport used to facilitate holiday activities: *e.g.* boats, cars, and vans. Energy consumption in this category was measured in terms of the amount of energy used per passenger kilometre.

◆ **Activity:** As Table 5.3 shows**,** emissions figures for activities undertaken by tourists were calculated exclusively from the main activities that take place on the island: *e.g.* sightseeing, shopping, nightlife and water activities. Regarding water activities, this category mainly covers motorised water activities. Secondary data gathered from TAT official document was used to quantify the percentages of tourists who participated in each kind of activity and the average number of hours they spent doing so. Taking these figures into account, as well as the types of fuel used by each activity, it would have been possible to estimate the total amounts of energy consumed and emissions released by each activity.

◆ **Waste and Sewage:** Given the specific circumstances of Koh Samui, energy consumption and CO_2 emissions linked to the sewage treatment system and waste management were taken into account in this study. The energy consumption and emission figures for this sector seem to be relatively small by comparison with rest of Koh Samui's tourism industry as well as the more hi-tech sewage treatment and waste management facilities used by developed countries. Nevertheless, sewage treatment and waste management on Koh Samui raise some important issues which are relevant to this study. As of 2008, 120 tons of rubbish was being generated daily on the island, of which approximately 58.14 tons came from the tourism industry. This total figure very nearly exceeded the maximum capacity of the island's refuse facilities which stood at about 130 tons per day in 2008 (TAT, 2008). This study explored the amount of waste and sewage produced by tourism-related activities and also investigated whether these figures peaked at the same time as tourism on the island. Since amount of them quantify the levels of energy consumption and CO_2 emissions were calculated for estimating EF.

It is also worth noting some issues about the definition and selection of variables which arose over the course of this study. Given variations in the meaning of the label, "tourist", this study has adopted the definition offered by the World Tourism Organisation (WTO):'persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes'. Therefore visitors who stayed on Koh Samui for more than 12 months were not considered in this study whereas tourists on day-trips were taken into account. Furthermore, of the various greenhouse gases produced by human activities (*e.g.* nitrous oxide or methane), only CO_2 was considered here since it is a major waste product from the combustion of fossil fuels (see in chapter2). The key findings of this study about CO_2 emissions are reported in Chapter Eight.

Finally, an energy consumption checklist was developed for collecting data in four components namely accommodation, transportation, activity and waste management (see Appendix 4 for a copy of the checklist form). The available data on energy consumption have been mainly taken from TAT's statistics on tourism in 2007 (TAT, 2008). The information gathered from the PEA and Koh Samui Municipality enabled this study to quantify the amount of energy used and CO_2 emissions released by Koh Samui's tourism industry as well as the consequent EF. The energy consumption, unite of analysis, data sources and emission factor of energy use has been record in checklist and data compilation form which facilitate data to estimate EFs by using conversion factors, rapid calculation, and the methods of EF analysis described in section 5.5.3.

5.3.4 Units of Measurement

In order to investigate the amount of energy consumed through tourism on Koh Samui, two units of analysis were identified. The first unit covers businesses involved in tourism: *e.g.* accommodation, restaurants, and transport. The second unit covers tourists in general. The research questions directed at both groups were intended to uncover the types and amounts of energy used by each of them and their attitudes and behaviour towards energy consumption.

5.3.4.1 Organisations

As mentioned above, tourism businesses were approached with a semi-structural interview and questionnaires which included some open-ended questions and so required a lot of time to fill in. Since these questionnaires asked businesses to disclose sensitive information they were posted with official letters from Walailak University, the researcher's host institution in Thailand, assuring them of the confidentiality of the data. The letter also informed the businesses about this research project, the researcher, the ethical code being followed, and its academic objectives. The data were collected by the researcher and in most cases filled out face-to-face at an appointed date. The follow-up attempts had been made to contact businesses who had received the questionnaire in order to obtain informed consent for interviews and to collect their responses in relation with questionnaires.

In total, 250 of tourism businesses on Koh Samui were eligible for the survey. Of these businesses, 100 refused to participate, mostly because of a lack of time (30%), but also due to limited staff availability or worries about confidentiality (10%). The remaining 150 businesses (60% in total) were willing to answer the questionnaire and also to be interviewed. However, in the final round, 75 (30%) of the latter group failed to provide sufficient data either due to a lack of preparation, time constraints, or the complexity of the survey. Therefore, only 70 questionnaires and 30 interviews were completed thus giving a response rate of 28%.

It is significant that the response rate from businesses was so low. The main reasons given by businesses for not being able to participate were either a lack of time or difficulty obtaining the relevant information. However, even though the questionnaire sample size for this sector fell slightly short of the target number, it still represents a healthy confidence level. Indeed, the questionnaire sample size was similar to or greater than those of a number of other studies which have used questionnaires in this research area. For example, Becken, Frampton and Case (2001) received 42 responses (10%) from accommodation businesses (see also Table 5.3). This also compares with a response rate of 3.89% achieved by a 2007 study of e-commerce in Thailand which was conducted in the same region as this study (National Statistical Office of Thailand, 2007).

Finally in order to complete the data collection process, the researcher checked the answers before leaving the businesses in order to ensure that the relevant data was received. Although the data is kept confidential, the respondents' contact details were also taken in case additional information was needed to fill out incomplete answers. As regards the collection of data on waste management, official letters were posted to the local government offices asking for access to the relevant information. Significantly, the local government was very supportive in providing secondary data which could be used to estimate the EF of waste management linked to tourism.

5.3.4.2 Tourists

In order to investigate the attitudes and energy-consuming behaviour of tourists at home and on vacation, questionnaires were developed in English and Thai. Before data was collected in the field, a sample of ten informants were asked to answer the questionnaires and give feedback on their wording, difficulty, and the amount of time they took to fill in. This feedback was used to edit the final version of the questionnaire by which data was gathered for this study.

The data were collected at two types of location—the main tourism destinations and on ferries carrying tourists back to the mainland. Firstly, the survey covered the eight main tourism destinations or beaches (called *Had* in Thai): namely, Had Na thon, Had Bang Po, Had Bo Phud, Had Maenum, Had Cheang Mon, Had Chaweng, Had Chaweng Noi and Had Lamai. This number of sites was chosen because the research needed to reflect the diversity of the tourists on the island: that is, in terms of their nationality, age, activities undertaken, and so on. Collecting data at a variety of different places can help to achieve this objective. Secondly, data was also collected on the Ferries taking tourists back to Surattani Province. Since the ferry trip to the mainland lasted about 1 hour and 45 minutes, there was plenty of time available to collect data from tourist data without disturbing their leisure time.

The questionnaires were distributed by hand and the researchers stayed with the respondents while they filled them out in order to answer any questions. The questionnaires were conducted at the two kinds of location mentioned above and took around 10 to 15 minutes to complete. The subjects were approached during their leisure time and informed about the purpose and ethical codes of the study in a polite and friendly manner. The researchers checked that the returned questionnaires were answered properly and completed in order to check that valid data was being received. Where researchers found incomplete or inconsistent answers, they politely asked respondents to complete or correct them. For example, in the question about modes of transport some respondents answered that they only used rental cars while in another question about on holiday behaviour they answered that they used public transport. In cases such as this, the researchers needed to ask informants to revise their answers. A small number of tourists withdrew from the survey before finishing the questionnaire. Therefore, these questionnaires were excluded from the analysis. Since tourists tended to travel with their families, friends, or partners, duplicate and uniform results were avoided by collecting data from only one member of each group. In this way, a wider range of tourists was covered by the survey.

5.3.5 The Pilot Study

According to Bryman (2004), it is always desirable to undertake a pilot study before collecting data. Instead of functioning as a pretest it was used more formatively to assist the researcher in developing relevant lines of questioning (Yin, 1994). In this respect, the pilot study provided a crucial opportunity for assessing and refining the research tools developed for this study.

The pilot study conducted for this study proved invaluable and it was conducted at Khanom beach in Nakhon Si Thammarat, Thailand, in October 2008. There were three key reasons for conducting the pilot study in this area. First, Khanom beach shares much in common with Koh Samui as a holiday destination. For example, similar in main modes of transport and activities are available to tourists and similar types of business operate in the area. Second, Khanom beach is less than half an hour away from the ferry port from which people embark to Koh Samui. Third, it was cheaper and more convenient to conduct the pilot study on Khanom beach because it is easier to get to from the Thai mainland.

In total, 32 responses to the tourist questionnaire, four responses to the business questionnaire, and two responses to the business interview were gathered during the pilot study. The most significant issue which it raised was the amount of time it took tourists and businesses to complete the questionnaires and interview. Accordingly, efforts were made to reduce the completion times for the questionnaires and to shorten the interview. The feedback from participants also suggested improvements needed to be made to the wording, skip pattern and general design of the questionnaires. The responses given to each question helped to highlight problems with the wording of the questionnaires.

The questions about how often people attended different activities and travelled in different modes of transport caused some confusion because clear units of frequency were not defined on the questionnaires. Therefore, units of frequency were provided in the revised questionnaires (times per trip for activities and hours per trip for transport). Some questions were routinely left blank by respondents such as the one about the number of hours spent traveling by ‘public transport’. This question did not take account of the absence of obvious forms of public transport like buses and trains on small islands and towns in Thailand. In such areas, pick-up trucks are the main form of public transport. Therefore, the vocabulary of this question was altered to reflect the way public transport is in small Thai holiday resorts.

The pilot studied also revealed that the skip pattern of questions about the types of transport used for traveling to holiday destinations was not working as planned because many alternative routes of transport disappear from the answer choices. Different modes of transport elicit different kinds of behaviour from tourists. Therefore, this question was changed in the tourist questionnaire to resolve the problem. Improvements were also made to the questions on the tourist questionnaire about energy-consuming behaviour at home and on vacation. The general design of those questions led the respondents to inadvertently overlook on either the series of questions related with home energy consumption or vacation energy consumption. Finally, the series of those questions were suitably separated and sufficient improvements were made to the questionnaire to ensure that all questions were completed by respondents.

The greatest difficulty raised by the pilot study was in collecting data from tourism businesses. Information about energy consumption is very sensitive and highly confidential for businesses in Thailand because of the implications it has about cost and finance. Many businesses were also concerned about the impact that the questions on garbage, waste water, and recycling could have on their reputations. Thus, in order to increase the response rate from businesses, it was decided that an official letter from the Energy Policy and Planning Office of Thailand’s Ministry of Energy should be attached with the questionnaires. This document gave official assurances that this research was being carried out for academic purposes only and also promised that all data will be kept confidential in the future.

5.4 SAMPLING METHODS

A variety of sampling methods need to be given careful consideration in order to gain results which are representative of the target group. These methods will be discussed in this section.

5.4.1 Target Population

Prior research into energy consumption and EFs in the tourism sector has laid the groundwork for defining the energy users and the energy providers which needs to be studied and how appropriate samples can be selected (Gössling *et al*., 2002; Peters and Schouten, 2006; Becken and Patterson, 2006; Kelly and Williams, 2007; Patterson *et al*., 2008). Following this body of work, the target population can be simply defined as the groups and individual elements that researchers are interested in and from which they wish to draw conclusions. Or in other words, the objects of interest can be "every possible case that could be included in your study" (David and Sutton, 2004:149).

The target population for this study has been separated into two distinct groups from which primary data about energy-consuming behaviour and related issues was collected. As discussed above, the first group consists of individual tourists who travelled to Koh Samui in 2008 while the second group is made up of businesses which supply tourists with accommodation, transport, and activities.

When a target population is very diverse, containing many different kinds of person, it may turn out to be too time-consuming and costly to collect data and make a comprehensive analysis of the relevant groups within that population. According to Bryman (2004) the factors of time and cost are very important for every researcher, as was the case with this study. Hence data was collected for this study from segments of the target population which were taken to be broadly representative of it.

5.4.2 Sampling Methods

Sampling is a procedure whereby general inferences are made about a group or thing by analysing a portion of a larger data set (Bryman and Bell, 2003; Neuman, 2003). In order for such findings to be valid researchers must use sampling techniques which help them to select a representative portion of the group being studied. There are two main ways of selecting a sample from a given population which can be classified as either probability or non-probability sampling methods. Although probability sampling methods will strengthen the external validity, or generalisability of results, they can also be costly and thus prohibitive for research projects (Robson, 2002). This study was also constrained by the time limits in which data needed to be collected so it required flexible and less time-consuming sampling methods.

Therefore, non-probability sampling methods were selected to draw out samples of international and domestic tourists above the age of 18 who travelled to Koh Samui in 2008. This sampling process involves selecting subjects on the basis of convenience (Zikmand, 2003). That is, the selection of participants for this study was based on "their proximity to the researcher and the ease with which the researcher can access [them]" (Jennings, 2001: 139). In order to reduce the possibility of bias when using convenience-based samples, data collection took place at multiple locations around Koh Samui: specifically Chaweng, Lamai, Bophut, Maenam Bang Po, Cheang Mon, Nathon and Chaweng Noi.

Business respondents were chosen for relevant questionnaire and interview using the purposive sampling technique (Table 5.1) which allows the researcher to obtain the most relevant and complete data about different kinds of respondent. For Berg (2001: 32) purposive samples are "used to ensure certain types of individuals or persons displaying certain attributes are included in the study". The business respondents in the sampling frame (Figure 5.1) were carefully selected so as to give a range of sizes and characteristics. The interview respondents received formal letters and emails asking for interview appointments and notifying them of the aims and objectives of this study. Given the complexity and sensitivity of the issues addressed in the interviews, interviewees representing businesses were selected on the basis of their accountability, management experience, influence, responsibility as regards strategic decision-making, and generally whether they were comfortable with the nature of the interview. They also need to possess a positive attitude to provide personal insights on the environmental impact from the energy consumption in tourism sector. The qualified participants then can provide a valuable source of insight on key issues of the EF.

5.4.3 Sample Size

It is important that the sizes of the samples of tourists and tourism businesses surveyed for this study are representative of those groups in general. The size of these samples depended on a variety of factors including many noted by Bryman (2004): time, cost, non-response, heterogeneity of the target population and the type of analysis being carried out. The sample sizes for this study are as follows: 485 responses to the tourist questionnaire; 70 responses to the business questionnaire; and 30 responses to the interview for businesses.

The size of the sample of tourists represents a healthy confidence level by the standards of Babbie (1998) who suggests 384 questionnaires are needed in order to achieve a 95% confidence level. Indeed, the sample size for this study was similar to or greater than those of some other tourism studies which employed questionnaires: e.g. 402 responses to questionnaires to Sanchez *et al* (2006); 220 responses to Pattersona, Niccoluccib, and Bastianonib (2007); 214 responses to Stern, Lassoie, Lee, and Deshler (2003); and 88 responses to Johnson (2003). Therefore, the size of the sample for tourists collected for this study was more than adequate for analysing and understanding the energy-consuming behaviour of tourists visiting Koh Samui.

However, for the sample size of businesses, it is determinded from the limited sources of this study and according to David and Sutton (2004), regarding the lack of cost and time, the experience level of researchers can make up for a small sample size. But even so, they still recommend that samples should be no smaller than 30. Furthermore, bearing in mind the research objectives of this study as regards the tourism business, the goal is not to make generalisations about the research population. Instead, the intention is to be able to describe or explain the trend of energy-consuming behaviour and attitudes about sustainability among tourism businesses on Koh Samui. Additionally, it is worth noting that the EF calculations made in this study do not depend on empirical data collected from tourism businesses. Rather, these calculations were made using the secondary data provided by energy suppliers about electricity consumption in tourism business and TAT about the energy-consuming behaviour of tourists. As mentioned above, the number of tourism businesses which responded to this study was similar to or greater than the numbers which responded to other studies of EFs in the tourism sector: e.g. 42 responses to McIntosh and Siggs (2010); 40 responses to McIntosh and Prentice (1999); 20 responses to Pattersona (2007); and 14 responses to Johnson (2003).

As regards the size of the sample of businesses interviewed for this study, it should be kept in mind that the purposes of the interviews was to gather in-depth qualitative data about the attitudes of those businesses towards energy consumption and the environment. Sample size is generally not an important issue for collecting qualitative data since the purpose of this kind of research is to gain detailed information. Clayton (1997) and Creswell (1998) have addressed the issue of how large samples for qualitative research should be, recommending somewhere between 15 and 25 participants in order to achieve thematic saturation. Therefore, by this measure, the 30 businesses interviews conducted for this study may be considered an appropriate sample size as well as being practical in terms of time and financial constraints.

5.5 DATA ANALYSIS

This study has obtained multiple data sets from different sources in order to provide understanding of the attitudes and behaviour of stakeholders toward environmental issues and practices. Therefore, both qualitative and quantitative techniques have been employed to analyse the data collected during the fieldwork. Accordingly, this section explains how data was coded, sorted, and interpreted in order to meet the stated research objectives.

5.5.1 Interpretation of Interviews

In analysing the qualitative data, the thematic process suggested by Attride-Stirling (2001) was employed to gain understanding of the behaviour and attitudes of stakeholders. Braun and Clarke (2006: 79) have defined thematic analysis as:

> "...a method for identifying, analysing and reporting patterns (themes) within data."

This approach helps researchers to capture important and relevant data related to their research questions. During the analysis process of this study, all data was transcribed and analysed in Thai in order to preserve any relevant meanings and themes related to environmental issues and practices. Data analysis was initially conducted after the completion of the data collection process. It has been recommended by Rubin and Rubin (1995) that data analysis should begin as soon as possible. The first stage of data analysis was to transcribe the data. The transcripts were read carefully in order to assign codes to each set. This is the basic stage of thematic analysis for classifying and grouping data sets. Bottom-up or inductive thematic analysis, as described by Braun and Clarke (2006), was employed to code the data without using prior coding frames. Following this process, initial codes and data sets were revisited in order to unfold and overlap and irrelevant codes. Different codes were reassigned to reflect the meanings of the data: for example, 'local concern', 'global concern', and ‘national concern’. As recommended by Braun and Clarke (2006), the data sets and codes were moved backwards and forwards until there were no additional codes. In other words, data were revisited until the interpretation process was completed (Mathwick, Wiertz, and de Ruyter, 2008).

Next, all codes and data sets were reconsidered in order to develop the themes. Different codes were categorised into potential themes which provided unique meanings. However, different levels of these themes—main themes and sub-themes—were considered in detail in order to ensure that they were all relevant and did not overlap. The themes were then reviewed until there were no more to be found in the overall data set. The details of each theme were developed into “stories” (Braun and Clarke, 2006) in order to provide further understanding of them. Finally, names were assigned to each theme (i.e. ‘level of environment concern’, ‘causes of CO_2 emissions’, ‘solutions for CO_2 emissions’, ‘actions to reduce energy consumption’, ‘requirements for environmental legislation’).

5.5.2 Statistical Analysis

This section explains how the quantitative data gathered through the questionnaires was processed: that is, edited, coded, entered into a database, and analysed. Descriptive and inferential statistics were employed to summarise and analyse the insights stakeholders gave into their views on the environment and sustainable practices. At first, code books were designed since the questionnaires had originally been developed to provide guidelines for coding the answers. Questionnaires received from informants were checked and invalid or incomplete questionnaires were removed to limit as far as possible errors in data processing. Codes were assigned to each item in the questionnaires from top to bottom and left to right before entering them into the Statistical Package for Social Sciences (SPSS). For example, travel methods in question 1 were coded as 1 for ‘A package tour’, 2 for ‘A semi-package tour’, 3 for ‘Independently’, and 4 for ‘Others’. Answers were placed on appropriate scales and coded by real values: e.g. ‘the number of nights stayed on Koh Samui’, ‘the number of members in groups per trip’, and ‘the amount of time spent using air conditioning’. Answers on the Likert scale (e.g. ‘level of concern’, ‘level of commitment’, and ‘energy consumption behaviour’) were coded from 1 to 5 depending on the direction of the questions (*i.e.* from positive to negative or *vice versa*):*i.e.* always: 5, Usually: 4, Sometimes: 3, Rarely: 2, Never: 1 or Strongly Agree: 5, Agree: 4, Neither Agree nor Disagree: 3, Disagree: 2, Strongly Disagree: 1. However, answers going in different directions were adjusted so that they moved in the same direction before coding. For example, the code “1” was assigned if respondents chose ‘Strongly Agree’ in response to the statement, ‘It’s not the responsibility of tourists to pay attention to energy shortages during their trips.’ After finishing the data entry process, everything in the SPSS format was checked for errors before it was processed (Pallant, 2007).

Both descriptive and inferential analyses were employed to interpret the data. Descriptive analysis, found in most quantitative works (e.g. Gibson, Willming, and Holdnak (2003), Haley, Snaith, and Miller (2005), Jenkins (1999), Kim, Wei, and Ruys (2003), Yeung and Leung (2007)), is a basic method of data analysis which focuses on summarising a single variable. Frequency and percentage have been used in this study to describe tourists’ leisure and energy-consuming behaviour, and their attitudes towards environmental issues and sustainable practices. Moreover, comparisons were made between tourists’ attitudes and energy-consuming behaviour at home and on holiday by mean and standard deviation. Additionally, inferential methods of analysis (*i.e.* t-test, Chi-Square test, and ANOVA) have been used to test the hypotheses outlined at 6.8. These statistical techniques help to provide understanding of the relationships and differences between two or more variables (Pallant, 2007).

According with statistical significance testing using inferential statistics,, this study employed both parametric and non-parametric statistics. For non-parametric statistics, the chi-square tests, the most common nonparametric test of significance in the traditional studies of social psychology were used to investigate the association of nominal or ordinal variables (Dolnicar and Leisch, 2008; Wang, 2011): e.g. demographic variables and type of transport. This thesis used one-way Analysis of Variance (ANOVA) and t-test, the most common parametric tests to evaluate hypothesis significance and comparing difference of means. To meet these statistical requirements, the data need to be collected in an interval or ratio variable. However, in practical many of tourism studies, especially the study of environmental behavior, tend to measure psychological factors by using ordinal or interval scales in various forms such as Likert scale. Although there is a limitation on using one-way Analysis of Variance with ordinal variables and some measurement scales such as likert scale, many scholars in tourism association with environmental behavior have employed it to test the difference of those scales. For example, Erdogan and Tosun (2009) have used one-way Analysis of Variance to test the hypotheses on difference environmental performance of accommodations in Goreme Historical National Park. The five-scale questionnaires were used to collect the data from 73 accommodations. Other studies were Buysse and Verbeke (2003) and Mowen, Graefe and Virden’s (1997) that used one-way Anova for hypothesis testing with the psychological variables.

The independent t-test is a statistical method used in tourism research to investigate whether differences between interval and ratio variables, on the one hand, and two independent variables on the other (Yeung and Leung, 2007). The independent t-test was specifically used in this study to analyse the differences between energy-consuming behaviour and membership of environmentalist groups. Additionally, paired t-test analysis was used to see whether there are any significant differences between dependent sampling variables: e.g. before and after travelling or behaviour at home and on vacation (Botha, Crompton, and Kim, 1999; Jarayaman et al., 2010). To further investigate whether there were any significant differences between interval and ratio variables and two or more ordinal and nominal variables, analysis of variance (ANOVA) tests were conducted which showed the mean differences among three or more variables: this method has been demonstrated in tourism research by Awaritefe (2003), Dolnicar and Leisch (2008), and Wang (2011). In this study ANOVA were used to investigate differences in energy-consuming behaviour in relation to demographic factors, travel behaviour, level of environmental concern and environmental attitude. Additionally, chi-square tests were used to investigate the association between nominal and ordinal variables (Dolnicar and Leisch, 2008; Wang, 2011): e.g. demographic variables and tourists' energy-consuming behaviour.

5.5.3 EF Analysis

The earlier discussion of calculation methods in Chapter Two is taken into account in this section which evaluates the EF as one such option, paying careful consideration to the pros and cons of each method. Prior research has shown that fossil fuels, especially coal, oil, and natural gas, which supply about 95% of the world's total energy demands, are also the main sources of energy for the tourism sector (see in Chapter Two). Likewise, in Thailand fossil fuels are the main energy source driving economic activity. Indeed, over 81.5% of the country's energy demands were met by the combustion of non-renewable fossil fuels in 2009. The remaining 18.5% can be accounted for by alternative energy sources (DEDE, 2009). Furthermore, the current footprint framework is incomplete since recent data have shown that calculating the EF of energy usually only accounts for major energy sources (Garbesi, 2010).

The calculation methodology calculation developed for this study builds on the original footprint framework developed by Wackernagel *et al*. (1999). In brief, this framework allows researchers to estimate energy footprints in terms of "fossil energy land" by calculating the land area required to absorb CO_2 emissions released by combusting fossil fuels (see also in

Bicknell *et al*., 1998; Van Vuuren and Smeets, 2000; Haberl *et al*., 2001; Ferng, 2002; Medved, 2006). Other energy sources, such as wood and other products from forestry, and solar, wind, and waste energy, were not taken into account in the energy footprint calculations made in this study. The reasons for this omission are, first, that the energy footprints of these fuel sources are relatively small by comparison with those of the primary fuel sources and, second, in order to avoid double counting.

Among the various methods which have been proposed for calculating EFs from energy consumption, Wackernagel's method for calculating energy footprints for fossil fuel consumption has gained a great deal of attention and has been applied widely in tourism studies (*e.g.* WWF, 2002; Gössling *et al*., 2002; Hunter and Shaw, 2007). Most of these studies focus on a single year as can be expected given that Wackernagel and Rees' (1996) method for making EF calculations involves dividing the annual average consumption of a product by its average annual productivity. Similarly, the energy footprint calculations made in this study are based on annual emissions from the previous 12 months.

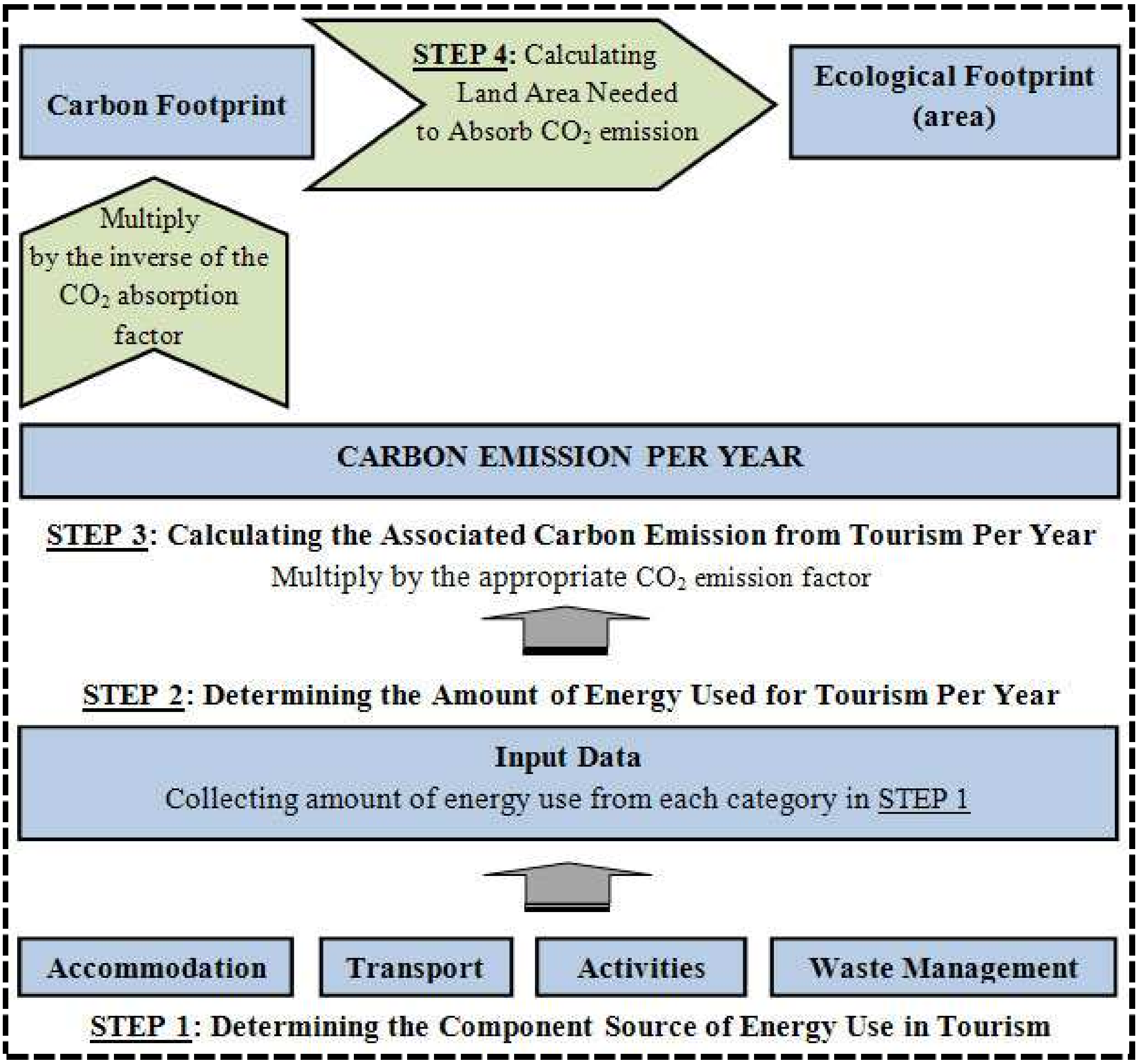
The whole calculation process adopted here follows the method outlined by Garbesi (2010). This study is also influenced by other works in which energy and ecological footprint measurements are made (Becken, 2001; Becken, 2002; WWF, 2002; Gössling *et al*., 2002; Becken and Patterson, 2006; Hunter and Shaw, 2007). The level of energy consumption in the tourism sector and the resulting EF is thus measured here in terms of the land area required to absorb CO_2 emissions released by combusting fossil fuels over the course of a single year. More details of this method may be found in Figure 5.4.

STEP 1: Determining the Component Source of Energy Consumption in Tourism

This study draws attention to several sub-sectors and types of service within the tourism industry (*i.e.* accommodation, transport, and activities) in which energy is consumed in different ways. Determining the amounts of energy and types of fuel used by each sub-sector marks the first step towards setting the scope for footprint calculations.For example, there are three main energy sources used by the accommodation sector, namely electricity, LPG for kitchen use and desalination plant. In theory, every way in which fossil fuels may be used should be considered here.

However, existing data concerning the amount of energy consumed should also be considered. For example, Gossling *et al* (2002) have calculated the EF of international tourists in the Seychelles by identifying five key areas of consumption: transport, accommodation, activities, and food and fibre. Similarly, Becken (2002b) has focused on energy consumption in three major sub-sectors of the tourism industry in New Zealand: transport, accommodation, and attractions and / or activities. As discussed previously, this study focuses on four areas of energy consumption linked to tourism on Koh Samui, namely transport, accommodation, activities and waste management.

Figure 5.4: Energy Footprint Calculation Method Diagram



Source: Adapted from Garbesi (2010)

Following precedents set by recent studies, there are five main components for tracking CO_2 footprints in the tourism sector: The five main components are transport, accommodation, waste, food and activity. Table 5.4 shows the main energy sources and the key sub-sectors investigated in a range of academic works. Most of these studies took account of transport, accommodation, and activities in order to estimate CO_2 emissions and corresponding EFs. However, these studies differed in how they treated waste and food as areas of energy consumption. Most of them took account of food but excluded waste in their EF calculations.

Furthermore, Becken and Patterson (2006: 326) have noted other problems raised by this area of tourism for studies of EFs: "[t]heir heterogeneous nature, which would increase the sampling frame considerably, but probably, would make little difference to the estimates of total emissions of CO_2". The categories of 'food and fibre consumption' proved to be similarly difficult due to the poor official statistical database available for Koh Samui and the unwillingness of the tourism industry to provide data (Gössling *et al*., 2002).

For this research, the study of four sub-sectors of tourism *i.e.* transportation, accommodation, waste, and activity, had been under taken in order to evaluate the CO_2 emissions from tourism sector in Koh Samui.

Table 5.4: The Component Sources of Carbon Footprint in Tourism Sector

Authors	***Sources of energy consumption and EF***				
	Transport	*Accommodation*	*Waste*	*Food*	*Activity*
1.WWF (2002)	✓	✓	✓	✓	-
2. Gössling *et al.* (2002)	✓	✓	-	✓	✓
3. Johnson (2003)	✓	✓	-	✓	✓
4. Peng and Guihua (2007)	✓	✓	✓	✓	✓
5. Becken (2002a)	✓	✓	-	-	✓
6. Peters and Schouten (2006)	✓	✓	-	-	✓
7. Becken and Carboni (2008)	✓	✓	-	-	✓

Source: Author

One major area of the tourism industry on Koh Samui, consisting of restaurants and other kinds of catering service, was not taken into account in this study because of severe limitations in the availability of data about the amounts and types of food being served to tourists on the island.

STEP 2: Determining the Amount of Energy Used for Tourism per Year

The amount of energy consumed in each of the sub-sectors of tourism identified above needed to be provided. Given that different forms of energy may be used by each sector, it is important to calculate their CO_2 emissions separately. Moreover, as Hunter (2002) has pointed out, the diversity of the choices made by tourists about transport, food, accommodation and activities means that the ecological footprint of each area must be determined separately before they are added together to find the overall footprints of individual tourists. Another point of concern is whether relevant data about fossil fuel consumption already exists. For example, if statistics about fuel consumption linked to transport are not readily available, valid estimates can still be made by taking account of the type of transport used, the distance traveled, and fuel efficiency (Becken, 2002a, Garbesi, 2010). It should also be mentioned here that a distinction can be made between "direct" and "indirect energy" which is important for the establishment of a calculation method in the next step. Becken (2002b: 38) has stated that the reasons for when, where, and why tourists consume energy are complex and that the borders of what is specifically allocated to tourism are not clearly defined. For example, the tourism industry purchases products from other industries, such as furniture, appliances, and vehicles, which all require the production and delivery of fuel sources. There is also no specific database about indirect energy consumption linked to the tourism industry on Koh Samui that would allow this study to estimate the corresponding EF. Therefore, calculations were made in this step only for the amounts of direct energy used for the purposes of tourism on Koh Samui.

STEP 3: Calculating Carbon Emissions Linked to Tourism per Year

The calculations for energy consumption made in STEP 2 were converted into figures for CO_2 emissions by using a specific conversion factor which takes stock of different activities and production backgrounds in different countries. For example, in order to determine quantities of CO_2 emissions, the original units in which data were recorded for this study (Kilowatt Hours (kWh) and Mega joules (MJ)) were adjusted using the following conversion factor, 0.580 $kgCO_2/MJ$, which is primarily based on the conditions of electricity production in Thailand (EGAT, 2008). Electricity is mainly produced in Thailand from natural gas, oil, lignite, water (hydropower), diesel, and coal. In contrast, CO_2 emissions from electricity production are different for other countries such as the United Kingdom, United States, and New Zealand to which the following conversion factors apply respectively: 0.430, 0.620 and 0.624 kg CO_2/MJ (defra, 2008 and Becken, 2002). So in the case of the accommodation sector, for example, figures for electricity consumption in kWh were converted into MJ by being multiplied by 3.6 (*i.e.* 1 kWh is equivalent to 3.6 MJ). Next, the conversion factor noted above was applied to the figures in MJ in order to calculate the quantity of CO_2 emissions for the accommodation sector. However, no data were available on the amount of electricity used in different types of accommodation hence this study focuses on the accommodation sector in general.

STEP 4: Calculating the Land Area Needed to Absorb Carbon Emissions

In this stage of the analysis, calculations were made of the land area (in global hectares (gha)) needed to absorb CO_2 emissions linked to tourism on Koh Samui. This study has used the calculation guidelines and equivalence factors established by earlier studies such as WWF (2000). The actual figures and calculations made for this study are discussed in detail in Chapter Eight.

5.6 RELIABILITY AND VALIDITY

Researchers must be concerned with reliability and validity in order to ensure the quality and credibility of their research findings. Chisnall (2001: 38) defines reliability as "[t]he stability and consistency of the results derived from research." In the other words, reliable research should provide findings which support each other. The main issue regarding reliability for this study was in the construction of the questionnaires. Accordingly, efforts were made to make the questionnaires as reliable as possible by developing them in response to the literature review and testing them on non-sample groups prior to the actual fieldwork taking place.

Meanwhile, validity relates here to the calculation methods, which must provide relevant and correct data (Ruane, 2005). In different words, validity is a quality control process which guarantees that research projects achieve whatever goals they claim to. Three types of validity have been identified in the literature relevant to this study: construct validity, internal validity, and external validity (Chisnall, 2001; Yin, 2003). Firstly, construct validity is the correct measurement from the relevant theory and information being studied here. This research addresses construct validity by developing research instruments in response to the concepts of tourism behaviour, the environment and energy issues. Secondly, internal validity is highlighted in the causal research because it is concerned with the actual relationship between two variables (*i.e.* the dependent and independent variables). More specifically, internal validity ensures that changes to dependent variables are caused by changes to independent variables (Ruane, 2005). Finally, external validity refers to the general capability of research findings.

5.7 ETHICAL ISSUES

The respondents were informed about the purpose of this study before they answered the questionnaires. They were also informed of their right to deny or withdraw their cooperation at any time. The researchers approached the respondents in a friendly manner. The data were gathered from tourists in confidentiality: no names, marks, or signs were noted on the questionnaires. The data gathered from tourism businesses were also kept confidential, although the respondents were asked to voluntarily provide contact numbers in case in case any of their answers needed to be followed up. The respondents were also provided with the contact details of the main researcher in case they want to ask about the result of this study.

Finally, in order to minimize ethical issues during the interview process, the researchers took extreme care to avoid any harm to the respondents by offering them the rights to free and informed consent, privacy, anonymity, confidentiality, and to not be deceived. For their part, the respondents had an obligation to be truthful (Zikmund 2003). For these reasons, the respondents were given the choice of whether or not to participate in the interview and did not have to disclose their names or any other information that would help to identify them. The purpose of the interview was also clearly described to them.

5.8 CONCLUSION

The issues of energy consumption and EF have often been overlooked in the literature relevant to this study and, when they have been used for the purposes of tourism research, the tendency has been to explore them separately from each other. Thus, at present, very little effort has been made in tourism studies to understand and explain how patterns of energy consumption influence EFs in different energy contexts. Accordingly, one key contribution made by this study is that it is one of the first and largest scale attempts to use of diverse primary and secondary data to study the relationships between patterns of energy consumption, the factors which influence them, the attitudes of both tourists and tourism businesses towards the environment, and the concept of EF.

This chapter has argued that the mixed methods approach, as discussed above, is the most appropriate way of achieving the goals of this study. Therefore, several collection tools-namely two questionnaires, a semi-structural interview, and an energy consumption checklist, were developed to obtain relevant qualitative and quantitative data. To further meet the research objectives of this study, secondary data were gathered from a variety of sources in order to develop a conceptual framework and make the necessary EF calculations.

Given the objectives and data requirements of this study, a decision was made to gather relevant information from tourists and tourism businesses on Koh Samui. TAT's official list of tourism businesses on Koh Samui provided a comprehensive sampling frame. Due to the limits of time and finance, the convenience sampling technique was employed to collect data from tourists while businesses were selected using the purposive sampling technique. Business organizations within the tourism industry were sorted into four categories depending on the kind of service they provide: that is, accommodation, restaurants, transport, and activities. The restaurant category was dropped at a later point because, as explained above, it proved overly difficult to obtain reliable data about energy consumption. Finally, this chapter discussed the sizes of the samples of respondents gained by the fieldwork: that is, 485 responses to the tourist questionnaire, 70 responses to the business questionnaire, and 30 responses to the business interview. The sample size of businesses for questionnaire responses may appear small compared to some tourism research but they are large in a number of respondents of interview comparison with other study of energy in tourism studies.

Descriptive and inferential modes of analysis were used to investigate quantitative data in order to provide understanding of the factors which influence energy-consuming behaviour. The energy consumption checklist, which shows the types and quantities of fuels used by the facets of the tourism industry relevant to this study, was based on data given by the PEA and TAT. These data enabled estimates to be made of the energy intensity, CO_2 emissions and EF of Koh Samui's tourism industry. By contrast, thematic analysis was used to examine the qualitative data gathered through the semi-structural interview. In this way, a number of themes emerged from the interview findings which were then integrated with the quantitative data to fulfill the research aims and objectives.

CHAPTER SIX

AN ANALYSIS OF TOURISTS' ENERGY CONSUMPTION

6.1 INTRODUCTION

As important stakeholders in the tourism industry, tourists cannot be excluded from studying their energy consumption and analysing its EF in tourism sector. Most of the energy consumed by the tourism sector is used to support the various activities of tourist's holidays including their journey to and from destinations. As direct users in mostly process of energy consumption, tourists are therefor one of the main cause of the CO_2 emissions of the tourism industry. As business customers, they also exert influence on the commercial sector, especially as regards business plans and decision making related to customer service which directly influence tourists' satisfaction. There are widely accepted that a number of businesses increasingly develop policy initiatives relevant to energy saving and climate change concern for being a low carbon company and consequently variety of action energy programmes are included and operated for customers. Hence the decisions tourists make such as the type of transport they use, the accommodation and activities they choose at their destination, their personal attitudes and level of environmental concern, can potentially influence the ways in which they use energy in relation to their vacations as well as the business decisions.

In order to research the objective 1, this chapter provides the results of tourist behaviour relevant to the energy consumption behaviour in three main areas: accommodation, transport and tourism activities. Basing on thesis objectives and study framework, it is also necessary to study tourists' attitudes towards energy consumption and climate change as well as to compare differences between their energy-use behaviour at home and on vacation.

In order to understand tourists' energy-use behaviour the influential factors, Analysis of Variance (ANOVA), t-distribution test, and Chi-square were applied to identify the differences and relationships between the types and volumes of energy-use by respondents. This will be done in relation to different variables namely tourists' personal backgrounds, travelling behaviour and their attitudes towards climate change. Energy-use behaviour and other crucial streams of data offer up-to-date bottom-up information which could seal the current gap between policy and strategies design delivering strength outcomes in environmental-health maintaining.

This chapter presents the analysis and discussion of data gathered from tourist's questionnaire. It starts with the general background of respondents in terms of demographic, travel characteristics and psychological factor toward global environment and energy consumption, while the next part continues by demonstrating the energy consumption patterns. It then continues by highlighting the analysis of energy consumption behaviour and its influential factors, while the conclusion section ends this chapter with a brief of key significant results and discussion.

6.2 THE DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Table 6.1 shows that of the 485 usable questionnaires, the gender distribution of the respondents was quite even: 52.0 % male respondents and 48.0 % female respondents. The average age of tourists of the respondents travelling to Koh Samui is approximately 34 years old and the dominant age group is 21 to 30 years (41.9 %), followed by the older group of 31 to 40 years (28.0 %). The majority of respondents (52.2%) are single, followed by the married group (39.8 %). According to information provided by respondents on their personal backgrounds, as seen from Table 6.1, nearly a half of them have two adults in the household (45.7 %) while most have no children (58.3 %).

The wide ranges of respondents' career have been grouped from opened question in tourists' survey. The results show that nearly a third of the respondents are employees of private companies (30.9 %) and also that a significant portion are business owners (21.7 %). Moreover, more than half of the respondents (51.8 %) come from the families which have a monthly income of more than £ 3,000, among whom the average monthly income is £7,157.81. As regards the educational backgrounds of the respondents, as seen from data presented in Table 6.1, almost 41.6 % have university level education level and 29.7 % high school level education. Data also shows that European visitors mainly from the United Kingdom, Germany, Italy and Switzerland make up the largest share of the total number of respondents (34.8 %) followed by domestic tourists (26.6 %) and Scandinavians (16.9 %) respectively. Nevertheless, only 14.8 % of respondents belong to environmental groups or organisations. However, due to the conceptual framework of EF which considers area and amount of energy consumption in the whole picture of tourism from all type of tourists visiting Koh Samui, this study then investigate their behaviour together in terms of domestic and international respondents.

Table 6.1: Frequencies and Percentage of Respondents Classified by Demographic Characteristics

Tourist Demographics	Frequency	Percent
Gender		
Male	252	52.0
Female	233	48.0
Age (Mean= 33.70 years)		
Less than 21 years old	32	6.6
21 - 30 years old	203	41.9
31 - 40 years old	136	28.0
More than 40 years old	114	23.5
Marriage Status		
Single	253	52.2
Married	193	39.8
Divorced	39	8.0
Occupation		
Business Owner	85	21.7
Private company employee	121	30.9
Government officer	70	17.9
Student	53	13.6
Engineer and technician	27	6.9
Others - farmers, retirements, etc.	35	9.0
Household Income per month: (Mean = £7,157.81)		
Less than £ 1,500	83	24.7
£ 1,500 - £ 3,000	79	23.5
£ 3,001 - £ 6,000	48	14.3
More than £ 6,000	126	37.5
Education Level		
Up to high school	43	8.9
High school	144	29.7
Bachelor	202	41.6
Postgraduate	96	19.8
Place of Origin		
Europe	169	34.8
Oceania	41	8.5
USA	25	5.2
Asia	33	6.8
Scandinavia	82	16.9
Thai	129	26.6
South Africa	6	1.2
Environmental Group membership		
Yes	72	14.8
No	413	85.2

Source: *Author's Fieldwork*

Respondents' personal profiles reveal that a wide range of alternative activities in Koh Samui attract men and women in equal proportion. Although holiday products appear to remain non-gender specific, simultaneously the minus of render invisible the economics and social difference between men and woman can affect their ability to take holiday in the same basis (Marshment, 1997). The notion of gender has been widely discussed in work relating to the behaviour of tourists. Differences between the domestic energy-consuming behaviour of men and women have also received considerable attention from academics: for instance, studies by Wilhite *et al.* (1996) and Lenzen *et al*. (2006) take gender roles into consideration. Thus special attention is given in this study as to whether there are significant differences in how men and women consume energy over the courses of their holidays: the results shows on the next part of statistical test for the comparison of samples.

It has been shown that most of holiday-makers visiting Koh Samui are either full-time employees of private companies or business owners. Most of them also possess household incomes in excess of £85,893 per annum or approximately £28,631 per person. It appears that the island shows dynamic system in her tourism evolution with changing of customer's characteristics, pattern of product to more nightlife and alternative activities, and supporting facilities (See also in Chevarot, 2006; Thiwaphan, 2004; Cohen *et al*., 1982). Recently there has been a shift away from the low-end backpackers' market, which mainly relies on cheap fan-cooled bungalows near to the sea, towards wealthier international holiday-makers who demand better quality accommodation, transport, and activities. As a result of this upmarket trend, low income holiday-makers, such as students and domestic tourists, have become a relatively minor part of Koh Samui's tourism sector as the island has developed into a more prestigious international holiday destination.

Koh Samui is now firmly established as a holiday destination for western tourists, particularly among Europeans who accounted for the largest group of international holiday-makers surveyed (most of them were from the United Kingdom). The UK is the fourth largest exporter of tourists in the world after the US, Germany and Japan (Meyer, 2003). Furthermore, the UK is a net exporter of tourists hence it contributes more than it receives in income from the global tourism industry. Recent research has shown that most of the UK population has taken a beach holiday (Shaw *et al*., 2000; Mintel, 2001).Thailand is one of the top 10 long-haul destinations for UK holiday-makers and has experienced a sharp increase in visits by visitors from the UK in recent years (Office of Tourism Development, 2007). Importantly, British holiday-makers tend to be attracted to "sun, sea and sand" products: a category into which Koh Samui certainly falls. However, Koh Samui has more to offer holiday-makers than just sunshine and beaches. Koh Samui is also of interest for its natural habitats, in respect of which alternative activities such as cruising, snorkelling and elephant riding are also popular among tourists. Moreover, it seems that the growing market for British and other European tourists on Koh Samui reflects steady growth in nightlife activities bar beer, pubs, and internet cafe' (Scheyvens, 2002; Thiwaphan, 2004).

Another important characteristic of tourists' personal profiles is whether they are members of environmental groups. This research shows that most are not involved in any local and/or international environmental activist groups. However, some of the respondents are members of such organizations, including the WWF and Friends of the Earth. It has been pointed out by Dalton (2005) that membership of environmental groups is influenced by nationality as, notwithstanding global concern for the environment, the differing socio-political conditions of different countries affect how their citizens respond to national and global environmental issues. Furthermore, membership of environmental activist groups is no guarantee that people will always behave in ways that accord with the principles of those groups. Nevertheless, concern for the environment is increasingly of concern to tourists, affecting how they choose their holiday destinations and activities and how they behave on holiday.

6.3 TRAVEL CHARACTERISTICS OF RESPONDENTS

This section presents the data collected on the travel behaviour characteristics of respondents in order to discuss whether they differ according to the respondents' attributes and energy-use behaviour. Travel behaviour characteristics significant to the study include travel options (*i.e.* privately or with a tour company), length of stay, size of travel group, relationships between members of travel groups and the main purposes of visiting Koh Samui. The choices made by respondents about their mode of transport to and from their destination are also discussed.

The data represented in Table 6.2 shows that most respondents (75.5 %) travelled independently while 15.1 % of them preferred package-holiday services in which all transport, tour operation and accommodation are included or managed in conjunction with a third party. The results of the survey show that most holidays to Koh Samui are organised independently of tour companies. This is true among Thai and foreign tourists. As Thai tourists are travelling within their own country, it is easy enough for them to arrange travel and accommodation by themselves.

Table 6.2: Frequency and Percentage of Respondents Classified by Travel Behaviour

Travel Characteristics	Frequency	Percent
Travel Arrangement		
Packaged tour	73	15.1
Semi-package tour	46	9.5
Independently	366	75.5
Length of Stay: (Mean = 10.88)		
1 - 5 days	224	46.2
6 - 10 days	122	25.2
11 - 15 days	70	14.4
More than 15 days	69	14.2
Number of People in Group:(Mean = 3.46)		
1 person	51	10.5
2 people	211	43.5
3 people	66	13.6
More than 4 people	157	32.4
Membership in a Group		
Alone	53	10.9
As a couple	130	26.8
With friends	197	40.6
With family	105	21.6
The purpose of visiting		
On holiday	372	76.7
Visiting friends or relatives	68	14.0
Attending conference or exhibition	12	2.5
On a business trip	33	6.8
Transit Place		
Bangkok	331	93.5
Others (Penang, Singapore, Hong Kong, *etc*)	23	6.5
Mode of transport for travel to destination		
By plane from Bangkok	268	55.3
By plane from Others (Phuket, Penang, Singapore, *etc*)	26	5.4
By plane from Bangkok to Surathanee	66	13.6
Train	50	10.3
Bus	15	3.1
Private Car	35	7.2
Other vehicles (Cruise, Boat, *etc*)	25	5.2
Accommodation (n = 483)		
hotel	180	37.3
Bed and Breakfast/Host accommodation	20	4.1
Staying with friends or relatives	25	5.2
Guest house or Bungalow	199	41.2
Eco-Lodge	26	5.4
Others (Rental house, Apartment, *etc*)	33	6.8

Source: *Author's Fieldwork*

The result that foreign tourists prefer to arrange their holidays to Thailand independently corresponds with the findings of Meyer (2003). However, it should be noted that package holidays are becoming increasingly popular among foreign tourists travelling to Koh Samui due to the convenience of having travel, accommodation, and activities organised for them.

Almost half of the respondents (46.2 %) spent 1–5 days in Koh Samui while 25.2 % stayed for roughly one week: the average length of stay among all respondents was 10.8, more than half of whom (53.8 %) stayed more than five days. This evidence suggests that the average length of stay in Koh Samui exceeds that typical of resort-based destinations in Thailand (TAT, 2008).

One of the most important decisions made by holiday-makers is how long they should stay at their holiday destination(s). This aspect of the behaviour profile of tourists affects their overall energy consumption. The findings show that the average period of stay per tourist is approximately one week, which suggests that tourism in Koh Samui has evolved to become more short-stay and weekend-visit oriented among tourists in general. However, increasing levels of expenditure on tourism may have the effect of driving down the average period of stay among tourists as found by Alegre and Pou (2006). Diminishing periods of stay in Koh Samui may reflect growing interest among tourists in visiting other nearby destinations, many of which are renound for their natural beauty *e.g.* Koh Pa Ngun, Koh Tao, Koh Nang Yuan, *etc*.

Regarding the characteristics of respondents' groups, our findings show that most travelled with friends (40.6 %) or as couples (26.8 %). The largest portion travelled in a group size of two (43.5 %) and nearly a quarter (23.3 %) travelled with groups of 4 or more. Furthermore, our findings show that although the majority (76.7 %) of respondents visited Koh Samui for holidays only, a significant portion (14.0 travelled there to visit friends or relatives.

As regards respondents' choices in transport and accommodation, Table 6.2 shows that a majority of international tourists flew directly from their home country to Bangkok. Furthermore, even though there are many ways to travel from Bangkok to Koh Samui, most respondents (55.3 %) chose to fly the distance: only a very small number of them (3.1%) opted to travel by bus.

Koh Samui has long been world famous as a 'Sea Sun Sand' type destination. Therefore, a modern transport system has been developed to provide tourists with ease of access to the island *i.e.* car, ferry, and air travel. It seems likely that because of it speed and convenience, air travel is currently the most popular mode of transport among tourists (especially foreigner tourists), as can be seen from the number of flights to Koh Samui operated by Bangkok Airways and Thai Airways. As a result, Samui Airport has become the second Thai International Flight Hub (Samui Airport Online, 2010).

Although some, especially domestic, tourists travel by train or private car, they also need to take ferry from the mainland to Koh Samui. As many scholars have demonstrated (Gössling, 2002; Gössling *et al*., 2002; Høyer, 2000), air travel emits greater levels of CO_2 emissions than other modes of transport, thus producing a larger carbon footprint.

The largest portion of respondents stayed in Guest houses and Bungalows (41.2 %), closely followed by Luxury hotels (37.3 %). Friends' houses, eco-lodges, rental houses and apartments make up the smallest proportion of accommodation among respondents to our survey. A wide range of accommodation is available at different prices on Koh Samui, thus affording tourists to the island a degree of choice in where they stay. Most tourists who stay in guest houses and bungalows are influenced by the price of this kind of accommodation. Hung *et al.* (2009) and Lockyer (2005) support this by demonstrating that pricing is one of the main factors taken into account by tourists when choosing accommodation. This is especially important for them when they are travelling to destinations where the cost of living is high such as Koh Samui. However, there are also a number of tourists who choose to stay at luxury hotels because they provide a better range of facilities and service, albeit at higher prices (Presbury, Fitzgerald, and Chapman, 2005).

6.4 LEVEL OF ENVIRONMENTAL CONCERN AND COMMITMENT TO ACT ON ENERGY SAVING

One of the most interesting points from literature is the association between people's level of concern for the environment and the extent to which they modify their behaviour in response to this. A small number of studies into energy consumption-behaviour have explored this association.

In the questionnaire respondents were asked to rate their level of concern for the environment and commitment to change their behaviour to lessen their impact on it on a 5-point Likert type scale. Respondents were asked to rate their level of concern using the following response categories: 'Not concerned at all' (1), 'Not concerned' (2), 'Uncertain' (3), 'Concern' (4), and 'Extremely concerned' (5); and they were asked to rate their level of commitment using the response categories: 'Not committed at all' (1), 'Not committed)' (2), 'Uncertain' (3), 'Committed' (4) and 'Totally committed' (5). Respondents were asked to indicate their level of concern and level of commitment toward environmental problems in regard to energy usage. The association between these two variables was subjected to the Chi-square test and categorised into three groups, the results of which are shown in Table 6.3.

Table 6.3: Number and Percentage of Respondents and the Association between a Level of Concerns and Commitment toward Environment and Energy Issues

Level of concern toward environmental problem Mainly from energy usage	**Level of commitment to act on global environmental problem and energy saving**						***Total***
	Not Committed		***Uncertain***		***Committed to act***		***n (%)***
	%	**n**	**%**	**n**	**%**	**n**	
Not Concerned	80.6	29	11.1	4	8.3	3	36 *(100)*
Uncertain	23.5	19	71.6	58	4.9	4	81 *(100)*
Concerned	7.9	29	22.3	82	69.8	257	368 *(100)*
Total	**15.9**	**77**	**29.7**	**144**	**54.4**	**264**	**485 *(100)***

Note: Chi-square = 238.077, Sig. = 0.000
Source: *Author's Fieldwork*

A significant association was found between the respondents' level of concern and level of commitment (chi-square = 238.077, Sig. = 0.000). Indeed, a higher proportion of respondents who expressed no concern about environmental problems also indicated that they were not committed to act on by saving energy (n = 29; 80.6%): this compares to the smallest portion who expressed concern for their environmental impact and also commitment to act on it by saving energy (n = 257; 69.8%). Although the overall ratio of respondents shows that the level of environmental concern among them is consistent with their respective levels of commitment to act towards its improvement, a small number of respondents showed considerable divergence between their expressed levels of 'concern' and 'commitment to act'. These results clearly indicate that about 77.7% of respondents identify themselves as tourists 'travelling with environmental concern', but only half of whom (54.4 %) are committed to act towards saving energy. They also confirm that respondents demonstrated a higher mean level of concern (4.00) for the environment than level of action tendency (3.5).

Hence, although most tourists show concern for the environment, relatively fewer express commitment to act towards saving energy out of environmental concern. These findings are consistent with those of Lee and Moscardo (2005), who have shown that high levels of environmental concern do not necessarily translate into environmental management practices at holiday destinations. Similarly, Budeanu (2007) and Manaktola and Jauhari (2007) have noted that even though tourists who express concern about environmental issues tend to choose environmentally friendly products, they often do not want to pay extra for those products. It may be that many such tourists believe that other stakeholders should take responsibility to provide greener services and practices.

6.5 TOURISTS' ATTITUDES TOWARDS THE GLOBAL ENVIRONMENT AND ENERGY CONSUMPTION

Using Likert scales, respondents were also asked to rate their attitudes towards global warming and climate change, and where they believe responsibility falls among stakeholders in the tourism industry to tackle these problems: the results are illustrated by Table 6.4. Respondents generally showed a high level of agreement (mean = 4.30) with the statement 'Reducing environmental impacts is important to tackling global warming and climate change'. Respondents also showed a high level (mean = 4.06) of support for tourism businesses implementing energy-saving practices in the high level, and agreed to a high level (mean = 4.04) that they would be prepared to follow guidelines to support environmentally friendly programmes at tourism destinations.

However, overall they showed slight agreement (mean = 3.58) with the statement 'It's the tourists' responsibility to pay attention to energy shortages during their trips'. They responded in contrast by showing slight disagreement (mean = 3.32) when asked if they should feel concern for natural resource problems such as water shortages or energy crises. Respondents expressed moderate concern (mean = 3.03) for energy saving campaigns during their vacations .

The research findings show that respondents agreed global warming and climate change are not only problems for individual or particular organisations, but also tourism businesses and tourists themselves. Significantly, the respondents' attitudes towards eliminating global environmental problems seem higher when compared with their attitudes towards their own responsibilities, *qua* tourists, to contribute towards such ends. This illustrates the overall moderate level of their attitudes related with energy saving campaigns and their tendency action toward natural resource problem along holiday.

Table 6.4: Means of Respondents' Attitude toward Environment and Energy Issues

Attitude about energy	Mean	S.D.
Reducing environmental impacts is important to tacking global warming and climate change	4.30	0.78
I always feel comfortable to follow the guidelines and support environmentally friendly programmes at my destination	4.04	0.88
It's the tourists' responsibility to pay attention to energy shortage during their trip	3.58	1.24
Energy should be part of the environmentally friendly practice of tourism business	4.06	0.85
Honestly, the energy saving campaigns doesn't bother me when I'm on holiday	3.03	1.27
Holidays are a time when I also need to concern natural resource problems such as water shortage and energy crisis	3.32	1.31

Source: *Author's Fieldwork*

6.6 EXISTING CAMPAIGNS AND ATTITUDES TOWARDS ALTERNATIVE ENERGY SOURCES

According to existing campaigns relating to the energy saving programme and alternative energy sources, such as solar and wind power, respondents were also asked to rate the level of information they had received during their vacations about environmental issues relating to the tourism sector. As shown in Table 6.5, more than sixty percent of respondents (60.6 %) did not receive good information about energy saving. More specifically, 30.9% did not receive any information, and 30.1 % were not impressed by the information they received. An other factor is the level of respondent support for using alternative energy sources. Interestingly, most respondents (78.4 %) do not support this, of whom 40.6 % were not very supportive at all and 37.8 % not very supportive. Only 6.6% of respondents show extremely support the use of alternative energy sources.

The results presented in Table 6.5 also show that there is a significant association between the level of information received in terms of energy saving campaigns in Thailand and respondents' support on alternative energy (Chi-square = 12.259, Sig. <.05). A significant result of this test can be interpreted that the group of respondents who gain more information of existing energy saving campaigns than other groups tend to show stronger supportive levels of alternative enrgy. In contrast the respondents who get the information in the level of 'not well at all' and 'not very well' reveal that they were not support the alternative source of energy.

Table 6.5: Chi-Square Test Results of Respondents' Perception toward Information of Existing Energy Saving Campaigns and Support of Alternative Energy

Level of information received	*Support for alternative energy*			
	Not supportive at all	Quite supportive	Very supportive	Total
Not well at all	76.2% (224)	19.0% (56)	4.8% (14)	60.6% (294)
Quite well	82.4% (89)	8.3% (9)	9.3% (10)	22.3% (108)
Very well	3.8% (67)	9.6% (8)	9.6% (8)	17.1% (83)
Total	78.4% (380)	15.0% (73)	6.6% (32)	100.0% (485)

Note: Chi-square = 12.259, Sig. = .016
Source: Author

However there were some groups of respondents who received related information very well and extremely well but they still showed lack of attention to support alternative energy. It can be explained that it is difficult for respondents to understand the energy sources e.g. high vs low carbon, renewable vs non-renewable, and so on (Devine-Wright, 2007). Furthermore, many scholars (e.g. Devine-Wright, 2007; Poortinga, Pidgeon and Lorenzioni, 2006; Shackley et al., 2005; Curry, Reiner et al., 2005) have demonstrated that the public attitudes towards the association between energy consumption and climate change are perceived at the low level of association. Hence receiving informatin related to energy saving campaigns on holiday have no effect on new energy supportive level because they may not differentiate environmental impact from traditional energy and alternative energy.

It is notable that in spite of the national policy of the Royal Thai Government to stimulate concern and responsibility for the environment, there were found to be no action plans or practical projects meeting these ends at the regional level in Koh Samui. However like other developing countries, Thailand is confronted with many energy-related issues, including shortages and rising import prices. Recently, the Royal Thai Government has been working hard to ensure the country's energy security by pursuing policies of energy conservation, developing renewable energy sources, and setting energy prices and market reforms (Banturngsuk, 2004). Developing clean technology is a higher priority for the Thai government than changing energy use behaviour. There is no doubt that most of the respondents to this survey did not receive any energy campaign literatures directly from the local government in Koh Samui.

6.7 ENERGY CONSUMPTION PATTERNS

6.7.1 Energy Consumption in Accommodations

Table 6.6 presents data supplied by respondents about their energy consumption patterns when using air conditioning in accommodation. The respondents turn the air conditioning on for most of the time they stay in accommodation with 9.70 hours in average of staying and 9.59 hours per day in keeping the air conditioning on. Most respondents (74.8 %) stayed in accommodation about 6 – 15 hours per day: of these, 47.4 % stayed in about 6 – 10 hours per day and 27.4 % about 11 – 15 hours per day, thus giving an average time of 9 hours 42 minutes per day spent in doors by respondents.

By comparing air conditioning usage during daytime and nighttime, respondents used air condition in the daytime (4 hours 6 minutes per day in average) less than the nighttime (4 hours 48 minutes per day). During the daytime 50.9 % of respondents used air conditioning for more than 3 hours per day, while this duration of usage during the nighttime was slightly higher than the daytime with 59.8 % of respondents. Interestingly, 16.5 % of respondents had never used air conditioning during the day, while this rate increased to 27.8 % for the night. However, in total, most respondents (75.9 %) used air condition more than 5 hours per day: 39.8 % used it for about 6 – 10 hours per day and 26.8 % for about 11 – 15 hours per day. Only 7.0 % of the respondents never used air conditioning. It is noteworthy that the most effective air conditioning temperature for saving energy and decreasing carbon footprint is 26 C^{o} (Yamtripat et al., 2006), but only 11.1 % of respondents stated this as the temperature they set.

Table 6.6: Air Conditioned Use Behaviour in Accommodation

Behaviour in Accommodation (*n = 485)	Frequency	Percentage (%)
Total hours for staying in accommodation per day* (Mean=9.70 hours/day)		
1 – 5 hours/day	80	16.5
6 – 10 hours/day	230	47.4
11 – 15 hours/day	133	27.4
More than 15 hours/day	42	8.7
Hour in using air condition in day time* (Mean=4.1 hours/day)		
Never	80	16.5
1 – 3 hours/day	158	32.6
4 – 6 hours/day	138	28.5
More than 6 hours	109	22.4
Hour in using air condition at night* (Mean=4.8 hours/day)		
Never	135	27.8
1 – 3 hours/day	60	12.4
4 – 6 hours/day	100	20.6
More than 6 hours	190	39.2
Hour in total of using air condition* (Mean=9.59 hours/day)		
Never	34	7.0
1 – 5 hours/day	83	17.1
6 – 10 hours/day	193	39.8
11 – 15 hours/day	130	26.8
More than 15 hours/day	45	9.3
The set-point temperature of air-conditioned room (n = 451)		
Less than 20 C^o	37	8.2
20 C^o	51	11.3
21 C^o	121	26.8
22 C^o	63	14.0
23 C^o	28	6.2
24 C^o	75	16.6
25 C^o	50	11.1
More than 25 C^o	26	5.8

Source: *Author's Fieldwork*

Table 6.7 presents the respondents' water consumption patterns while in accommodation in terms of their bathing and showering behaviour. In average the respondent took a bath every other day (0.49 times/day), and they took a shower nearly twice per day in average (1.72 tmies/day). Interestingly, a large portion of respondents (68.5 %) did not take baths and only 3.5 % of those who did bathed more than twice per day. These findings also show that more than fifty percent (59.6 %) of respondents showered more than once per day and 46.5 % showered twice per day.

Table 6.7: Warm Water Use Behaviour in Accommodation (n = 485)

Energy Consumption in Accommodation	Frequency	Percentage (%)
Frequency of taking a bath (Mean=0.49 times/day)		
Never	331	68.5
1 time/day	88	18.2
2 times/day	48	9.8
More than 2 times/day	18	3.5
Frequency of taking a shower (Mean=1.72 times/day)		
Never	17	3.5
1 time/day	179	36.9
2 times/day	225	46.5
More than 2 times/day	64	13.1

Source: *Author's Fieldwork*

In accommodation, respondents consumed electricity through lighting, air conditioning, heating and bathing to support their daily routines. Of these sources of energy use, greatest concern is paid by environmentalists to air conditioning. It is indicated by Kitpipat (2007) that in tourism accommodation, the greatest amount of energy is used by electric appliances, but especially air conditioning. The finding shows that on average respondents' used air conditioning for 9.59 hours per day. This corresponds with studies of tourism businesses that have shown that air conditioning is used mostly by tourists. For example, Deng and Burnett (2000) have found in their study of a Hong Kong hotel that approximately one third (32 %) of the total electricity consumed by the hotel can be accounted for by air-conditioning. However, the necessity of air conditioning has been challenged by Bromberek (1999) who argues that it is a cultural product, which is of greater benefit to businesses than their customers. Nonetheless, the different weather conditions between Koh Samui and Bromberek's (1999) place of study (*i.e.* northern Queensland in Australia) may account for this discrepancy.

6.7.2 Energy Consumption Behaviour Related with Activity

Table 6.8 presents data on the frequency and duration in which respondents participated in different types of activity during their vacations. Most respondents participated in mass activities at Koh Samui: swimming / sun bathing (74.4 %), shopping (66.8 %), and sightseeing (64.1 %). Meanwhile, a smaller number of respondents participated in luxury activities such as golf (4.1 %) and cruises (8.5 %). Interestingly, although only a small number of respondents (8.2%) participated in nightlife activity, their average participation time was longer than other activities at around 6 hours 22 minutes. And similarly with golf, even though only 4.4 % of respondents undertook this activity, it had the second longest average duration at 4 hours 54 minutes.

Table 6.8: Respondents' Activity and Average Hours of Participation

Activities (n = 485)	Frequency	Percentage	Time Used (hours)
Sightseeing	311	64.1	2.71
Swimming/ sun bathing	361	74.4	3.85
Golf	20	4.1	4.89
Cruise	41	8.5	2.95
Cultural arts and heritage	89	18.4	1.90
Driving	102	21.0	5.25
Shopping	324	66.8	3.70
Nightlife	40	8.2	6.37

Source: *Author's Fieldwork*

The third longest average duration for any activity was driving for pleasure (which had a 21% rate of participation) at 4 hours and 15 minutes. By contrast, respondents spent less time on average undertaking the most popular activities: swimming/sun bathing (3 hours and 51 minutes), shopping (3 hours and 42 minutes), and sightseeing (2 hours 42 minutes). Tourism activity is the main goal of tourists who are on the vacation. The findings show that the main activities of tourists in Koh Samui are beach activities (*e.g.* swimming / sun bathing, *etc*.) and sightseeing, both of which can be done nearby accommodation. This finding corresponds with Thornton (1999) in that most of tourist visiting the beach tends to engage in sightseeing. However, the sightseeing activity in Koh Samui likely do not require any vehicles to travel long distances, while car and coach play as key transport to tourist's holiday in Thornton's research as walking in the coastal side influences by time. Comparing the percentages and time attendance of these activities with the average rate of energy consumption in Becken *et al*. (2003), it can be determined that these activities produce less CO_2 emissions.

6.7.3 Energy Consumption Behaviour in Transport

Table 6.9 presents data on the frequency and duration in which respondents made use of different modes of transport during their vacations. Most respondents made use of mass forms of transport while on Koh Samui: taxi (42.9 %), ferry/ sea trans/ boat (40.6 %), and public transports (36.1 %). Private forms of transport (23.3 %) and motorbikes (17.3 %) were used less often those aforementioned. Nevertheless, the average length of time spent by respondents in private modes of transport was greater than the corresponding figure for mass forms of transport: 15 hours and 27 minutes for motorbikes and 18 hours 38 minutes for rental cars. By contrast, although respondents used taxis and ferries most frequently, they spent far less time on travelling in them: for taxis 2 hours 49 minutes and for ferries 3 hours 11 minutes.

Table 6.9: Respondents' Transport and Average Hours of Using

Transport (n = 485)	Frequency	Percentage	Using time (Total hours/trip)
Public Transport	175	36.1	6.27
Rental Car	138	28.5	18.64
Private Transport	113	23.3	15.46
Taxi	208	42.9	2.83
Ferry/Sea Trans/boat	197	40.6	3.19
Motorbike	84	17.3	15.45

Source: Author

As mentioned earlier, most tourists travel to Koh Samui by air and rely on taxis as their main form transport while on Koh Samui because of the privacy, speed and convenience they offer. Although energy consumption from taxis is not mentioned by Becken *et al*. (2003), they do point out that rental cars are three times less energy intensive than air travel. Tourists can also travel to and around Koh Samui by ferry, seatrans, and boat, but this is mostly preferred by domestic tourists: as stated previously, most foreign visitors travel to Koh Samui by direct flight from Bangkok. Moreover, the findings of this study show that most tourists prefer fast and private modes of transport: *e.g.* planes, taxis, rental cars, motorbikes, and private transport. However, these forms of transport also produce a greater carbon footprint is (see also Table 3, Becken *et al*., 2003: 51).

The travelling behaviour of tourists demonstrates that they place their own convenience above any concern they may have for the environment. This can be seen quite clearly from the fact that they tend to use rental cars instead of public buses, which, as Becken and Patterson (2006) have shown in regard to New Zealand, emit far higher emissions in total than buses.

Nevertheless, there is still a significant portion of tourists who choose to travel by bus. Public buses are the main form of local transport on Koh Samui: they are known locally as pick-up trucks or *Rot Song-Thaew*. The main advantaged offered by *Rot Song-Thaew* is that they are relatively cheap by comparison with taxis. However, they are also unattractive for tourists because they tend not to provide direct access to the main tourism destinations and often require long waits.

6.8 ENERGY USE BEHAVIOUR AND INFLUENTIAL FACTORS: HYPOTHESIS TESTING

Regarding objective 1 of this study, this sub-section mainly investigates the energy-use behaviour of the respondents and the factors which influence it. This includes a comparison of the energy-use behaviour of tourists at home and on holiday. As there are widely different travel choices of tourists among the diversity of tourists' background and their travel behaviour, these factors were also investigated in terms of the association with energy-use on vacation using statistical analysis.

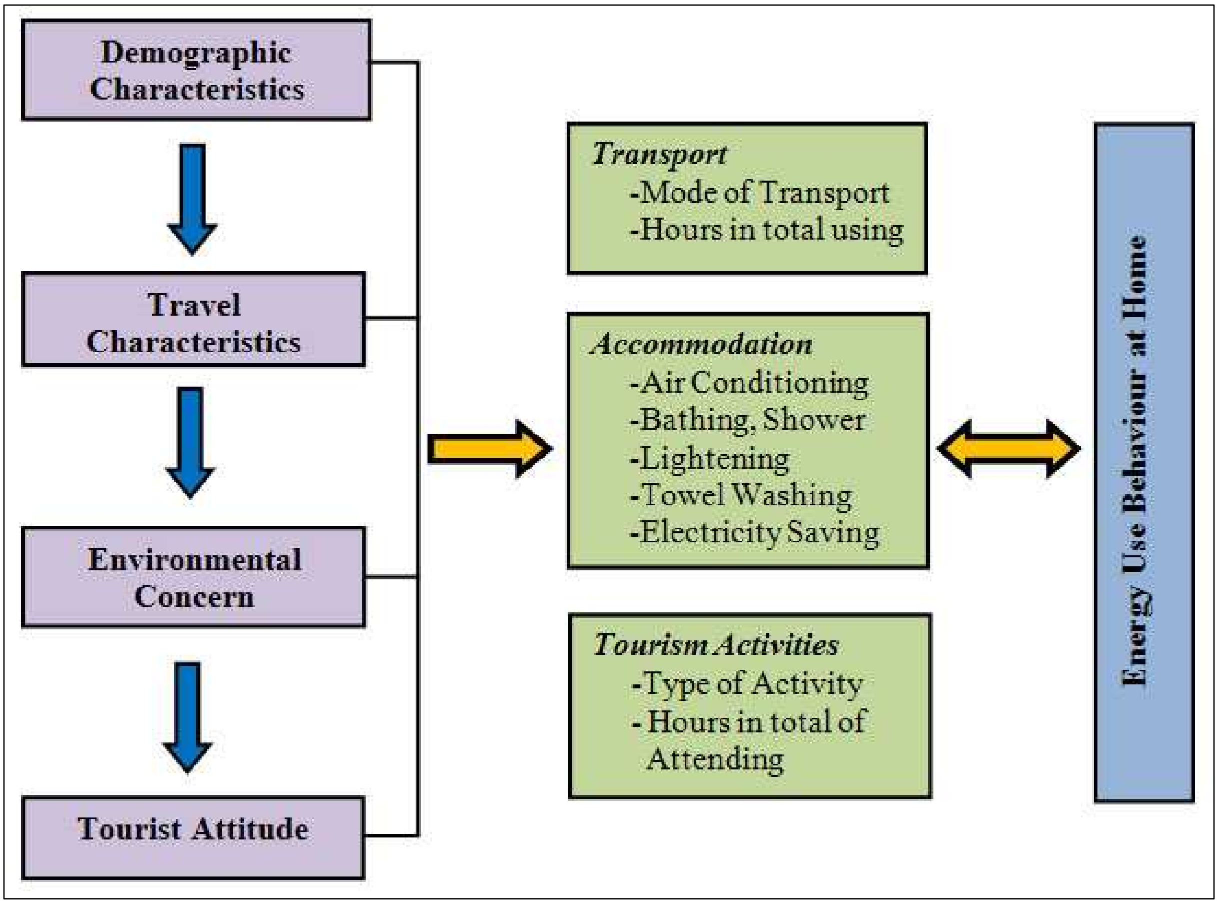
Energy-use behaviour and influential factors were analyzed by way of the Analysis of Variance (ANOVA), t-distribution test, and Chi square (X^2) tests in order to investigate the association and mean differences between energy-use behaviour related to transport, accommodation and activities and the demographic and travel characteristics and level of environmental concern and attitudes reported by the respondents.

The influential factors as regards tourists' backgrounds, attitudes and travel behaviour were derived from the reviewed literature and then placed in a conceptual diagram (see Figure 6.1). The diagram shows the variables considered to testing their influence on tourist behaviour and energy-use at tourism destinations.

The 5 main hypotheses derived from the conceptual diagram are as follows:

1. Demographic characteristics, namely age, gender, occupation, educational background, income and country of origin, have a significant impact on the energy-use behaviour.
2. Travel characteristics, such as travel arrangements, length of stay, number of people in a travel group, membership of a travel group and type of accommodation, affect tourists' energy-use behaviour.
3. Tourists' energy-use behaviour differs according to their level of environmental concern and whether they are members of environmental activist groups.
4. Tourists' attitudes towards the environment have a significant influence on their energy-use behaviour while on holiday.
5. There are significant differences between the energy-use behaviour of tourists when they are at home and on vacation.

Figure 6.1: Energy Use Behaviour on Vacation



Source: *Author*

As discussed in Chapter Two, accommodation, transport and activity are viewed here as the main sources of energy demand in the tourism industry. In respect of this, the term *energy-use behaviour* refers to these three areas of energy consumption by tourists. The respondents' answers to the set of energy-use questions, which also encompass environmentally friendly behaviour, were analysed to find the mean between their energy-use behaviour on vacation and at home. The results of the statistical tests are shown as follows:

6.8.1 Demographic Characteristics and Energy-Use Behaviour

ANOVA, t-distribution test, and Chi-square were performed in order to determine whether there were differences among derived factors with respect to demographic characteristics and energy-use behaviour. The results of the analysis are presented in the following section.

6.8.1.1 Age and Energy-Use Behaviour

Table 6.10 shows the frequency with which respondents in the different age groups used the different forms of transport. The respondents' energy-use behaviour was investigated in

Table 6.10: Chi-Square Test Results of Using Transport Behaviour in Different Groups of Age of the Respondents

Type of Transports	18 – 29 Years (n= 212)		30 – 40 Years (n= 155)		>40 Years (n= 112)		Chi-square
	%	n	%	n	%	n	
Public Transport	51.5	89	30.6	53	17.9	31	6.865*
Rental Car	44.1	60	36.0	49	19.9	27	1.803
Private Transport	36.6	41	38.4	43	25.0	28	3.742
Taxi	49.0	100	32.8	67	18.1	37	6.026
Ferry/Sea trans/Boat	50.0	98	35.2	69	14.8	29	13.760**
Motorbike	42.9	36	23.8	20	33.3	28	6.660*

*Significant statistics at 0.01, ** Significant statistics at 0.05
Source: *Author's Fieldwork*

relation to three age groups: 18 – 29 years, 30-40 years, and older than 40 years. The results, presented on Table 6.10, show that there is a significant association between the age of respondents and their behaviour in using the three main modes of transport: namely public transport (Chi-square = 6.865, Sig. < 0.05), ferry/sea trans/ boat (Chi-square = 13.760, Sig. < 0.01), and motorbike (Chi-square = 6.660, Sig. < 0.05). Considered in detail, these results show that the youngest group makes up the largest share of respondents who tended to use public transport, ferry/ sea trans/ boat, and motorbikes. No other significant differences were found between the types of transport favoured by the different age groups.

Table 6.11 presents additional data showing the mean differences between the average numbers of hours for which the different age groups used different modes of transport. The results show significant differences in all three types of vehicle which were grouped into public transport (F= 4.604, Sig. <.05), personal road transport (F= 3.813, Sig. <.05) and marine transport (F= 5.585, Sig. <.01). It is mean that the ages of the respondents significantly influence their behaviour in using transport. In other words, respondents in different ages have different behaviour in travelling in destination by means of transport.

These results reveal that personal road transport (*e.g.* rental or private cars, taxis and motorbikes) is the most popular mode of transport and used for the longest time. With *post hoc* test, there is a significant difference between the number of hours travelled by car by the youngest and middle age groups. The middle-aged group preferred to travel by private vehicle, longer than the youngest group on average for 7.73 hours per trip per person.

Table 6.11: One-Way ANOVA Results of the Mean Difference of Transport Use in Different Groups of Age

Group of age	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
A number of hours in using public transport (hours/trip)						
18 – 29 Years*	87	6.93	6.66	2	4.604	0.011
30 – 40 Years*	50	6.99	6.41			
>40 Years*	29	3.08	4.30			
Total	166	6.28	6.38			
A number of hours in using personal road transport (hours/trip)						
18 – 29 Years*	174	10.68	12.14	2	3.813	0.023
30 – 40 Years*	131	18.41	29.77			
>40 Years	90	18.18	41.15			
Total	395	14.95	27.46			
A number of hours in using marine transport (hours/trip)						
18 – 29 Years*	99	3.16	2.51	2	5.585	0.004
30 – 40 Years*	69	2.74	1.79			
>40 Years*	28	4.44	2.47			
Total	196	3.19	2.33			

Note: * Post-hoc test with statistic significance of 0.05
Source: *Author's Fieldwork*

It was also found from the *Post-hoc* results that respondents aged 18 – 29 and 30 – 40 years travelled by public transport for more hours than the oldest group (*c*. 3.85 and 3.91 hours respectively). Conversely, the findings show that respondents in the oldest age group spent more time using marine transport than both the younger groups (*c*. two hours).

The release of CO_2 from the burning of fossil fuels is most likely responsible for climate change. Transport sector consequently is one of the largest emitters of GHGs and private cars are at the forefront of the production of pollution (Defra, 2008). Bearing this in mind, it can be likely considered that the groups of tourists aged over 40 years, through their use of transport while on holiday, behave unfriendly consumption behaviour: it can potentially cause the EF of tourists in general. This is mainly due to their preference for private cars over public transport. In this way, they avoid sharing CO_2 emissions with other passengers and so end up increasing their carbon footprint through their choices in transport. Similarly, respondent's aged more than 40 years also spend more times on the transport which provides heavily carbon footprint (see in Becken, 2002) than other groups did.

Table 6.12 presents the mean differences between energy-use behaviour in different age groups. The results show significant differences between the age groups in taking baths (F = 4.041, Sig. = 0.018), turning off lights (F = 9.357, Sig. = 0.000), saving energy (F = 6.678, Sig. = 0.001), recycling waste (F = 5.129, Sig. = 0.006) and willingness to pay for environmentally products (F = 4.26, Sig. = 0.015). Although the oldest group of respondents relied heavily on private cars (see also Table 6.11), they also displayed more environmental friendly behaviour than the younger groups by using less water when bathing and showering, turning off lights when going out, and expressing general commitment to saving energy as much as they can. Importantly, they were also more willing than the younger groups to pay for environmental friendly products. This clearly corresponds to the prior finding that older tourists express greater commitment to engage in environmental friendly activities. In contrast, the youngest group (18 to 29 years) of respondents expressed less commitment towards environmentally friendly behaviour such recycling and saving energy.

Additionally, the total number of hours spent engaging in nature-based recreational activities, such as sightseeing, swimming and golf was affected by age at a significance level of 0.05: this does not follow for other activities.

Table 6.12: One-Way ANOVA Results of the Mean Difference of Energy Use in Accommodation and Activity in Different Groups of Age

Group of age	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Accommodation:						
Take a bath rather than take a shower (tims/day)						
18 – 29 Years	213	2.82	1.42	2	4.041	0.018
30 – 40 Years*	155	3.14	1.38			
>40 Years*	112	2.65	1.54			
Turn off the light, when I go out (Likert's 5 rating scale)						
18 – 29 Years*	213	4.13	0.90	2	9.357	0.000
30 – 40 Years*	155	4.12	0.91			
>40 Years*	112	4.54	0.83			
Save energy such as electricity, gas and petro etc, as much as I can(Likert's 5 rating scale)						
18 – 29 Years*	213	3.34	1.15	2	6.678	0.001
30 – 40 Years	155	3.56	1.15			
>40 Years*	112	3.83	1.19			
Bring empty bottles to a recycling bin(Likert's 5 rating scale)						
18 – 29 Years*	213	2.86	1.31	2	5.129	0.006
30 – 40 Years**	155	2.88	1.39			
>40 Years*,**	112	3.36	1.45			
Willing to pay more for environmentally - friendly product (Likert's 5 rating scale)						
18 – 29 Years*	213	2.78	1.13	2	4.26	0.015
30 – 40 Years	155	2.89	1.17			
>40 Years*	112	3.18	1.26			
Activity:						
Nature Recreation (times/trip)						
18 – 29 Years*	213	2.86	1.31	2	8.205	0.000
30 – 40 Years*	155	2.88	1.39			
>40 Years*	112	3.36	1.45			

Note: * Post-hoc test with statistic significance of 0.05
Source: *Author's Fieldwork*

The *post hoc* test shows that respondents belonging to the oldest age group spent more time on nature-based recreational activities than the younger group (F = 8.205, Sig. = 0.000). These results reveal that personal road transport (*e.g.* rental or private cars, taxis and motorbikes) is the most popular mode of transport and used for the longest time. With *post hoc* test, there is a significant difference between the number of hours travelled by car by the youngest and middle age groups. The middle-aged group preferred to travel by private vehicle, on average for 7.73 hours per trip per person: by contrast, the youngest group.

6.8.1.2 Gender and Energy-Use Behaviour

This section presents the mean difference of energy-use behaviour classified by gender in order to determine whether gender affects energy-use behaviour. By conducting the t-distribution test, it can be shown that gender does not significantly influence respondents' preferences for transport and activities. The only significant differences uncovered by this research, as shown in Table 6.13, are firstly, that male respondents tended to use air conditioning for longer than female respondents (t=3.137, Sig.<.010.002), and secondly that female respondents expressed greater willingness than male respondents to pay for environmentally-friendly products (t=-2.839, Sig.<.010.005). Otherwise, the differences between male and female respondents were slight. The most likely reason for this is that most of the respondents were travelling in mixed-gender couples or family groups consisting of about 3 people.

Table 6.13: The t-test Results with the Mean Difference of Energy Use in Different Genders

Gender	***n***	***Mean***	***S.D.***	***d.f.***	***t***	***Sig.***
Keep the air conditioner on for most of the day (Likert's 5 rating scale)						
Male	252	3.39	1.20	2	3.137	0.002
Female	233	3.04	1.25			
Willing to pay more for environmentally - friendly product (Likert's 5 rating scale)						
Male	237	2.76	1.23	2	-2.839	0.005
Female	210	3.06	1.09			

Source: *Author's Fieldwork*

The findings of this study regarding how gender affects energy-use behaviour corresponds with that of previous studies *e.g.* Agarwal (1992, 1997). As seen above, gender has a limited impact on respondents' travel choices, but affects their behaviour within accommodation since male tourists tended to use air-conditioning more than female tourists. In contrast, female tourists showed greater willingness to pay for environmental friendly products and services. This corresponds with the findings of Agarwal (1992, 1997) who points out, in his work on gender and the environment in India, that woman tend to show greater concern than men for the environment.

6.8.1.3 Occupation and Energy – Use Behaviour

Respondents were placed in five categories according to their vacation for the purposes of statistic analysis (these categories excluded minor occupations such as farming and retirement, *etc*).

Table 6.14: One-Way ANOVA Results of the Mean Difference of Transport Use in Different Occupation Groups

Group of Occupation	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
A number of hours in using public transport				4	0.746	0.563
A number of hours in using personal road transport (hours/trip)						
Business owner*	77	22.09	22.58	**4**	**4.203**	**0.003**
Private company employee*	97	12.04	23.84			
Government officer	57	13.91	14.71			
Student*	45	11.19	12.12			
Engineer and technician *	23	7.90	10.25			
Total	299	14.54	20.12			
A number of hours in using water transport				4	0.678	0.608
Prefer to use personal car (times/trip)						
Business owner*	85	3.86	1.07	**4**	**5.776**	**0.000**
Private company employee*	121	3.21	1.56			
Government officer*	70	3.24	1.29			
Student*	53	3.15	1.16			
Engineer and technician *	27	2.96	1.09			
Total						

Note: *Post-hoc test with statistic significance of 0.05
Source: *Author's Fieldwork*

The results, present in Table 6.14, indicate no significant differences in the use of public and water transport among the respondents according to their vocation. On the other hand, significant differences were found according to the vocational backgrounds of the respondents in their use of personal road transport (F= 4.203, Sig. = 0.003). The *post hoc* test shows that of the respondents, business owners spent more time travelling by personal car than employees of private companies, students and respondents in the engineering group. Indeed, business owners spent three times more time travelling by private car than respondents in the engineering group.

No significant differences were found according to the vocations of respondents in how they used air conditioning (there is no significance at level 0.05). However, the findings presented in Table 6.15 clearly show that business owners and students tend to be less concerned about the environment and saving energy than respondents in the other three occupational groups. The business owners used air conditioning at night for more hours in total than any other occupational group at the significance level of 0.05 (6.36 hours, F = 3.736, Sig. = 0.005): they were followed in this respect by the student group (5.21 hours). This pattern of behaviour (*i.e.* business owners and students show less concern for the environment and commitment to save energy) is consistent in several aspects of energy-use behaviour: *i.e.* day-time use of air conditioning (F = 5.05, Sig. = 0.001), taking a bath rather than a shower (F = 7.236, Sig. = 0.007), turning off the light when going out (F = 3.56, Sig. = 0.007), and unwillingness to pay the extra cost of environmentally-friendly products (F = 4.267, Sig. = 0.002).

Therefore, it seems that business owners tend as a group to hold less concern for the environment and show unwillingness to pay for eco-friendly products. In contrast, engineers and technicians, employees of private companies, and government employees tend to be more eco-friendly than business owners and students in spite of the fact that business owners should show greater concern for the environment, energy, and climate change and global warming than the others. Business owners gain the greatest benefits from the environment and natural resources, but show less social and environmental responsibility towards them.

Table 6.15: One-way ANOVA Results of the Mean Difference of Energy Use in Different Occupation Groups

Occupation	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Using air conditioner at night in total hours (hours/night)						
Business owner*	85	6.36	3.61	4	3.736	0.005
Private company employee*	121	4.56	3.80			
Government officer	70	4.98	4.10			
Student	53	5.21	3.64			
Engineer and technician *	27	3.81	3.98			
Frequency of bathing per day (times/day)						
Business owner*	85	0.75	0.96	4	3.567	0.007
Private company employee	121	0.58	0.85			
Government officer	70	0.41	0.77			
Student	53	0.43	0.80			
Engineer and technician *	27	0.15	0.36			
Keep the air conditioner on for most of the day (Likert's 5 rating scale)						
Business owner*	85	3.77	0.99	4	5.050	0.001
Private company employee*	121	3.16	1.24			
Government officer*	70	2.98	1.36			
Student	53	3.23	1.05			
Engineer and technician	27	3.22	1.19			
Take a bath rather than a shower (Likert's 5 rating scale)						
Business owner*	85	3.55	1.29	4	7.236	0.000
Private company employee*	121	2.76	1.32			
Government officer*	70	2.47	1.42			
Student	53	2.94	1.41			
Engineer and technician *	27	2.55	1.62			
Turn off the light, when going out (Likert's 5 rating scale)						
Business owner*	85	4.10	0.84	4	3.560	0.007
Private company employee	121	4.32	0.92			
Government officer*	70	4.42	0.81			
Student	53	4.00	0.94			
Engineer and technician	27	4.29	0.67			
Need to wash bath towel after each day's use (Likert's 5 rating scale)						
Business owner*	85	4.05	0.95	4	3.604	0.007
Private company employee*	121	3.54	1.12			
Government officer*	70	3.44	1.23			
Student	53	3.57	1.16			
Engineer and technician	27	3.70	1.20			
Willing to Pay More for Environmentally - Friendly Product (Likert's 5 rating scale)						
Business owner*,	85	2.73	1.23	4	4.267	0.002
Private company employee*	121	3.26	1.19			
Government officer	70	3.04	1.15			
Student*	53	2.58	1.03			
Engineer and technician	27	2.85	1.20			

Note: * Post-hoc test with statistic significance of 0.05

Source: *Author's Fieldwork*

6.8.1.4 Education and Energy-Use Behaviour

There was found to be a statistically significant difference between respondents' level of education and the number of hours they spent using personal road transport (F= 10.952, Sig. = 0.000) as shown in Table 6.16. The results indicate that the most highly educated respondents (*i.e.* to postgraduate level)tended to rely more heavily on personal modes of transport such as private or rental cars and taxis than less well-educated respondents (*e.g.* on average postgraduates spent 40.00 hours on private transport longer than high school educated respondents). Furthermore, comparing the other three educational groups, respondents who had not been educated to high school level spent more time using private transport than respondents in both the other groups (high school and bachelor level). Nevertheless, no significant differences were found, according to the educational groupings, between the number of hours spent using public and water transport.

Table 6.16: One-Way ANOVA Results of the Mean Difference of Transport Use in Different Educational Groups

Group of Education	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
A number of hours in using public transport				3	1.681	0.173
A number of hours in using personal road transport (hours/trip)						
Less than high school*	283	14.06	20.57	**3**	**10.952**	**0.000**
High school*	39	11.23	11.22			
Bachelor degree*	47	12.48	17.23			
Postgraduate *	45	51.23	91.68			
Total	23	15.20	27.71			
A number of hours in using water transport				3	0.598	0.617

Note; * Post-hoc test with statistic significance of 0.05
Source: *Author's Fieldwork*

Table 6.17 shows the different means of energy-use behaviour corresponding to the four educational groupings at the significance level of 0.05. Differences can be seen in how respondents falling into these categories tended to use air conditioning during the daytime (F = 2.625, Sig. = 0.049), their preferences for taking baths or showers (F = 2.754, Sig. = 0.042), and turning off lights when going out (F = 2.911, Sig. = 0.034). Notably, respondents with less than high school level education tended to be more eco-friendly than more highly educated respondents.

Table 6.17: One-way ANOVA Results of the Mean Difference of Energy Use in Different Educational Groups

Education	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Accommodation:						
Keep the air conditioner on for most of the day (Likert's 5 rating scale)						
Less than high school	43	2.88	1.24	3	2.625	0.049
High school	144	3.09	1.22			
Bachelor degree	202	3.37	1.18			
Postgraduate	94	3.28	1.35			
Take a bath rather than a shower (Likert's 5 rating scale)						
Less than high school	43	2.30	1.37	3	2.754	0.042
High school	144	2.99	1.41			
Bachelor degree	202	2.94	1.43			
Postgraduate	94	2.82	1.56			
Turn off the light, when going out (Likert's 5 rating scale)						
Less than high school	43	4.39	0.93	3	2.911	0.034
High school	144	4.17	0.89			
Bachelor degree	202	4.14	0.92			
Postgraduate	94	4.43	0.82			
Activity:						
Motorised water activity (hours/trip)						
Less than high school*	9	4.67	9.97	3	6.701	0.000
High school*	23	2.00	2.64			
Bachelor degree*	54	2.67	2.66			
Postgraduate *	26	26.25	25.43			
***Nature Recreation* (times/trip)**						
Less than high school*	34	5.16	6.07	3	5.864	0.001
High school*	107	4.12	4.89			
Bachelor degree*	163	4.34	5.49			
Postgraduate *	73	12.92	21.51			

Note; * Post-hoc test with statistic significance of 0.05
Source: *Author's Fieldwork*

Educational level was also found to influence to what extent respondents engaged in two kinds of tourism activity: namely motorised water activities and nature-based recreation. The most highly educated respondents spent the longest amount of time (*c.*26.25 hours per holiday) participating in motorised water activities which carry a high carbon footprint (F = 6.701, Sig. = 0.000). The same group of respondent also attended nature-based recreational activities for around 12.92 hours per holiday. These findings surely reflect the association between education and income since expensive activities such as golf, nature sightseeing, and motorised water activities are most popular among the most highly educated respondents, presumably because they can afford to pay for them.

6.8.1.5 Income and Energy Behaviour

For the purposes of statistic al analysis, the respondents were grouped into three brackets: low income (<5000 US$), medium income (5000 – 20,000 US$) and high income (> 20,000 US$).

Table 6.18: One-way ANOVA Results of the Mean Difference of Energy Use in Different Income Groups

Income	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Using air conditioner at night in total hours (hours/night)						
Low income	182	4.14	3.91	2	9.055	0.000
Medium income	123	5.13	3.80			
High income	91	6.19	3.70			
Frequency of bathing per day (times/day)						
Low income	182	1.58	0.88	2	4.262	0.015
Medium income	123	1.85	0.69			
High income	91	1.65	0.78			
Take a bath rather than a shower (Likert's 5 rating scale)						
Low income	182	2.68	1.35	2	6.120	0.002
Medium income	123	3.04	1.49			
High income	91	3.28	1.38			
Need to wash bath towel after each day's Use (Likert's 5 rating scale)						
Low income	182	3.43	1.11	2	10.584	0.000
Medium income	123	3.83	1.13			
High income	91	4.03	1.03			
Save energy such as electricity, gas and petro etc as much as I can (Likert's 5 rating scale)						
Low income	182	3.68	1.13	2	4.055	0.018
Medium income	123	3.48	1.17			
High income	91	3.26	1.31			
Bring empty bottles to a recycling bin (Likert's 5 rating scale)						
Low income	182	3.23	1.34	2	6.867	0.001
Medium income	123	2.62	1.36			
High income	91	2.83	1.37			
Cutting down electricity bills to protect an energy shortage (Likert's 5 rating scale)						
Low income	182	2.93	1.36	2	5.053	0.007
Medium income	123	2.52	1.25			
High income	91	2.52	1.14			
Prefer to use public transport (Likert's 5 rating scale)						
Low income	182	3.39	1.15	2	5.148	0.006
Medium income	123	3.09	1.22			
High income	91	2.93	1.27			
Prefer to use car (Likert's 5 rating scale)						
Low income	182	3.17	1.23	2	4.405	0.013
Medium income	123	3.46	1.19			
High income	91	3.60	1.23			

Source: *Author's Fieldwork*

A notable finding of the One-way ANOVA test was that despite there being significant differences between the respondents' incomes and energy-use behaviour in the accommodation and transport categories; this did not follow for the activity category.

As shown in Table 6.18, there were found to be few differences between energy use behaviour in transport sector and income. Respondents in the low income group used public transport less than those in the high income group, the latter of whom tended to use personal cars more than the low income respondents at the significance level of 0.01 and 0.05 respectively. However, it can be noted that the total hours in using public transport, personal road transport and water transport were not affected by respondents' income.

Significant differences were also found between energy use behaviour in accommodation and income. Considered in details, low income respondents were more eco-friendly than the higher income respondents when using air conditioning at night (F = 9.055, Sig. = 0.00), taking baths (F = 4.262, Sig. = 0.015) and showers (F = 6.12, Sig. = 0.002), how often they washed their bath towels (F = 10.584, Sig. = 0.00), generally saving energy as much as possible (F = 4.055, Sig. = 0.018), recycling empty bottles (F = 6.867, Sig. = 0.001), worrying about electricity bills (F = 5.053, Sig. = 0.007), using public transport (F = 5.148, Sig. = 0.006), and preferring to use cars (F = 4.405, Sig. = 0.013).

Not surprisingly, respondents on higher incomes tended to consume more energy than those on lower incomes. This may be because respondents on higher incomes are more able to afford the cost of hiring a personal car, staying in luxury hotels with access to various electrical appliances and no limits on the electricity supply. However, this finding may also be explained further in regard to the respondents' demographic profiles.

The demographic factors of education, vocation and income, in addition to reflecting social status, may also be taken as significant indicators of energy-use behaviour. People in the higher income groups, especially self-employed businessmen, tend to be more familiar with luxury lifestyles and convenience than those with lower incomes.

Therefore, during their holidays wealthier people may demand more facilities in their accommodation, such as air-conditioning and baths instead of showers, and dislike using public buses. Cohen *et al.* (2010) have identified lifestyle factors such as these as significant indicators of the level to which different people demand and consume energy. For example, tourists who are well-educated professionals, with high incomes, more often tend to demand luxury, energy-intensive products than their less well-educated and wealthy peers, and so have a greater environmental impact.

6.8.1.6 Global Regions and Energy Behaviour

There were found to be notable differences in the time spent using transport by respondents from different countries. Table 6.19 shows that respondents' country of origin bears some influence on their behaviour in using the three main types of transport identified by this study: public transport (F= 4.960, Sig. = 0.000), personal road transport (F= 2.313, Sig. = 0.033) and water transport (F= 5.226, Sig. = 0.000).

It was found that domestic respondents were more likely to travel by private car than western respondents. Moreover, domestic respondents used personal cars on average for 15.56 hours

Table 6.19: One-Way ANOVA Results of the Mean Difference of Transport Use in Different Global Regions

Group of Country of Origin	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
A number of hours in using public transport (hours/trip)				6	4.960	0.000
Europe*	51	5.51	6.10			
Oceania	11	6.20	5.64			
USA and Canada	11	5.23	6.89			
Asia*	20	4.70	6.34			
Scandinavia *	23	2.24	2.99			
Thai*	50	9.61	6.31			
Africa	2	10.10	11.45			
Total	168	6.27	6.36			
A number of hours in using personal road transport (hours/trip)						
Europe*	143	13.43	25.76	6	2.313	0.033
Oceania*	34	10.08	10.76			
USA and Canada*	15	6.75	10.07			
Asia*	30	8.19	7.24			
Scandinavia *	67	12.62	45.02			
Thai*	104	22.31	20.98			
Africa	5	26.80	42.76			
Total	398	14.85	27.38			
A number of hours in using water transport (hours/trip)				6	5.226	0.000
Europe*	45	3.62	2.58			
Oceania*	8	6.12	4.64			
USA and Canada	11	3.90	2.78			
Asia	8	3.00	1.69			
Scandinavia	25	3.81	2.08			
Thai*	96	2.47	1.62			
Africa	4	4.5	1.91			
Total	197	3.19	2.32			

Note; * Post-hoc test with statistic significance of 0.05
Source: *Author's Fieldwork*

longer than tourists from the USA and Canada who used personal cars for the shortest average length of time. However, Thais also relied heavily on public transport, which they used for longer periods than Europeans and other Asians.

Furthermore, comparing the mean total hours spent using water transport, it can be seen that respondents from Oceania travelled by water for longer on average than both Europeans and Thais at about 2.5 and 3.65 hours per person per trip respectively.

Table 6.20 presents data showing the mean differences between the energy-use behaviour of respondents from different regions of the world as well as domestic Thais ethnic groups'. The findings show that tourists' place of origin is a reliable indicator of differences in their energy-use behaviour at the significance level of 0.05. Domestic Thai tourists were the least eco-friendly when compared with respondents from the other groups. This obviously reflects the fact that consumption habits correspond to the eco-friendliness of tourists activities.

Table 6.20: One-way ANOVA Results of the Mean Difference of Energy Use in Different Global Regions

Energy Use Behaviour	***Global Regions***							***F***	***Sig.***
	Europe	***Oceania***	***USA& Canad***	***Asia***	***Scandi -navia***	***Thai***	***Africa***		
Using air conditioner in total hours per day.	8.55	9.39	10.6	11.54	7.65	8.95	11.16	3.429	0.003
Frequency of bathing per day	0.40	0.27	0.17	0.82	0.46	0.68	0.67	3.389	0.003
Keep the air conditioner on for most of the day.	2.99	3.04	3.12	3.42	3.06	3.66	3.17	4.343	0.000
Take a bath rather than a shower.	2.63	2.61	2.48	3.18	2.56	3.05	2.33	6.850	0.000
Turn off the light, when going out.	4.33	4.22	3.84	3.85	4.59	4.00	4.50	6.051	0.000
Need to wash bath towel after each day's use.	3.48	3.85	3.20	3.67	3.63	4.13	3.50	5.604	0.000
Save energy such as electricity, gas and petro etc as much as I can.	3.48	3.56	3.16	3.42	3.94	3.41	3.67	2.446	0.024
Bring empty bottles to a recycling bin.	3.04	3.24	3.04	3.24	3.23	2.61	2.50	2.747	0.012
Willing to pay more for environmentally-friendly product.	2.96	3.19	2.72	3.03	3.16	2.62	2.33	2.812	0.011
Nature recreation activity	6.90	4.39	3.13	3.52	7.08	3.80	4.00	2.827	0.011
Building activity (museum, temple etc.)	4.68	2.16	17.20	1.40	4.46	1.42	-	3.933	0.003

Source: *Author's Fieldwork*

Thais tourists tended to keep air conditioning on for longer (mean = 3.66, F = 4.343, Sig. = 0.000), wash their bath towels every day (mean = 4.13, F = 5.604, Sig. = 0.000). Moreover, Thai tourists preferred baths over showers (mean = 3.05, F = 6.850, Sig. = 0.000) at an average rate of 0.68 times per day (F = 3.389, Sig. = 0.003), which was only less than other Asian tourists. They also expressed less commitment to save energy in general (mean = 3.41, F = 2.446, Sig. = 0.024) and less willingness to pay for the additional cost of environmentally-friendly products (mean = 2.62, F = 2.812, Sig. = 0.011).

In contrast, western tourists from Scandinavia, Oceania, and Europe are the most eco-friendly tourists at the significance level of 0.05, respectively in order of environmental friendly behaviour. Even though tourists who come from these regions mostly live in cold climates that are very different to that which is normal on Koh Samui, they nevertheless show a marked tendency to consume habitually less energy and electricity than their Thai and Asian peers: *e.g.* by using air conditioning and taking baths less often per day.

Additionally, the significant differences were found in the activity preferences of respondents according to their place of origin. As regards nature-based activities, the findings show that European respondents spent longer engaged in this kind of activity than domestic Thai tourists at around 3 hours on average (F = 2.827, Sig. = 0.011). However, Scandinavian respondents spent the most time engaged in this kind of activity at 7.08 hours on average. Noteworthy differences were also found according to place of origin in the attendance of building activities (F = 3.933, Sig. = 0.003). This research indicates that respondents from the USA and Canada were by far the keenest to attend building activities, the average time taken up by this activity for this group being 17.20 hours.

6.8.2 Characteristics of Travel and Energy-Use Behaviour

6.8.2.1 Travel Arrangements and Energy Use-Behaviour

This section analyses the association between travel and energy-use behaviour using the one-way ANOVA test at the significance level of 0.05. As Table 6.21 shows, there are only mean difference of energy use in different travel arrangements on transport uses at the significance level 0.05. Respondents who travelled independently preferred to use cars more than respondents on package or semi-package holidays (mean = 3.85, F = 3.317, Sig. = 0.037), but tended to use marine transport less often than those other groups (mean = 2.93, F = 5.134, Sig. = 0.007). It can be assumed from the findings of this research that respondents travelling independently relied on high-carbon modes of transport such as personal cars but also used public transport more often than respondents on package or semi-package holidays. In contrast to the independent group, the package and semi-package groups spent the most time using water transport. The popularity of marine transport among the latter two groups can be accounted for by the fact that package-tour products for Koh Samui typically include water-based activities such as cruises. Furthermore, the operators of package tours usually make travel arrangements with private companies hence the apparent unpopularity of public transport among the package and semi-package holiday groups.

Table 6.21: One-way ANOVA Results of the Mean Difference of Energy Use in Different Type of Travel Arrangements

Travel Arrangement	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
A number of hours in using personal road transport						
A packaged tour*	58	7.39	9.38	2	3.065	0.048
A Semi packaged tour	35	11.68	14.15			
Independently*	305	16.63	30.42			
Total	398	14.84	27.38			
A number of hours in using marine transport						
A packaged tour*	23	4.23	3.35	2	5.134	0.007
A Semi packaged tour	16	4.25	2.30			
Independently*	158	2.93	2.08			
Total	197	3.19	2.32			
Prefer to use public transport.						
A packaged tour*	73	2.88	1.14	2	3.323	0.030
A Semi packaged tour	46	3.35	1.10			
Independently*	366	3.26	1.22			

Source: *Author's Fieldwork*

6.8.2.2 Total Length of Stay and Energy-Use Behaviour

As regards the transport sector, the results of the ANOVA tests, presented in Table 6.22, highlight significant differences in the number of hours spent by respondents, as categorised according to the length of their stay on Koh Samui into three groups, using personal road transport (F=3.724, Sig. = .025). Sheffe multiple range tests were conducted in order to investigate the source of this difference across these three groups. This *post hoc* test illustrates a significant difference between the 1-5 and 10+ nights of stay groups. On average, respondents in the latter group spent more time using personal cars than those in the former group: mean = 20.41 hours and 12.03 hours respectively.

As regards the accommodation sector, the findings of this research show that the length of stay affects the mean difference of energy-use at the significance level of 0.05, especially in tourism activities. Respondents who stayed more than 10 nights tended to participate in

Table 6.22: One-way ANOVA Results of the Mean Difference of Energy Use in Different Lengths of Stay

Energy Use Behaviour	**Mean of Energy Use Behaviour in Each Length of Stay**			*F*	*Sig.*
	1 – 5 nights	***6 – 10 nights***	***>10 nights***		
A number of hours in using personal road transport	12.03	12.95	20.41	3.724	0.025
Using air conditioner in total hour per night	5.12	5.23	4.08	3.663	0.026
Keep the air conditioner on for most of the day	3.40	3.80	3.07	4.092	0.017
Turn off the light, when I go out	4.05	4.26	4.47	10.091	0.000
Save energy such as electricity, gas and petro etc as much as I can.	3.43	3.53	3.76	3.932	0.020
Bring empty bottles to a recycling bin.	2.83	2.85	3.33	6.501	0.002
Willing to pay more for environmentally-friendly product.	2.83	2.78	3.14	4.039	0.018
Motorised Water Activity	2.17	3.21	9.55	6.023	0.003
Nature Recreation	2.95	5.25	9.23	26.281	0.000
Building (e.g. Museum, Temple)	1.76	2.81	7.26	4.108	0.018

Source: *Author's Fieldwork*

sightseeing (4.12 hours/trip), swimming (6.36 hours/trip), driving around the island (10.54 hours/trip), and shopping (5.48 hours/trip) more than respondents who stayed on Koh Samui from less than 10 nights. These activities result in much higher levels of energy and electricity consumption.

However, when energy saving and electricity consumption were taken into account, the respondents who stayed longest on Koh Samui tended to behave in a more eco-friendly manner than those in the two other groups: e.g. by turning off air conditioning for most of the day (F = 4.092, Sig. = 0.017), turning off lights when going out (F = 10.091, Sig. = 0.000), generally saving energy as far as possible (F = 3.932, Sig. = 0.02), recycling empty bottles (F = 6.501, Sig. = 0.002), and being willing to pay more for environmentally-friendly products (F = 4.039, Sig. = 0.018). Hence these results show that the longer tourists stayed on Koh Samui, the more they tended to behave in environmentally-friendly ways.

Finally, as regards the tourism activity sector, the results of the ANOVA tests indicate significant differences between the kinds of activity attended by respondents according to the length of their stay on Koh Samui: the number of hours spent doing motorised water activities (F=6.032, Sig. = 0.003), nature-based recreation (F=26.281 , Sig. = 0.000), and visiting buildings (F= 4.108, Sig. = 0.018). Again, Sheffe multiple range tests were conducted in order to investigate these differences. In this way, a proportional association was found between length of stay and amount of time engaged in these activities: that is, the longer respondents stayed, the more time they spent on average engaged in motorised water, nature-based, and building activities.

6.8.2.3 Number of People in Travel Group and Energy-Use Behaviour

As shown in Table 6.23, differences were found between the mean periods of time for keeping air conditioning on (F = 4.531, Sig. = 0.011) and cutting down on electricity bills to protect against future energy shortages (F = 4.82, Sig. = 0.008). Respondents who travelled in groups of 4 or more people tended to keep air conditioning on for most of the day (3.30 hours), but they also worried about future energy shortages and so tried to help to cut down on their accommodation's electricity bills (mean = 2.96). Hence this finding shows a conflict between respondents' intentions to try to save electricity and their need to keep cool in a hot climate such as on Koh Samui.

Table 6.23: One-way ANOVA Results of the Mean Difference of Energy Use in Different Numbers of People in Travel Groups

A number of people in travel group	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Keep the air conditioner on for most of the day (Likert's 5 rating scale)						
1 - 2 persons*	262	3.11	1.27	2	4.531	0.011
2 - 4 persons	110	3.20	1.24			
More than 4 persons*	113	3.52	1.10			
Cutting down electricity bills to protect an energy shortage (Likert's 5 rating scale)						
1 -2 persons*	262	2.58	1.19	2	4.820	0.008
2 - 4 persons*	110	2.46	1.14			
More than 4 persons*	113	2.96	1.19			

Note; * Post-hoc test with statistic significance of 0.05
Source: *Author's Fieldwork*

6.8.2.4 Membership in Travel Group and Energy-Use Behaviour

The result in Table 6.24 presents the significant difference of energy use behaviour from different types of association within travel group on tourism activities; golf, cultural arts and heritage and shopping, and energy saving behaviour; frequency of taking bath, using public transport, and keeping air condition on at the significance level 0.05.

The results show that tourists who travelled with friends tended to use public transport (7.42 hours, F=4.141, Sig. = 0.007) and lone tourists tend to stay in the building (11.50 hours, F = 4.720, Sig. = 0.004). Moreover, lone tourists also tended to bath (mean = 1.168, F = 3.264,

Table 6.24: One-way ANOVA Results of the Mean Difference of Energy Use in Different Types of Relationships within Travel Groups

Types of relationship in travel group	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Using public transport in a total hour of this trip (hours/trip)						
Alone	19	7.06	7.12	3	4.141	0.007
As a couple	30	2.95	4.33			
With friends	90	7.42	6.79			
With family	29	5.61	5.06			
Frequency of bathing per day (times/day)						
Alone	53	1.168	0.78	3	3.264	0.021
As a couple	130	1.67	0.81			
With friends	195	1.84	0.84			
With family	102	1.55	0.69			
Keep the air conditioner on for most of the day (Likert's 5 rating scale)						
Alone	53	2.83	1.44	3	4.441	0.004
As a couple	130	3.05	1.26			
With friends	197	3.42	1.15			
With family	105	3.28	1.21			
Building Acitivity (times/trip)						
Alone*	12	11.50	7.64	3	4.720	0.004
As a couple*	28	6.07	4.37			
With friends*	46	4.47	2.41			
With family *	23	5.53	4.78			

Note; * Post-hoc test with statistic significance of 0.05
Source: *Author's Fieldwork*

Sig. = 0.021) and use air conditioning (mean = 2.83, F = 4.441, Sig. = 0.004) least often per day. In contrast, respondents who travelled with friends tended show the least concern for the environment and saving energy out of the groups surveyed.

6.8.2.5 Mode of Transport to Travelling to Destination and Energy-Use Behaviour

The results of analysis of variance, as shown in Table 6.25, highlight statistically significant differences between modes of transport used by respondents for travelling to Koh Samui and personal car usage while on the island (F = 3.543, Sig. = 0.015). Respondents who travelled to Koh Samui by train had the lowest mean score for the rate of their preference to use personal cars to get around the island. In contrast, respondents who travelled to Koh Samui by personal car also had the highest mean score for the rate of their preference to make short trips around the island using their personal cars.

Other prominent differences were found between the behaviour of respondents using different modes of transport to get to Koh Samui. Respondents who travelled to Koh Samui by plane were typically more eco-friendly than others in so far as they tended to stay in their

Table 6.25: One-way ANOVA Results of the Mean Difference of Energy-Use in Different Mode of Transport of the Respondents

Mode of transport	*n*	*Mean*	*S.D.*	*df*	*F*	*Sig.*
Frequency of bathing per day						
Air plane	268	0.44	0.79	3	4.235	0.006
Train	25	0.76	1.12			
Bus	65	0.64	0.91			
Private car	47	0.85	0.98			
Frequency of taking a shower per day						
Air plane	268	1.60	0.72	3	4.960	0.002
Train	25	1.88	0.78			
Bus	65	2.00	1.06			
Private car	47	1.79	0.78			
Keep the air conditioner on for most of the day						
Air plane	268	3.07	1.29	3	6.920	0.000
Train	26	3.15	1.12			
Bus	66	3.51	1.01			
Private car	50	3.84	0.99			
Take a bath rather than a shower						
Air plane	268	2.71	1.48	3	8.595	0.000
Train	26	3.03	1.45			
Bus	66	3.24	1.21			
Private car	50	3.72	1.12			
Turn off the light, when I go out						
Air plane	268	4.32	0.84	3	3.667	0.012
Train	26	4.11	1.03			
Bus	66	4.00	0.84			
Private car	50	4.02	0.98			
Need to wash bath towel after each day's Use						
Air plane	268	3.63	1.20	3	5.118	0.002
Train	26	3.58	1.14			
Bus	66	3.94	0.97			
Private car	50	4.24	0.72			
Bring empty bottles to recycling bin						
Air plane	268	3.10	1.43	3	3.853	0.010
Train	26	2.88	1.42			
Bus	66	2.95	1.00			
Private car	50	2.40	1.21			

Source: *Author's Fieldwork*

accommodation rather than moving around: this can be seen from the information they gave on the extent to which they used public and private transport. Meanwhile, respondents who travelled to Koh Samui by private car tended to show less concern for the environment and energy saving in general by bathing (mean = 0.85, F = 4.235, Sig. = 0.006), using private transport (21.44 hours, F = 6.1, Sig. = 0.001), and keeping air conditioning on (mean = 3.84, F = 6.92, Sig. = 0.000) more often per day, as well as taking baths rather than showers (mean 3.72, F = 8.595, Sig. = 0.000), washing bath towels daily (mean = 4.24, F = 5.118, Sig. =

0.002), not recycling empty bottles (mean = 2.40, F = 3.853, Sig. = 0.01), and preferring to use cars (mean = 4.01, F = 3.543, Sig. = 0.015).

6.8.2.6 Type of Accommodation and Energy-Use Behaviour

The results of analysis of variance tests, shown in Table 6.26, indicate significant variation in the travelling behaviour of respondents staying in different types of accommodation, particularly regarding their tendency to use private and public modes of transport (F= 10.766, Sig. = 0.000 and F = 4.123, Sig.= 0.001).

According to the mean total of hours respondents spent using each mode of transport in Table 6.27, personal cars were most popular. Respondents staying in rental houses were most likely to consume energy through both public transport and private transport since the findings show they used these types of transport more often than other respondents (mean= 10.82). Due to the fact that most rental houses are typically located on the outskirts of urban areas and some distance away from the sea, respondents staying in this type accommodation tend to rely on road transport to travel to attractions around the island.

Table 6.26: One-way ANOVA Results of the Mean Difference of Total Hours in Transportation Usages in Different Accommodation of the Respondents

Type of Accommodation	*N*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Using public transport in a total hour of this trip						
Hotel	50	3.95	5.36	5	4.123	0.001
Bed and Breakfast	3	1.07	0.11			
Guest house/ Bungalow	90	7.21	6.48			
Eco-lodge	8	5.5	4.75			
Rental house	14	10.82	7.21			
Staying with friends or relatives	3	2.67	2.08			
Using personal road transport in a total hour of this trip						
Hotel	150	10.68	9.42	5	10.766	0.000
Bed and Breakfast	17	6.00	4.55			
Guest house/ Bungalow	165	19.21	12.96			
Eco-lodge	19	44.50	55.06			
Rental house	23	61.00	46.25			
Staying with friends or relatives	23	20.28	27.50			
Using marine transport in a total hour of this trip						
Hotel	61	3.99	2.86	5	2.988	0.013
Bed and Breakfast	5	3.40	1.52			
Guest house/ Bungalow	90	3.03	2.11			
Eco-lodge	8	1.70	0.68			
Rental house	23	2.51	1.39			
Staying with friends or relatives	9	2.31	2.24			

Source: *Author's Fieldwork*

The results of the one-way ANOVA test, which are presented in Table 6.27, show that respondents who stayed in hotels tended to be less eco-friendly. This can be seen from the length of time they used air conditioning during the day (4.53 hours, F = 2.328, Sig. = 0.042) and night (5.36 hours, F = 3.621, Sig. = 0.003), and frequency with which they had their towels washed daily (mean = 3.81, F = 2.423, Sig. = 0.035). In contrast, respondents who stayed in eco-lodges and rental houses were the most eco-friendly in as much as they typically used the air conditioning less during day and night.

Moreover, as regards water consumption behaviour, hotel residents tended to prefer taking baths rather than showers (mean = 3.17). Different types of accommodation influence to energy use behaviours whereby hotel and Bed & Breakfast residents used less public transport and rental car service than others.

Table 6.27: One-way ANOVA Results of the Mean Difference of Energy Use in Different Accommodation of the Respondents

Type of Accommodation	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Using air conditioner in total hour of daily time						
Hotel	180	4.53	3.26	5	2.328	0.042
Bed and Breakfast	20	3.55	2.01			
Guest house/ Bungalow	199	4.08	3.20			
Eco-lodge	26	3.53	3.87			
Rental house	33	2.66	2.59			
Staying with friends or relatives	25	3.68	3.42			
Using air conditioner in total hour of night time						
Hotel	180	5.36	3.77	5	3.621	0.003
Bed and Breakfast	20	6.55	4.63			
Guest house/ Bungalow	199	4.67	3.78			
Eco-lodge	26	2.85	3.37			
Rental house	33	3.67	4.09			
Staying with friends or relatives	25	4.36	4.25			
Take a bath rather than a shower						
Hotel	180	3.17	1.46	5	3.538	0.004
Bed and Breakfast	20	2.20	1.19			
Guest house/ Bungalow	199	2.68	1.48			
Eco-lodge	26	2.69	1.41			
Rental house	33	3.15	1.20			
Staying with friends or relatives	25	2.72	1.37			
Need to wash bath towel after each day's Use						
Hotel	180	3.81	1.11	5	2.423	0.035
Bed and Breakfast	20	3.50	1.28			
Guest house/ Bungalow	199	3.57	1.16			
Eco-lodge	26	3.69	1.16			
Rental house	33	4.21	0.74			
Staying with friends or relatives	25	3.60	1.00			

Source: *Author's Fieldwork*

These findings are congruent with those of Becken *et al.* (2003) who have also studied how the decisions made by tourists at their holiday destinations affect how much energy they use. For example hotel residents used marine transport longer hours than others (3.59 hours).

6.8.3 Environmental Concern and Energy-Use Behaviour

6.8.3.1 An Environmental Group and Energy-Use Behaviour

The results of t-tests, presented in Table 6.28, reveal an important correspondence between membership of environmental activism groups and travelling behaviour, specifically as regards the use of private (t = 7.153, Sig. = .009) and public (t = 17.342, Sig.= .000) transport. Research findings show that respondents who are members of environmental activism groups tend to rely more heavily on personal cars while on holiday than respondents were do not belong to any such groups (Mean = 43.18 and 12.43). Respondents who belong to environmental groups also tended to use public transport less often than those who do not (Mean = 3.12 and 3.75). These findings show an important discrepancy between respondents' level of environmental concern in terms of environmental-protection performance and their day-to-day decision-making in choosing transport while on holiday.

Table 6.28: The t-test Results of the Mean Difference of Energy Use in the Different Status of Environmental Member Groups

Member of an environmental group	*n*	*Mean*	*S.D.*	*d.f.*	*t*	*Sig.*
Using personal road transport in a total hour of this trip						
Member	11	43.18	106.25	1	7.153	0.009
Not a member	101	12.43	17.69			
Level of using public transport						
Member	72	3.75	1.19	1	17.342	0.000
Not a member	413	3.12	1.18			
Turn off the light, when going out.						
Member	72	4.44	0.77	1	5.075	0.025
Not a member	413	4.18	0.91			
Save energy such as electricity, gas and petro etc as much as I can.						
Member	72	3.83	1.06	1	5.766	0.017
Not a member	413	3.47	1.19			
Bring empty bottles to a recycling bin.						
Member	72	3.30	1.27	1	4.775	0.029
Not a member	413	2.93	1.37			
Willing to pay more for environmentally-friendly product.						
Member	72	3.26	1.14	1	7.823	0.005
Not a member	413	2.84	1.18			
Cutting down electricity bills to protect an energy shortage.						
Member	72	3.29	1.32	1	21.629	0.000
Not a member	413	2.53	1.27			

Source: *Author's Fieldwork*

Most significantly, it seems that respondents who had joined environmental groups tended to produce a higher carbon footprint than those who had not.

However, regarding energy-use behaviour in accommodation, the results in Table 6.28 show significant differences between respondents belonging and not belonging to environmental activism groups in fives factors. In contrast to the previous findings on travelling behaviour, respondents belonging to environmental activism groups tended to act in a more positive way towards the environment. They were more likely to turn off lights when they went out, saving energy, recycle bottles, and showed a general willingness to pay more for environmentally-friendly products and cut down on electricity usage where possible with the significances = 0.025, 0.017, 0.029, 0.005 and 0.000 respectively.

6.8.3.2 Level of Concern and Energy-Use Behaviour

Table 6.29 presents data showing the mean differences in energy-use behaviour classified according to respondents' level of concern about environmental problems. The results show that respondents who expressed different levels of concern exhibited different energy-use behaviours: i.e. using air conditioning during the night ($F = 3.796$, Sig. = 0.005), using public transport ($F = 2.508$, Sig. = 0.044), saving energy as much as possible ($F = 3.643$, Sig. = 0.006), recycling empty bottles ($F = 3.258$, Sig. = 0.012), and willingness to pay the extra cost of environmentally-friendly products ($F = 3.859$, Sig. = 0.004). A proportional relationship can generally be observed between degree of concern and environmentally-friendly behaviour: that is, the behaviour of respondents who expressed more concern tended to be more environmentally friendly and *vice versa*. However, this relationship did not hold as regards the use of air conditioning during the night, since according to the results of our survey respondents who expressed greater concern for the environment used air conditioning at night for longer on average (5.08 hours) than those who expressed less concern (4.49 hours).

In this section, respondents were asked to rate their attitudes on a Likert scale. In order to make the results suitable for ANOVA tests, six attitude components were summed up and the overall values were ranked by using the mid-range into three groups: pro-environmental attitude ($n = 227$), neither positive nor negative attitude ($n = 112$) and negative attitude towards the environment ($n = 146$). The results of ANOVA tests reveal no significant differences between respondents with different attitudes towards the environment and energy-use behaviour in tourism activities.

Table 6.29: One-way ANOVA Results of the Mean Difference of Energy Use in Different Rate of Environmental Concern of the Respondents

Level of concerns	*n*	*Mean*	*S.D.*	*d.f.*	*F*	*Sig.*
Using air conditioner in total hour of night time						
Extremely concerned	168	5.14	3.86	4	3.796	0.005
Quite concerned	200	4.26	3.73			
Neither concerned	81	4.93	4.05			
Not very concerned	19	7.58	3.22			
Not concerned at all	17	4.82	4.60			
Using public transport in a total hour of this trip						
Extremely concerned	56	8.37	7.21	4	2.508	0.044
Quite concerned	72	5.21	5.25			
Neither concerned	30	5.58	7.13			
Not very concerned	7	4.75	2.00			
Not concerned at all	3	3.00	5.80			
Save energy such as electricity, gas and petro etc as much as I can.						
Extremely concerned	168	3.71	1.18	4	3.643	0.006
Quite concerned	200	3.51	1.25			
Neither concerned	81	3.39	1.19			
Not very concerned	19	2.74	1.20			
Not concerned at all	17	3.35	1.37			
Bring empty bottles to recycling bin.						
Extremely concerned	168	3.24	1.32	4	3.258	0.012
Quite concerned	200	2.94	1.23			
Neither concerned	81	2.75	1.41			
Not very concerned	19	2.47	1.26			
Save energy such as electricity, gas and petro etc as much as I can						
Extremely concerned	168	3.71	1.18	4	3.643	0.006
Quite concerned	200	3.51	1.25			
Neither concerned	81	3.39	1.19			
Not very concerned	19	2.74	1.20			
Not concerned at all	17	3.35	1.37			
Bring empty bottles to recycling bin						
Extremely concerned	168	3.24	1.32	4	3.258	0.012
Quite concerned	200	2.94	1.23			
Neither concerned	81	2.75	1.41			
Not very concerned	19	2.47	1.26			
Not concerned at all	17	2.59	1.58			
Willing to pay more for environmentally-friendly product						
Extremely concerned	168	3.09	1.22	4	3.859	0.004
Quite concerned	200	2.95	1.08			
Neither concerned	81	2.63	1.17			
Not very concerned	19	2.37	1.01			
Not concerned at all	17	2.47	1.66			

Source: *Author's Fieldwork*

Nevertheless, there were significant differences between respondents with different attitudes towards the environment and energy-use behaviour regarding transport and accommodation.

The results of this study were found to be similar to those of previous studies. For instance, Budeanu (2007) found that tourists who are more aware of the environmental and social problems caused by tourism typically expressed more positive attitudes towards efforts to reduce them. This study has found that respondents with pro-environmental attitudes made up the largest total share (46.7%) of the survey group while those with negative attitudes accounted for nearly a third (30%) of all respondents. Explain more in energy consumption behaviour context

This study confirms that respondents' attitudes towards the environment affect their energy-use behaviour while on holiday. The 'not green at all' tourist is likely to show only a passing interest in environmental issues related with tourism (Swarbrooke and Horner, 2007), whereas respondents with 'pro-environmental attitudes' are far more likely to take positive action to benefit the environment such as using electrical appliances less often to save energy, recycling and being willing to pay more for environmentally-friendly products. Furthermore, our findings in regard to respondents' travel behaviour correspond with those of Mokhtarian (2005), who has found that tourists' attitudes are an important factor triggering transport choices at holiday destinations.

Table 6.30: One-way ANOVA Results of the Mean Difference of Energy Use in Different Respondents' Attitudes on Environment

Energy Use Behaviour	*Tourist's Positive Attitude toward Environment*			F	Sig.
	Pro-environment Attitude	*Neither positive nor Negative*	*Negative*		
Air conditioner in total hours per day	8.45	8.38	10.05	*5.508*	0.004
Keep the air conditioner on for most of the day	**2.99**	**3.29**	**3.59**	***8.026***	**0.000**
Take a bath rather than a shower	**2.70**	**2.91**	**3.51**	***7.523***	**0.001**
Need to wash bath towel after each day's Use	3.54	3.74	4.41	*6.551*	0.002
Save energy such as electricity, gas and petro etc as much as I can	**3.73**	**3.47**	**2.82**	***8.120***	**0.000**
Bring empty bottles to a recycling bin	3.25	2.91	2.13	*4.547*	0.011
Willing to Pay More for Environmentally - Friendly Product	**3.27**	**2.76**	**2.30**	***19.728***	**0.000**

Source: *Author's Fieldwork*

6.8.4 Tourists' Energy Consumption Behaviour: Comparison between Home and Vacation

As shown in Table 6.31, respondents were asked to rate comparatively their energy consumption behaviour at home and on vacation. The findings seem to show that respondents care more about energy saving at home than on vacation. Indeed, respondents show approximately three times more concern for saving energy at home than while on vacation: for example, 21.6 % of respondents never used air conditioning or heating at home compared with 11.3 % on vacation; more dramatically, whereas only 4.5 % of respondents reported keeping air conditioning or heating on constantly at home, 17.2 %, or approximately 4 times more, reported doing this while on vacation.

Table 6.31: Frequency and Percentage of Respondents Classified by Behaviour in Energy-Use at Home and on Vacation (n = 485)

Energy Consumption Behaviour	At Home					On Vacation				
	Always	*Usually*	*Sometimes*	*Rarely*	*Never*	*Always*	*Usually*	*Sometimes*	*Rarely*	*Never*
1. Keep the heating (or the air conditioner) on for most of the day.	22 (4.5)	112 (23.2)	153 (31.5)	93 (19.2)	105 (21.6)	84 (17.2)	129 (26.6)	141 (29.1)	74 (15.3)	57 (11.8)
2. Take a bath rather than a shower	23 (4.7)	47 (9.7)	131 (27.0)	97 (20.0)	187 (38.6)	81 (16.7)	107 (22.1)	101 (20.8)	63 (13.0)	133 (27.4)
3. Turn off the light, when I go out.	271 (55.9)	147 (30.3)	57 (11.8)	5 (1.0)	5 (1.0)	234 (48.3)	149 (30.7)	85 (17.5)	11 (2.3)	6 (1.2)
4. Need to wash bath towel after each day's use.	44 (9.1)	80 (16.5)	181 (37.3)	105 (21.6)	75 (15.5)	140 (28.9)	157 (32.4)	117 (24.1)	49 (10.1)	22 (4.5)
5. Save energy such as electricity, gas and petro etc as much as I can.	180 (37.1)	191 (39.4)	82 (16.9)	25 (5.2)	7 (1.4)	115 (23.7)	153 (31.5)	122 (25.2)	63 (13.0)	32 (6.6)
6. Bring empty bottles to a recycling bin.	159 (32.8)	147 (30.3)	116 (23.9)	37 (7.6)	26 (5.4)	85 (17.5)	100 (20.6)	111 (22.9)	100 (20.6)	89 (18.4)
7. Willing to pay more for environmentally - friendly product.	60 (12.4)	122 (25.2)	200 (41.2)	72 (14.8)	31 (6.4)	50 (10.3)	94 (19.4)	175 (36.1)	93 (19.2)	73 (15.0)
8. Worry about electricity bill.	110 (22.7)	155 (32.0)	137 (28.2)	42 (8.7)	41 (8.4)	47 (9.7)	85 (17.5)	134 (27.7)	86 (17.7)	133 (27.4)
9. Use public transport.	70 (14.4)	149 (30.7)	131 (27.1)	87 (17.9)	48 (9.9)	75 (15.5)	133 (27.5)	153 (31.5)	69 (14.2)	55 (11.3)
10. Prefer to use private car.	142 (29.3)	133 (27.4)	114 (23.5)	68 (14.0)	28 (5.8)	106 (21.9)	110 (22.7)	146 (30.1)	86 (17.7)	37 (7.6)

Source: *Author's Fieldwork*

Similarly, whereas only 1.4 % of respondents reported that they never attempted to save energy at home, 6.6 %, which is a fivefold increase, reported the same behaviour while on holiday. And likewise, the 8.4 % of respondents who reported never having worried about electricity bills at home rose to 27.4 % when on holiday. It is also noteworthy that whereas 25.6 % of respondents reported washing bath towels daily when at home, 61.3 % reported the same behaviour while on holiday.

Table 6.32 presents the results of a paired t-test in order to compare the mean figures of tourists' energy consumption behaviour at home and on vacation at the significance level of 0.05. The findings show that only respondents' tendency to use public transport remained unchanged while on vacation. Otherwise, significant variation was found between energy-use behaviour at home and on vacation at the significance level of 0.05. The findings show that tourists generally accept greater responsibility for saving energy and environmental concerns when they are at home than on vacation. The only exception is car usage which tended to be higher at home which may reflect the greater need for convenience and economy when on vacation.

As shown in Table 6.32, tourists typically kept the heating or air conditioning on for longer during their vacations than they would at home at the significance level of 0.05 ($t = -7.33$, Sig. = 0.000). They bathed frequently ($t = -9.28$, Sig. = 0.000) and required clean towels everyday ($t = -13.06$, Sig. = 0.000) when on vacation. By contrast, they tended to save more energy when at home. This can be seen from the behaviour they reported in turning off lights before going out ($t = 3.58$, Sig. = 0.000), generally saving as much energy as possible ($t = 9.903$, 0.000), and worrying about electricity bills ($t = 11.25$, Sig. = 0.000). Interestingly, tourists also expressed greater willingness to pay the extra cost of environmentally-friendly products ($t = 5.67$, Sig. = 0.000) and recycle bottles ($t = 9.76$, Sig. = 0000) when they are at home than on vacation.

One possible reason for this result is that tourists believe they have paid for all services hence they do not feel any need to worry about the extent of their energy consumption. By contrast, they tend to pay more attention to energy saving in their daily lives when it is clearly their responsibility to pay for the full cost of the energy they use. Another possible reason for tourists' more relaxed attitudes towards energy consumption while on vacation is that they are more focused on the cost rather than environmental impact of their behaviour.

Table 6.32: Results of Paired t-test between 'Energy Consumption Behaviour at Home' and 'Energy Consumption Behaviour on Vacation'

Consumption Behaviour	*Home Mean*	*Vocation Mean*	*Mean Difference*	*t-Value*	*Sig.*
Keep the heating or the air conditioner on for most of the day	2.81	3.31	-0.50	-7.33	0.000
Take a bath rather than take a shower	2.28	2.99	-0.72	-9.28	0.000
Turn off the light, when I go out	4.36	4.20	+0.16	3.58	0.000
Need to wash my bath towel after each day's use	2.85	3.76	-0.92	-13.06	0.000
Save energy such as electricity, gas and petro etc. as much as I can	3.99	3.53	+0.46	7.59	0.000
Bring empty bottles to a recycling bin	3.71	2.98	+0.74	9.76	0.000
Willing to pay more for environmentally - friendly product	3.20	2.91	+0.29	5.67	0.000
Worry about electricity bill	3.45	2.57	+0.88	11.25	0.000
Use public transport	3.20	3.21	-0.01	-0.12	0.915
Prefer to use car	3.73	3.33	+0.40	5.45	0.000

Note: Energy consumption ranges from 1(Never) to 5 (Always).
Source: *Author's Fieldwork*

For example, as far as there is no extra cost in using electrical appliances in holiday accommodation, tourists will not worry too much about how often and how long they use them for: at home the full costs of using electrical appliances are more apparent.

Nevertheless, many respondents did report good energy saving behaviour while on holiday, especially as regards turning off lights, using public transport, and avoiding using private cars. For example, respondents who reported concern about their electricity bills while at home tended to turn off lights before going out both at home and on vacation (the mean relating to vacations is slightly less than that for being at home). This may be a good habit which respondents maintain while on vacation. Similarly, respondents who preferred to use public transport at home tended to do the same when on vacation (slightly more in fact), while those who preferred to use cars at home tended to use them less than on vacation.

However, it is also worth considering the extent to which people's domestic behaviours such as recycling and donating to environmental organisations change when they are on holiday. Wearing *et al.* (2002) have found that tourists who tend to participate in environmentally-friendly schemes and pay the extra cost of corresponding products in their home lives do not necessarily do the same when on holiday. When asked to account for this discrepancy in their behaviour, most responded that they ‘ didn’t’ know’, which the authors put down to a lack of knowledge about environmentally-responsible tourism products and a lack of awareness of environmental issues associated with tourism. Another factor influencing tourists’ attitudes and behaviour, as found by Gössling *et al* (2006), is the generally low level of awareness among young, educated, and wealthy tourists of the environmental problems caused by their energy-intensive lifestyles. Therefore, all that can be concluded here is that more research is needed to clarify the extent to which consumer characteristics and socio-economic context affect people’s energy-use behaviour, particularly as regards how they consume environmental assets.

6.9 CONCLUSION

This chapter has sought to address the lack of attention given in tourism literature to the energy consumption behaviour of tourists and the relationship between this kind of behaviour and factors such as demographic profile, travel characteristics, and environmental concerns and attitudes. This chapter has therefore sought to explore how respondents’ backgrounds shape their behaviour in ways which affect the environment (mainly through energy use). One-way ANOVA tests were employed to investigate the relationship between energy-use behaviour and these factors, while T-test was used for testing mean difference of energy-use behaviour among gender and membership of environmental group. A summary of results is presented only the factors which have statistical significance on energy consumption behaviour of study framework (Table 6.33).

In order to provide rigid data to support policy-makers and thereby meet the objectives of this s/tudy, comparisons were also made between energy-use behaviour at home and on vacation. The summary of results consequently highlights tourists’ patterns of energy use and the comparative description from different influence factors, all of which has nitrated with amount of energy use and the EF in tourism sector which will be explored further in the following chapters of this study.

As mentioned in Table 6.1, respondents’ demographic characteristics are benefit to our understanding of their attitude and behaviours toward climate change and global warming, including their leisure behavior. Therefore, these data have been employed to test the hypotheses in order to provide the insights about tourists’ attitude and behaviour toward environment. The findings in this thesis are compatable with many works (*e.g.* Dodds *et al.*, 2010; Lenzen *et al.*, 2006; Marshment, 1997; Wilhite *et al.*, 1996 and so on) by demonstrating that demographic characteristics, especially age, income, and country of origin, should be taken into account for understanding tourists' attitude and behaviour. However, the findings in this thesis are contrast with some studies *e.g.* Agarwal, 1992, 1997; Hudson and Ritchie, 2001; Lindén, 2007; Kalinkara, 1997 that gender is not the important factor of tourists' attitude and behaviours. It is related to air condition use behaviour and willing to pay more for eco-friendly products, significantly.

Table 6.33: Summary of Statistical Test Results

Influence Factors	***Energy Use Behaviour***													
	Transport			*Accommodation*								*Tourism Activity*		
	T1	*T2*	*T3*	*A1*	*A2*	*A3*	*A4*	*A5*	*A6*	*A7*	*A8*	*V1*	*V2*	*V3*
Demographic Factors														
Age	P<.01	P<.05	P<.01	-	P<.05	P<.001	-	P<.001	P<.05	P<.001	-	-	P<.001	-
Gender	-	-	-	P<.01	-	-	-	-	-	P<.05	-	-	-	-
Occupation	-	P<.01	-	P<.001	P<.001	P<.01	P<.01	-	-	P<.01	-	-	-	-
Education	-	P<.001	-	P<.05	P<.05	P<.05	-	-	-	-	-	P<.001	P<.001	-
Income	P<.01	P<.05	-	P<.01	P<.01	-	P<.01	P<.05	P<.001	-	P<.01	-	-	-
Global Regions	P<.001	P<.05	P<.001	P<.001	P<.001	P<.001	P<.001	P<.05	P<.05	P<.05	-	-	P<.05	P<.01
Travel behaviour														
Travel Arrangement	-	P<.05	P<.01	-	-	-	-	-	-	-	-	-	-	-
Length of Stay	-	P<.05	-	P<.05	-	P<.001	-	P<.05	P<.01	P<.05	-	P<.01	P<.001	P<.05
Mode of Transport	-	P<.05	-	P<.001	P<.001	P<.05	P<.01	-	P<.01	-	-	-	-	-
Type of Accommodation	P<.01	P<.001	P<.05	P<.05	P<.01	-	P<.05	-	-	-	-	-	-	-
Environmental Concern														
Environmental Group	-	P<.01	-	-	-	P<.05	-	P<.05	P<.05	P<.01	P<.001	-	-	-
Level of Concern	P<.05	-	-	P<.01	-	-	-	P<.01	P<.01	P<.01	-	-	-	-
Tourist Attitudes														
Over all of Positive Attitudes toward Environment	-	-	-	P<.001	P<.001	-	P<.01	P<.01	P<.01	P<.001	-	-	-	-
Level of Commitment	-	-	-	-	-	-	-	P<.001	P<.01	P<.001	P<.01			

Note: T1= Public transport, T2 = Personal road transport, T3= Marine transport, A1= Keep air conditioner on for most of the day, A2= Take a bath rather than a shower, A3 = Turn off the light, when going out, A4= Need new clean towel daily, A5 = Save energy as much as I can, A6= Bring empty bottle to a recycling bin, A7 = Willing to pay more for environmentally-friendly product, A8= Cutting down electricity bills to protect the energy shortage, V1= Motorised water activity, V2 = Natural recreation activity, V3= Building activity (museum, temple *etc.*), - = no significance

By considering travel behaviour, it is one of the important factors related to the energy consumption consumption behaviour. Like demographic characteristics, it contributes us to determine tourist behaviour related to eco-friendly activities. The results in this thesis demonstrate that night of stay has related to energy use behaviour toward transport, accommodation, and tourism activity in the eco-friendly way, significantly. It is congruous with Peeters and Schouten (2006) that travel behaviour plays an important role to require different level of energy consumption – the longer tourists stay in the destination, the more eco-friendly behaviour they do. Moreover, these data can be employed to consider the derived demand of energy use and other facilities, especially modes of transport (Becken *et al.*, 2003; Tabatchnaia-Tamirisa *et al.*, 1997). For example, three-quarter of respondents have travelled to Koh Samui by plane, 18.5 % by other modes of transport, and only 7.2 % of them travel by private car. Thus, it is able to assume that the majorities of tourists (92.8 %) need the local transport in order to travel within the destination.

As presented in Table 6.3, three-quarter of respondents have concerned toward environmental problem, but only 69.8 % of them have committed to act on the global environment and energy issues. This is correspondent with many scholars *e.g.* Chafe (2005), Dalton *et al.* (2008), Tartaglia and de Grosbois (2009) and so on, that most tourists have concerned about environment issues, but a small number of them have acted eco-friendly behaviour. However, from the Chi-Square test, tourists who concern toward environmental problems tend to commit in acting global environment issues, significantly.

The results related to tourists' attitude toward environment reveal that respondents have positive attitude toward reducing the environment impacts, following the eco-friendly guidelines, and supporting tourism business to concern about energy in their business practices. However, they seem to have the moderate attitude when they have to consider or adapt environmental issues with their holiday. In the other words, they tend to focus on their leisure activities, rather than commit to act eco-friendly behaviour (Dalton *et al.*, 2008). This is because most tourists receive less information about energy saving and climate change. It is congruent with the findings about the concern and commitment to act eco-friendly behaviour that most of them are welcome to use alternative energy.

By considering tourists' behaviour toward accommodation, guesthouse or bungalow and hotel are the major accommodation of tourists during their holiday in Koh Samui. As mentioned in many works (*e.g.* Deng and Burnett, 2000; Kittipat, 2007; Dick Sisman & Associates, 2007; Tartaglia and Grosbois, 2009; and so on) that air condition and lighting are the main energy use in tourism accommodation. The results in this thesis also demonstrate that respondents have stayed in accommodation about 10 hours per day in average. They tend to turn air condition on when they are in the accommodation with 9 hours 36 minutes in average. During the day time, respondents turn air condition on for 4 hours and about 5 hours during the night time. Moreover, most respondents (83.1 %) set the temperature below the economy point, 25 C^o that may affect the higher cost of electricity in accommodation. Therefore, the education and energy reduction campaign need to be communicated with tourists in order to ask their cooperation to mitigate the environment impacts.

As mentioned in Table 6.8, most tourists have participated in less energy-consumption activities *i.e.* swimming/sun bathing, shopping, and sightseeing because the efficiency of consumption is calculated in average per tourist (Becken and Patterson, 2006). The energy use in these activities does not depend on a number of tourists; therefore, the increasing or decreasing of tourists in each activity does not affect the amount of energy use. In the other words, these activities can be catagorised as ‘energy sharing activities’. In contrast, some activities, *i.e.* cruise, driving, and golf, have consumed a lot of energy even there are few participants in these activities (see also Becken *et al.*, 2003).

It is mentioned earlier that most tourists have travelled to Koh Samui by plane and foreign tourists also rely on the long hual flights from their country of origin. Therefore, it is inevitable to mention that air transport is the most energy consumption. It is corresponding with Becken and Patterson (2006) that air transport requires the most energy consumption by comparing with other modes of transport. By considering modes of transport within the destination, rental car, private transport, and motorbike have been used in the longer time than other transports, especially the public transport which tourists have employed only 6.27 hours. This is because in Koh Samui, there is only Rod Songteaw (minibus) – unprofessional and unsafe service which operates by local business and requires the long waiting time– as public transport for tourists. This is correspondent with Anable and Gatersleben (2005) and Van Middlekoop *et al.* (2003) that tourists tend to choose the transport from the distance to the destination and available of transport.

This study has also made important results by the comparison of tourists’ energy-use behaviour at home and on vacation. Specifically, the results of the paired t-tests reveal significant differences between respondents’ energy-use behaviour in their daily lives and while on vacation. It may be concluded from these results that during holiday periods, tourists tend place their convenience over any concerns they may have about their environmental impact. Importantly, the extent to which tourists behave in environmentally-friendly ways is influenced by the level of support for such behaviour provided by tourism businesses and local authorities at holiday destinations. For example, in Thailand there is no waste recycling policy such as is now common in western countries. Accordingly, many tourists find they are provided with fewer opportunities to recycle waste while on holiday in Thailand than are normally made available to them, privately or publically, at home. This may result in different waste separation behaviour between domestic and international tourists.

CHAPTER SEVEN

PATTERNS OF BUSINESS ENERGY CONSUMPTION

7.1 INTRODUCTION

In light of recent studies, it is now widely accepted that businesses are both the main engine of economy growth and the significant producers of CO_2 emissions (Carlsson-Kanyama and Lindén, 1999; Becken, and Carboni, 2008). Accordingly, private businesses are the main targets of various international bodies and initiatives aimed at reducing GHG emissions: for example, 'the carbon trust' and 'carbon credit trading'. Basing this chapter on the research objective 2, this thesis focuses on investigating the energy-used behaviour among tourism businesses and their attitudes toward energy management relevance to the EF and climate change from energy use. Furthermore, this research objective does not only tend to track the energy-used in private company but also focus on their global environmental concern and existing environmental programme of the key industries in Koh Samui's tourism sector. Therefore, this chapter focuses on the results of the patterns of business energy consumption in order to explain the main areas of energy demand and provide insights into the attitudes and behaviour of respondents toward energy-use.

This chapter explains the results of energy consumption on four key areas of the tourism industry in Koh Samui: namely accommodation, restaurants, tour operations and others such as rental car, golf and spa. However, the research does not only examine the patterns of energy consumption in them, but also it considers the attitudes of respondents from these businesses towards public policies. This is because they receive a great deal of advice and regulation of both energy management and environmental practices in regard to which they can be key players in most initiatives designed to mitigate the impact of travel and tourism on the environment.

In order to respond the objective 2, this chapter also reports the responses of seventy tourism-related businesses in Koh Samui through the questionnaire-survey as mentioned in data collection section, Chapter Five. In addition to this, the researcher conducted more semi-structure interviews with twenty of these businesses to gain insights of their attitudes toward environmental problems and sustainable energy management (including strategies and policies related to energy saving in their businesses). The results are presented in five sections. This chapter begins by demonstrating the business background before mentioning the pattern of energy consumption in order to understand the tourism businesses' behaviours toward energy use. The following section is to present their attitude to energy and climate change. Then, the comparison of tourism businesses' attitudes and energy use behaviours is demonstrated. Final section is to demonstrate the qualitative insights of climate change concern and managing energy use.

7.2 BUSINESS BACKGROUND

This section is to demonstrate the background of tourism businesses in Koh Samui classified by frequency and percentage. Table 7.1 shows that the greatest numbers of respondents (57.2 %) are accommodation-providers. In this thesis, the types of hotel have distinguished by using the star rating-system *i.e.* 5 Star Hotels (15.7 %), 4 Star Hotels (5.7 %), 3 Star Hotels (8.6 %), 2 Star Hotels (14.3 %), and 1 Star Hotels (12.9 %). The remainders of respondents have been classified as tour businesses (24.3 %), restaurants (7.1 %), and others include rental car, golf and spa businesses (11.4 %). Importantly, most hotels (62.5 %) have an occupancy rate of about 60 – 70 %. Nearly two-thirds of the respondents have been operating in the tourism industry for 1 – 15 years. 37.1 % of the respondents have been operating for 1-10 years; 21.4 % of them have been active for 11 – 15 years, 8.6 % for 16 – 20 years, and 18.6 % for 21 – 25 years, respectively.

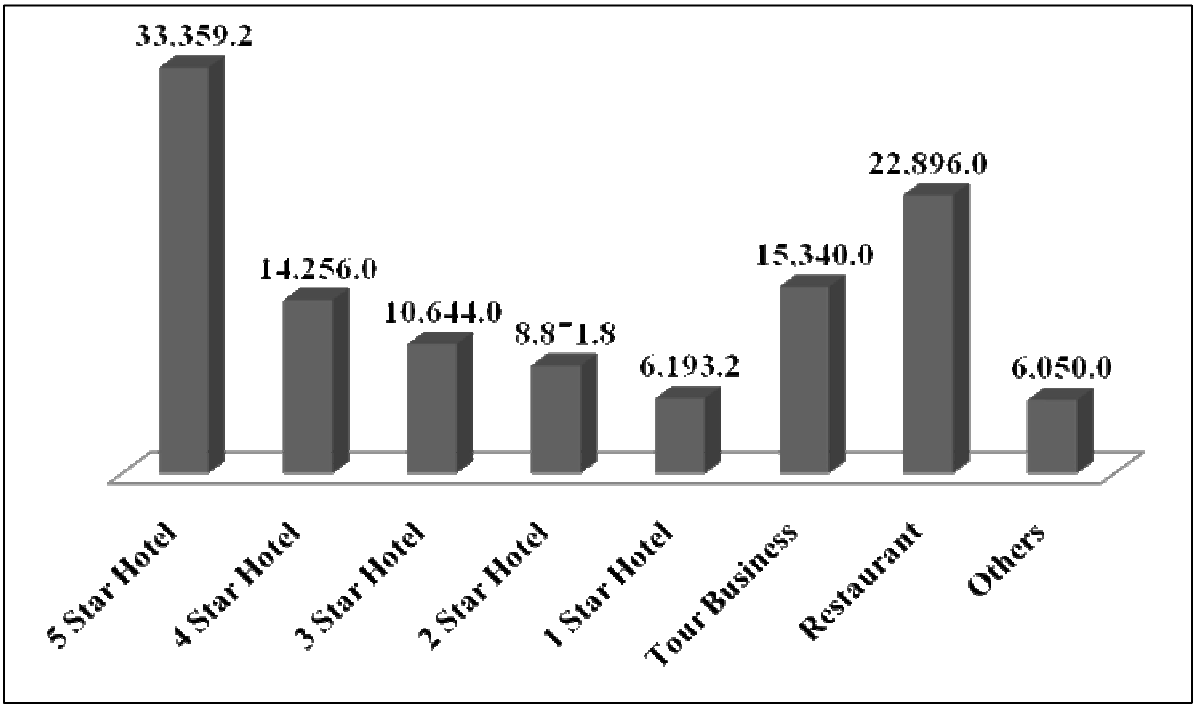
Table 7.1: Frequency and Percentage of Business Classified by Business Background

Variable	Frequency	Percentage (%)
Type of business (n= 70)		
5 Star Hotel	11	15.7
4 Star Hotel	4	5.7
3 Star Hotel	6	8.6
2 Star Hotel	10	14.3
1 Star Hotel	9	12.9
Tour Business	17	24.3
Restaurant	5	7.1
Others (Rental car, Golf and Spa business)	8	11.4
Occupancy rate of hotel (n=40)		
Less than 60	9	22.5
60 – 70	25	62.5
More than 70	6	15.0
Operating time (n=69)		
1 – 10 years	25	37.1
11 – 15 years	15	21.4
16 – 20 years	6	8.6
21 - 25 years	13	18.6
More than 25 years	10	14.3

Source: *Author survey*

Figure 7.1 shows the average number of customers serviced per annum by each type of business in Koh Samui. The results show that on average, 5 Star Hotels served the greatest number of customers per annum (33,359.2). Following this, restaurants served the second (22,896.0) and tour businesses the third largest (15,340.0) average numbers of customers per annum in 2008. In contrast, small-scale businesses served the smallest average numbers of customers per annum (6,050.0), and 1 and 2 Star Hotels respectively served the second (6,193.2) and third (8,871.8) smallest average numbers of customers per annum.

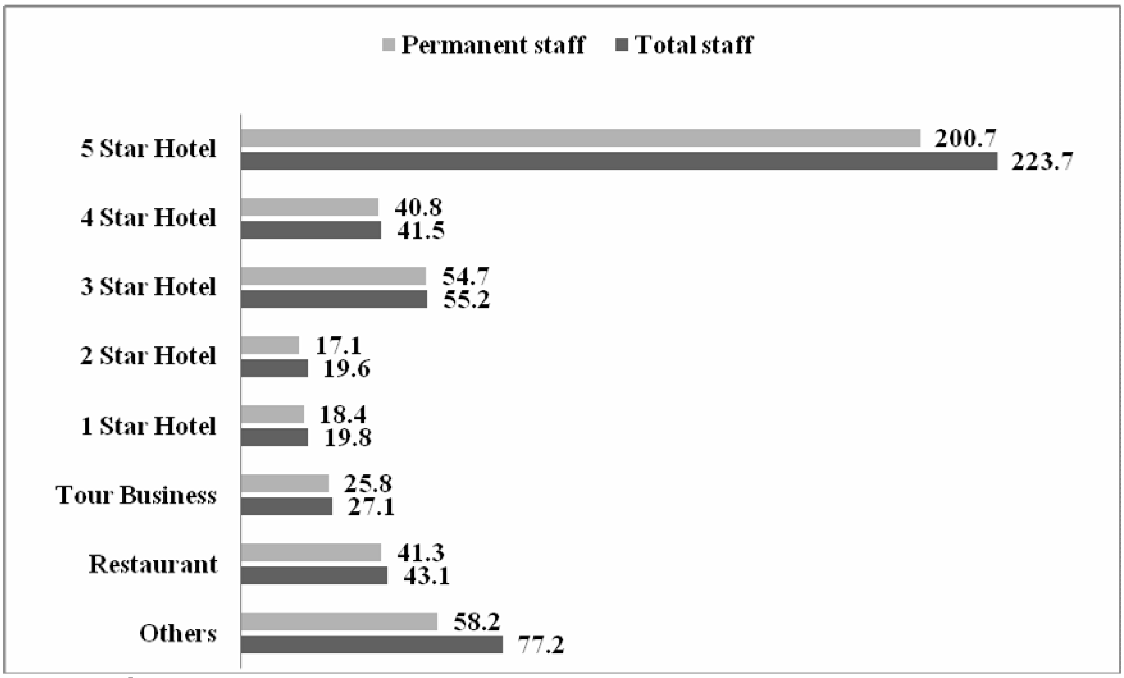
Figure 7.1: Average Number of Annual Visitors by Tourism Business Represented in This Survey



Source: *Author survey*

Figure 7.2 shows the total numbers of permanent and total staffs including temporary staffs employed by the types of businesses in Koh Samui relevant to this study. This shows that tourism businesses in Koh Samui have different numbers of permanent and overall staffs. The 5 Star Hotels have the greatest average number of staff per business (200.7 permanent and 223.7 in totals). The 2 Star Hotels employ the smallest average number of permanent and total staffs (17.1 and 19.6 respectively); on average, the 1 Star Hotels employ slightly more staffs (18.4 permanent and 19.8 in totals).

Figure 7.2: Average Numbers of Staff Classified by Type of Business



Source: *Author survey*

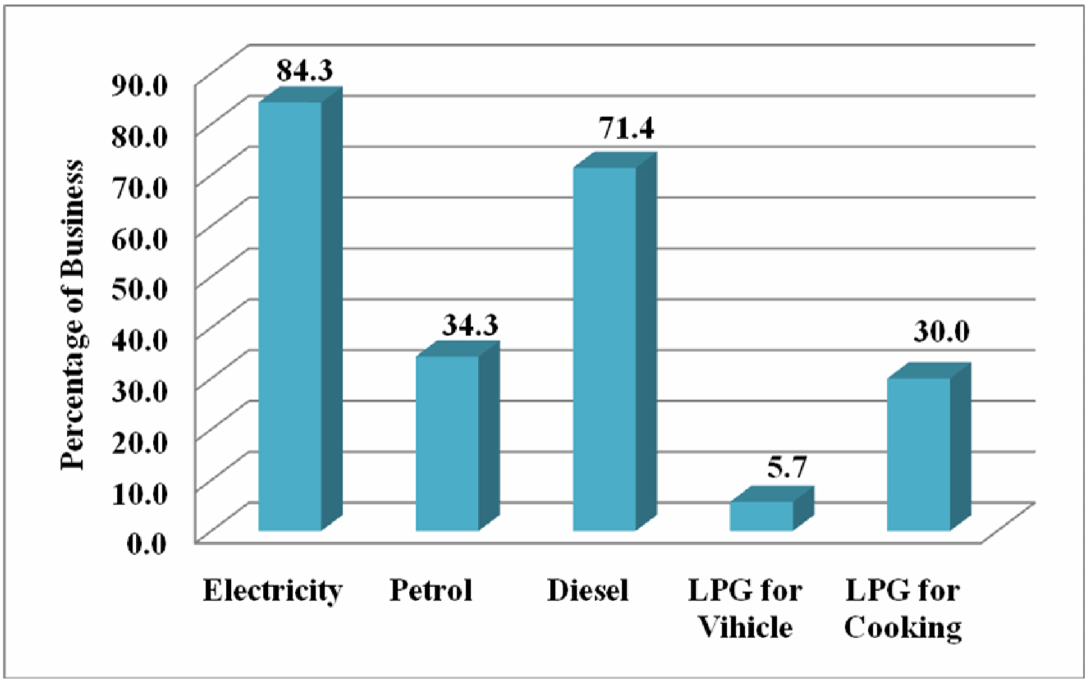
7.3 PATTERNS OF CONSUMPTION

7.3.1 Energy Sources of the Tourism Business

There are two main types of energy source used in Thailand; commercial and renewable energy which respectively account for about 81.5% and 18.5% of Thailand's energy consumption. Petroleum products (*e.g.* diesel, petrol, and LPG since 2008) have long been the most popular fuels in Thailand, accounting for 57.8% of commercial energy-use (of which, 48.6 % is accounted for by the use of diesel, 16.9% by petrol, and 13.4% by LPG). They are followed in this regard by electricity (21.5%), coal (14.7%) and natural gas (6.0%) (Energy Policy and Planning Office, 2010). Accordingly, diesel always remains the key fuel in the kingdom followed by petrol and LPG.

In order to investigate the patterns of energy consumption in Koh Samui's tourism sector, questionnaire survey and interviews were conducted with representatives of 70 relevant businesses. The finding shows that the most significant source of energy used by the tourism sector is electricity; almost all tourism businesses rely on electricity (84.3%). This is followed by diesel, which is relied upon by 71% of the surveyed businesses, and petrol (including gasohol) which is relied upon by 34.3% of businesses. Liquid Petroleum Gas (hereafter; LPG) is also a major source of energy for kitchen use and running vehicles (see Figure 7.3).

Figure 7.3: Energy Sources Used by Tourism Businesses (n=70)



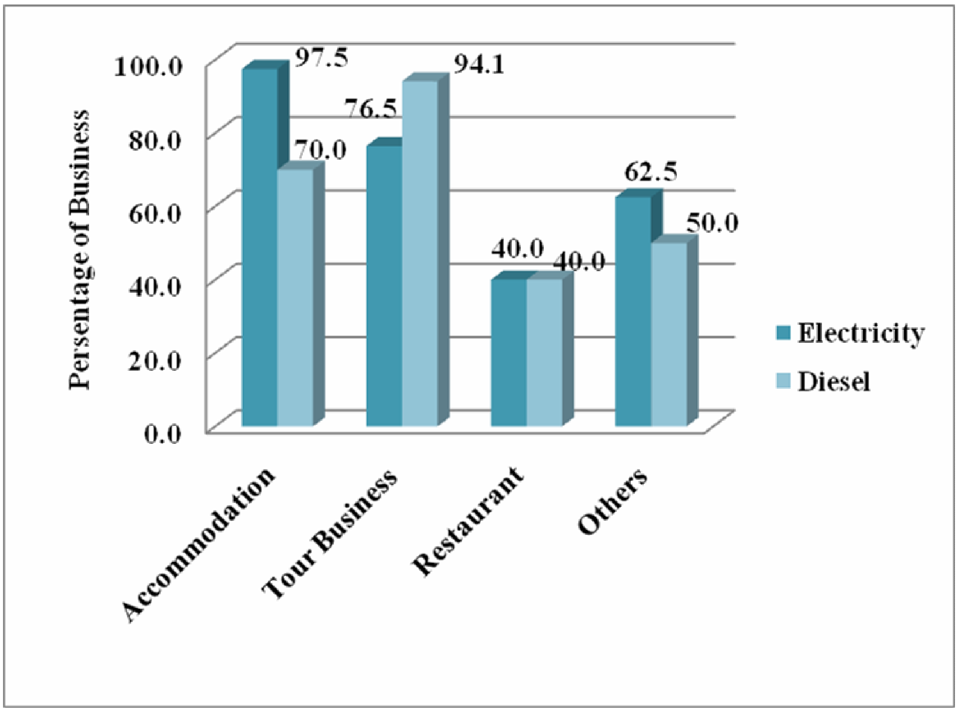
Source: *Author survey*

The sources of energy used by businesses in Koh Samui are similar in terms of both type and pattern of consumption to those used in the urban areas of Thailand. For example, Bangkok's transport system shows similar patterns of fuel consumption for liquid petroleum (mainly diesel and petrol); LPG is a relatively minor fuel source (Phdungsilp, 2009). These fossil fuels also account for the largest share of global commercial energy and the main activities in cities across the world.

It is noteworthy that diesel is a more popular fuel than petrol among businesses on the island. A driving factor for this may be the modes of transport used for tourism activities around the island's coastline, as ferries and boats mainly consume diesel. However, global trends in the price of oil are probably the strongest factor to have contributed to the growth in the popularity of diesel in Thailand (Ng, 2006). It is clear that islanders have shifted their patterns of energy consumption in response to the rising price of petrol in recent years.

There are some significant differences between the main energy sources used by the different types of business surveyed here. It is worth to noting that there is no use of solar, photovoltaic, nuclear or any renewable energy in Koh Samui. The most common kind of business operating in Koh Samui's tourism sector provides accommodation (these account for 57.2% of respondents to our survey). It is noteworthy that these businesses also hold the large share of all types of energy use in Koh Samui's tourism sector. This is compared with the percentages of major energy-use, electricity and diesel, for other types of business in Figure 7.4 below:

Figure 7.4: Comparing the Percentage of Businesses and Their Main Sources of Energy



Source: *Author survey*

Figure 7.4 shows that compared among themselves, 97.5 % of accommodation businesses rely on electricity, thus making them the largest consumers of electricity on the island. Meanwhile, tour operators consume the largest share of diesel fuel.

In addition to the main result of Figure 7.4, it is also significant that half of the other group of businesses (*i.e.* car rentals, golf courses, and spa services) and 40% of restaurants rely on petrol for energy. Nevertheless, only 37.5% of hoteliers choose petrol for their business, while this fuel was supplied to 17.6% of tour operators. The other important fuel is LPG which has been used by 30% of respondents (mainly hotels and restaurants) to fuel kitchen appliances.

It is worth mentioning that the general pattern of energy use in Koh Samui, in terms of the energy source relied upon by businesses, does not meet the targets set by both Thai government and the Kyoto Protocol on the reduction of emissions from fossil fuels. Eliminating CO_2 emissions from the burning of fossil fuels is the main priority of the Kyoto Protocol. However, Samui's tourism sector relies on fossil fuels to maintain its services. Moreover, natural gas or LPG has recently become the most important indigenous energy resource. It has been promoted by the Ministry of Energy as an alternative means of fueling vehicles in order to replace gasoline and diesel (Amranand, 2009). In order to decrease the importation of expensive fuels, biofuels and natural gas in vehicle are fostered to be used with the lower price. Therefore, since 2005 the consumption of natural gas in vehicles has risen along with the price of oil. However, due to its geography and also a lack of natural gas service stations, Koh Samui does not fit this trend. This research confirms this by showing that none of the surveyed businesses rely on NGV (Natural Gas Vehicle) to fuel vehicles; they continue to rely on traditional petroleum fuels.

7.3.2 The Energy Consumption of Tourism Businesses

As mentioned above, the availability of energy sources on Koh Samui and their relative popularity in the island's tourism industry are discussed. The volume of consumption for the major energy sources (electricity, petrol, diesel and LPG), as revealed by this thesis, is discussed based on the questionnaire results of 70 respondents in this section.

7.3.2.1 Electricity Consumption

The tourism businesses surveyed in this thesis can be split into two groups according to the level of their electricity usage: heavy users (*i.e.* businesses that use more than 10,000 kWh) and light users (*i.e*. businesses that use less than 5,000 kWh); this research reveals that 47.6% are heavy users and 42.9 % are light users (see Table 7.2). So, the respondents were asked for estimating their average monthly electricity bill and found that most respondents (63.2 %) has the average monthly electricity bill less than £ 1,000; of these, 40.8 % spent between £200 - £1,000 per month and 22.4 % less than £200 per month, respectively. It is noteworthy that the 24.6 % of respondents who gave specific information about their electricity bills paid on average more than £2,000 per month. By considering in detail, the heavy users of electricity are the 5 star hotels and other tourism businesses *e.g.* rental car or golf and spa and so on (see also Table 7.16) by which it is caused by derived demand from tourists. However, as the respondents come from different subsectors in tourism, including tour operators, for whom electricity is not a major energy source, the figures of electricity usage shown in the table seem to vary and also underestimate the actual level of electricity use.

However, the availability and use of electricity is a vital element in tourism particularly for the operation of accommodation businesses. Recently, accommodation business makes the largest share account for 70% of electricity consumers in the top 20 list of customer ranging from their individual electricity consumption at Koh Samui (PEA, 2007). As a result, tourism accommodation accounts for the largest share of energy use (40.6%) through electrical appliances, exceeding the total amount of electricity used by Koh Samui's commercial sector and native residents.

Nevertheless, there are some common facility operations in major services. In particular, most of the electricity used by accommodation businesses in Koh Samui can be accounted for by lighting, hot water, laundry and catering. Additionally, as Koh Samui is a tropical destination, a great deal of electricity is also used by hotels to power air conditioning. The greater importance of these services (especially lighting and air conditioning) in hotels means that more electricity is used by the tourism sector than for public services.

Table 7.2: Frequency and Percentage of Business Classified by Electricity Use

Variable	**Frequency**	**Percentage (%)**
Quantity (Mean = 149,023.80 kWh)		
Less than 5,000 kWh	9	42.9
5,000 – 10,000 kWh	2	9.5
More than 10,000 kWh	10	47.6
	21	**100.0**
Bills (Mean = £4,476.5)		
Less than £200	11	22.4
£200 - £1,000	20	40.8
£1,001 - £2,000	6	12.2
More than £2,000	12	24.6
	49	**100.0**

Source: *Author survey*

7.3.2.2 Petrol Consumption

The majority of the oil consumption on Koh Samui can be accounted for by cars and trucks using different types of fuel. Table 7.3 shows that more than half of the respondents (58.8 %) keep 1 or 2 cars as part of their businesses and 41.2 % keep more than 3 cars. Of the latter group, 13.7 % keep 3 to 4 cars and 21 % keep 5 to 6 cars. Table 7.3 also shows the pattern of petrol usage in tourism businesses on Koh Samui (classified by frequency and percentage). These results demonstrate that 46.7 % of respondents used between 100–500 litres of petrol per month while 40.0 % of them used more than 1,000 litres of petrol per month. As regards petrol bills, 47.1% of respondents spent more than £1000 or 55,000 baht per month while 29.4 % spent less than £1000 per month. Less than half of the respondents revealed the oil consumption of their businesses (those who did not cited confidentiality as the reason for this), but of those which did, most of them relied on diesel engines.

Table 7.3: Frequency and Percentage of Business Classified by Petrol Consumption

Variables	Frequency	Percentage (%)
Number of car (Mean = 2.98)		
1 – 2	30	58.8
3 – 4	7	13.7
5 – 6	11	21.6
More than 6	3	5.9
	51	**100.0**
Petrol use monthly (Mean = 5,462.58)		
100 - 500 Litres	7	46.7
501 – 1,000 Litres	2	13.3
More than 1,000 Litres	6	40.0
	15	**100.0**
Petrol bill monthly (Mean = £2,665.0)		
Less than < £100	5	29.4
£100 - £1000	4	23.5
More than £1000	8	47.1
	17	**100.0**

Source: *Author survey*

Petrol cars have recently become unpopular in Thailand; this trend is likely to continue on Samui Island. Of the 34.3% of respondents who were still using oil, the level of petrol consumption was lower. Sensitivity to the rising price of petrol has led to most of them preferring diesel to run their businesses.

7.3.2.3 Diesel Consumption

Substantially more diesel was used on average per month than petrol (see also Table 7.4); 63.7% of respondents consumed more than 1,000 litres per month as compared with 40% of respondents who consume similar amounts of petrol. Furthermore, 64.0 % of respondents spent more than £1,000 on diesel per month.

Of the variety of different fuels available in Thailand, diesel has gained in popularity in the tourism industry, and especially in the marine transport’s sector. Technically, it offers them a lower price which helps them to minimise their costs. Nevertheless, as a fossil fuel which is consumed on a vast scale in the tourism industry, diesel is at the centre of public concern about the risk of global warming. Those critical issues mainly focus on reducing the consumption of fossil fuels as well as searching for more environmentally friendly energy sources.

Table 7.4: Frequency and Percentage of Business Classified by Diesel Consumption

Variables	Frequency	Percentage (%)
Diesel Quantity Monthly (Mean = 46,473.58)		
100 - 500 Litres	3	13.6
501 - 1,000 Litres	5	22.7
More than 1,000 Litres	14	63.7
	22	**100.0**
Diesel Bill Monthly (Mean = £16,974)		
Less than £100	2	8.0
£ 101 - £1,000	7	28.0
More than £1,000	16	64.0
	25	**100.0**

Source: *Author survey*

7.3.2.4 LPG Consumption

In Thailand LPG has traditionally been used by the catering industry. However, since the prices of gasoline and diesel rose rapidly in the first half of 2008, the practice of converting vehicles to run on LPG has become widespread in Thailand (Amranan, 2008). LPG could also be considered as an alternative energy source for Thailand as 60% of the kingdom's LPG supply comes from its own natural gas reserves, in which respect it has a much lower

Table 7.5: Frequency and Percentage of Business Classified by LPG Consumption

Variables	Frequency	Percentage (%)
Gas for Kitchen Use (Mean = 25,762.78)		
Amount of LPG		
Less than 200 Kg.	7	38.9
201– 500 Kg.	4	22.2
More than 500 Kg.	7	38.9
	18	**100.0**
Gas for Kitchen Use (Mean = 25,762.78)		
Amount of LPG		
Less than 200 Kg.	7	38.9
201– 500 Kg.	4	22.2
More than 500 Kg.	7	38.9
	18	**100.0**
LPG Bill (Mean = £42,709.07)		
Less than £40	2	11.2
£40 - £200	8	44.4
More than £200	8	44.4
	18	**100.0**

Source: *Author survey*

production cost than oil-based alternatives. This has led to a rapid increase in the sale of LPG for the purposes of running vehicles.

However, Koh Samui presents a different situation as most LPG supplied to the island is currently used in kitchens only; LPG station service are not currently available regarding the level of LPG consumption in Koh Samui's vehicles. In regard to LPG usage, an equal number of respondents (38.9 %) used less than 200 Kg and more than 500 Kg per month for kitchen-work while the remainder used between 200 – 500 Kg per month for the same purposes (see also Table 7.5). There were also an equal number of respondents (44.4 %) who spent between £40 – £200 per month and more than £200 per month on LPG, while the rest (11.2 %) spent less than £40 per month.

7.3.3 Energy Use for Water and Waste Management

Exploring the demands placed on the island's environment by energy use in tourism sector, the pattern of energy use supporting the island's environmental-impact treatment were investigated by using questionnaire survey. The results associated with water, sewage treatment, and waste management in tourism sector also described in this part.

7.3.3.1 Water Consumption and Wastewater Treatment

The largest consumers of water in Koh Samui's tourism sector are hotels and golf courses which use large quantities of water for tasks like filling swimming pools, watering lawns and gardens, and supplying the general needs of tourists (*e.g.* washing, drinking, and so on). This can result in water shortages and the degradation of water supplies, the latter of which has recently become a major problem on the island, as well as generating a greater volume of wastewater.

Table 7.6 shows that 18 businesses from the accommodation sector which responded to our survey specified the area of their swimming pools. Most of them have pools with an area greater than 150 cubic metres (66.7 %); additionally, 38.9 % have pools with an area 150 – 500 cubic metres and 16.7 % of them have pools with an area between 501 – 1,000 cubic metres.

Half of the respondents (52.4 %) who provided data on their water usage used more than 500 cubic metres per month on average, while 28.6 % of them used less than 50 cubic metres and

19.0 % of them used about 50–500 cubic metres on average per month. Therefore, this amount of water use requires the high level of electricity for transforming sea water to be fresh water; approximately its cost is greater than processing from ground water about 17 times (TRF, 2005). This is compatible with Briassoulis (2002) that tourism industry has to take responsibility of higher water use. Significantly, 57.1% of respondents spent less than £200 on their water bills per month on average while 22.9 % of them spent more than £1000 per month on average. 39.1 % of respondents produced more than 1,000 cubic metres of sewage per month while 34.8 % of them produced between 100–1,000 cubic metres of sewage per month and 26.1% produced less than 100 cubic metres of sewage per month.

Table 7.6: Frequency and Percentage of business Classified by Pattern of Energy Use

Variables	**Frequency**	**Percentage (%)**
Area size of swimming pool (Mean = 561.50)		
Less than 150 cubic meter	6	33.3
150 – 500 cubic meter	7	38.9
501 – 1,000 cubic meter	3	16.7
More than 1,000 cubic meter	2	11.1
	18	**100.0**
Average monthly of Water usage		
Water Amount (Mean = 4,751.12)		
Less than 50 cubic meter	6	28.6
50 – 500 cubic meter	4	19.0
More than 500 cubic meter	11	52.4
	21	**100.0**
Water Bills (Mean = £200**)**		
Less than £200	20	57.1
£200 – £ 1000	7	20.0
More than £1000	8	22.9
	35	**100.0**
Sewage management		
Average sewage (Mean = 6,770)		
Less than 100 Cubic Meter/month	6	26.1
100 – 1,000 Cubic Meter/month	8	34.8
More than 1,000 Cubic Meter/month	9	39.1
	23	**100.0**
Sewage treatment system		
Yes, we do operated it	11	27.5
No, we don’t have	29	72.5
	40	**100.0**
Reuse of waste water		
Yes, we do reused	15	46.9
No, we don’t reused	17	53.1
	32	**100.0**

Source: *Author survey*

Most respondents (72.5 %) operated sewage treatment; however, only 46.9 reused sewage water. Water consumption in the tourism sector can put enormous pressure on vulnerable islands like Samui where water supply is limited and wastewater is also discharged into rivers and the sea. Basing on average size of swimming pool above, it can be estimated that 5 Star hotels, 102 hotels in 2007, which account for 24% of hotel businesses on Koh Samui, consume approximately 57,273 m^3 of water per day in total to fill their swimming pools.

In contrast to the average water use of 0.2 m^3 per capita per day of residents on Koh Samui (Koh Samui Municipality, 2009). Statistics gathered in 2008 by the Koh Samui Municipality also show that the water required for island's 52,277 native residents use only 10,455.4 m^3/day. In other words, that amount of water filling swimming pool in one day is enough to support 39 villages on Koh Samui about 5 days.

As long as water remains a fundamental part of the service provided by the tourism sector, which is steadily growing in the region, water shortages will continue to become more severe and then it can press more pressure to fresh water conflict use between tourism sector and residents. If this trend continues, then the demand for desalinated seawater, which consumes vast quantities of electricity, will also gradually increase, potentially exacerbating the current rate of energy use for wastewater treatment processes.

7.3.3.2 Waste Treatment

Table 7.7 shows that more than half of the respondents (61.7 %) produced less than 1,001 Kg of waste per month, of which 38.2 % produced between 100–1,000 Kg per month. However, 38.3 % of respondents produced more than 1,000 Kg of waste per month, and significantly, 71.1 % of respondents did not recycle their waste. Furthermore, 81.4 % of respondents separated solid and garbage waste before disposing of them.

Waste is one of a major problem on Koh Samui. The island's landfill capacity is very limited and has nearly been exceeded since 2007 (EEC, 2007). Moreover, waste disposal processes place additional demands on the Island's energy sources including the vast quantities of fuel needed to transport waste to landfill sites. The amount of energy used for these waste treatment processes is discussed in Chapter Eight.

Table 7.7 Frequency and Percentage of Business Classified by Environmental Management

Variable	Frequency	Percentage (%)
Waste management		
Average waste quantity (Mean = 1,646.18)		
Less than 100 Kg/month	8	23.5
100 – 1,000 Kg/month	13	38.2
1,001 – 5,000 Kg/month	8	23.5
More than 5,000 Kg/month	5	14.8
	34	**100.0**
Solid-waste separation		
Yes, we do separate waste	35	81.4
No, we don't separate waste	8	18.6
	43	**100.0**
Recycle of waste		
Yes, we do recycle	11	28.9
No, we don't recycle waste	27	71.1
	38	**100.0**

Source: *Author survey*

7.4 ATTITUDES RELATED TO ENERGY AND CLIMATE CHANGE

As shown in Table 7.8, respondents were asked to rate the level of their actions toward the environmental management. These results show that most respondents (80.0 %) have considered using alternative energy sources to run their businesses, and 87.1 % of respondents believe that businesses are responsible for global warming and climate change. Although respondents put more weight on global warming and climate change, most of them (78.5 %) need to give priority to the demands of tourists. For example, they have to provide air conditioning, changing bath towels everyday, or provide all facilities to tourists. However, most respondents (78.5 %) understand the benefits of energy saving campaigns and 85.7 % of them mention that they have adopted environmentally friendly measures in their business plans. Obviously, 87.1 % of respondents agree that cooperation is needed between governments and tourism businesses in order to find policy-based solutions to climate change and global warming. However, most of them (80.0 %) believe that high costs and technical issues make it impossible for them to measure their energy footprints and only 57.1 % of them believe that laws and regulations can persuade tourism businesses to measure and manage their emissions.

Table 7.8: Frequency and Percentage of Business Classified by Level of Actions towards Environmental Management

Attitude variable	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. We consider more alternative energy sources such as sun light, water, etc.	34.3 (24)	45.7 (32)	15.7 (11)	4.3 (3)	-
2. We are aware that we have to take responsibility for global warming and climate change.	37.1 (26)	50.0 (35)	10.1 (7)	1.4 (1)	1.4 (1)
3. As the nature of business, we have to put the priority on tourist's demand rather than energy saving.	31.4 (22)	47.1 (33)	5.7 (4)	12.9 (9)	2.9 (2)
4. Saving energy does not only cut costs down but also helps to save global environment.	47.1 (33)	31.4 (22)	5.7 (4)	12.9 (9)	2.9 (2)
5. Recently, we have adopted environmentally friendly measures in our business plan.	45.7 (32)	40.0 (28)	10.0 (7)	4.3 (3)	-
6. The cooperation between government and tourism business in Koh Samui make the climate change policy possible.	35.7 (25)	51.4 (36)	10.0 (7)	-	2.9 (2)
7. Energy footprint measurement is impossible due to cost and technical limits.	24.3 (17)	55.7 (39)	17.1 (12)	2.9 (2)	-
8. Only law and regulation can control businesses to achieve emission control.	15.7 (11)	41.4 (29)	25.7 (18)	7.1 (5)	10.1 (7)
9. Environmental friendly policy offer better value for customers and make our product more competitive.	38.6 (27)	47.1 (33)	5.7 (4)	8.6 (6)	-

Source: *Author survey*

Although these businesses expressed concerns about global warming and many of them have considered using alternative energy sources to lower their costs and reduce their emissions, they still identify customer demands as their utmost priority. This is because there are a limited number of the energy sources in Koh Samui (Samui-SD, 2005) and the demand of energy use in tourism industry is the derived demand (Tabatchnaia-Tamirisa *et al.*, 1997); therefore, tourism businesses have to focus on their profitability by satisfying tourists *e.g.* providing air-conditioning, building the big swimming pool, providing transport both within the business and outside, and so on. It is also noteworthy that financial problems are a critical issue as far as improving the management of energy resources goes. Hence long term success in reducing the emissions of businesses depends mostly on the demands of tourists, financial support for low carbon energy solutions, and government policies which can help to establish a shift towards a low carbon economy and promote environmentally friendly tools to achieve this.

7.5 COMPARING OF ATTITUDES AND ENERGY-USE BEHAVIOUR

This section is to compare tourism businesses' attitude and their behaviour toward energy use and climate change in order to understand their sense of environmental responsibility and their environmental-friendly practice. One way ANOVA was employed to analyse the differentiation of mean from different types of business toward attitude and behaviour within the significance level of 0.05.

7.5.1 Comparing Attitudes in Different Types of Business

The mean difference analysis of tourism businesses' attitudes *i.e.* interest of alternative energy sources, awareness of climate change, priority of their business toward energy use, saving energy and the global environment, adopting environmental measurement in business plans, and understanding of benefits from environmental friendly policy are presented in this section:

7.5.1.1 Interest among Businesses in Alternative Energy Sources

Table 7.9 shows that different types of business responded differently to questions concerning whether they would consider using more alternative energy sources at the significance level of 0.05 (F = 2.850, Sig. = 0.021). This research found that higher-ranked (*i.e.* in terms of stars) hotels tended to show more interest in alternative energy sources while lower-ranked hotels and other forms of accommodation business tend to show less interest**.** Importantly, restaurants showed the highest level of interest in alternative energy sources (with a mean score of 5.00) while tour operators showed the least interest.

In order to demonstrate an awareness of the environmental impact of their services on their brand image and also to lower their running costs, 4 and 5 star hotels invested more into looking for renewable energy sources than lower ranking hotels. Recently, some of Koh Samui's 5 star hotels have taken a pro-active stance, voluntarily playing a leading role in the Green Island Project: For example, they have contributed in this respect by operating low carbon activities for local schools on Koh Samui (TAT, 2009). As large scale businesses with attractive products, luxury hotels are potentially able to launch climate concern's programme. Meanwhile, smaller-scale hotels which use less energy seems overwhelming only on how to persuade tourists to buy their product rather than consider the alternative energy which may have a little impact on their operating cost.

Among tour operators, the general assumption seems to be that they are limited in which fuels they can use to operate their vehicles (*i.e.* ferries, boats, and cars) and that converting their engines to alternative fuel sources is not cost effective for them. Accordingly, these businesses tend to assume that alternative energy sources are not worthy of their consideration.

Table 7.9: **One-way ANOVA Results of Alternative Energy Consideration and Types of Businesses**

Types of Businesses	*We consider more alternative energy sources such as sun light, water, etc*					
	n	***Mean***	***S.D.***	***df***	***F***	***Sig.***
5 Star Hotel	11	4.45	0.69	7	2.850	0.021
4 Star Hotel	4	4.25	0.50			
3 Star Hotel	6	4.17	0.41			
2 Star Hotel	10	3.90	0.57			
1 Star Hotel	9	3.89	0.93			
Tour Operators*	17	3.65	1.00			
Restaurant*	5	5.00	0.00			
Others (Rental car, Golf and Spa)	8	4.38	0.74			

*Post Hoc Test: differences between tour operators and restaurants (Sig. = 0.018)
Source: *Author survey*

7.5.1.2 Awareness of Climate Change among Businesses

Table 7.10 illustrates that different types of businesses show different attitudes towards the responsibility of businesses for global warming and climate change at the significance level 0.05 (F = 2.316, Sig. = 0.036). Considered in more detail, it shows that restaurants agreed at the highest level with a mean score of 5.00 while tour operators showed the lowest level of agreement with a mean score of 3.71. 5, 3, and 1 Star Hotels also agreed at a high level while 2 and 4 Star Hotels agreed at a slightly lower level.

The environmentally friendly attitudes of restaurants and 5 star hotels are significantly higher than those of the other types of businesses surveyed. By contrast, tour operators showed the poorest level of ecological consciousness. Carey *et al.* (1997) have pointed out that tour operation is one of the key sectors which influence the sustainability of the tourism industry. Based on the criteria examined by this study, most of the tour operators which responded to our survey are 'mass tour operators' who do not assume responsibility for environmental issues; rather, they react to the needs of the market. In general, it seems that tour operators mainly focus on marketing activities and are not particularly interested in the long term impacts of tourism (Budeanu, 2007).

Table 7.10: One-way ANOVA Results of Awareness of Global Environmnetal Impact and Types of Businesses

Types of Businesses	*We are aware that we have to take responsibility for global warming and climate change.*					
	n	***Mean***	***S.D.***	***df***	***F***	***Sig.***
5 Star Hotel	11	4.55	0.69	7	2.316	0.036
4 Star Hotel	4	4.00	0.00			
3 Star Hotel	6	4.33	0.52			
2 Star Hotel	10	4.20	0.42			
1 Star Hotel	9	4.22	0.67			
Tour Operators*	17	3.71	1.16			
Restaurant*	5	5.00	0.00			
Others (Rental car, Golf and Spa)	8	4.25	0.46			

*Post Hoc Test: differences between tour operators and restaurants (Sig. = 0.023)
Source: *Author survey*

7.5.1.3 Priority on the Demands of Tourists

Table 7.11 reveals that different types of business express different attitudes about how much priority they should place on the demands of tourists at the expense of saving energy at the significance level of 0.05 (F = 2.576, Sig. = 0.021). Detailed consideration of this show that 5 and 1 Star Hotels agreed at the highest level while 2 and 3 Star Hotels agreed at a slightly lower level. Significantly, only restaurants and 4 Star Hotels agreed with this at a moderate level. This suggests that only restaurants and 4 Star Hotels are more concerned about environmental issues than their profits.

Table 7.11: One-way ANOVA Results of Attitude toward Tourist's Demand and Energy Saving Schemes and Types of Businesses

Types of Businesses	*As the nature of business, we have to put the priority on tourist's demand rather than energy saving schemes.*					
	n	***Mean***	***S.D.***	***df***	***F***	***Sig.***
5 Star Hotel	11	4.64	0.50	7	2.576	0.021
4 Star Hotel	4	3.00	1.15			
3 Star Hotel	6	4.00	0.89			
2 Star Hotel	10	4.10	0.88			
1 Star Hotel	9	4.44	0.53			
Tour Operators	17	3.47	1.23			
Restaurant	5	3.20	1.10			
Others (Rental car, Golf and Spa)	8	3.88	1.36			

* Post Hoc Test: differences between five-star hotels and tour operators (Sig. = 0.004)
Source: *Author survey*

7.5.1.4 Saving Energy and the Global Environment

Table 7.12 shows that different types of business hold different attitudes about the benefits of energy saving in order to cut their costs and saving the environment at the significance level of 0.05 (F = 3.422, Sig. = 0.004). Again, detailed consideration of these results shows that only the 5 and 3 Star Hotels agreed at a moderate level while the other businesses agreed the benefits of energy saving do not only cut their costs, but also help to save the global environment. It should be noted that this corresponds to the results shown in Table 7.11 in that restaurants and 4 Star Hotels including rental, golf and spa businesses are more aware of the benefits of energy saving than other types of business.

Table 7.12: **One-way ANOVA Results of Attitude toward Advantages of Saving Energy and Types of Businesses**

Types of Businesses	*Saving energy does not only cut costs down but also helps to save global environment.*					
	n	***Mean***	***S.D.***	***df***	***F***	***Sig.***
5 Star Hotel*	11	3.09	1.45	7	3.422	0.004
4 Star Hotel	4	4.75	0.50			
3 Star Hotel	6	3.33	1.21			
2 Star Hotel	10	4.30	0.95			
1 Star Hotel	9	3.78	1.39			
Tour Operators	17	4.24	0.83			
Restaurant	5	4.80	0.45			
Others (Rental car, Golf and Spa)*	8	4.88	0.35			

* Post Hoc Test: differences between five-star hotels and “others” (car rentals, golf courses and spas) (Sig. = 0.020)
Source: *Author survey*

7.5.1.5 Adopting Environmental Practice in Business Plans

Table 7.13 demonstrates that different types of business have acted in different ways to bring environmentally friendly measures into their business plans at the significance level of 0.05 (F = 2.842, Sig. = 0.012). Taking environmental concern showing in a business plan into account, restaurants, 5 Star Hotels, and other businesses have respectively adopted environmentally friendly measures in their businesses at the high level. However, 4 Star Hotels, which show greater concern and understanding of the benefits of energy saving, conversely show the low level of uptake for environmentally friendly business plans; some of them have not put official plans into operation.

By considering Post Hoc Test, the results in Table 7.13 show that there is the mean difference between 5 Star Hotel and Tour Operators at the significance level of 0.05.

Table 7.13: One-way ANOVA Results of Attitude toward Adopting Environmental Practices and Types of Businesses

Types of Businesses	*Recently, we have adopted environmentally friendly practices in our business plan.*					
	n	***Mean***	***S.D.***	***df***	***F***	***Sig.***
5 Star Hotel*	11	4.67	0.52	7	2.842	0.012
4 Star Hotel	4	3.82	0.58			
3 Star Hotel	6	4.10	0.82			
2 Star Hotel	10	3.50	0.53			
1 Star Hotel	9	4.00	0.87			
Tour Operators*	17	3.26	0.95			
Restaurant	5	4.80	0.45			
Others (Rental car, Golf and Spa)	8	4.63	0.52			

* Post Hoc Test: differences between 5 star hotels and Tour Operators (Sig. = 0.024)
Source: *Author survey*

The 5 Star Hotels have adopted the environmental friendly programme in their business plans in the highest level showing by the highest mean among other types of tourism business, whereas Tour Operators have adopted this programme in the lowest level.

This result can link back to the previous literatures in chapter four that the SMTEs tend to neglect the sustainable practices. Although their size of business, flexible management and strong commitment labours enable them to respond very quickly to implement environmental strategies, those SMTEs tend to neglect for adopting sustainable practices (Farsari et al., 2007; Redmond et al., 2008). The small companies of tour operator's respondent in Koh Samui show the least attention to take an environmentally friendly practice into their business plan in this study.

This result relates to previous studies that many SMEs consider the environment to be a peripheral rather than core business issue and consequently they do not perceive that they provide a significant impact on the environment (Peters and Turner, 2004; Redmond et al., 2008). For many scholars, the the level of resources available and the prvailing attitudes of the SMEs owner-managers are the most influence factor to adopting sustainable practices (Condon, 2004; Luetkenhorst, 2004; Worthington and Patton, 2005). Hence it is important to consider this sector of tourism as tour operators are the large facilitators of information between suppliers and tourists and, consequently, influencing how the tourist market can evolve towards more sustainable and responsible.

Table 7.14: One-way ANOVA Results of Attitude toward Advantages of Environmental Policy and Types of Businesses

Types of Businesses	*Environmental friendly policy offering better value for customers and making our product more competitive.*					
	n	***Mean***	***S.D.***	***df***	***F***	***Sig.***
5 Star Hotel	11	3.91	1.04	7	2.955	0.01
4 Star Hotel	4	4.25	0.50			
3 Star Hotel*	6	3.00	1.10			
2 Star Hotel*	10	4.30	0.48			
1 Star Hotel	9	4.67	0.50			
Tour Operators	17	4.18	0.95			
Restaurant*	5	4.50	0.53			
Others (Rental car, Golf and Spa) ***	8	4.60	0.55			

*Post Hoc Test: difference between 3 and 2 star hotels (Sig = 0.047), 3 star hotels and restaurants (Sig = 0.019), and 3-star hotels and others (Sig = 0.031)
Source: *Author survey*

7.5.1.6 Benefits of Environmental Friendly Policy

Table 7.14 illustrates that different types of businesses hold different attitudes towards the benefits of environmentally friendly policies for themselves (*i.e.* by increasing their competitiveness) and their customers at the significance level of 0.05 (F = 2.955, Sig. = 0.01). The research found that in the accommodation sector 1, 2 and 4 Star Hotels agreed at the highest level while 5 and 3 Star Hotels did not quite agree that environmental friendly policy offering better value for customer and making their accommodation more competitive. Interestingly, 3 Star Hotels have employed environmental friendly programme in the highest level (see also Table 7.13), but they view that environmental friendly policy offering better value and competitiveness at the least mean among other types of business.

7.5.2 Energy-Use Behaviour in Different Types of Business

The mean difference analysis of tourism businesses' behaviour toward energy use from waste generation and electricity consumption are presented in this section:

7.5.2.1 Waste Generation

Different sectors of Koh Samui's tourism industry produced different amounts of waste at the significant level of 0.05 (F = 3.475, Sig. = 0.01) (see Table 7.15). The results show that most waste from Koh Samui's tourism businesses is generated by five-star hotels, golf courses, and spa operation with 3841.70 Kg per month and 2,925.0 Kg per month respectively.

Table 7.15: One-way ANOVA Results of the Mean Differences between the Quantities of Waste Produced by Different Types of Businesses

Types of Businesses	*Amount of Waste in Kg/month*					
	n	***Mean***	***S.D.***	***df***	***F***	***Sig.***
5 Star Hotel	9	3,841.70	3460.78	5	3.475	0.01
4 Star Hotel	3	583.33	797.39			
3 Star Hotel	5	460.00	395.92			
2 Star Hotel	7	515.00	676.07			
1 Star Hotel	6	340.00	573.31			
Golf and Spa Business	4	2,925.00	2947.74			

Source: *Author survey*

Due to the larger numbers of guests which they may accommodate, the top-range hotels are undoubtedly the island's largest producers of waste. However, as the Green-Island Project has recently been implemented in Koh Samui, hotels and resort waste management policies have become more prevalent and the shift towards environmental sustainability has increased.

7.5.2.2 Electricity Consumption

The research suggests that expenditure on electricity varies among the different kinds of tourism-related business that operate on Koh Samui (F = 2.551, Sig. 0.028); this is illustrated by table 7.16. Our evidence shows that five-star hotels pay the highest costs on average for their electricity and consume the largest share of the electricity used in Koh Samui's tourism industry *(c.* £ 20,302.5 per month).

Table 7.16: **One-way ANOVA Results of the Mean Differences between the Electricity Expenses of Different Types of Businesses**

Types of Businesses	*Electricity Expenses (£/Month)*					
	n	***Mean***	***S.D.***	***df***	***F***	***Sig.***
5 Star Hotel	7	20302.5	25554.8	7	2.551	0.028
4 Star Hotel	3	1246.7	866.3			
3 Star Hotel	4	695	250.5			
2 Star Hotel	10	1079.6	1195.2			
1 Star Hotel	5	315.6	238.7			
Tour Operation	12	439.7	472.8			
Restaurant	6	1478.0	1982.7			
Others (Rental car, Golf and Spa)	2	12007.0	20013.3			

Source: *Author survey*

The main factors affecting the level of electricity consumption are the size of companies, the numbers of customers that they serve, business activity, and the personal behaviour of tourists including energy policy in individual organization. Earlier in this study it was reported that most of the energy consumed by the accommodation sector is used to operate heating and cooling systems, hot water supplies, fridges and freezers, and lighting (Becken and Hay, 2007). In tropical destinations, the single largest burden on energy supplies is air conditioning which is often switched in unoccupied rooms to prevent the growth of indoor moulds and smells (Trung and Kumar, 2005 and Becken and Hay, 2007).

7.6 THE CLIMATE CHANGE CONCERN AND MANAGING ENERGY-USE

The following section presents qualitative data from interviews about CO_2 emissions. Respondents were asked to participate in a semi-structural interview in order for us to investigate their views on CO_2 emissions: particularly the problems associated with this and solutions to them. The data collected from these interviews can be employed to develop a policy of tourism management for Koh Samui. The data were summarised and analysed manually in the Thai language before they were translated into English. The transcripts were read carefully in order to conduct hand-coding. The data were reread and categorised until a convergence was found. In order to understand respondents' concerns, the contents of the interview data were analysed and sorted into prominent categories according to frequency tabulation. The codes in each category were manually counted in order to develop the readable format and tabulation. The prominent texts were also presented anonymously in order to maintain the confidentiality of the respondents' attitudes and 'themes' on climate change and global warming.

7.6.1 Attitudes towards CO_2 Emissions and Energy-Use

The first question is 'From the statement: "almost half of Thailand's carbon dioxide emissions come from energy we use every day – at home and when we travel. By saving energy we can all help prevent climate change." Do you agree with this statement? Why?'

Table 7.17: Opinion toward the Statement Regarding Sources of CO_2

Agreement	Percentage of Respondents
Yes	96.4
No	3.6

Source: *Author interview*

After themes were developed and reread, the code is processed manually in order to demonstrate content of this statement. So, the level of concerns, causes of problems, and solutions are presented:

Most respondents (96.37 %) agreed with the above statement (see Table 7.17). Table 7.18 shows that more than half (57.4 %) of the respondents expressed concern about global CO_2 emissions. In addition to this, 29.6 % of respondents agreed that CO_2 emissions are a national problem and 13.0 % agreed that it is a local (Koh Samui) problem. This is a positive sign as it shows that most tourism businesses in Koh Samui agree that CO_2 emissions are not merely a local problem related to their businesses. Instead they agree that it is either a national or global problem in which they are all stakeholders. One of the respondents, quoted anonymously as Respondent A, stated:

> "…the problem of climate change is a global issue which requires cooperation from all countries…it is difficult for one country to address this global concern, but it is possible to solve it through international cooperation."

(Respondent A, Tour Operator, Manager)

Respondent A, a tour operator, provides an example of global concern and believes that climate change and global warming are not a problem of individual tourism businesses or countries. Rather, they are global problems, solutions for which require global cooperation among countries. This is congruent with Budeanu (2005) and Scott and Becken (2010) that this issue needs the cooperation from all international countries.

Table 7.18: Level of Concern towards CO_2 Emissions

Level of Concerns	Percentage of Respondents
Global concern	57.4
National concern (Thailand)	29.6
Local concern (Koh Samui)	13.0

Source: *Author interview*

As was mentioned above, Respondent A was concerned that climate change cannot be solved or alleviated by individuals or countries acting alone. Instead, this respondent took the view that global cooperation is required to tackle climate change. However, many of the interviewees also expressed awareness of the necessity for them or their businesses to take action against pollution or climate change at a local level, as the following extracts from interviews with Respondent B and C show:

"…pollution has dramatically increased, especially air pollution. Collaboration among stakeholders can decrease the level of pollution, and bring our country's pollution to a normal level."

(Respondent B, One-star hotel, Owner)

"…cooperation among all hotels in Koh Samui toward energy saving and environment management can solve this problem."

(Respondent C, Two-star hotel, Owner)

Respondent B clearly believes that solving the climate change issue will be beneficial for Thailand even though its effects are global. The perspective offered by Respondent C is similar in that it is limited to Koh Samui. In contrast with Budeanu (2005), Scott and Becken (2010), and also the international organisations *e.g.* UNWTO, UNFCCC, WWF, and so on, both Respondent B and C have only focused their environmental issue as national and local level. This may be able to explain that both of them are 1 Star and 2 Star hotels which run by local people who mostly are family businesses and lack of the awareness and knowledge toward climate change and global warming.

Table 7.19 shows what the respondents believe are the main causes of CO_2 emissions as percentages. The most common responses were transport (32.7%), household consumption (10.9%), tourism (10.9%), and waste disposal (9.1%). Importantly, only very small numbers of respondents believe that electricity generation (3.6%) and law enforcement (1.8%) are major causes of CO_2 emissions.

It is noteworthy that the three main causes of CO_2 emissions identified by interviewees relate to everyday activities. In the following extracts, Respondents D and E identify transport as a major source of CO_2 emissions:

"…transport is the main source of carbon. I believe that increasing the efficiency of energy use will totally control changes to the global environment…"

(Respondent D, Five-star hotel, Resident Manager)

"…we release carbon dioxide from automobiles, ignitions, and household consumption."

(Respondent E, Three-star hotel, Assistant Manager)

It can be seen here that he reason they give for this answer is transport is a main cause of problem because it does not only need energy; petrol or diesel, to run the engine, but it also exhausts CO_2 to atmosphere. This is correspond with Becken and Patterson (2006) and Becken *et al.* (2003) who provide empirically that transport is the main cause of CO_2 emissions.

Meanwhile, electricity is identified in the following extract as a cause of pollution (see also Table 7.19). However, it was mentioned by the less number of tourism businesses, in spite of the fact that it is a main source of energy in tourism accommodation (Becken, 2000; Deng and Burnett, 2000; Kitpipat, 2007; Dick Sisman & Associates, 2007).

> "…using electricity can release heat-power because all activities from electricity production to electricity consumption, especially inappropriate uses of electricity …"
>
> (Respondent F, One-star hotel, Owner)

This respondent believes that electricity contributes to pollution but only providing heat-power. However, Respondent F has overlooked other sources of energy *i.e.* coal, diesel, or water which are needed to generate electricity in the first place. The use of these energy sources can also provide CO_2 emissions. In the other words, electricity may directly impact the global warming and climate change by providing heat wave, and also provide indirect impact (*i.e.* CO_2 emissions) from the production process of electricity.

Table 7.19: Causes of CO_2 Emission

Causes of Problem	Percentage of Respondents
Transport	32.7
Household consumption	10.9
Tourism demands	10.9
Wastes	9.1
Development/Business growth: reducing the natural zone	7.3
Industrial factory	7.3
Thais' habit to ignore the saving energy	5.5
Electricity	3.6
Weakness of law enforcement	1.8

* Respondents can specify more than one answer
Source: *Author interview*

7.6.2 Solutions for Reducing CO_2 Emissions

From the semi-structure interviews, respondents were asked questions related to the climate change and global warming, their attitude and behaviour toward the climate change and global warming in order to provide insights of their behaviour as mentioned in Objective 2.

This section demonstrates how tourism businesses consider the way to reduce the impacts from their operation.

Table 7.20 shows what respondents believe are the best means of reducing CO_2 emissions as percentages: Most significantly, 43.6 % suggested that individual businesses need to use less energy, while 38.2 % argued that cooperation is required among all participants (governments, tourism businesses, households, tourists, and other stakeholders) in order to reduce energy consumption. In addition to this, equal numbers of respondents (12.7%) suggested that using alternative energy sources and law enforcement are the best solutions to enforce businesses for more effective environmental management while 10.9 % recommended that implanting a greater sense of social responsibility to all stakeholders is necessary.

The following extracts show some of the solutions to the problems of global warming and climate change that were suggested by interviewees. Although the views of respondents on this are all to some extent subjective, some are less so than others in as far as they relate to the practical measures that policy-makers can take to tackle global warming. By contrast, some of the ideas posited by respondents cannot obviously be acted upon in the public-policy domain.

> "…this problem requires cooperation between the government, private sector, and local community to find objectified solutions to save energy, and use alternative sources of energy…The government should strictly enforce pollution-controlling laws."
>
> (Respondent G, Tour Operator, Manager)

Like Respondent A, Respondent G suggests that it is the responsibility of all participants or stakeholders in tourism industry to find solutions to solved energy problem. However, this respondent also seems to believe that a shared sense of responsibility among stakeholders is not in itself enough to make them cooperate as a group to reduce their emissions. This is suggested by his/her recommendation that governments need to strictly enforce legislation intended to regulate emissions.

> "As transport is the main cause of carbon dioxide emissions, strong law enforcement needs to be used. Moreover, government should support the use of alternative fuels for automobiles – NGV gas or electricity."
>
> (Respondent H, Spa Business, Owner)

The views of Respondent G are supported by Respondent H, who also believes that strict legislation is required, especially in regard to transport, in order to reduce CO_2 emissions. Moreover, Respondent H believes that governments should play an active role in supporting the use of alternative energy sources to fuel vehicles, thereby reducing CO_2 emissions. This is because, at present, the supply of alternative energy sources to tourism businesses in Koh Samui is insufficient.

> "We need to find solutions to tackle this problem. Moreover, we need to implant a sense of social responsibility in the new generation and all the other participants in order to increase awareness of carbon dioxide emissions and their effects."
>
> (Respondent I, Four-star hotel, Manager)

In contrast, Respondent I believes that a broad sense of social responsibility can play an important role in tackling global environmental change The organisations which are responsible for tackling climate change and global warming should build a sense of social responsibility among tourism businesses. Accordingly, as seen from Respondent I that it is the responsibility of humanity in general to change its behaviour in ways that can reduce global warming. In the other words, it is not only the responsibility of businesses or governments to address the threats posed by global warming; tourists and local communities must also play their part.

Finally, in the following extracts, Respondents J and K clearly place the onus for action against climate change on businesses and governments:

> "Tourism businesses should develop ecologically-friendly tourism programmes for themselves, and also adapt to use natural products."
>
> (Respondent J, Tour Operator, Manager)

> "We should implant a good sense of environment responsibility in all businesses. Businesses should plant trees. The government should promote 'how to reduce carbon dioxide emissions' and 'categorising the wastes' to all participants seriously and continuously. Moreover, the government should initially develop eco-friendly programmes for its bureaucratic offices, and continuously evaluate them."
>
> (Respondent K, Restaurant, Owner)

Respondents J and K believe that it is the responsibility of tourism businesses to employ eco-friendly strategies. Respondent K also argues that the Thai government should act by adopting eco-friendly programmes in its facilities in order to increase awareness and concerns about climate change. It is noteworthy that these respondents suggest more than one way of reducing CO_2 emissions. Importantly, they believe that all participants or stakeholders, including tourism businesses, should work together to build a sense of concern for the environment, enforcing laws, using alternative sources of energy. On the one hand, individual people or businesses should have a sense of social responsibility; while on the other hand, governments should strictly enforce laws governing pollution and the environment.

As seen in Table 7.20, the most economy and easy solutions are less concerned in spite of the fact that these solutions can be done to effect dramatically huge reduction of CO_2 emission. It is noteworthy that only 3.6 % of Respondents state that using car-pool systems, adapting to a natural way of living, developing environmental friendly tourism activities, and developing mass transport are the most economically effective solutions Importantly, these solutions are on the supply side meaning that tourism businesses are in a position to supply them directly to tourists so as to gradually change their behaviour and attitudes towards the environment.

The observations as tourists in Koh Samui confirm that public transport is a problem on the island because tourist are currently limited to using either taxis, which are expensive, or traditional Thai minibuses which may not meet the international quality standard of safety. Thus, tourists are forced accidentally use limousines or private cars.

Table 7.20: Solutions of CO_2 Emission

Solution	Percentage of Respondents
Saving energy	43.6
Cooperating from all stakeholders	38.2
Using alternative sources of energy	12.7
Enforcing Legislation	12.7
Implanting a sense of social and environment responsibility	10.9
Developing new technologies	5.5
Recycling wastes and water	5.5
Educating new generation to aware the impacts of climate change	5.5
Building additional natural areas	5.5
Using car pool	3.6
Adapting natural way of living	3.6
Developing environmental friendly tourism activities	3.6
Developing mass transport	3.6

* Respondents can specify more than one answer
Source: *Author interview*

7.6.3 Actions to Reduce Energy-Use

The second question is ‘Have you taken any type of initiatives to reduce the amount of energy used by this establishment, for instance, using technologies to increase the efficiency of air conditioning system, environmentally friendly policy etc.? Please describe.’

The transcripts were read and themes were developed relating to how the businesses represented by the respondents have tried to save energy. It should be noted that the importance of this question is that it leads us to understand how tourism businesses can tackle this issue. As Table 7.21 shows, tourism businesses in Koh Samui have attempted to reduce their energy consumption in a variety of ways: saving electricity, setting company policies, recycling waste and sewage, using alternative energy sources, and using less petrol or diesel among other things.

Many respondents have tried to reduce the amount of electricity used by their businesses. Turning off electrical appliances after use is the most form of action (55.8 %). In addition to this, 26.9% of respondents try to use electrical appliances more efficiently (*e.g.* by having them regularly serviced or keeping the air conditioning temperature at 25 ºC. Importantly, only 3.8% of respondents use energy saving appliances and likewise for turn off unnecessary lights. In the following extract, Respondent I relates how they try to save electricity:

> “…reducing energy consumption by saving electricity, and turning off air conditioning, light bulbs, water when we aren’t using them…”

(Respondent I, Four-star hotel, Manager)

This highlights some very simple methods that any business can employ to save energy. However, this also requires *a sense of environment and social responsibility* from businesses and their staffs. The following quote from Respondent L highlights another way in which tourism businesses can reduce energy consumption.

> “…we always…replace old or mal-functioning appliances, which may consume unnecessary electricity, in order to maximise our use of energy saving appliances…”

(Respondent L, Four-star hotel, Resident Manager)

Updating electrical appliances also requires a sense of responsibility among businesses and their staffs. However, as Respondent L notes, it presupposes greater *commitment* than simply turning off appliances because it can increase the operation costs of running a business albeit it with the potential reward of reducing expenditure on electricity.

Rather than depending on individual social responsibility and commitment, Koh Samui's tourism businesses have acted together by setting-up initiatives aimed at tackling climate change and global warming by gradually reducing energy consumption among them (electricity, petrol/diesel, and so forth). Of respondents, 26.9% specified saving energy as being part of the codes of conduct operated by their businesses / employers and 17.3% specified saving energy as being an objective of their work. The following extract, provided by Respondent M, illustrates how energy saving has been adopted as a policy by some businesses:

> "We have announced our code of conduct to save energy as our business policy in order to continuously habituate our executives and staffs. This policy has directly reduced costs for our business, and indirectly effected the environment – turning off electricity, water, air conditioning, saving petrol/diesel, and planting trees"

(Respondent M, Tour Operator, Manager)

As Respondent M notes, by being *aware of the advantages of pursuing environmentally-friendly programmes*, businesses can help to slow down global warming as well as reducing their operational costs. Moreover, some businesses on Koh Samui have participated in the Green Hotel and Green Island projects (5.8 % of respondents) by agreeing to meet the project criteria while the same amount of respondents (5.8 %) have promoted environment friendly programmes and energy saving to their customers.

In addition to participating in projects like these, businesses may independently seek out energy-saving solutions. For example, in the following extract, Respondent N identifies some alternative energy-saving solutions that tourism businesses may choose to employ:

> "…we can save energy costs by recycling waste and paper, planting trees to be shady and cool, developing high-roof buildings for ventilation and reducing electricity-use, and importantly, promoting an awareness of wasteful and unnecessary energy expenditures which may affect our staffs' service charge "

(Respondent N, Two-star hotel, Owner)

Importantly, the same amounts of respondents (19.2%) have separated types of waste and planted trees within their businesses. In order for them to do this, tourism businesses must have some awareness of benefits of energy-saving practices on their business portfolios as well as the global environment. It is also worth noting that Respondent N identifies staff-awareness as an important means by which businesses may save energy: Businesses may adopt strategies such as *the compensation system* to make their staff more aware of the importance of saving energy in their working-lives. This strategy encourages employees to be aware of the benefits of saving energy both for businesses and the global environment.

In order to tackle climate change and global warming, the motivating factors for reducing energy consumption are more important than the actions that businesses have actually taken to this effect. This is because the contextual challenges faced by each business in reducing their energy consumption vary. Thus, the emergent themes in Table 7.21 demonstrate why businesses employed different strategies to reduce energy consumption. The results presented on Table 7.21 show the importance of a sense of environmental and social responsibility, commitment, awareness of the advantages offered by environmentally-friendly programmes, and compensation system in the tourism sector. Energy-saving benefits tourism businesses by reducing their expenditure and also serves the purposes of reducing the CO_2 emissions produced by the burning of fuels, thus benefitting the local and global environments. This is correspondent with Becken and Hay (2007) and Scott *et al.* (2008) that saving energy can benefit tourism businesses by reducing their operating costs. However, in order to achieve these ends, cooperation is needed from all stakeholders.

Table 7.21: Type of Actions to Reduce the Amount of Energy Use

Actions	Percentage of Respondents
Electricity Saving	
Turning off light bulbs and appliances after use	55.8
Using electricity or appliances in the appropriate ways	26.9
Using economy saving appliances	3.8
Turning off some light bulbs	3.8
The Green Business Policy	
Setting the business policy to save energy	26.9
Setting goals from saving energy as employees’ code of conduct	17.3
Joining the Green Hotel or Green Project	5.8
Asking cooperation from tourists	5.8
Recycle Policy	
Separating types of wastes before binning	19.2
Using efficiently both side-papers and recycling them	13.5
Reducing the use of plastics	9.6
Reusing sewage treatment	5.8

Table 7.21: (Continue')

Actions	Percentage of Respondents
Natural Way	
Planting trees around business area	19.2
Designing environment friendly building	7.7
Using non-toxic or non-chemical washing/cleaning liquid	5.8
Using new saving energy technologies	3.8
Fuel Saving	
Car pool	1.9
Using eco-car	1.9
Using mass transport	1.9
Campaigning the environment friendly programme	3.8
Using as marketing campaign	1.9
Alternative Sources of Energy	
Employing heat from boilers	7.7
Using solar cells	1.9

* Respondents can specify more than one answer
Source: *Author interview*

7.6.4 The Requirement for Environment Legislation

The third question is "Do you think that more legislation is needed for more responsible towards the environment in business operation?" This question relates to a means by which force stakeholders could potentially be forced to cooperate with the Environmental Code of Conduct introduced by the Thai government. This section discusses how the respondents supported the answers they gave.

Importantly, most respondents (78.9 %) agree that more legislation is needed to control the CO_2 emissions of Koh Samui's tourism sector. In contrast, only 10.9 % of respondents disagreed with the need for legislation, specifically because they believe that a sense of the environment and social responsibility is more important. Additionally, 8.8 % of respondents agreed with this statement, but also argued that stakeholders need a sense of responsibility in order for the problem to be solved. Only 1.8 % of respondents believe that integrating a compensation system with legislation is the best solution to the problem. The following extracts show some of the opinions that our respondents expressed on this issue:

> "The government can employ compensation to motivate tourism businesses to reduce their carbon dioxide emissions in order for them to meet the requirements and earn the benefits of tax reductions…"
>
> (Respondent F, One-star hotel, Owner)

Table 7.22: Needs for Legislation to Control Business Operation

Legislations	Percentage of Respondents
Necessary – needs to be enforced	78.9
Not necessary – it depends on a sense of responsibility	10.9
Necessary – but stakeholders should have a sense of responsibility	8.8
Necessary – but should use with the compensation system	1.8
Reason for Enforcing Legislations	
To enforce businesses to follow codes of conduct and legislations	33.3
To increase awareness and sense of responsibility	31.6
To create the sustainability of environment and natural resources	19.3

* Respondents can specify more than one answer
Source: *Author interview*

Respondent F argues that a compensation system should be employed by the Thai government to encourage businesses to commit themselves to reducing their CO_2 emissions. Conversely, in the following extract, Respondent G asserts that the problem can be solved by the Thai government and tourism sector working together to encourage greater social responsibility among tourists:

> "We don't need it. But, instead, the government and tourism businesses have to implant and create a sense of responsibility in tourists for preserving the environment and using energy."
>
> (Respondent G, Tour Operator, Manager)

Thus, Respondent G believes that legislation would not be necessary if tourists could be encouraged to moderate their demands for power-hungry services. In other words, Respondent G believes that the problems of climate change and global warming can be alleviated by making tourists more aware of the impact of their activities on the environment and climate change. Hence tourism businesses should develop a campaign to improve tourists' awareness of the environment and their sense of responsibility towards it. The views expressed by Respondent I are similar to those of Respondent G in that they both agree that a lack of social responsibility and concern for the environment among businesses and stakeholders is a major problem:

> "Very necessary, but it cannot be accomplished if businesses and stakeholders lack a sense of social and environmental responsibility. Therefore, the results can only be an abstraction."
>
> (Respondent I, Four-star hotel, Manager)

According to Respondent I, all stakeholders in the tourism industry (including tourists) need to take responsibility for the good quality of environment. Respondent I believes that legislation is necessary, but s/he also asserts that it can only be effective if stakeholders understand the benefits of reducing CO_2 emissions. In a similar vein, Respondent L also argues that we need legislation to increase the sense of social responsibility among [tourism stakeholders:

> "It is very necessary because some businesses or people have less sense of social responsibility, and are more concerned with their own benefit than society's…ignoring their responsibility, then we cannot tackle this problem. Thus, legislation is the best way."

(Respondent L, Four-star hotel, Resident Manager)

Respondent L agrees that social responsibility is an important part of tackling climate change and global warming; however, s/he also believes that legislation is necessary to force stakeholders to take responsibility for the environment, CO_2 emissions, and climate change. A view is expressed by Respondent O:

> "Legislation can call attention and alert tourism businesses to the need to cooperate and take responsibility in the same direction which can recover the natural resources in Koh Samui."

(Respondent O, Restaurant, Manager)

Respondent O believes that legislation can force tourism businesses to take more responsibility for reducing their environment impacts. In the other words, Respondent O believes that tourism businesses need to be compelled to cooperate with other stakeholders for the purposes of tackling climate change and global warming. And again, Respondent P also believes that tourism businesses need to be forced to take responsibility for the environment:

> "Necessary. Because tourism businesses gain benefits from using natural resources and energy, they should take responsibility for preserving these resources sustainably."

(Respondent P, Tour Operator, Assistant Manager)

Respondent P clearly believes that because tourism businesses exploit natural resources for their own profitability, they should therefore take greater responsibility for reducing CO_2

emissions. Governments should introduce legislation to force tourism businesses to take responsibility.

In conclusion, Respondent F believes that government-sponsored compensation schemes are the best way of encouraging tourism businesses to reduce their CO_2 emissions, particularly because they provide businesses with objectified incentives to do so; by contrast, the goal of combating global warming may be too abstract for businesses to appreciate how it benefits them. Meanwhile, Respondent G believes that the best way of reducing CO_2 emissions is to promote a sense of responsibility for the environment among tourists. And finally, Respondents L, O, and P believe that legislation is very important because it can create a sense of social responsibility by enforcing measures that actively reduce CO_2 emissions.

7.6.5 The Energy Saving Action and Business Image

The fourth question is "From your activities to save energy: Which one can contribute to strengthen your business image and appeal more tourists?" This question is intended to reveal the benefits that accrue to businesses which operate eco-friendly programmes. Only half of the respondents shared their views on the positive benefits of eco-friendly programmes for them (as shown in Table 7.23). Most of respondents (65.38 %) have employed a natural way of life to save energy in their businesses and gain good feedback from tourists. Planting trees and maintaining gardens are the most common actions employed by tourism businesses to save energy. The main advantages provided by these activities are the cooling-effects of shade from trees. Some businesses also exploit natural resources such as wind and sunlight to save energy (particularly through the design of buildings). The following extracts relate how tourism businesses on Koh Samui may use a natural way of life to save energy:

> "In our hotel, we plant many trees and don't cut down any trees or coconut trees in our area…we try to keep our hotel as natural as possible."

(Respondent D, Five-star hotel, Resident Manager)

Table 7.23: Energy Saving Campaign to Attract Tourists

Campaign	Percentage
Natural way of life	65.38
Environmental friendly campaign	15.38
Waste management	7.69
Electricity	3.85
Do nothing	3.85

* Respondents can specify more than one answer
Source: *Author interview*

Thus, the business managed by Respondent D operates a policy of maintaining a natural environment on its premises. In this sense, a natural environment does not only play an important role in saving energy and preserving environment; it also helps to attract tourists. A similar policy of using a natural environment to attract customers is operated by the business managed by Respondent E:

> "We try to save energy by planting trees in our hotel, reducing our fuel consumption, and joining the Green Hotel project in order to create a good image."

(Respondent E, Three-star hotel, Assistant Manager)

Much like Respondent D's business, Respondent E views the creation of a natural environment as a way of marketing the hotel and helping to reduce its impact on the environment. Importantly, Respondent E believes that participating in the Green Hotel campaign can create a good public image. Similar views are expressed by Respondent S:

> "…use natural products because they don't destroy natural resources. This can make a good image about conservation of the environment and culture to foreign tourists."

(Respondent S, Three-stat hotel, Manager)

Like Respondent E, Respondent S believes that having a natural environment in the hotel is attractive to tourists. This contrasts with the opinion of some respondents, mentioned above, that tourists demand convenience and luxury causes of huge energy consumption.

Respondent F also explains how tourism businesses can harness the natural environment to reduce their CO_2 emissions and reduce their operation costs:

> "We use the principle of self-sufficiency to conserve energy; for example, building open-air guest rooms which make use of the natural breeze to keep them cool. We use economy saving appliances and plant trees."

(Respondent F, One-star hotel, Owner)

Respondent F highlights another important way by which tourism businesses can use the natural environment to save energy while meeting their customer needs: namely by making use of the natural air supply, instead of air-conditioning, to keep their rooms cools. Planting trees in the hotel also helps to shield tourists from the heat of the Sun (Akbari, 2002).

In addition to operating environmentally friendly programmes, some businesses conduct public-relations campaigns which emphasise their commitment to protecting the environment in order to improve their image. By doing this, businesses can save energy, reduce their costs, and maintain a good public image. In the following extract, Respondent Q explains how he has used eco-friendly programmes as part of a public-relations campaign for his business:

> "We conduct environmentally-friendly programmes, and promote them to tourists in order to make them realise socially responsible behaviour of hotels such as turning down/Laundry on request to save electricity and water, or employing lighting and air conditioning which turn themselves off when tourists leave their rooms."

(Respondent Q, One-star hotel, Owner)

Importantly, Respondent Q believes that it is difficult for hotels to save energy because the demands of tourists play an important role in defining how they may operate. Respondent R expresses similar concerns:

> "…saving energy in guest rooms may not be possible because all tourists need to be comfortable. However, we believe that all hotels already have energy saving campaigns..."

(Respondent R, Three-star hotel, Manager)

The assumption driving these views is that the comfort and luxury demanded by tourists invariably require a high energy-input from hotels. However, Respondents Q and R seem to underestimate the extent to which hotels can save energy while continuing to provide their guests with comfortable and luxury accommodation.

Hence these respondents are aware that saving energy can benefit hotels by strengthening their business image among tourists. Most of them try to harness aspects of the natural environment (*e.g.* wind, sun light, shade, and so on) to save energy within their businesses. However, some of them also mistakenly believe that they cannot save energy and meet their customers' demands in tandem. In the first place, not all tourists demand luxury beds, Jacuzzis, and other power-hungry facilities. And even so, saving energy emphatically does not mean that business cannot create comfortable or luxurious environments for their customers.

7.7 CONCLUSION

This chapter has analysed the patterns of energy consumption in the Koh Samui tourism industry. Data was gathered from 70 tourism businesses in Koh Samui using a questionnaire-survey and semi-structural interview. However, it should be noted that our research methods are problematic as far as the conclusions that can be drawn from it can only be as good as the data itself (which may be subject to sampling errors: Becken 2002). The main results are summary as follows.

Most of tourism businesses in Koh Samui rely on electricity, diesel, and petrol. Hotels are the largest electricity users, while diesel and petrol are major fuel sources for tour operators. The remaining sources like LPG generally are generally used by restaurants and accommodation businesses for catering purposes.

Wastewater and waste management are also major sources of energy consumption; significantly, they consume energy both for the transport and treatment of waste. It appears that on average, commercial units on Koh Samui produce 1,646.18 Kg of waste per month. This causes two major problems; firstly, it puts pressure on the island's limited landfill capacity, and secondly, waste disposal and treatment processes are mainly powered by electricity (thus increasing the island's demand for electricity). It should also be noted that the largest groups of tourism businesses on Koh Samui do not currently operate recycling policies. Therefore, Thai government planners need to introduce and promote recycling as part of a broader drive to raise green consciousness among businesses. Information services and recycling facilities should be made available for the whole island.

It should be stressed that water is an important resource for Koh Samui's tourism sector. A great deal of energy to needed to supply water and treat wastewater. There is a vast consumption of water in the accommodation sector. Water demand for swimming pools in Koh Samui accounts for 27,074 m^3 /day and about 99,187.89 m^3 of water have been used on a daily basis to support the island's tourism businesses. This contrasts sharply with the 10,455.4 m^3/day of water consumed daily by the island's native population.

It is noteworthy that according to our research five-star hotels show the greatest interest in alternative energy sources and the highest levels of concern for global warming and climate change. However, customer-satisfaction remains their main priority, not least as they often hesitant to engage in activities that could be perceived as reducing comfort and convenience for their customers.

Finally, the businesses that have been surveyed understand that there is a well-established case for reducing their CO_2 emissions and improving their energy efficiency. Furthermore, they realise that as an industry, tourism seriously affects the sustainability of future developments on Koh Samui. Therefore, it is desirable for them to show leadership on Koh Samui in addressing the issues of pollution and global warming, particularly by making changes to their energy supply so as to initiate a broader shift from fossil fuels to renewable energy sources.

CHAPTER 8

ENERGY CONSUMPTION OF TOURISM AND ITS ECOLOGICAL FOOTPRINT

8.1 INTRODUCTION

It is usually thought that the rate of consumption among tourists is generally higher when they are on holiday than at home (Cole and Sinclair, 2002; Akama, 1999). As discussed in Chapter Two, the tourism industry claims to be aware of its impacts on global climate and also that it aspires to reduce its CO_2 emissions across its operation and related activity. The EF concept then has recently come to the centre of attention among scholars and policy makers because by conceptualizing CO_2 emissions in terms of the land area required to absorb them, the notion of EF helps us to understand the demands placed on the planet by energy consumption (see in Chapter Two).

As can be seen from the literature examined in Chapter Two, EF is often interpreted and expected to work as an indicator of sustainability which can help policy-makers to develop proactive policies of reducing carbon emissions and also to set targets in the medium and long term to measure whatever actions have been taken (Hunter and Shaw, 2007; Gössling *et al*., 2002; Curry, Simmons, and McDald, 2004). EF was originally intended as a decision-making tool for assessing the sustainability of energy management in terms of the area of land needed to absorb the CO_2 emitted by burning fossil fuels (Wackernagel *et al*., 1999; Ferng, 2002). In order to create a low carbon economy and to make a step towards changing the amount of energy used in human activities, it is necessary to take stock of CO_2 emissions and the ecological footprints which result from them.

There have been a number of studies which have made calculations of the EFs resulting from tourism (Cole and Sinclair, 2002; Gössling *et al*., 2002; Hunter and Shaw, 2007; Patterson *et al*., 2007; Peng and Yang, 2007; Patterson *et al*., 2008; Rendeiro Martín-Cejas and Pablo Ramírez Sánchez, 2010). Meanwhile, other studies have concentrated on energy-consumption behaviour in tourism (Tabatchnaia *et al*., 1997; Gössling, 2000; Becken and Simmons, 2002; Becken *et al*., 2003; Nepal, 2008; Bakhat and Rosselló, 2011). Very little effort has been made to integrate these two areas of study. This study intends to fill this gap by investigating the relationship between the behaviour of stakeholders in terms of energy-use and the EFs which are the outcomes of this behaviour. Theoretically, the EFs which are discussed in this chapter are consequences of energy-use behaviour on both the demand and supply sides of the tourism sector. These issues have been investigated by this study, the results of which were presented in the previous chapter.

In order to meet the third objective of this study, the present chapter aims to estimate the EFs of four facets of Koh Samui's tourism sector: namely transportation, accommodation, activities, and waste management. In this way, it will provide understanding of how each of these sectors contributes towards the total energy consumption, CO_2 emissions and EF of Koh Samui's tourism industry through energy-use. The EF calculations in this study are based on secondary data which was mainly gathered from existing databases maintained by the Royal Thai Government, Koh Samui City Municipality, TAT, and an official organisation of energy, PEA.

Therefore, this chapter provides further analysis of the results of the EF assessments made by this study. The first section examines the energy-intensity of holiday accommodation and the extent to which different patterns of behavior therein generate CO_2 emissions. The second, third and forth sections do the same for the three other areas of the tourism industry covered by this study: namely transportation, tourism activities, and waste management respectively. The fifth section estimates the total EF which results from energy-use in these sectors. This is followed by a conclusion which will be brief the key results of this chapter and also discuss the main issues of these results.

8.2 ENERGY CONSUMPTION AND CO_2 EMISSION IN ACCOMMODATION

8.2.1 The Information Background of Accommodation

In order to measure the CO_2 emissions produced by energy consumption in the accommodation sector, this study first needed to convert measurements of electricity from kWh into MJ by multiplying them by 3.6, in which respect 1 kWh is equivalent to 3.6 MJ. We then calculated CO_2 emissions by applying electricity measurements in MJ to a conversion factor of 0.580kgCO_2/MJ (which is primarily based on the methods by which electricity is generated in Thailand (EGAT, 2008)). Importantly, most electricity in Thailand is generated from natural gas, oil, lignite, hydropower, diesel and coal (EGAT, 2008). Therefore, the conversion factor for Thailand was different to those which have been applied to other countries such as the United Kingdom (0.430kg CO_2/MJ), United States (0.620kg CO_2/MJ) and New Zealand (0.624kg CO_2/MJ) (Defra, 2008; Becken, 2002a).

Table 8.1: Total Expenditure and Decision Making on Accommodation Choices Classified by the Number and Percentage of Domestic and International Tourists

Variable Relevant	***Tourists***					
	Domestic Tourists		***International Tourists***		***Total***	
	Unit	***%***	***Unit***	***%***	***Unit***	***%***
Expenditure*	Million THB		Million THB		Million THB	
Accommodation	240.74	28.24	4,237.78	32.06	4,478.52	31.83
Food & Beverage	148.45	17.41	2,229.05	16.88	2,377.50	16.90
Souvenir	147.67	17.32	1,993.50	15.08	2,141.17	15.22
Entertainment	100.73	11.81	1,756.91	13.29	1,857.64	13.20
Tour Operation	33.25	3.90	591.01	4.47	624.26	4.44
Transportation	141.28	16.57	1,915.02	14.49	2,056.30	14.62
Others	40.49	4.75	493.28	3.73	533.77	3.79
Total	852.61	100.00	13,215.55	100.00	14,069.16	100.00
Accommodation	Frequency		Frequency		Frequency	
Hotel	77,960	50.78	775,515	86.38	853,485	81.18
Relative House	50,968	33.20	76,667	8.54	127,635	12.14
National Parks	24,315	15.84	45,617	5.08	69,932	6.65
Others	295	0.18	-	-	295	0.03
Total	153,538	100.00	897,799	100.00	1,051,337	100.00

Source: Adapting from TAT (2008a)

However, there was no available data for the amount of electricity used in different kinds of holiday accommodation so this study could only make a general assessment of the amount of energy consumed in Koh Samui's accommodation sector as a whole. Accommodation is the main product offered by Koh Samui's tourism industry. Table 8.1 shows that tourists spent the single largest share of their budgets on accommodation. This can be seen from data collected in 2007 which shows that out of a total of 14,069.16 Million THB spent by tourists on Koh Samui, 4,478.52 million THB, or 31.83%, was spent on accommodation. Foreigners accounted for by far the largest total share of tourist spending on Koh Samui in 2007: out of the total of 14,069.16 Million Baht spent by tourists in that year, 13,215.55 million can be attributed to foreigners. Furthermore, hotels were the most popular form of accommodation on Koh Samui, particularly among international tourists. By contrast, domestic tourists tended to stay with relatives on the island in terms of friends and familiy or at accommodation in national parks.

Hotels were accommodation which was a greatest share of total expenses and most of tourists visiting Koh Samui also choose to stay in hotel.However, most holiday accommodation in Thailand is classified by price from most expensive to cheapest rates to be five-star hotel, four-star hotel, three-star hotel, two-star hotel and one-star hotel by TAT (2008a). Obviously, a large majority of tourists (81.18%) stayed in theses hotels ranking from five-star to one-star hotels. Table 8.2 presents more data about hotels in the different star-rating categories. Most hotels on Koh Samui are low-cost one- or two-star rated types, but there are also 93 five-star hotels which provide 5,798 luxury rooms (40.25% of total room-space among Koh Samui's hotels). High-cost hotels were also the most popular type of accommodation among tourists: they hosted a total of 361,181 tourists (42.32%) in 2007 which gave them an occupancy rate of 68.63%. Moreover, tourists stayed longer on average in high-cost hotels (7.71 nights) than in other types of hotel. Although the average of length of stay in Koh Samui's hotels may seem relatively short, it is longer than in other well-known holiday destinations in Thailand like Phuket where the average length of stay in 2007 was 3.72 days (TAT, 2009).

Table 8.2: Information Background of Five-Star to One-Star Hotels in Koh Samui

Hotel Category	***5 Star (%)***	***4 Star (%)***	***3 Star (%)***	***2 Star (%)***	***1 Star (%)***	***Total***
Number in total	93 (23.08)	65 (16.12)	51 (12.66)	96 (23.82)	98 (24.32)	403 (100.00)
Room in total	5,798 (40.25)	2,352 (16.33)	1,849 (12.84)	2,334 (16.20)	2,072 (14.38)	14,405 (100.00)
Number of tourist	361,181 (42.32)	156,651 (18.35)	108,631 (12.73)	123,124 (14.43)	103,888 (12.17)	853,475 (100.00)
Occupancy rate (%)	68.63	65.72	62.63	58.96	57.61	64.23
Average length of stay (day)	7.70	6.98	7.25	7.27	7.40	7.42

Source: Adapting from TAT (2008a)

8.2.2 Energy-Use in Accommodation

As mentioned in the methodology chapter 5, most of the energy used in hotels on Koh Samui is electricity generated by burning fossil fuels. Therefore, the energy consumption in accommodation in this study was mainly examined from electricity only, while the energy in the extent to which hotels used fossil fuels for transporting tourists was taken into account in the transportation category rather than the accommodation category. Accordingly, the only kinds of fuel source which are taken into account in the accommodation category are electricity and Liquefied Petroleum Gas (LPG), the latter of which is used in hotels for cooking. Table 8.3 illustrates the extent to which electricity supplies the energy needs of the hotel industry, which, in total, used around 656,880,000 MJ or 182,466,566 kWhs worth of electricity in 2007. The average rate of electricity consumption in Koh Samui's accommodation is 144.14 MJ/visitor/night. This is no doubt due to the greater use made of air-conditioning and other electronic appliances such as lights, fridges, and laundry services in hotels. Interestingly, Koh Samui's hotels consume more than twice the amount of the energy per bed-night as hotels in the Seychelles (Gössling *et al*., 2002) where the average is 51.25 MJ/visitor/night (this figure rises to 110 MJ/visitor/night for five-star hotels). By contrast, the energy-intensity of Koh Samui's hotels is similar to that of New Zealand's hotels (Becken, 2002) which consume around 155 MJ/visitor/night. However, another five categories of accommodation in New Zealand, including B&Bs, motels and hostels consumed less energy than hotels in Koh Samui. Thus, it is clear that hotels in Koh Samui use vast amounts of energy to serve tourists and thereby make a significant contribution to the overall CO_2 emissions of the island's tourism sector.

Table 8.3: Energy Use and CO_2 Emissions Classified by Different Sources of Accommodation

Sources of Energy	*Amount of use*	*Unite*	*Total Energy Use (TJ)*	*Energy Use Per Visitor-night (MJ)*	*Visitor Nights*
Electricity for hotel	182,466,566	kWh	656.88	103.73	6,332,784.5
Desalination	4,370,992	kWh	15.74	2.48	-
LPG for kitchen used	5,003,977	Kg	240.19	37.93	-
Total	-	-	912.81	144.14	-

Source: Author

8.2.3 CO_2 Emissions from Accommodation

A total of 853,485 tourists stayed in Koh Samui's hotels in 2007. The average stay was 7.2 nights thus giving a total of 6 million bed nights as shown in Table 8.4. From these figures it can be calculated that the overall CO_2 footprint for tourists visiting Samui is around 122 thousand tones per year and that each bed-night contributes about 19.4 kg of CO_2. Furthermore, this study found that energy-use per visitor trip was about 144.14 MJs and that the hotel sector produced the single largest share of CO_2 emissions (86.13%) through electricity consumption. These results can be compared with the results of a WWF (2002) study which focused on UK tourists staying at hotels in Cyprus. The WWF study found the average length of stay among a sample of 1,486,000 UK visitors to be 11.2 days and also estimated the overall CO_2 footprint of hotel operation in Cyprus at about 916 tonnes. The latter figure is dramatically lower than the corresponding figure given above for hotel operation in Koh Samui even though energy sources other than electricity, such as gas and oil, were taken into account in the Cyprus study. The main factor driving this difference was electricity consumption: on average, tourists staying at hotels on Koh Samui used 213.79 kWhs per visitor trip whereas UK visitors to Cyprus used only 1.39 kWhs per visitor trip.

On the other hand, it has been noted above that the energy demands of Koh Samui's hotel sector is similar to that of New Zealand (Becken, 2002b): 144.14 MJ per visitor-night and 155.0 MJ per visitor night respectively. Consequently emissions for hotels in Koh Samui and New Zealand were nearly equal in terms of kg per bed-night. The quantities of emissions were also similar between Koh Samui and Fiji where Becken (2004) has estimated that accommodation generated a carbon footprint of approximately 11.13 kg per visitor night while hotels in Koh Samui produced 19.40 kg per visitor night. Desalination plants can be another major source of CO_2 emissions. Compared with other contributing factors, desalination plants produced a relatively small share of the overall CO_2 emissions linked to tourism on Koh Samui. However, we should consider the possible future need for desalination plants if tourism and environmental factors simultaneously put pressure on the island's fresh water supply. Sisman & Associates (2007) have pointed out that desalination plants require 106,000 kWhs to produce 10 million gallons of fresh water per day and thus release around 12,300 tonnes of CO_2 per year. Furthermore, they found that the process of supplying water to accommodation generates 2,535.18 tonnes of CO_2 emissions per yea.

It is also worth noting that in terms of electricity consumption hotels are the dominant sources of CO_2 emissions on Koh Samui representing 40.56% of the island's total carbon footprint. By contrast, local residents produced only 27.73% of the island's total carbon footprint with each one generating approximately 3.96 kg CO_2 per night as shown in Table 8.5.

Table 8.4: CO_2 Emissions from Different Sources in the Hotel Industry

Source of Energy	*CO_2 in Total (tonnes)*	*CO_2 Per Visitor (kg)*	*CO_2 kg per visitor-night*
Electricity for hotel	105,830.61	124.00	16.71
Desalination	2,535.18	2.97	0.40
LPG for kitchen used	14,507.53	17.00	2.29
Total	122,873.32	143.97	19.40

Source: Author

It is also worth comparing that in term of electricity consumption, the dominant source of emissions in Koh Samui was hotel business representing 40.56 % of carbon footprint share, whereas Koh Samui's resident produced only 27.73% with CO_2 intensity of 3.96 kg per resident-night as demonstrates in Table 8.5.

Table 8.5: Comparing Sources of CO_2 Emissions from Electricity Use in Koh Samui

Source of Electricity	*Amount of use (kWhs)*	*Total Energy Use (TJ)*	*CO_2 in Total (tonnes)*	*Percentage of CO_2 Emissions*	*Energy average Use per Unite*
Hotel	182,466,566	656.88	105,830.61	40.56%	16 kg/tourist-night
Other Businesses	120,328,367	433.18	69,790.45	26.75%	45.40 kg/Business-night
Residents	124,752,712	449.11	72,356.57	27.73%	3.96 kg/Resident-night
Government Offices	6,789,864	24.44	3,938.12	1.51%	63.84 kg/Office-night
Temporal Servers	15,526,256	55.89	9,005.23	3.45%	15.24 kg/Server-night
Total	449,863,765	1,619.51	260,920.98	100.00	-

Source: Author

8.3 ENERGY-USE AND CO_2 EMISSIONS FROM TRANSPORTATION

Tourists often require multiple forms of transport for their vacations. This is especially the case for tourists travelling to Koh Samui to whom there are at least four different modes of transport available for getting to the island. The results discussed in this section are broken down into three parts as follows.

8.3.1 Energy-Use and CO_2 Emissions from International Air Travel

A series of component calculations were conducted for international air travel, including the weighting of values by a factor of 2.5-3.0 in order to take into account the increased warming effects of aircraft emissions released at an altitude of 10-12 km (IPCC, 1999). This research made use of a five-step method developed by Hunter and Shaw (2007: 49) for calculating the ecological footprint of air travel.

1) Determine the total round-trip flight distance (km)

2) Obtain figures for energy-use per tourist in megajoules (MJ) by multiplying flight distance by an energy intensity conversion factor of 1.75 – 2.75 MJ/km

3) Calculate the area of land (ha) needed to absorb the CO_2 emissions produced annually by each tourist by dividing energy-use per tourist by 73 GJ/ha (*i.e.* the number of gigajoules worth of CO_2 produced by burning liquid fossil fuels that 1 ha of forest will absorb in a year) (WWF, 2000).

4) Allow for the additional radioactive forcing of aircraft emissions released at high altitudes (IPCC, 1999) by multiplying that areas from 3 by an average factor of 2.7 (Gossling *et al*., 2002), thus giving a new estimate for the area of forest (ha) required

5) Multiply by the year-appropriate 'equivalence factor' to account for the above average productivity of forests, as compared with average world space, to give a final estimate of the transit zone per tourist footprint

In regard to the energy footprints which result from international air travel, this study only takes account of the energy used for the flights themselves. It does not take account of energy used in other stages of transit such as people travelling to and from airports in their home countries. Different conversion factors are needed to translate distances travelled by airplane into figures for the amount of energy used in MJ per km, the quantity of CO_2 emitted per km travelled from the fuel-burning process and the overall EF. Excluding the energy used to extract, refine and transport fuels, Lenzen (1999) has reported that modern aircraft travelling long distances consume 1.75 MJ per km of secondary energy. Conversion rates are also available from British Airways and Lufthansa: 2.03 MJ/km and 1.86 MJ/km respectively (Green Globe, 2000, cited in Becken, 2002a). Alternatively, Gössling *et al.* (2002) have suggested a conversion rate of 2.0 MJ/km, while Becken (2002a) has adopted Lenzen's factor of 1.75 MJ/km to estimate energy-use from air travel.

According to figures on travelling distances, most international tourists visiting Koh Samui relied on long haul flights. Accordingly, this study adopts an energy intensity value of 2.0 MJ/km because, as Hunter and Shaw (2007:46) note, "[i]t falls between the extremes figures and would seem most appropriate to the medium and long haul flight scenarios presented".

The calculations made here for energy-use and CO_2 emissions resulting from international tourists travelling to Koh Samui are based on tourist arrival statistics from 2007 provided by TAT (2008a). These statistics show that 898,765 international tourists from 48 countries travelled to Koh Samui by airplane in 2007. Table 8.8 shows that tourists from the United States travelled the longest average distance at about 13,941 km one way. The minimum flying distance was recorded for tourists from Singapore at around 1,434 km one way. Visitors from the UK represented the largest single share (14.19%) of international tourists who travelled to Koh Samui by air in 2007. The travel distance for each tourist from their country of origin was converted into a figure for energy-use by applying energy intensity of air travel. In this way, our calculations show that the 898,765 international tourists who used air travel to get to Koh Samui in 2007 consumed a total of about 11,009.58 terajoules (TJs) per annum and emitted around 759.66 kilo tonnes of CO_2. Interestingly, the results displayed on Table 8.6 demonstrate that tourists from five countries account for roughly half (340.47 kilo tonnes) of the total CO_2 emitted by Koh Samui's tourism industry: namely the United Kingdom, Germany, Australia, Sweden and Switzerland.

Table 8.6: Summary of Energy Use and CO_2 Emissions in 2007, of Tourists from Different Countries and Average Flying

Country of origin	*Total air arrivals*	*Distance (km)*	*Energy use per tourist (GJ)*	*Energy use per Country (TJ)*	*CO_2 per country (ktons)*	*Energy Footprint (Gha/tourist)*
U.K.	127479	9545	38.18	4,867	70.54	1.95
Germany	113282	8537	34.15	3,868	56.06	1.74
Australia	65532	7543	30.17	1,977	28.66	1.54
Sweden	35545	8277	33.11	1,177	17.06	1.69
Switzerland	35077	9042	36.17	1,269	18.39	1.85
U.S.A.&Canada	34194	13941	55.76	1,907	27.63	2.85
France	28531	9454	37.82	1,079	15.64	1.93
Russia	28352	7074	28.30	802	11.63	1.44
Italy	28288	8839	35.36	1,000	14.49	1.80
Japan	24002	4613	18.45	443	6.42	0.94
Netherlands	19376	9183	36.73	712	10.31	1.87
Austria	18335	8450	33.80	620	8.98	1.73
Israel	18277	6893	27.57	504	7.30	1.41
Denmark	17776	8628	34.51	613	8.89	1.76
Korea	13746	3726	14.90	205	2.97	0.76
Norway	13012	8683	34.73	452	6.55	1.77
China	12322	3298	13.19	163	2.36	0.67
New Zealand	10320	9755	39.02	403	5.84	1.99
Finland	8577	7896	31.58	271	3.93	1.61
Hong Kong	8038	1725	6.90	55	0.80	0.35
Singapore	7860	1434	5.74	45	0.65	0.29
Spain	6997	10187	40.75	285	4.13	2.08
East Europe	10621	8829.00	35.32	375	5.44	1.80
Other Asia	20414	1679.00*	6.72	137	1.99	0.34
Other Countries	69562	7833.04*	31.33	2,180	31.59	1.60
Total	775,515	AV=7,402.56	AV= 30	25,408.41	8,320.00	AV=1.51

Note: * estimates based on average distance between those countries and Thailand
Source: Author

Moreover, it can clearly be seen from these results that tourists from the United Kingdom accounted for the largest single share of energy used and CO_2 emitted by international flights to Koh Samui in 2007. The total amounts of energy used and CO_2 emissions released by tourists from each country of origin are presented in Table 8.8.

The results discussed above can be compared to those gathered for Fiji by Becken (2004). Becken's research shows that in 2002, 397,859 international tourists flew to Fiji thereby using a total of 5, 562 TJs of energy and producing 383,771 tonnes of CO_2. By contrast, the total amount of energy consumed by international tourists flying to Koh Samui was higher than for Fiji. This is clearly because more than twice as many international tourists flew to Koh Samui in 2007 than to Fiji in 2002 and moreover the total distances travelled by tourists to each host country were different.

8.3.2 Energy-Use from Domestic Transport

Due to the typical itineraries of tourists visiting Koh Samui, this study takes account of the energy used by tourists for transport in two categories energy. The first deals with the overall energy used by tourists to travel from their points of entry into Thailand, such as Suvarnabhumi airport, Bangkok to the holiday destination. The second covers all the energy used for transport at the holiday destination. In order to avoid double counting in this area the energy and emissions from transport used by international tourists to get to and from Koh Samui from within Thailand and to travel around the island once they had got there were calculated separately. Therefore, transport of the latter type is taken into account in the activities category. For this reason, the data discussed here focuses only on energy consumed by either international visitors travelling to Koh Samui from Thailand's international airports or domestic tourists travelling to Koh Samui from their home provinces. All forms of transport used in the process of transferring both domestic and international tourists in Thailand to and from Koh Samui are taken into account here.

Table 8.7 reveals the distribution of both domestic and international tourists across the different modes of transport available for travelling to Koh Samui. Air travel was the most commonly used form of transport among tourists visiting Koh Samui in 2007 (40.58%). The next most common forms of transport to the island were buses and private cars. Significant differences can be seen between the travel behaviour of domestic and international tourists in that most the latter group (40.58%) preferred to travel by air. In contrast, 41.06% of Thai visitors drove from their home provinces to ferry ports and then spent two hours on ferries before reaching Koh Samui. Supporting the calculation, this study made use of transport energy efficiencies (MJ/km) supplied by Becken *et al* (2003) to determine the amounts of energy used by each type of transport .

Table 8.7: Number and Percentage of Domestic and International Tourists Divided by Mode of Transport Available for Travelling to Koh Samui

Mode of Transport	***Domestic Tourists***		***International Tourists***		***Total***		***Variable associated with energy use***	
	N	**%**	**N**	**%**	**N**	**%**	*Distance (km)*	*Energy Intensity MJ/km**
Domestic air	28,062	17.45	401,855	44.71	429,917	40.58	470	2.75
Train	21,599	13.43	154,005	17.14	175,604	16.57	650	1.44
Bus	44,440	27.62	177,363	19.73	221,803	93.20	739	1.01
Private Car	66,064	41.06	146,708	16.32	212,772	20.08	739	1.59
Others	712	0.44	18,834	2.10	19,546	1.84	739	1.01
Total	160,877	100.00	898,765	100.00	1,059,642	100.00	-	-

Note: * The conversion factors have been taken from Becken *et al* (2003)
Source: Author

Without doubt, domestic air travel consumed roughly half (555.67TJ) of the total amount of energy used by tourists to get to Koh Samui from within Thailand. The next largest share of energy was consumed by private cars. It can also be seen from Table 8.8 that international tourists consumed far more energy than domestic tourists since they accounted for85.25% (1,182.76 TJ) of overall energy-use in this sector. This imbalance can be accounted for by the fact that the most popular choice among international tourists for getting from Bangkok to Koh Samui was by air (as our data shows, 40.58% of tourists took this option). Meanwhile, domestic tourists mainly opted to use private cars and buses.

Among the different modes of transport used by tourists for getting to and from Koh Samui from within Thailand, air travel consumed the largest average amount of energy per passenger trip at around 1,292.50 MJs as well as the highest share of overall energy consumption in the transportation sector. This is obviously a reflection of the fact that air travel also accounts for the largest single share of the total CO_2 emissions linked to tourism on Koh Samui, as discussed in the following section.

Table 8.8: Total Energy Use for Different Modes of Transport Comparing Domestic and International Tourists

Mode of Transport	*Energy Use by*		*Total of Energy Use*		*Proportion of energy use in each transport %*
	Domestic Tourists (TJ)	*International Tourists (TJ)*	*Total (TJ)*	*Energy average use MJ/visitor-trip*	
Domestic air	36.27	519.40	555.67	1,292.50	46.98
Train	21.54	153.60	175.14	997.39	14.81
• Taxi	1.04	7.39	8.43		
• Ferry	0.29	2.06	2.35		
Bus	35.30	140.90	176.20	794.39	14.90
• Ferry	2.13	8.51	10.65		
Private Car	80.80	179.43	260.22	1223.01	22.00
• Ferry	3.17	7.04	10.21		
Others	0.57	14.95	15.53	794.39	1.31
• Ferry	0.03	0.90	0.94		
Total	174.48	1,008.28	1,182.76	1116.19	100.00

Notes: Tourists travelling by train, bus, private car and other road vehicles need ferry for 20 km. to complete their journey and travelling by train also need taxi for 13 km. to reach the ferry port and all of energy use for ferry and taxi was already included in the main mode of transport.
Source: Author

The means by which tourists travelled between their homes and Koh Samui have a crucial effect on the overall amount of energy used in the transport sector. As Table 8.9 shows, by far the largest share of energy was used by tourists traveling by airplane (83.76%). These tourists then had been transfered from Koh Samui airport to accommodation by transportation service of hotels because most of them already booked for hotel vehicles such as van and private car which readily included in accommodation bill. Public passenger vehicles [*songthaews*] are the most popular form of transport among domestic Thai tourists and especially among those who arrive at the ferry port which sits 30 km away from the main area of accommodation.

8.3.3 CO_2 Emissions from Domestic Transport

Table 8.10 shows that, all together, the domestic transportation emitted 79,818.35 tonnes of CO2, of which 38,189.53 tonnes were produced by airplanes, 27,948.44 tonnes by private cars and 12,041.91 tonnes by buses. Unsurprisingly, private cars contributed a significant portion of total CO_2 emissions (30.67%), while the largest single share of CO_2 was contributed by domestic air travel (41.91%). Similarly, the largest single share of total CO_2 emissions associated with tourism on Koh Samui can be attributed to international air travel.

Table 8.9: Total Energy Use of Tourist Transfers from the Airport and Ferry Port to their Accommodation

Main of travelling	*Transfer by*	*Domestic Tourists (MJ)*	*International Tourists (MJ)*	*Total (MJ)*	*Energy average use MJ/visitor -trip*	*%*
Domestic air	Private car	1,338,557	19,168,483	20,507,040	47.70	83.76
Train	Pick-up truck	206,054	1,469,208	1,675,262	9.54	6.84
Bus	Pick-up truck	423,958	1,692,043	2,116,001	9.54	8.64
Others	Pick-up truck	6,792	179,676	186,468.84	0.88	0.76
Total		1,975,362	22,509,410	24,484,772	1,252.67	100.00

Note: Due to unavailability of data on distribution of tourists in each transport including taxi, pick-up truck and private car from ferry port to accommodation, energy consume in transfer process assumed to be the lowest energy uses -the pick-up truck.
Source: Author

There are obvious differences between the modes of transport favoured by foreign and domestic tourists for travelling to Koh Samui. These differences result in very different figures for the overall amounts of emissions produced by each group. More than half of the total number of foreign tourists travelled by plane compared with only 21.54% of Thais. Unsurprisingly, 85.5% of CO_2 emissions linked to domestic transport within the tourism sector in 2007 can be attributed to international tourists.

As regards the intensity of CO_2 emissions per visitor trip, the results show that the difference between domestic and international tourists was about 4,000 kg of CO_2: that is, 71.94 tonnes per visitor trip for domestic tourists and 75.93 tonnes per visitor trip for international tourists. It can be assumed from these figures that fewer domestic tourists travelled by air. However, for the sake of convenience most of them preferred to use private cars which are still a major source of CO_2 emissions at around78.23 kg CO_2 per visitor trip to Koh Samui.

Table 8.10: CO_2 Emissions from Each Mode of Transport Comparing Domestic and International Tourists

Mode of Transport	Domestic Tourists		International Tourists		Total		CO_2 Kg/ visitor -trip
	Total CO_2 (Tonnes)	%	Total CO_2 (Tonnes)	%	Total CO_2 (Tonnes)	%	
Domestic air	2,492.75	21.54	35,696.78	52.31	38,189.53	47.85	88.83
Train	1,461.71	12.62	10,418.44	15.27	11,879.61	14.88	67.65
Bus	2,412.69	20.85	9,629.21	14.11	12,041.91	15.09	54.29
Private Car	5,168.49	44.66	11,477.64	16.82	16,646.13	20.86	78.23
Others	38.66	0.33	1,022.52	1.50	1,061.17	1.33	54.29
Total	11,573.76	100.00	68,244.59	100.00	79,818.35	100.00	39.29

Notes: 1. An emission factor of 189 gCO_2/passenger km for the short - haul flight (<1,000km) (Becke and Patterson, 2006)
2. 629.75 tonnes in total of CO_2 emissions from travel 20 km of ferry were allocated proportionally to mode of train, bus, private car and others for completing journey
3. 48.65 and 346.92 tonnes emissions of Taxi travelling roughly 13 km from train station to ferry port were added to domestic tourists and international tourists travelling by train respectively.
Source: Author

8.4 ENERGY-USE AND CO_2 EMISSIONS FROM TOURISM ACTIVITIES

8.4.1 Tourism Activities on Koh Samui

As one of the world's most popular holiday destinations, Koh Samui offers tourists a wide variety of activities as well as a beautiful natural environment including as well as beautiful natural settings, including beaches, waterfalls, and forests, around which activities can take place.Table 8.11 shows that the most popular activities among tourists visiting the island were sightseeing along the beaches which surround it (86.68%), shopping (37.55%), motorized water activities (24.43%), and entertainment mainly in nightclubs and bars (14.99%). The results comparing the activities preferred by Thai and international tourists illustrate some significant differences. In particular, they show that higher proportions of international tourists went shopping and attended night-time entertainments and adventure activities than domestic tourists whereas, by contrast, much larger proportions of domestic tourists participated in motorized water activities and visited cultural attractions than foreign tourists.

On the other hand, fairly similar proportions of domestic and foreign tourists went sightseeing (including visiting natural attractions), attended health and spa activities, or played sports.

Table 8.11: Number and Percentage of Domestic Tourists and International Tourists Classified by Tourism Activity in Koh Samui

Activity	*Domestic Tourist*		*International Tourist*		*Total*	
	N	**%**	**N**	**%**	**N**	**%**
Sightseeing around island	135,168	84.02	7,832,734	87.15	7,967,902	86.68
Shopping (souvenir and others)	17,358	10.79	380,537	42.34	397,896	37.55
Motorised water activity	89,158	55.42	169,687	18.88	258,845	24.43
Entertainment/Nightlife activity	14,028	8.72	144,881	16.12	158,909	14.99
Health & spa activity	21,605	13.43	110,997	12.35	132,603	12.52
Adventure activity	6,982	4.34	124,479	13.85	131,461	12.40
Visiting Cultural attraction	17,020	10.58	33,463	8.41	50,484	8.74
Visiting nature attraction	6,161	3.83	62,104	6.91	68,266	6.44
Sport activity	5,212	3.24	55,184	6.14	60,396	5.70
Others (visiting farm, specific site)	24,936	15.50	12,223	1.36	37,159	3.51

Source: Adapted from *TAT (2008a)*

8.4.2 Energy-Use from Tourism Activities

As shown in Table 8.12, more than half (67.73TJ) of the total energy used by tourism activities can be attributed to sightseeing which was very popular among both foreign and domestic tourists. The next highest proportion of energy (52.29 TJ) was consumed by motorized water activities such as diving, jet skiing, and cruises. By contrast, adventure and sporting activities accounted for much smaller proportions of overall energy consumption: 5.65 TJ and 2.60 TJ respectively. Nevertheless, the rate of energy consumption for both these types of activity was high at 43 MJ per visit. The highest rate of energy consumption was recorded for motorized water activities at 52.29 MJ per visit. Indeed, even though sightseeing consumed the largest single share of energy in the activities category, motorized water activities consumed considerably more energy than sightseeing or any other activities in terms of the energy used per visit. For example, the total amount of energy used by 135,168 sightseers was about 1.15 TJ: the amount of energy needed to put on motorized water activities for the same number of people would be about 27.30 TJ.

Table 8.12: The Energy Use of Domestic and International Tourists Classified by Tourism Activity

Activity	*Energy Intensity (MJ/Visit) **	*Domestic Tourists (TJ)*	*Foreigner Tourists (TJ)*	*Total (TJ)*	*Proportion %*
Sightseeing around island	8.50	1.15	66.58	67.73	50.39
Shopping (souvenir and others)	6.90	0.12	2.63	2.75	2.04
Motorised water activity	202.00	18.01	34.28	52.29	38.90
Entertainment/Nightlife activity	6.90	0.10	1.00	1.10	0.82
Health & spa activity	8.50	0.18	0.94	1.13	0.84
Adventure activity	43.00	0.30	5.35	5.65	4.21
Visiting Cultural attraction	3.50	0.06	0.12	0.18	0.13
Visiting nature attraction	8.50	0.05	0.53	0.58	0.43
Sport activity	43.00	0.22	2.37	2.60	1.93
Others (visiting farm, specific site)	11.50	0.29	0.14	0.43	0.32
Total		20.48	113.93	134.42	100.00

Notes: ***** The conversion factors were taken from Becken and Cavangh (2003) and Becken and Patterson (2006**)**
Source: Author

8.4.3 CO_2 Emissions from Tourism Activities

Tourism activities are one of the main attractions which effectively attract a number of tourists and foreign exchanges to Koh Samui. However, the results of this study show that they are also a major source of CO_2 emissions. The results displayed by Table 8.13 show that a total of 7982.85 tonnes of CO_2 were emitted as a result of activities undertaken by 1,059,642 tourists who visited Koh Samui in 2007. Thus, on average tourists visiting Koh Samui in 2007 produced 7.53 kg of CO_2 through activities.

The total of amount of CO_2 emissions depends on visitor numbers as well as the intensity factors of specific activities. As a result, motorized water activities released a total of 3,963.43 tonnes of CO_2 and thus had the largest overall impact, followed by sightseeing and adventure activities. Other activities such as entertainment and visiting cultural attractions accounted for much smaller amounts of CO_2 per visit. Interestingly, just as both Thai and foreign tourists tended to prefer travelling in vehicles which emit high levels of CO_2, they also tended to undertake or participate in activities which emit high levels of CO_2: namely sightseeing and motorized water activities such as diving, jet skiing, and scenic cruises.

Table 8.13: The CO_2 Emissions from Each Different Choice of Activity and the Comparisons between Domestic and International Tourists

Activity	*Domestic Tourists*		*International Tourists*		*Total*		*CO_2 Kg /visit*
	Total CO_2 (Tonnes)	*%*	*Total CO_2 (Tonnes)*	*%*	*Total CO_2 (Tonnes)*	*%*	
Sightseeing around island	56.37	3.80	3266.25	50.24	3322.62	41.62	3.62
Shopping (souvenir and others)	5.99	0.40	131.29	2.02	137.27	1.72	0.34
Motorised water activity	1365.19	92.13	2598.25	39.97	3963.43	49.65	15.31
Entertainment/ Nightlife activity	4.84	0.33	49.98	0.77	54.82	0.69	0.35
Health & spa activity	9.18	0.62	47.17	0.73	56.36	0.71	0.42
Adventure activity	15.65	1.06	278.96	4.29	294.60	3.69	2.24
Visiting Cultural attraction	2.93	0.20	5.76	0.09	8.68	0.11	0.17
Visiting nature attraction	2.57	0.17	25.90	0.40	28.47	0.36	0.42
Visiting nature attraction	2.57	0.17	25.90	0.40	28.47	0.36	0.42
Sport activity	8.72	0.59	92.38	1.42	101.10	1.27	1.67
Others (visiting farm, specific site)	10.40	0.70	5.10	0.08	15.50	0.19	0.42
Total	1481.83	100.00	6501.03	100.00	7982.85	100.00	3.60

Source: Author

8.5 ENERGY-USE AND CO_2 EMISSIONS FROM WASTE MANAGEMENT

As a consequence of tremendous growth in its tourism industry, Koh Samui is currently facing serious environmental problems, not least as a result of the waste produced by the island's hotel industry which comes in two main forms: solid waste and wastewater. As of 2007, there were 403 hotels operating on Koh Samui with a total of 14,405 rooms. It is clear that the increasing amount of solid waste and wastewater being produced by these hotels is having a negative impact on the quality of Koh Samui's natural environment. Moreover, as the number of tourists visiting Koh Samui is set to increase, the environmental problems associated with hotel waste can also be expected to grow. This section mainly discusses energy consumption and CO_2 emissions linked to waste and sewage management. However, the information background associated with waste and wastewater discharge can provide a broader picture for the whole of Samui Island as follows.

8.5.1 Quantities of Waste and Patterns of Disposal

In 1999 Koh Samui was producing about 30–70 tonnes of waste per day (Manicipality of Samui Island, 2000). According to a recent feasibility study on sustainable development in Koh Samui conducted by Environmental Engineering Consultants Co., Ltd (EEC), the island’s municipal authority were collecting and dispoting of approximately 140 tonnes of solid waste per day in 2007 (EEC and EAEF 2008). According to the most up to date data provided by the Koh Samui Municipality, approximately 80% of the island’s solid wasted is collected daily by a fleet of 21 trucks. Furthermore, daily waste collections, currently totaling about 120 tonnes, are close to exceeding the capacity of the municipality’s incinerator which is designed to burn around 140 tonnes of waste per day.

8.5.2 Energy Required for Waste Treatment

The EEC report notes that the quantity of waste generated per capita on Koh Samui is highest in urban areas where the amount of commercial and tourist activity is highest. Furthermore, Greenpeace (2005) has revealed that tourists are responsible for a large portion of Koh Samui’s total waste output. Another feasibility study for Koh Samui conducted by the Public Work Department estimates that in 2007, 8,625 hotel rooms alone will generate about 26 tons of waste per day, thus accounting for about a third of the total garbage generated by the island. For example, each Thai resident of Koh Samui generates around 1.18 kg of refuse per day while a single hotel room generates about 2.9 kg per day.

In order to estimate the amount of energy currently being used for waste management, an initial attempt was made to determine the specific quantity of waste generated by the tourism sector. Based on the data above, it can be estimated that 1,051,337 tourists spread between 14, 405 hotel rooms over the course of 2007 generated about 46.70 tonnes of waste per day. Therefore, it can be estimated that at least 40% of energy used for waste management in 2007 went towards processing waste from tourism. However, due to the limitations of the available data, the calculation method used here does not take account of refuse collection and transfer to landfill. In other words, the fuel used to collect waste from accommodation and to take it to landfill sites or treatment facilities is not taken into account by this study.

Table 8.14 shows that the municipal incineration plant on Koh Samui consumes about 338,688.00 kWh (1,219,277 MJ) of electricity per year to meet the demands for waste disposal placed upon it by the tourism sector. However, even this is only a conservative estimate due to gaps in the available data.

CO_2 emissions linked to direct energy usage were calculated according to the type of fuel or energy source whereby they were released. A conversion factor of 0.580 kg CO_2/MJ was used (EGAT, 2008) to quantify the amount of CO_2 released by electrical appliances used for waste management in Thailand. This calculation method reveals that about 707,180.66 kg of CO_2 was released as a result of electrically-powered waste treatment facilities processing waste from Koh Samui's tourism sector. However, as mentioned above this figure can only be taken as a conservative estimate of the carbon footprint of waste management linked to the tourism sector. The energy used at other points in the chain of waste management, such as collection, transport, landfill management , and monitoring were excluded from the above calculations because of a lack of available data. Domestic waste collection services are provided by the local government authority. Although the local government on Koh Samui provides a waste collection service for the commercial sector, including businesses such as hotels, as in many under-developed countries there is no formal system for collecting domestic waste. Accordingly, it is difficult to estimate how much energy is expended by domestic waste disposal because there is no systematic means in place for dealing with it.

Table 8.14: Energy Use of Waste Treatment Plant

Source of Energy	***Amount of use***	***Unite***	***Total Energy Use (MJ)***	***Energy Use Per Visitor-night (MJ)***	***Energy Use Per Tourist (MJ)***
Electricity for *Waste* Treatment Facilities	846,720.00	kWh	3,048,192	-	-
Total for Tourism Use	338,688.00	kWh	1,219,277	0.054	0.322

Source: Author

8.6 THE ECOLOGICAL FOOTPRINT FROM ENERGY CONSUMPTION

This section aims to provide an answer to the third research objective of this study by calculating the EF resulting from energy-use in Koh Samui's tourism industry. As mentioned previously, the EF is calculated from the four main sub-sectors of the tourism industry: *i.e.* accommodation, transport, activities/attractions, and waste management. Table 8.15 shows that the average EF per capita for tourists visiting Koh Samui is 3.14 gha. This means that an area of forest measuring 3.14 gha is needed to absorb the CO_2 released through the energy consumed by each tourist on Koh Samui. This figure is close to the findings of a recent study conducted by Hunter and Shaw (2007) into the EF resulting from the transit zone into New Zealand. By using the equivalence factor of 1.38 recommended by previous studies of the carbon footprint of tourism (WWF, 2004; Becken, 2002b), Hunter and Shaw calculated the EF of one-way transit into New Zealand at around 1.76 gha per tourist. These figures of EF calculation are also close to the findings of other studies which have calculated EFs for the citizens of certain countries by taking all types of energy consumption into account. Importantly, these studies found that energy consumption accounts for approximately 90% of the per capita EF**.** For example, two WWF (2002, 2004) studies of Spanish citizens put their EF at around 4.80 gha. Likewise, the EF of UK citizens has been calculated at around 5.40 gha and that of New Zealand citizens at around 8.68 gha. A lack of available data in some categories for supporting EF calculations (especially concerning waste management) can lead to them being underestimated amount of EF in this case.

As regards the consumption of energy sources, international transport, especially long-haul aviation, released the largest share of CO_2. Therefore, the greatest area of forest is needed to offset the emissions from this sector. In contrast, waste management uses the smallest share of energy. However, as explained above, this finding does not reflect the full environmental impact of waste management on Koh Samui because it only takes account of electricity used at waste management facilities. Nevertheless, it should still be stressed that the EFs which result from waste management and also tourism activities are relatively small by comparison with those of the other sectors taken into account by this study.

Table 8.15: Ecological Footprint from Energy Use by Tourism per Year

Energy Source	Amount of Energy-Used (GJ)	Total Area (hectare)[1*]	Global hectare/ tourist/year [2*]	Percentage
Accommodation	912,810	12504.25	0.02	0.59
International Transportation	50,816,820	696120.82	3.34	97.95
Domestic transportation	2,687,960	18,410.68	0.05	1.46
Activity	134,420	1,841.37	0.00	0.00
Waste	1,219	16.70	0.00	0.00
Total	54,553,229.28	728,893.83	3.41	100.00

Notes: 1* Based on 73 GJ need by 1 hectare for absorbing CO_2 (WWF, 2000).
2* multiplying with equivalence factor of 1.38 to translate area into global unite (WWF, 2004)
Source: Author

8.7 CONCLUSION

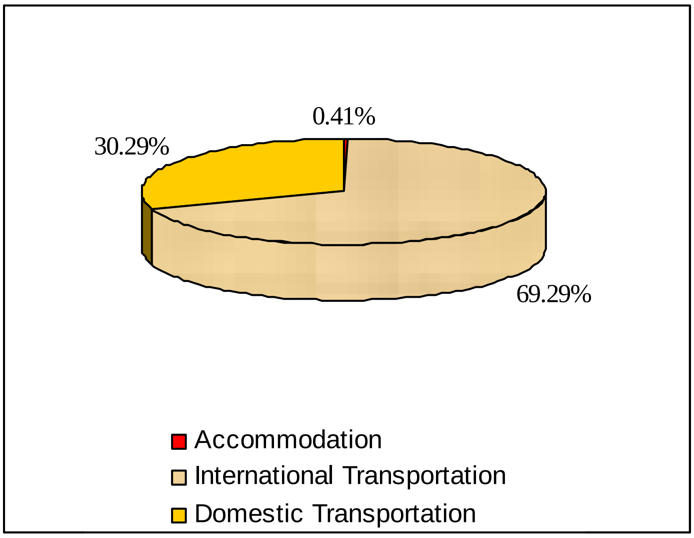
Once people have decided to spend a holiday at a given destination, they must also make decisions about how they will get there and where they will stay and what they will do once they are there. The decisions which they make on these matters will affect not just their holiday experiences but also the energy demands and CO_2 emissions linked to the tourism sector at their holiday destination and thus the extent of its EF.

A key conclusion which can be drawn here is that the four main components of Koh Samui's tourism industry, namely transport, accommodation, activities and waste management, rely heavily on energy generated by burning carbon-rich fuels: the total annual rate of energy consumption for these sectors is about 54.553 PJ per year, of which 51.48 GJ can be attributed to each tourist. Therefore, as mentioned above, taking account of the 1,059,642 tourists who visited Koh Samui in 2007 (77,515 of whom came from outside of Thailand), the per capita EF for tourism on Koh Samui can be calculated at 3.41 gha: this figure is 159 times larger than the area of the island.

As explained previously, this study has calculated the EFs of the four main sectors of Koh Samui's tourism industry separately. The results indicate that, of these four sectors, transportation consumed the most energy. This is undoubtedly due to air travel, particularly international flights, which is responsible for the largest share of the EF resulting from energy-use in the tourism sector: that is, 69.29% as shown in Figure 8.1. This result is congruent with previous studies which also show that air transport makes the largest impact on the global environment of any facet of the tourism industry (Becken, 2002a; Gossling *et al*. 2002; Gössling and Hall, 2005; Peeters and Schouten, 2006). Furthermore, this study has revealed that the total amount of energy needed to support long-haul flights to Koh Samui (25.41 PJ) is close to the equivalent figure calculated for long-haul flights to New Zealand (27.8 PJ) (Becken, 2002a). However, it should be noted that the EFs of waste management were excluded to compare in this figure due to its smallest size which has lead to dramatically be different scale in this pie chart.

Accordingly, it is now important to consider the environmental footprint and sustainability of tourism on Koh Samui in a global context. Koh Samui is one among many world-class tourism destinations which potentially generates emissions from international air transport.

Figure 8.1: EFs Expressed As Percentages for Main Contribution Sectors of Koh Samui's Tourism Industry



Source: Author

The cumulative effects of tourism on a global scale must become a more prominent concern for future studies of the environmental impact and sustainability of tourism at specific holiday destinations. Thus in brief, in order to make tourism more sustainable it is absolutely necessary to adopt a more global perspective of its environmental, social, and economic effects.

It was noted above that domestic transport accounted for a significant share of the EF ascribed by this study to Koh Samui's tourism industry. This is obviously an outcome of the behaviour of tourists. As Chapter Six revealed, more that 80% of respondents took domestic flights to their destination while the next largest share used personal cars. As a consequence, domestic transport accounted for 30.29% of the EF of tourism on Koh Samui.

By comparison with transportation, the other sectors of the tourism industry covered by this study need very small areas land to absorb their CO_2 emissions. However, if the vast amounts of energy consumed by international and domestic air travel are excluded, the accommodation sector becomes the main contributor of CO_2 emissions at the destination level. It is also important to allow room for tourists to change their behaviour in both transportation and accommodation. These tourists possess positive attitudes which can be promoted for acting more friendly to environment. For example, Chapter Six discussed the fact that most tourists who responded to this study were highly concerned about global environmental problems and expressed positive attitudes towards environmentally-responsible behaviour. However, the present chapter shows that tourists staying in holiday accommodation on Koh Samui consumed about 144.14 MJ per visitor night. However, the true figure for the amount of energy consumed per visitor night in holiday accommodation on Koh Samui is probably lower because this study only took account of electricity consumption while excluding the energy used by transportation and waste management linked to accommodation. By contrast, studies by Becken (2002a) and Gössling *et al.* (2002) have found, respectively, that tourists staying in holiday accommodation consume about 155.0 MJ/visitor/night in New Zealand and 40 – 110 MJ/visitor/night in the Seychelles (the figures for the Seychelles range from simple guesthouses to five-star hotels).

The large quantity of electricity consumed in holiday accommodation may be linked back to the ways in which tourists use energy. As noted in Chapter Seven, there is currently no system in place for recycling solid waste generated by the business sector and, moreover, businesses did not seem very enthusiastic about introducing any such system. This helps to explain why, as reported in Chapter Six, 62.9% of tourist respondents gave the answer, 'sometimes to never', when asked how often they recycled waste during their vacations. Indeed, this study has found that tourists tend to adopt a variety of environmentally-damaging patterns of behaviour which they would not normally follow in their home lives (see Chapter Six). For example, respondents to this study tended to wash their towels and take baths instead of showers every day, use air conditioning throughout most of the day, and use personal cars rather than public transport. Other kinds of environmentally-responsible behaviour which tourists tended to drop on vacation include bringing empty bottles to recycling bins, paying more for environmentally-friendly products, and turning off lights when they leave the hotel rooms. The cumulative outcome of these types of behaviour is that a large amount of energy is consumed by the accommodation sector which could potentially be saved by a variety of means. Thus, it is important that stakeholders on both the supply and demand sides of the tourism industry give consideration to how tourists may be encouraged to act in less environmentally-harmful ways when they are on holiday.

Finally, it can be concluded that Koh Samui's tourism industry currently produces CO_2 emissions at about twice the rate that the planet Earth is able to absorb to them. As discussed previously, the average amount of global resources available per person, namely the world-average biocapacity, stands at around 1.8 gha per capita (Peeters and Schouten, 2006): tourism in Koh Samui requires an area nearly double this size, 3.4 gha per capita, to absorb its CO_2 emissions. In other words, it takes the world about two years to absorb the amount of carbon emissions produced in one year by tourism on Koh Samui. Thus, if all tourists around the world consumed energy at the same rate as tourists on Koh Samui, another Earth would be needed to absorb all the CO_2 released as a result. However, it is easy to underestimate the size of the ecological footprints which come about through energy-use at the destination level in any study area. For example, a lack of official data about waste management on Koh Samui has meant that this study can only provide a conservative estimate of how much energy is used to dispose of waste linked to tourism on the island and the consequent EF. Improvements are needed to the information available about this facet of the tourism industry. Therefore, stakeholders should begin to compile systematic records about consumption and waste within the industry.

CHAPTER NINE

CONCLUSION

9.1 INTRODUCTION

The main objectives of this study are to apply the concept of EF to the tourism industry in order to examine its EF from energy consumption and also to investigate energy consumption behaviour among both tourists and businesses. The energy-consumption behaviour of tourists and businesses was also investigated for integrating with the result of an energy footprint. A preliminary research model was developed for the purposes of this study in response to the existing literatures on EF and energy-consumption in the tourism sector. Next, a conceptual framework and relevant tools (*i.e.* questionnaires and semi-structural interviews) were constructed. A pilot project was conducted in which these tools were tested on tourists and key informants from different groups of research samples. The insights gained from questionnaire analysis and interviews helped to validate the conceptual framework and aid in adjusting these instruments. Field work was then conducted in which primary and secondary data were collected: primary data was gathered from a sample of 485 tourists staying on Koh Samui and 70 tourism businesses operating on the island; secondary data was mainly collected from statistical databases provided by official organisations. The results of the survey and interviews were analysed. The data used to quantify energy footprints were mainly taken from the Tourism Authority of Thailand, Koh Samui City Municipality and the Provincial Electricity Authority: these bodies are in charge of gathering data about tourism in Thailand, waste and sewage management, and power distribution on Koh Samui respectively. Furthermore, in order to examine the area of forest absorbing CO_2 from the tourism sector, the emission and specific conversion factors of energy in Thailand were available from the Ministry of Energy and the Electricity Generating Authority of Thailand.

The purpose of this final chapter is to draw some conclusions from the results of this research and to link them to the objectives of this study. The first section summarises the keys findings of this study about the energy-consumption behaviour of tourists and the main challenges faced by tourism businesses in managing their energy footprints. This section also draws some conclusions from the findings of this study on the amount of energy-used by tourism on Koh Samui and the resulting EF. Finally, this section considers the implications and limitations of this study and makes some recommendations for further research.

9.2 SUMMARY OF RESEARCH FINDINGS

The key findings of this study are broken down into three sections which reflect the research objectives outlined in Chapter One. The relevance of the literature review in Chapters Two, Three and Four is also taken into account here. Given the findings of this study, some conclusions can be drawn in the following section:

9.2.1 Energy Consumption Behaviour of Tourists

The first research objective was to analyse the energy consumption behaviour of tourists and the factors which influence it (demographic characteristics, travel characteristics, environmental concern and environmental attitude). In order to gain more profound understanding of these relationships between the patterns of energy use of tourists at home and on vacation are also examined.

In relating to energy use behaviour in ***transportation***, international tourists made up the largest share of the total number of visitors are obviously a reflection of the fact that Koh Samui relies on the long-haul air-travel market. Europeans were the major groups of respondents followed by Scandinavians. It was found that most flew directly from their respective countries of origin, mainly in Europe, to Bangkok international airport and then on to Koh Samui by a short-haul domestic flight. Furthermore the study found that 73% of respondents travelled to Koh Samui by air plane and most of them travelling on the Island by private mode of transport especially by taxi and rental car. In the light of prior research, (Tunç, Akbostancı, and Türüt-Aşık, 2010; Gössling and Peeters, 2007; Becken and Simmons, 2005; Hunter and Shaw, 2007) which pointed out that air travel is arguably the largest contributor to the EF, it seems reasonable to assume from this finding that tourism in Koh Samui potentially harms the global environment.

Regarding tourist energy use in ***accommodation***, guest houses and hotels were the most popular forms of accommodation on Koh Samui. This research found that the operation of accommodation facilities, particularly in terms of electrical appliances was one of the major components of energy use in destination. The findings of this study confirm the results of prior works on energy consumption of accommodation that the pattern of energy-use in them was dominated by air conditioning as can be expected in a tropical climate (Deng and Burnett, 2000). The other main electrical appliances are lights, tankless hot water heaters and washing machines. It is noteworthy that while the average temperature on Koh Samui is about 30 degrees Celsius, the respondents of this study still preferred heated water for bathing and showering. Furthermore, domestic tourists were most likely to shower twice a day. Incredibly, after spending time in hot baths or showers, many respondents then needed to switch on their air conditioning to about 21 degrees Celsius in order to cool themselves down. Moreover, nearly two thirds of respondents (60%) cleaned their towels daily. Certainly, this pattern of electricity usage seem to be an extravagant energy use and will affect the further findings of EF calculation which show how much energy is needed to produce enough electricity to support the demands of tourist accommodation and the size of the EF left by this.

The electricity use of respondents in terms of using air conditioning, bathing and cleaning towels daily also varied considerably according to the type of accommodation in which they stayed. Hotel customers consumed more energy than those who stayed in rental properties and eco-lodges. Electrical appliances and other facilities were the most important influence in this regard because 7% of respondents who stayed in small bungalows reported not using air conditioning at all. This is consistent with Beccken *et al.* (2003), who also found that the quantity of energy usage in accommodation varies according to the facilities and services available in different types of accommodation. However, this study adds the finding that type of accommodation does not significantly affect whether respondents recycle waste, save energy and show willingness to pay more for environmentally-friendly products.

For the energy-used behaviour related with ***tourism activity***, like other tropical sea, sun, and sand destination, Koh Samui offers a great range of activities. The most popular choice among respondents was beach activities mainly in sun or sea bathing and swimming. Other favorite activities for respondents were shopping, sightseeing and nightlife respectively.

9.2.2 Factors Influencing the Energy-Behaviour of Tourists

Independent t-tests and Analysis of Variance (ANOVA) were used to analyze differences in energy-use behaviour and how they relate to demographic factors, travel behavior, and attitudes and level of concern towards the environment. For the purposes of this study, energy-use behaviour is divided into three categories which reflect the main sources of energy-consumption in the tourism industry as shown in Chapter Six: transport, accommodation, and activities.

The findings of this study indicate that certain demographic factors and level of environmental concern affect energy-consumption through transportation. Figure 9.1 demonstrates the influence of measured factors on energy-use behaviour in relation to the transport sector. It is evident from this diagram that the factors of education, type of accommodation, age, country of origin and travel arrangements exert the most influence on transport decision-making. High performance respondents in terms of high income, high educated and self-employed respondests tended to choose more power-hungry modes of transport. Postgraduate respondents and business owners tended to rely more heavily on personal road transport than less well-educated respondents and employees. However, respondents who opted for rental houses, ecolodges and guest houses also used personal road transport for longer in total than respondents who stayed in other types of accommodation. Furthermore, findings related with public transport factors shows that respondents in the age group 18-29 or who came from Africa, Thailand, and Oceania were most likely to use low-carbon public transport.

In regard to the results shown in Table 6.33, 'membership of an environmental group' is also a key factor influencing transport behaviour. Surprisingly, the results reveal that respondents who were involved in any kind environmental group used personal road transport more than respondents who had no commitments to environmental organizations. This evidence provides insights into the relationship between respondents' behaviour at home and on holiday. People who commit to environmental groups and recycling at home (section 6.8.4) do not automatically choose environmentally friendly transportation during their vacations. This results correspond to a recent study of Barr *et al*. (2010: 477) on the key differences between environmental practices at home and whilst on holiday which found that the major group of respondents tend to be home-based' environmentally-conscious consumers, bought organic food, composted their waste and boutht environmentally-friendly products. However, they have a least committed to environmental actions on holiday and "rarely transferred environmental habits to holidays or to their air travel attitudes". Nevertheless, this discrepancy may be accounted for by the fact that many people travel to holiday destinations to escape the obligations of their daily lives hence during this time they are less interested in environmentally responsible behaviour.

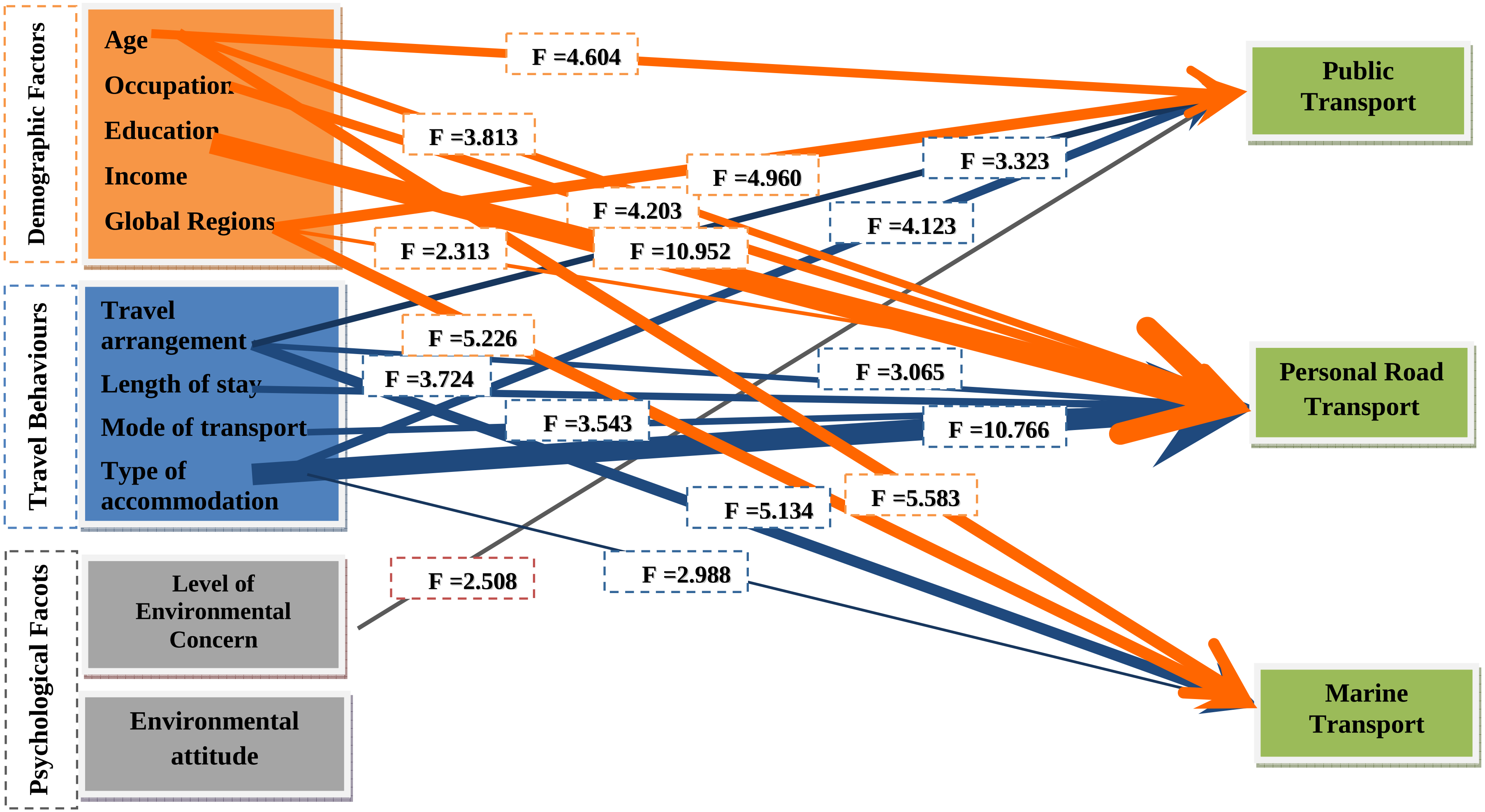
It is also noteworthy that although the tendency of respondents to use public transport was influenced statistically by concern for the environment, no significant correspondence was found between respondents' environmental attitudes and the decisions they made about transportation. This may be counted as evidence of conflicts between tourists' attitudes and behaviour. Even though the majority of respondents to this study expressed positive attitudes towards the environment, this did not translate into a commitment to use public transport in order to save energy. However, the relative unpopularity of public transport among tourists should also be viewed in light of its drawbacks. Problems such as a lack of security are likely to discourage tourists from using public transport. As Budeanu (2007: 503) points out, "environmental alternatives may be far away and difficult to access, less comfortable (coach transport), less appealing or require additional time for tourists shifting from aeroplane to train transportation". Hence the implications in relation with transportation for encouraging tourist to behave more responsible environmental behaviour are provided in further section of this chapter.

In *accommodation* area, most of the personal factors identified by this study affected energy-use behaviour in accommodation as shown in Figure 9.2: particularly Global Regions of original country, income, age and occupation. Business owners and respondents with high incomes tended to consume more energy than the rest, especially as regards air conditioning usage, turning off lights, and taking baths instead of showers. They were less willing to save energy in general and preferred to use personal cars rather than public transport. In short, businessmen and high income respondents generally behaved in less environmentally-friendly ways than low income respondents. In contrast, low-income respondents were more willing to save energy as far as they could, recycle waste, help to cut down on electricity bills and preferred to use public transport rather than personal cars.

Importantly, the geographical origin of respondents, along with attendant socio-cultural differences, can be seen from this research finding to have a significant impact on their energy-use behaviour while on holiday. Respondents from Scandinavian countries were the most environmentally-friendly, whereas their Asian and North American peers demonstrated the least environmentally-friendly behaviour. Particular concern should be raised by the finding that domestic Thai respondents used air conditioning throughout the day, needed clean towels every day, ignored waste recycling programmes and were largely unwilling to pay for environmentally-friendly products.

Respondents' attitudes towards the environment did not prove to be statistically influential factors on decision-making for *activities.* The most significant factors (Figure 9.3) were rather those relating to respondents' personal profiles (namely age, education and country of origin) and the amount of time taken up by each activity also vary in a number of night spending by respondents. It can be noted that the EF from energy use of tourism activities does not seem to be a major problem for Koh Samui. However, it should be born in mind those water-based activities, which produce the highest carbon footprint (see in Becken, 2001) in the tourism sector, are not the most popular activity among tourists on the island.

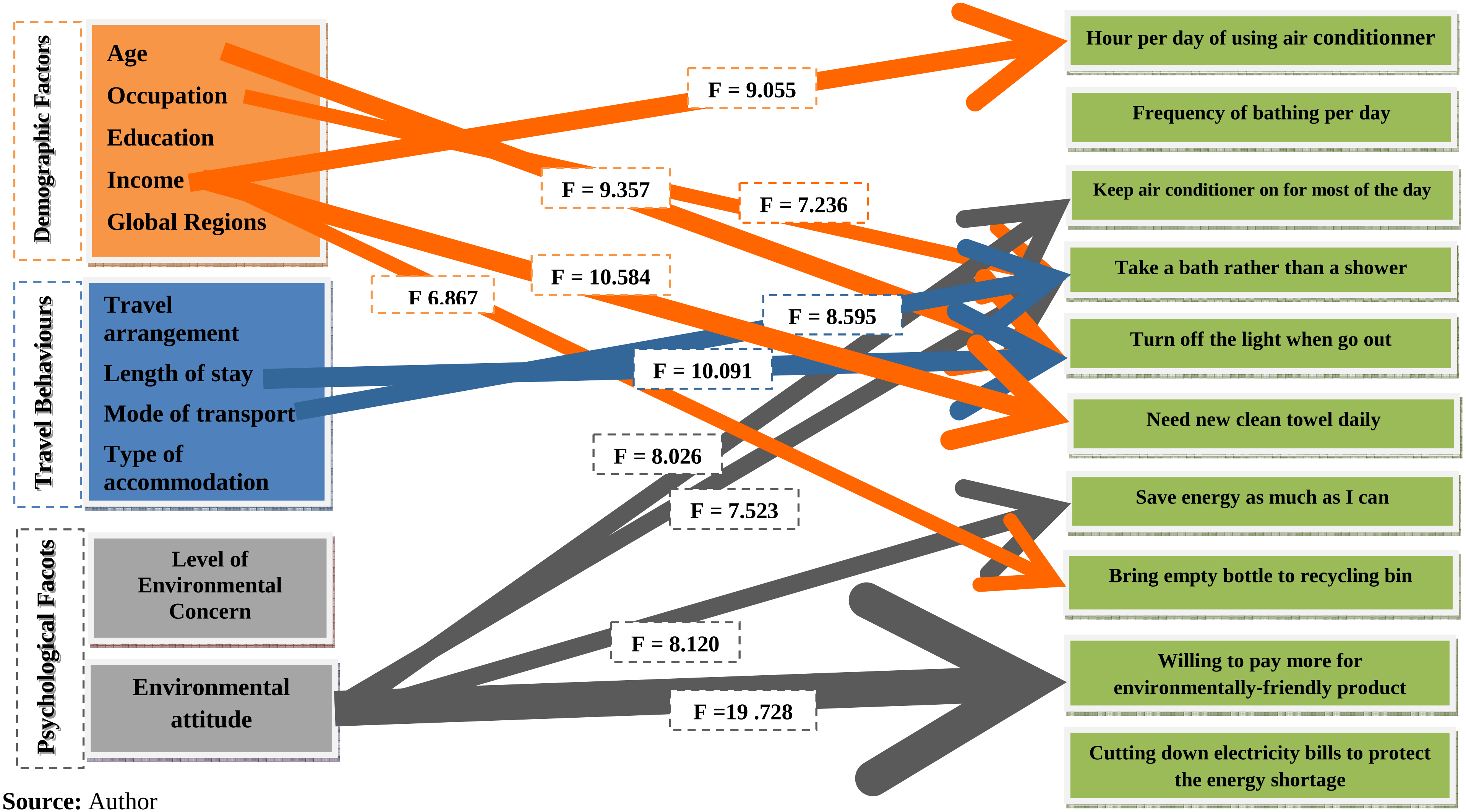
Figure 9.1: Diagrams Representing Preceding ANOVA Analysis of the Impact of Independent Variables on the Energy-use Behaviour of Respondent in Transport



Source: Author

Note: arrows increase with size according to their influence power derives from one-way ANOVA results

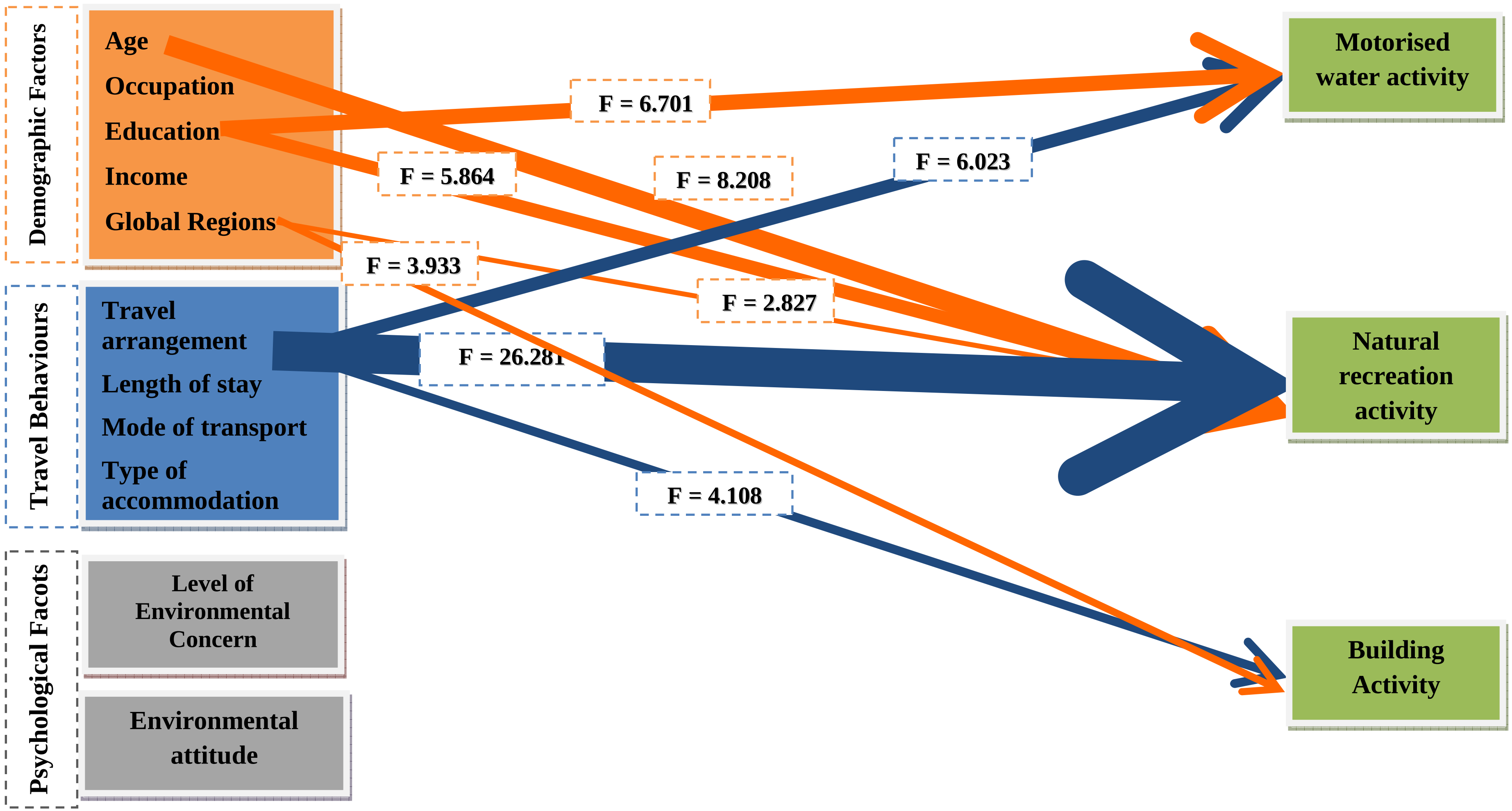
Figure 9.2: Diagrams Representing Preceding ANOVA Analysis of the Impact of Independent Variables on the Energy-use Behaviour of Respondent in Accommodation



Source: Author

Note: arrows increase with size according to their influential power which is F derived from F-Test (F) and the key significant factors

Figure 9.3: Diagrams Representing Preceding ANOVA Analysis of the Impact of Independent Variables on the Energy-use Behaviour of Respondents in Tourism Activity



Source: Author

Note: Arrows increase with size according to their influential power which is F derive from F-Test (F)

9.2.3 The Energy-Consumption Patterns of Tourism Businesses

The second objective of this study was to investigate the energy-consumption patterns of three major components of the tourism industry (transport, accommodation and activities) in order to identify the key areas of energy-use and provide insights into the attitudes and behaviour of businesspeople involved in tourism towards energy-use. This study builds upon the recent work of many scholars into research framework and mehtodology (*e.g.* Becken (2002b), Becken and Cavanagh (2003), Becken and Patterson (2006), Budeanu (2005), Kelly and Williams (2007)) by conducting qualitative and quantitative inquiries which shed light on the behaviour and attitudes of tourism businesses in regard to climate change and global warming. These findings contribute to the EF analysis (see also Chapter Eight) and demonstrate the level of concern and awareness of climate change and global warming among entrepreneurs. In other words, the findings about the patterns of energy-consumption among tourism businesses provide understanding of how we can manage or tackle the EF of the tourism industry.

The results of this study (see Fig. 9.4) confirm that different sub-sectors of the tourism industry consume a considerable amount of energy at various stages. Hotels account for the single biggest share of the electricity used by Koh Samui’s tourism industry. This finding conforms to the patterns of energy-consumption which have been observed in the tourism industries of other countries (Bohdanowicz *et al.*, 2001; Deng and Burnett, 2000). This study also demonstrates the reliance of many of Koh Samui’s tourism businesses on fossil fuels (typically diesel or petrol).

This research into the supply-side of the tourism industry shows that five-star hotels are the biggest consumers of electricity: in this respect, these findings corroborate studies on energy-use in the tourism industry by Bohdanowicz *et al.* (2001), Deng and Burnett (2000), and Trung and Kumar (2005). For example, Deng and Burnett (2000) found that 73% of the total energy consumed by Hong Kong’s hotels is electricity. Likewise, Trung and Kumar (2005) have reported that in Vietnam’s hotel industry, electricity invariably accounts for the largest share of energy-consumption in luxury hotels.

Significantly, these findings also reveal that one-star hotels use the least electricity among the other types of tourism businesses in Koh Samui. A similar pattern holds for waste production: five-star hotels produce the greatest volume of waste while one-star hotels produce the lowest. The main reason for this pattern is that five-star hotels operate on a much larger scale than other types of hotel and tourism businesses (see also Bohdanowicz *et al.*, 2001).

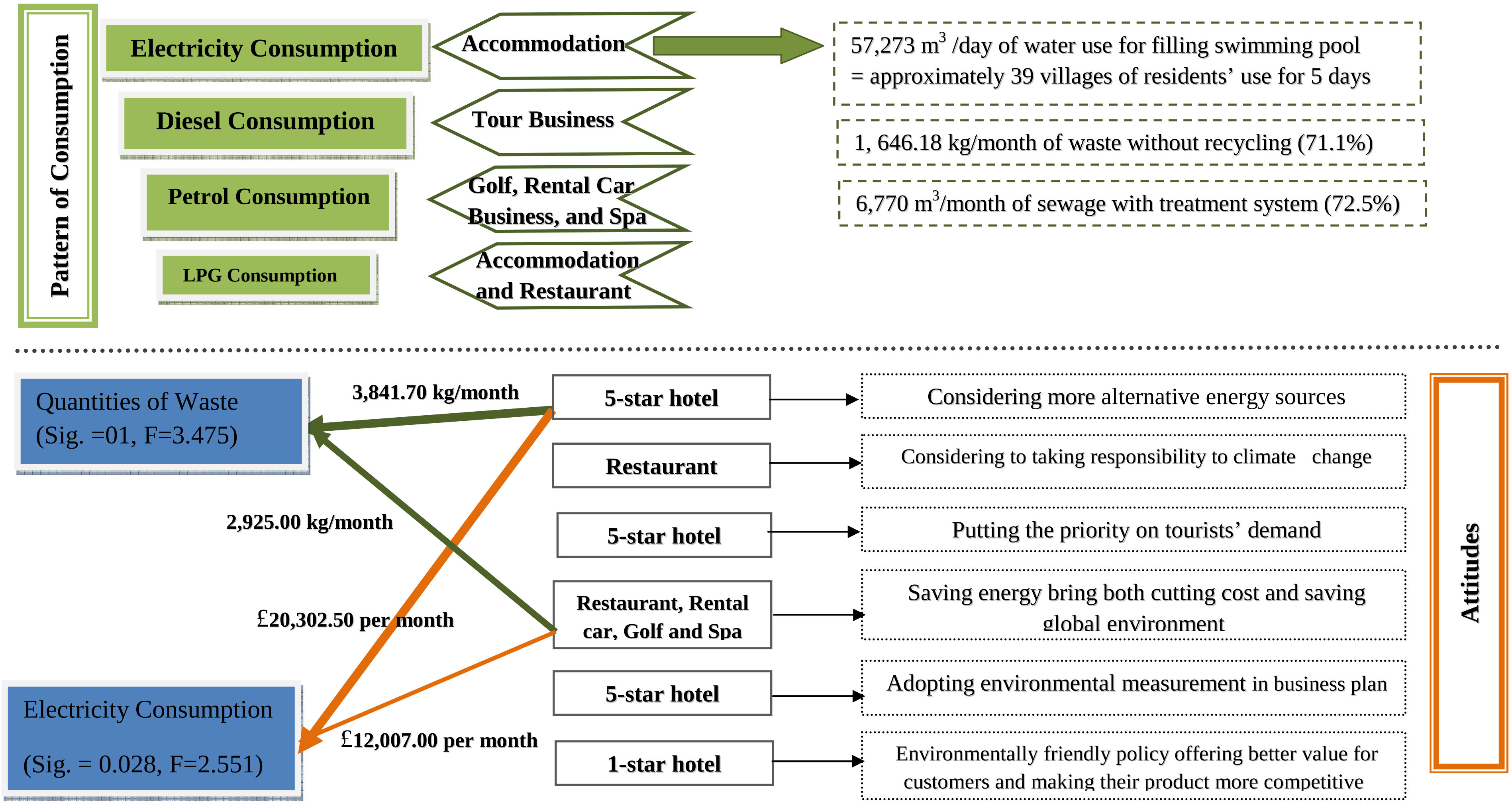
The most common sources of fuel on Koh Samui are diesel, petrol and LPG. The main findings of this study about fuel-consumption correspond to those of a recent study on energy-consumption in New Zealand's tourism industry which found that electricity is the most commonly used energy source, followed by diesel, petrol and LPG (Becken and Carboni, 2008). However, it is worth pointing out that the kinds of fuel used in other countries' tourism industries can be more varied than on Koh Samui (*i.e.* natural gas, coal, wood and solar power).

Importantly, tourism in Koh Samui mostly relies on a single or limited range of fuel sources for business operation: either diesel or petrol. The future supply of these fuels is insecure because of their limited availability and recent fluctuations in their price. Alternative energy sources, such as solar power and low-carbon fuels, should be taken into account in future projects on the island. Notwithstanding financial issues, culture and the environment are also important factors in energy-use behaviour. In order to control patterns of energy consumption, the Thai government should provide adequate data and attractive plans.

In addition to the consumption of energy, the tourism sector places a significant burden on Koh Samui's environment through the production of waste and wastewater, nearly all of which needs to be treated by the local government. In short, most waste produced by the tourism industry was generated by five-star hotels, golf courses, and spas (3841.70 Kg/month and 2,925.0 Kg/month respectively). The quantity of waste generated by the tourism sector puts pressure on the island's environment, particularly because of the limited landfill space available (as noted previously, the amount of waste almost exceeded the plant capacity in 2007 (EEC, 2008)).

Taking Koh Samui's tropical climate and "Sun-Sea-Sand" product into account, the availability of water is a major concern. Vast quantities of water are consumed by the tourism sector, especially by hotels which operate on a large scale and provide their customers with personal pools. Therefore, the effects of water shortages and the energy needed to meet the rising demand for desalination plants on the island need to be taken into account.

Figure 9.4: Diagram Illustrating the Key Pattern of Business Energy Consumption and the Attitudes towards Energy and Climate Change



Source: Author

Finally, to sum up the results of energy-use in the business sector, the key findings illustrated by Figure 9.4 indicate that water demand, solid-waste discharge, and wastewater discharge were the main issues related with energy-use in the accommodation sector: 5-star hotels were a significant source of solid waste and made up the largest share of electricity consumption across the tourism sector. The vast amounts of water needed to fill hotel swimming pools far exceed the rate at which local residents use water: The amount of water needed daily to fill hotel swimming pools can support around 39 villages on Koh Samui for five days. Furthermore, this pattern of water-use has a knock-on effect on electricity-consumption because of the power demands of the wastewater treatment system. Another major contributing factor towards the EF of the business sector is solid-waste management. The major groups of accommodation have failed to adopt recycling and continue to throw all their rubbish away. This situation leads to additional energy-consumption required for waste disposal including at incineration plants which process solid municipal waste.

However, the patterns of energy-consumption in the business sector tend to clash with the attitudes of businesses toward environmental management issues. Most businesses expressed highly positive attitudes about saving energy, taking account of climate change in their management policies, and adopting environmentally-friendly programmes. The data gathered by this study shows that different types of business have different attitudes toward environmental management. Five-star hotels expressed the most concern about adopting alternative energy sources and environmentally-friendly business plans. However, they also held the traditional attitude that customer demand is their top priority in operation. Likewise, restaurants, car rental businesses, golf clubs and spas expressed a high level of concern for reducing their environmental impact and saving energy such as considering to taking responsibility to climate change and saving energy. However, as with five-star hotels, these types of business are also power-hungry and produce high levels of waste.

9.2.4 The Concerns of Tourism Businesses and Managing Energy-Use

9.2.4.1 Level of Concern

Most respondents of tourism businesses in Koh Samui are concerned by CO_2 emissions; most of them view this problem as a global threat to humanity. However climate change issues have dramatically advanced to the centre of public concern in recent years; for example, Leiserowitz (2006) studied the concerns of Americans toward global warming and found that 50 % of them believed that it will affect everybody in the world. Some tourism businesses, corresponding with The Green Island Project on Koh Samui (2009), believe that this problem requires cooperation from all stakeholders related to tourism industry in order to reduce energy consumption (*e.g.* tourism businesses, the government, tourists, local communities, NGOs, and so on).

However, tourism businesses which view this problem at the national (Thailand) and local (Koh Samui) level do not mean to ignore the *global* effects of CO_2 emissions. Rather, their perspective is that working on these problems at a national or local level can help to alleviate the global effects of CO_2 emissions and thus reduce global warming.

9.2.4.2 Sources of CO_2 Emissions

Transport is viewed as the main source of CO_2 emissions. This is consistent with Stohl's (2008) study in which he argues that transport is the largest producer of CO_2 emissions. Moreover, Mukhopadhyay (2008) has shown that transport relating to the global tourism industry accounted for 75 % of all global CO_2 emissions; 40 % from air travel, 21.0 % from accommodation businesses, and the rest from other sources of energy. Tourism businesses believe that 'saving energy' is the optimal way of reducing the CO_2 emissions; this requires cooperation from all stakeholders in the tourism industry. Importantly, the findings of this study contrast with those of UNEP (2008) which recommends that car-pooling schemes and other forms of public transport offer an alternative way of reducing CO_2 emissions in the tourism industry. Of the tourism businesses surveyed for this study, only 3.6 % believe that car-pooling schemes and mass transport can help to reduce CO_2 emissions.

9.2.4.3 Activities for Reducing Energy-Use

In line with UNEP (2008), tourism businesses in Koh Samui employ easy and efficient methods of reducing the amount of their energy use: *e.g.* saving electricity by tuning off unused appliances or lights and generally using electrical appliances as efficiently as possible. This is reflected in the opinions expressed by the businesses we surveyed on the best ways to reduce CO_2 emissions (see section 7.7.2.2). Additionally, very few of the respondents believe that car-pooling schemes and public transport are the best ways to reduce energy consumption (only 1.9 %). In spite of the fact that both car-pools and public transport are recommended by UNEP (2008) for reducing energy consumption, they are not employed by tourism businesses on Koh Samui because at present there is not enough public transport to meet their needs (The Green Island Project Koh Samui, 2009). Other methods employed by tourism businesses to reduce their energy consumption include setting eco-friendly business policies, separating and recycling waste, planting trees, and developing eco-friendly codes of conduct for their staffs. In other words, tourism businesses in Koh Samui have employed ‘The Green Business policies’, ‘Recycling policies’ and ‘Natural ways’ to reduce their the amount of energy they consume. However, as Table 7.21 shows, tourism businesses tend to reduce the amount of electricity they consume rather than fossil fuels.

9.2.4.4 The Commitment of Tourism Businesses to Reducing Energy Consumption

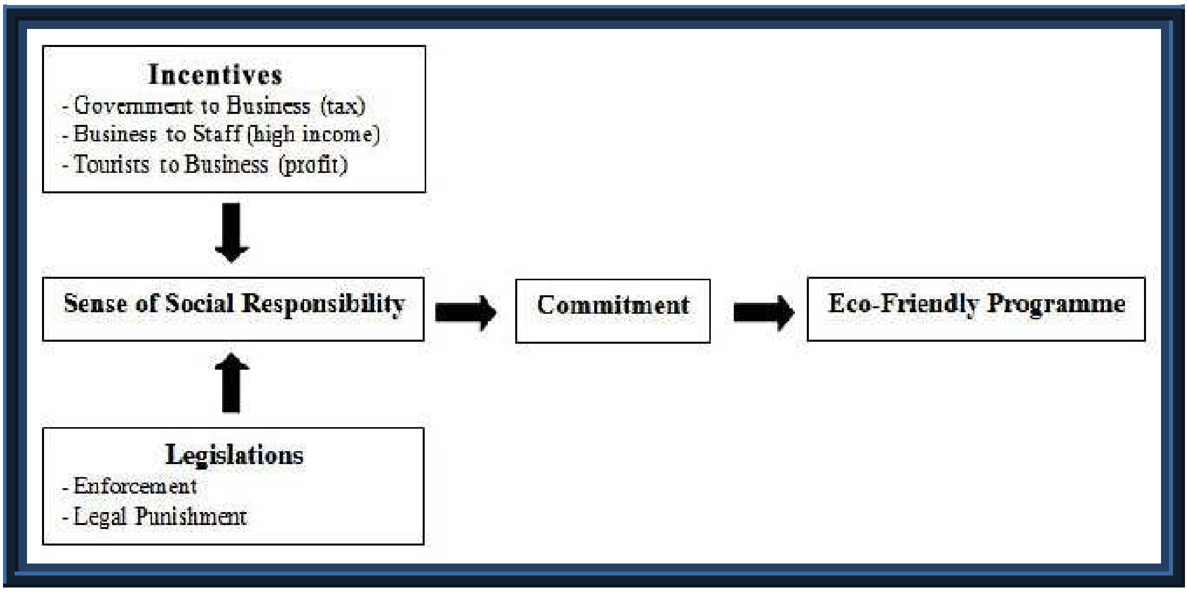
Most tourism businesses in Koh Samui agreed that legislation is required to reduce CO_2 emissions. In the other words, they believe that businesses need to be forced by laws to take responsibility for their impact on the environment. Legislation is a possible means by which tourism businesses can be encouraged or forced to act responsibly towards environment (Kolk and Pinkse, 2004). Many tourism businesses in Koh Samui also realise that they can help to promote awareness of, and a sense of responsibility towards CO_2 emissions. Moreover, some businesses are already taking advantage of the opportunities provided to them by environmental issues to strengthen their business image. This is congruent with Kolk’s and Pinkse’s (2004) finding that businesses can make themselves more attractive to customers by gaining a more ‘green’ image.

9.2.5 The Environmentally Responsible Behaviour

The results of this research in Chapter Seven have indicated that incentive compensation and legislation are possible ways to increase the commitment of tourism businesses to reducing their energy consumption and promoting more environmentally responsible business (as shown in Figure 9.5). Most of respondents belive that legislation associated with environmental impact can control the carbon footprint in tourism sector because in their perspective, it can force stakeholders in this industry to take responsibility for the environment. They demonstrated the solution for promoting more environmentally responsible behaviour among businesses by combining incentive conpensation and legislation to be the important tools. In their opinion, these tools will persuade business to commit and take action on implementing the environmental initiatives. Figure 9.5 is derived from tourism businesses’ insights of their attitude toward the solution for energy-use reduction and fostering more sustainable practices in order to control the environmental impacts. In order to increasing tourism businesses’ commitment to conduct eco-friendly programmes, sense of social responsibility plays an important role to persuade them to commit to the eco-friendly practices. However, they believe that tourism businesses in Koh Samui need both compensation and legislation to create the sense of social responsibility. Certainly, tourism businesses in Koh Samui believe that both measures are necessary to encourage their commitment to reducing the amount of energy they use. This is in congruence with Sparkes and Cowton's (2004) finding that businesses tend to invest in social responsibility activities in response to pressures placed on them by legislation and their stakeholders.

Figure 9.5 shows that compensation appeals to businesses by offering them tangible benefits for being socially responsible (Friedman, 1970). This is congruent with Friedman's (1970) argument that compensating employers is another means of encouraging social responsibility. By doing this, governments may develop tax allowance programmes for businesses which offer them positive reasons to commit themselves to taking responsibility for their impact on the environment. For their part, businesses should promote the benefits of social responsibility to their staffs by compensating them with higher incomes (service charges).

Figure 9.5: How to Increase Tourism Businesses' Commitment for Reducing Energy



Source: Author's analysis

Meanwhile, it seems today that legislation provides an effective way of promoting a sense of social responsibility among tourism businesses. Carroll (1991) has argued that legislation is an effective means of making businesses take more responsibility for their impact on the environment. Complying with legislation, or 'obey by Laws' (Carroll, 1991), can lead businesses to a sense of responsibility and commitment towards the environment and good citizenship. Therefore, governments (in this case, both the Royal Thai Government and the local administration on Koh Samui) should develop legislative programmes which serve to promote and enforce social responsibility in the business sector.

Moreover, social responsibility can strengthen the images of businesses in the public eye. Social responsibility can be used as public relations programme (Mintzberg, 1983) to improve public perception of businesses and reduce advertising costs. Importantly, tourism businesses in Koh Samui see the main benefit to them of energy saving campaigns as attracting customers. Most of them (65.38 %) believe that a natural way of life can attract tourists to visit their businesses. Although electricity is the main source of energy within tourism industry, only 3.85 % of businesses surveyed believe that saving electricity can attract tourists. This is because saving electricity is not as visible to potential customers as the natural way of life. Tourists can perceive the commitment of businesses to eco-friendly activities if the businesses premises seem like a natural environment because tourists can touch, view and engage with the natural atmosphere of the business. On the other hand, it is difficult for tourists to perceive how businesses reduce their electricity consumption.

9.3 THE EF RESULTING FROM ENERGY-USE IN THE TOURISM SECTOR

The third research objective of this study is to estimate the EFs resulting from energy-use in four facets of Koh Samui's tourism sector, namely transport, accommodation, activities, and waste management, which were selected for study here in response to prior research **(**Gössling *et al.*, 2002; Becken, 2002b; WWF, 2002; Peters and Schouten, 2006; Becken and Carboni, 2008**).** In 2007 the total energy consumed by the tourism industry on Koh Samui was 54.55 PJ which equates to an EF of about 3.41 gha. Transportation accounted for the largest share of this energy-use and thus the greatest quantity of CO_2 generated by tourism on Koh Samui.

Based on the publication of Global Footprint Network in 2010, the EF generated by Koh Samui's tourism industry exceeded the fair earth share which is calculated in relation to world-average bio-capacity, which currently stands at 1.8 gha per capita. The key conclusion which can be drawn from this finding is that the current rate of tourism development in Koh Samui is unsustainable even though, as Peeters and Schouten (2006) have mentioned, sustainable development is theoretically possible if the EF of human activities in general is reduced to below the capacity of the earth. Furthermore, if energy-use from long-haul aviation is excluded, Koh Samui's tourism industry produces a lower EF than the average earth share.

Air travel contributes by far the largest share of the total EF of the transportation sector. Compared with prior studies, Gössling *et al.* (2002) found the EF produced by the burning of fossil fuels to be substantial (1.73 gha per capita per year), about 97% of which resulted from air travel. This figure is compatible with this study's finding that international transport accounts for 97.95% of the EF of energy-use. Peeters and Schouten (2006) came up with similar findings in their study of the ecological footprint generated by inbound tourism to Amsterdam: that is 87% due to air transport followed by 5% to private cars and 3% to trains. They also found that the average ecological footprint for travel to Amsterdam per tourist and per visit day is 5.4 times greater than the daily 'fair earth share'. The EF calculations made for Amsterdam by Peeters and Schouten are greater than those of this study because they took account of EFs from all types of resource-use whereas our research examined EFs from energy-use only.

International air transport was employed by 898,765 tourists in 2007 travelling to Koh Samui who thereby used 11,009.58 TJ of energy and 759.66 Kilo tonnes of CO_2 emissions. It is worth noting that the average amount of energy used and CO_2 emitted by international tourists visiting Koh Samui is about twice that of international tourists visiting Fiji (Becken, 2004). When considering just transport within Thailand, air travel accounts for the largest share of the energy used by domestic travel, specifically 555.67 TJ, of which 519.40 TJ can be attributed to international tourists. As mentioned in Chapter Eight (see also Table 8.10), domestic air travel consumes the most energy among other modes of transports at around 1,292.50 MJ/visitor trip. This is followed by private cars at around 1,223.01 MJ/visitor trip and trains at around 997.39 MJ/visitor trip. Moreover, among all forms of domestic transport air travel emitted the greatest share of CO_2 (47.85 %): specifically 88.83 Kg/visitor trip and 38,189.53 tonnes in total. This finding sits in sharp contrast with Becken's (2009) study showing that cars account for the greatest share of CO_2 emissions among domestic transport used by tourists in New Zealand. This is partly because, being an island, travel choices to and from Koh Samui are limited by its geography and also because travel distances within Koh Samui are much shorter than across the whole of New Zealand (the area covered by Becken (2009)). Moreover, it is the longer trip for travelling from the hubs (*i.e.* Bangkok, Phuket, and Chiang Mai) to Koh Samui by car as mentioned by Bohler *et al.* (2005) that the distance of travelling is the important factor for making decision about modes of transport. It is also worth mentioning that tourists travelling to Koh Samui by road will necessarily require other forms of transport such as ferries.

In spite of the fact that a long haul-flight to Koh Samui generates less CO_2 per km than domestic flights, the quantity of CO_2 emissions generated by travelling to Koh Samui by air (88.83 kg/visitor/trip) is nearly equal to that produced by private cars (78.23 kg/visitor/trip) travelling to the island. Comparisons of the EFs of different modes of transport allow us to see the specific issues that policy-makers must address. Thus, this study shows that public transportation has the greatest energy-saving potential and that it should form a significant part of any strategy for decreasing the environmental impact of transportation linked to the tourism sector.

As regards energy-consumption in accommodation, this study supports Becken and Patterson's (2006) finding that the tourism sector is heavily reliant on fossil fuels both directly. While the electricity which is very important energy for these uses also often generated from petroleum, coal or gas, leading to the emission of CO_2. As discussed in Chapter Eight, this research reveals that electricity was mainly used in the accommodation sector of Koh Samui at an average rate of 144.14 MJ/visitor/night. This rate of electricity consumption in accommodation exceeds that of tourists in the Seycelles who used an average 51.25 MJ/bed-night (this rose to 110 MJ/bed-night for those staying in five-star hotels) (Gössling *et al*, 2002). Furthermore, although the rate of average energy-use in holiday accommodation on Koh Samui is slightly lower than that for hotels in New Zealand (155 MJ/bed-night), it is still higher than the rates for five other categories of accommodation in New Zealand including B&Bs, Motels, and Backpacker in Becken (2002b).

However, by converting the rates of energy-use into EFs, it can be shown that holiday accommodation on Koh Samui accounts for a much smaller share of the tourism sector's overall EF than in Amsterdam (See in Peeters and Schouten, 2006). The rate of energy consumption for holiday accommodation on Koh Samui requires the considerably smaller area of 0.02 gha/tourist/year, accounted for 0.59% to absorb CO_2. By comparison, holiday accommodation in Amsterdam accounts for 21.3% of the local tourism industry's overall EF. This discrepancy may be due to this study having focused solely on energy-use excluding, in particular, supporting data on energy-use resulting from the production and consumption of food and beverages across Koh Samui's tourism sector (*i.e.* in accommodation, transport, and during activities). However, as discussed in Chapter Two, there are well-documented problems with gaining this kind of data.

Regarding activities, tourists on Koh Samui tended to spend the greatest share of their time sightseeing, followed by shopping and participating in motorised water activities. As mentioned by Becken and Patterson (2006), motorised water activities are the most energy-intensive of the various leisure pursuits available on Koh Samui whereas building activities (*e.g.* museums, shopping, and so on) followed by natural attractions consume the least energy per head. Therefore, tourists who are attracted by sightseeing and shopping activities tend to generate less CO_2 emissions per head than those who are attracted by motorized activities. This finding is supported by Becken (2009) who argues that the amount of CO_2 generated by shopping is small by comparison with other tourism activities. Around half of domestic tourists on Koh Samui participate in motorized water activities. By contrast, the share of international tourists participating in such activities is much smaller at around 18.88 %. The total amount of energy consumed by attractions and activities is about 134.42 TJ. Sightseeing accounts for about half of this total with the next largest share being generated by motorised water activities. Although, motorised water activities emit the highest emission of CO_2 in terms of energy intensity in MJ per visit, it affect to EF in Koh Samui less than sightseeing. Therefore, it can be concluded that less energy-intensive activities may still contribute a large share of total CO_2 emissions if they are popular among tourists.

9.4 POSSIBLE IMPLICATIONS FOR MANAGMENT

Perhaps most notable among the findings on respondents' travelling behaviour is that most of them prioritised convenience and saving time over saving energy as presented in behaviour theory. However, tourists' environmental concerns may be exploited in order to change their travelling behaviour. Although it is more difficult to change the behaviour of wealthier tourists who can afford air travel and private cars, cost concerns clearly influence the tendency of many tourists to use public transport. Lower income respondents typically preferred to travel by public transport rather than by air or personal vehicles. In order to balance the needs of tourists and the environment, policy-makers should take account both of tourists' environmental concerns and problems with existing forms of public transport. In this way, they may be able to find public transport solutions which are more attractive to high income tourists. More specifically, policy-makers should look towards providing cleaner and more convenient forms of public transport which can help to meet low carbon policies. Thus, the following section shows how the findings of this study may be used in practice to diminish CO_2 emissions produced by Koh Samui's tourism industry**.**

9.4.1 Providing Tourists with Alternative Energy Sources

The main threats to the developing low carbon economy of Koh Samui are insufficient supply of alternative energy sources and a lack of good public transport. As explained in Chapter Six, although most tourists are in favour of using clean energy and saving energy, there are not many choices available to them for acting in environmentally-friendly ways. As mentioned in Chapter Six, tourists have notified that they are ready to apply the alternative energy during their holiday. The supply of alternative energy sources in Koh Samui is very limited. Therefore, the Royal Thai Government, including local authorities, should cooperate with tourism businesses to find ways of providing alternative forms of energy. The government should seek out other potential sources of energy such as solar power which can be developed to meet the needs of Koh Samui's tourism industry.

At the same time, there need to be reductions in the use of non-renewable energy, especially in the transportation sector through the promotion of environmentally-friendly modes of transport. Importantly, the findings show that tourists' attitudes have no significant impact on energy-saving behaviour in the transport category. This can be accounted for by the lack of choice in transport available on Koh Samui: especially public transport which comes only in the form of *Rod Song Taew* [minibus] which is operated by local businesses in an unprofessional and unsafe manner. Therefore, the local authorities in Koh Samui should develop new forms of public transport which provide tourists with a safe and reliable service (*e.g.* electric trains or clean energy buses).

9.4.2 Educating and Asking for Cooperation from Stakeholders

It was mentioned in Chapter Seven that most tourism businesses agreed that climate change and global warming are global issues which need cooperation from all stakeholders. These businesses are eligible to support this view because they can directly contact or get impacts from tourists. As mentioned in Chapter Six, some tourists spent their holidays participating in energy-intensive leisure pursuits which generate large quantities of CO_2 (*e.g.* water transport, golf, and riding motorcycles). This group has clearly chosen convenience and hedonism over concern for the environmental. Additionally, the everyday habit of tourist is one of the causes which have a major impact on how they consume energy while on holiday (*e.g.* bathing twice a day or always leaving room lights on). Therefore, educational programmes are needed to encourage tourists to reduce their CO_2 emissions. The Royal Thai Government, local authorities, and also tourism businesses should cooperate to develop such educational programmes. Moreover, the government may provide subsidies and other benefits to tourism businesses (*e.g.* tax allowances, knowledge, and technology) in order to encourage them to provide low carbon services.

9.4.3 Employing the Ecological Footprint as Key Performance Index

To develop the low carbon economy, the EF should be employed to be the key performance index (KPI) for both the government and tourism businesses in their strategic planning.
This contrast sharply with the usual key performances indices used by these organisations, such as the financial index and market growth which may ignores the environment. For example, they can use their internal data to calculate the index and set up the goal for mitigating the EF within their organisations. This index would activate them to provide environmental friendly products and services in order to lead Koh Samui into the low carbon destination. The Royal Thai Government or local authorities may issue the legislation in regarding to the EF as the index to control the EF from business sector.

9.5 KEY RESEARCH CONTRIBUTIONS

This research makes several important theoretical and methodological contributions to the existing literature on adopting EF concept to tourism study and also on energy-use behaviour. More specifically, it addresses the implicit patterns of the energy use and it's EF in Koh Samui, Thailand. These findings benefit to consider the way to develop sustainable initiatives that can reduce EF from energy use and move towards more sustainable energy-consumption patterns. It also provides a general discussion of energy-use behavior of tourist and its influential factors.

9.5.1 Contribution to Theory

Firstly, investigating energy use for tourism sector and its EF bringing together the EF concept and the research area of the energy-use behaviour is a key contribution of this study. Although tourism's contribution to the consumption of energy has been acknowledged to be potentially considerable (Gössling, 2002), in recent years there have been very few studies of energy-consumption by tourism activity and the resulting EF (Becken, 2002b; Gossling, 2000; Hunter, 2002; Hunter and Shaw, 2007). By contrast, there have been numerous studies of, on the one hand, EFs in tourism (see Cole and Sinclair, 2002; Gössling *et al*., 2002; Hunter and Shaw, 2007; Patterson *et al*., 2007; Peng and Yang, 2007; Patterson *et al*., 2008; Martín-Cejas and Ramírez Sánchez, 2010) and, on the other hand, energy-consumption behaviour (see Tabatchnaia *et al*., 1997; Gössling, 2000; Becken and Simmons, 2002; Becken *et al.*, 2003; Nepal, 2008; Bakhat and Rosselló, 2011). Thus it can be seen that there is currently a lack of interest in integrating studies of resource-use behaviour and the concept of EF. The findings of this thesis make a significant contribution in terms of useful data for supporting the adoption of EF concept into tourism as one of a key environmental indicator and also reveal energy consumption behaviour of both demand and supply side.

It was shown in Chapter Eight that the demand for energy coming from Koh Samui's tourism industry currently exceeds what the planet can supply. The world-average biocapacity, which is to say the average amount of global resources available per person, is currently reckoned at 1.8 gha per capita (Peeters and Schouten, 2006). Koh Samui's tourism industry currently requires 3.4 gha to offset the environmental impact of each tourist. Given the most important advantages of the EF framework as a means of measuring the sustainability of tourism, a crucial outcome from the adoption of this tool must be that it facilitates comparisons between different studies in global level. This study provides empirical support for previous studies of EF and also shows how it can be applied within the tourism sector. Furthermore, this study presents methodological guidelines which show how the concept of EF may be effectively used in tourism studies and also mirrors the problem of the data accessibility for energy-consumption study in a developing country's perspective.

Exploring the energy-use behaviour to gain the better understanding on what are the fundamental reasons behind the patterns of energy consumption including considering on influential factors toward those behaviour, provide the key contribution to theory of tourist behaviour in association with tourist consumption and responsible tourist behaviour in energy-use context. Understanding what drives the personal EFs of tourists is the first step towards making positive decisions about tackling them. Furthermore, individual tourists can play a key role in putting pressure on governments and businesses to change how they manage energy-consumption.

This thesis shows the link between EFs and tourist behaviour. For example, the findings show that transport was the main source of energy consumption in Koh Samui's tourism industry. Regarding with the study findings, international visitors were the main group of Koh Samui's tourist who travel to Thailand by long-haul flights. It is also exacerbated by the popular decision-making among them to opt airplane and personal car as their domestic transport rather than public transportation for getting to Koh Samui. As a result, private modes of transport such as taxi, rental or personal cars and motorbikes remain the most popular ways of them to travel around the island. The domestic tourists also tend to rely heavily on personal car for traveling to and from Koh Samui and within the island. These key findings help to explain why the EF resulting from energy-use in Koh Samui's tourism industry exceeds the earth-share capacity.

Another key contribution of this study related to electricity-use and environmentally-responsible behaviour in holiday accommodation which is benefit for explaining the EF results from energy consumption. This thesis supports previous studies (Deng, 2000; Becken *et al.*, 2001; Shiming and Burnett, 2002; Trung and Kumar, 2005) which show that hotel operation accounts for the largest share of electricity consumed by the tourism industry. In tropical climates, air conditioning consumes the largest share (45%) of the total amount of electricity used by hotels (Shiming and Burnett, 2002). This study builds upon the findings of these studies by providing insights into the behaviour of tourists in holiday accommodation. In particular, this research indicates that most of respondents kept air-conditioning on throughout the time they spent in their accommodation (see in section 6.7). Furthermore, only 5.8% of respondents set the temperature at the standard point of 26 C^o, thereby helping to save energy and preserve the environment (see Yamtraipat *et al*., 2006; Atthajariyakul and Lertsatitanakorn, 2008). The remainder of the respondents set the temperature of their air conditioning below the standard point at between 20 C^o - 25 C^o and so consumed more energy and released more CO_2. This research into the behaviour of respondents when using water to take baths or showers provides further evidence about the ways in which electricity is consumed in holiday accommodation. Importantly, the findings of this study add to current understanding of how the behaviour of tourists differs between their daily lives and when they are on vacation. Hence in addition to showing how the concept of EF can benefit tourism studies, this study also provides a great deal of adding more knowledge and insights into the energy-use behaviour of tourists which affect the EF on Koh Samui.

9.5.2 Contribution to Methodology

This research has contributed to the methodology for estimating EFs. In line with current trends toward sustainable development, tools and standards are being developed around the world to make assessments of sustainability, the current EF, the depletion of natural resources, and the interrelationships between different factors affecting the environment (Chen, Chen and Hsieh, 2009). The EF approach is intellectually appealing and it has been widely adopted by the tourism community even though it suffers from some difficulties such as the problems inherent in converting different kinds of impact into common units (Sisman & associates, 2007). There is also some debate about whether EFs generated by tourists should be compared to their EFs at home or to the EFs of local residents at their holiday destinations. Addressing this issue, Hunter and Shaw (2007:50) have stated that, on average, tourists either consume resources at their holiday destinations in approximately the same manner and to the same extent as they would at home or in the same manner and at the same rate as the average local resident. Accordingly, there is more than one possible method for calculating the EFs of tourists which depends on whether the key point of comparison is with tourists' EFs in their home countries or the EFs of local residents at holiday destinations.

This study provides empirical evidence to show that the average EF of tourists in developing countries is higher than the average EF of their local residents: more specifically, this study found that the EF of tourists in Koh Samui was 3.4 gha whereas the EF for Thais, as measured in 2007 (Global Footprint Network, 2010), was 2.37 gha. However, the average EF for tourists staying on Koh Samui is significantly larger than the average EF for residents of developed countries. For example, the EF of UK citizens generated by energy-use in 2007 was 2.44 gha [the vast majority of international tourists] (estimating from 50% of the total EF in Wackernagel and Rees, 1996; Global Footprint Network, 2010, Calcott and Bull, 2007). This figure is smaller than the EF produced from energy-use by tourists in Koh Samui. However, the EF generated by energy-use of the average London resident which accounts for 3.32 gha out of a total EF of 6.63 gha is very similar to the EF of tourists in Koh Samui (see in Calcott and Bull, 2007).

By making these comparisons it is clear that results can be underestimated if the EF is quantified by using residential rate of consumption in developing country. The EF in the host country like developing country can potentially be estimated by taking the average annual per capital footprint from the host- nation citizens in developed country. In other words, the findings of this thesis support more accuracy estimation of EF in developing country by taking the national EF of tourists' home country for EF calculation. Furthermore, the findings that the levels of environmentally responsible behaviour of respondents tend to drop on vacation comparing with home context bring also benefit to EF calculation. It imply that tourists tend to change their pattern of consumption on their holiday away from home to less concern on environment and consequently the 'true' EF occurring on vocation possibly is larger than the EF of developed-country resident. Furthermore, this research finding that most respondents behaved in less environmentally-friendly ways while they were on vacation can inform how EF calculations are made. Consequently the 'true' EF of tourists is possibly larger than the EF of residents of developed nations.

9.5.3 Contribution to Energy Management in Tourism

The third most important contribution made by this study is its analysis of the factors influencing energy-use behaviour in tourism. In particular, it takes account of how the personal characteristics of tourists may influence their behaviour in ways which clash with the mainstream findings of tourism literature. It should be noted that the factors which affect how far tourists behave in environmentally sustainable ways are likely to differ according to their backgrounds. For example, it has been shown that highly-educated and high-earning eco-tourists who also profess a high level of concern for the environment often behave in more environmentally-friendly ways (Dolnicar, 2010). As regards energy-use behaviour, this study argues that high-earning and business-owning respondents tended to consume more energy through air conditioning, lighting, and washing than the rest. Thus, the findings imply that respondents who are rich and have a high education tend to produce the largest EFs. This links up with prior research into EFs produced by home consumption-behavior. For instance, it has been shown that people in richer cities spend more on things like cars, houses, and eating out and so produce larger footprints than people living in less-wealthy cities: hence it can be concluded that life-style choices linked to wealth influence the size of people's EFs (Calcott and Bull, 2007: 5).

This study clearly links the effects of energy-consumption in terms of EF with the patterns of energy-consumption of tourists and businesses in the tourism sector. These findings may be beneficial to the management of tourism businesses. Information about the ways in which tourists consume energy and their attitudes towards the environmental impact of tourism can help resort administrators to take action to reduce the EF of tourism in their area. In order to take appropriate action to reduce EFs it is important to understand which sectors consume the most energy. This research clearly shows that the transport sector contributes the greatest share of the EF of Koh Samui's tourism industry. Information such as this can help policy-makers to promote more sustainable patterns of energy-use and thereby reduce the EF of tourism at holiday destinations.

Finally, the finding that there is a discrepancy between the level of environmental concern expressed by tourists and how far they act on this concern when they are on holiday is of considerable importance to policy-makers. This research result implies that people tend to adopt less environmentally-friendly patterns of behaviour when they are on holiday than would normally be the case when they are at home. The environmentally-friendly patterns of behaviour which tourists follow in their home lives are sensitive to conditions at their holiday destinations. Addressing this issue, Barr (2003:238) has stated that in terms of recycling, high levels of behaviour were achieved when convenience was maximized, effort minimized and subjective norms activated. Hence the presence and availability of facilities which support environmentally-friendly behaviour in host countries such as public transport, recycling systems, and sustainability initiatives have a major impact on whether tourists maintain their normal environmentally-friendly patterns of behaviour on holiday.

9.6 LIMITATIONS OF THIS STUDY

Previous studies have been constrained by the limitations of the statistical databases available for estimating EFs. Likewise, this study has faced problems with the quality of the data available on some components, especially waste management. As Becken and Cavanagh (2003: 30) have pointed out, "[d]espite efforts to obtain reliable data, the data supplied are of variable accuracy as it is dependent on what level of detail and what information was kept by operators." In order to investigate EFs it is necessary to have access to detailed databases on energy consumption. As a consequence, it is more difficult to apply this model to developing countries where official data is generally less good. The lack of adequate data accounting for the main sources of waste and energy consumption in this research is critical to its success. It was also difficult to obtain reliable estimates from the Thai government of the amounts of fuel used for waste disposal and waste generated by tourism businesses on Koh Samui. However, despite the general lack of information about waste management on Koh Samui, statistical data was available from PEA on the amount of electricity used by waste combustion plants serving Koh Samui and average monthly totals of the quantity of waste produced. This data was crucial to the EF calculations in this study.

There were also problems with the data available on tourism businesses due to changes which had been made over time. For example, most of the 1 and 2 star hotels in TAT's list had disappeared or been closed down. Moreover, some of the 3 and 4 star hotels had been upgraded to 4 or 5 star status. Therefore, it was very slow in the process of address tracking and re-checking sample groups.

Limited access to the required resources is another common factor which always constrains the process of conducting research. Since this research with business involved gathering sensitive and confidential data, the researcher found many potential respondents reluctant to cooperate and allow researcher to access their energy use. This considerably decreased the share of total or partly refused interviews thus affecting both the research timetable and finance of study. In addition to the response factors, business respondents tended to say "no" rather than "yes" because "yes" led to more questions. For example, in response to the question about whether businesses maintained energy strategies or were investing in energy-saving equipment, most respondents answered “no we don’t have or we do not think about that”. This is in spite of the fact that many of them also rated themselves as 5 when asked how far they agreed with the statement: “we consider more alternative energy sources such as sun light, water, etc.” Hence it is clear that the researcher needs to cross check information for every single question throughout the interview process.

In order to analyse EFs and energy-use behaviour it is necessary to gather a great deal of detailed information. As a result, the questionnaires developed for both tourists and businesses were complex and demanded that respondents reflect on their experiences of transportation, accommodation and activities. Furthermore, the business questionnaire contained more specific questions about the consumption of fuel, electricity appliances, and waste management all requiring precise answers. Much of this data couldn’t be given off-hand. Many of the business respondents needed more time to fill in the questionnaire and 30% most of them gave up. However, in order to improve the reliability and validity of our research, secondary data was taken from TAT which systematically recorded information related to tourism in 2007 in order to estimate its EF by using conversion factors available from previous studies.

The findings of the three main components of this study are based on different sets of data from different periods. Given the common and fundamentally secondary nature of the data required for EF calculations (Becken *et al.*, 2003), this study was able to take data gathered by TAT in 2007 for the purposes of examining EFs. However, this research on the energy-use behaviour of both tourists and businesses was undertaken in 2008. Therefore, the findings of this study represent only a snapshot of the situation in 2008. Meanwhile, in Thailand the extension of carbon reduction development programmes has been encouraged by changes in government policies and management. These are external factors which may influence the findings of this study.

Finally, it is now widely accepted that EF analysis can be beneficial to investigations of sustainable development in tourism. The present work is one among a number of studies which extend understanding of the environmental impact of tourism through energy-use. The key conclusion of this study in particular is that tourism development in Koh Samui is currently unsustainable because its EF exceeds the fair earth share. However, even if the EF of international transport is excluded from the overall EF measurement for energy-use from tourism in Koh Samui (thus bringing it below the fair earth share), it still cannot be concluded that Koh Samui's tourism industry is sustainable. A major limitation of the EF framework is that it does not cover a range of other impacts: particularly social and economic impacts, the availability of water, and toxicity, all of which must also be taken into account by strategies and policies intended to reduce the negative effects of tourism.

9.7 FUTURE RESEARCH

This study opens up a range of possibilities for future research into the global environmental impact of tourism. The limitations of this study in terms of time and other resources as discussed in the previous section may also be supplemented by future research exploring tourism through the concept of EF. Moreover, the concept of EF can be applied to different scales of the tourism industry from individual holiday-makers up to the industry as a whole thereby allowing plenty of room for future studies. Finally, the key findings and implications of this study may be applied to other concepts and contexts as will be discussed below.

As this study has shown, the transportation sector contributed the biggest share of the total EF of Koh Samui's tourism industry especially through long-haul international flights and domestic travel. Therefore, one potentially fruitful course for future research would be to develop a more comprehensive overview of the EF of transportation in the tourism industry particularly as regards the factors which influence the travel choices and behaviour of tourists. It could also be worthwhile integrating EF calculations for both international and domestic transportation and it would be interesting to include other land area such as energy land, building land for road and other constructions in that EF measurement.

Further studies should also be undertaken to improve our understanding of the negative effects of tourism on the environment and thereby find better ways of encouraging tourists to lessen their environmental impact. It would also be worthwhile identifying the constraints which discourage or prevent tourists from using more environmentally-friendly forms of transport in a variety of situations and destinations.

As discussed in the literature review, most prior studies of environmentally-friendly behaviour focus on tourists' attitudes rather than their actual behaviour. In this study, energy-use behaviour was evaluated in terms of actual behaviour which was measured as the total number of hours for which respondents used electrical appliances and different types of transportation. However it is also important to mention that making measurements of tendency behaviour enable this thesis to take account of the differences between behaviour at home and on holiday. Hence in order to gain a clearer picture of the impact of tourist behavior on the environment suitable for comparison with other studies, further research could focus on quantifying the environmental impact of other kinds of actual behaviour (*e.g.* reusing towels or recycling).

It is important that future research involving the concept of EF gives consideration to the broader EF of tourism not just in terms of energy consumption but also of all the other kinds of resources used in tourism. In short, we need to develop an understanding of the whole system that it would be also interesting to compare the results of different studies into the total EF of tourism.

This study has addressed a gap in the existing literature by exploring the relationship between the energy-use behaviour of tourists and tourism businesses and the EF of Koh Samui's tourism industry thereby demonstrating clear links between these three things. The more energy tourists and tourism businesses consume the larger the EF for the tourism sector will be. However, there are also other external variables which influence energy-use and the size of EFs such as government policies and related regulations. Hence there is a need to investigate existing policies and any environmental projects associated with climate change tracking in the study location. It would be interesting to investigate how policy-makers and the commercial sector cooperate with each other to address environmental issues. There is a further need for similar research into other holiday destinations since EF and energy-use behaviour will differ from place to place. Moreover, any such projects may need to develop their own standard methods, indicators, and calculations in order to aid comparisons with other projects, areas, or countries.

More research is needed to obtain reliable results about sustainable practices associated with climate change and EF reduction in the business sector. This study's finding that SMEs often lack concern for their environmental impact is also worth exploring further. By doing so, it may be possible to shed more light on the factors which discourage or constrain businesses from taking positive action to reduce their environmental impact.

Future research should also take account of issues such as the promotion of investment in energy-efficiency programmes and renewable energy sources or the development of collaborative networks to help businesses reduce their carbon emissions and campaigns to encourage consumers to behave in more environmentally-friendly ways.

Finally, the most obvious area requiring further research is highlighted by one of the key findings of this study: namely that tourism relies heavily on fossil fuels which generate vast amounts of CO_2 emissions and lead to larger EFs. In order to make energy-use and tourism more sustainable we need to find alternative energy sources which can replace fossil fuels. Thus, further studies should investigate the availability and viability of alternative energy sources as well as the technology needed to harness them effectively. It is important that future research outlines the key challenges presented by the introduction of renewable energy sources and strategies which can encourage the tourism industry to adopt them and so reduce its EF. For example, future studies could focus on how solar energy can be effectively used by the hotel industry or how technology and building design can be used to keep living spaces at comfortable temperatures without the need for energy-intensive air-conditioning or heating systems.

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APPENDIX 1

Tourist Questionnaire

[Next page]

UNIVERSITY OF EXETER

Energy Policy and Planning Office MINISTRY OF ENERGY

มหาวิทยาลัยวลัยลักษณ์ Walailak University

Tourist Questionnaire

This research is a part of my doctorate. I am conducting the research into how people travel and their energy use in their travel. This study is funded by the Energy Policy and Planning Office, Ministry of Energy. All data from this survey will be analyzed and treated as confidential. Your help in completing this questionnaire is greatly appreciated.

Section I: General Information about your travel

1. How did you travel to Koh Samui? (Please tick <u>one</u> only)

❑ A packaged tour (all transport and accommodation arranged)
❑ A semi packaged tour (only part of the above)
❑ Independently
❑ Others (please specify) ………………………..

2. How long do you plan to stay in Koh Samui in total? …………… Total nights

3. How many people are there in your group (including yourself) ………. Person

4. Are you travelling?
❑ Alone ❑ With friends ❑ As a couple ❑ With family (adults and children)

5. Please respond to the following statements about how you get to Koh Samui

I flew from ……………………. (**City name** of your original country)
to ❑ **Bangkok** ❑ Other, please indicate …………………………………
from destination above, **how can you travel to Koh Samui** ?

❑ I **flew** directly from Bangkok to Koh Samui
❑ I went **by train** from Bangkok to ferry port
❑ I went **by Bus** from Bangkok to ferry port
❑ I went **by private car** from Bangkok to ferry port
❑ I **flew** from ………………………..… (City's name) to …………………. (City's name) and traveled by ferry to Koh Samui
❑ Others, please indicate …………………………………

6. Which one of these best describes the main purpose of your visit to Koh Samui?

❒ On holiday away from home ❒ On a day out/day-trip from home

❒ Visiting friends or relatives on holiday ❒ On a business trip

❒ Attending a conference / exhibition ❒ Others, please indicate ……………………

7. According to accommodation where you stay during your vocation in Koh Samui;

The name of accommodation Length of stay (days)

…………………………...…… …………………

…………………………...…… …………………

What type of accommodation which you mention above?

❒ Luxury hotel/Superior class hotel ❒ Guest house/Bungalow

❒ Bed and Breakfast/ Host Accommodation ❒ Eco-lodge

❒ Staying with friend/relative ❒ Others, please indicate ……………

Section II: You and Energy Consumption

8. Please, select all type of energy use activity or electricity appliances you have involved on this holiday.

❒ Lighting ❒ Air Conditioning ❒ Hot water production

❒ Cooking ❒ Refrigeration ❒ Television

❒ Laundry ❒ others, please indicate ………………

9. Approximately, in 24 hours how many hour totally do you stay in accommodation room? ………………. Hour(s)

10. Approximately, how many hours do you use air conditioner?

10.1 Daily time ………..… hours/day 10.2 Night time …………… hours

11. What is your set-point temperature of air-conditioned rooms (your flavor temperature)?

❒ < 20 ˚C ❒ 20 ˚C ❒ 21 ˚C ❒ 22 ˚C

❒ 23 ˚C ❒ 24 ˚C ❒ 25 ˚C ❒ >25 ˚C

12. Approximately, you take a bath with warm water ……………… time(s)/day and

13. Approximately, you take a shower with warm water ………..… time(s)/day.

14. What mode of transportation you use along your holiday in Koh Samui? (Please tick **<u>any</u>** that apply) And could you please estimate your daily travel hours in each type of them?

	Hours in total	**Didn't use it**
❒ A Pick-up Truck		
❒ Rental Motor Bike		
❒ Private Transportation		
❒ Taxi		
❒ Boat/ Ferry/Sea trans		
❒ Other…………………		

15. Which of the following have you visited/participated in so far? (Please tick **any** that apply) And please also indicate location, and how often you participate in each activity?

	Participation (times in total Hours)	Location	Didn't do it
❒ 1.Sightseeing			
❒ 2.Swimming (Seaside)			
❒ 3.Elephant Trekking			
❒ 4.Snorkeling/ diving			
❒ 5.Canoeing/kayaking			
❒ 6.Cruise,travelling to island nearby Samui with tour guide			
❒ 7.Shopping			
❒ 8. Joining Nightlife , Club			
❒9. Others, please indicate ………………………..			

Section III: You and Environment Issues

16. How would you describe your level of concern about global environmental problem specifically in energy use? (Please circle one that apply)

Extremely concerned 5 4 3 2 1 **Not concerned at all**

17. How would you describe your level of commitment to act on energy saving and decrease environmental problem such as global warming, energy scarcity etc.?

Totally committed 5 4 3 2 1 **Not committed at all**

18. Please state how much you agree or disagree with the following list of statements (Tick **one** box only for each statement).

	Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**
1. Reducing environmental impacts is important to tacking global warming and climate change.	❒	❒	❒	❒	❒
2. I always feel comfortable to follow the guidelines and support environmentally friendly programmes at my destination.	❒	❒	❒	❒	❒
3. It's not the tourists' responsibility to pay attention to energy shortage during their trip.	❒	❒	❒	❒	❒
4. Energy should be part of the environmentally friendly practice of tourism business.	❒	❒	❒	❒	❒

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
5. Honestly, the energy saving campaigns quite bothers me when I'm on holiday.	❒	❒	❒	❒	❒
6. Holidays are a time when I don't have to think about energy crisis.	❒	❒	❒	❒	❒

19. Please, check all lists which describe your behaviour, when you are at home and on your holiday.

Energy Consumption Behaviou	**At Home**					**On Vacation**				
	Always	***Usually***	***Sometimes***	***Rarely***	***Never***	***Always***	***Usually***	***Sometimes***	***Rarely***	***Never***
1. Keep the heating (or the air conditioner) on for most of the day.										
2. Take a bath rather than a shower.										
3. Turn off the light, when I go out.										
4. Need to wash your bath towel after each day's use.										
5. Save energy such as electricity, gas and petro etc as much as I can.										
6. Bring empty bottles to a recycling Bin.										
7. Willing to pay more for environmentally - friendly product.										
8. Worry about electricity bill.										
9. Use public transportation.										
10. Prefer to use car.										

20. For this trip, how well do you feel you have been kept informed about energy saving campaigns in Thailand?

❒ Extremely well ❒ Very well ❒ Quite well
❒ Not very well ❒ Not well at all

21. How supportive are you for using energy from the other alternative sources of energy such as solar cell, wind energy, water energy etc to serving tourists in Koh Samui?

❒ Extremely Suportive ❒ Very Supportive ❒ Quite Supportive
❒ Not very Supportive ❒ Not at all

Last Section: About You

22. How old are you? ……….. years old

23. Please indicate your gender ❒ Male ❒ Female

24. Please indicate your marriage status

❒ Single ❒ Married ❒ Divorce ❒ Widow ❒ Others …………..

25. How many adults and children live in your household?

Adults ………………. Children ………………… (under 18 years)

26. Working Status

❒ Employed full-time ❒ Employed part-time ❒ Currently unemployed

❒ Retired ❒ Other

……………………………………………..

27. What was your highest educational qualification?

❒ Up to three years secondary or high school ❒ Secondary or high school

❒ Bachelor's ❒ Master's

❒ Doctorate ❒ Others.…………………………..

28. Please state your approximate monthly household income? ………………… US$

29. What is your country of origin? (Please, enter)……………..…………………………

30. Are you a member of an environmental group e.g. WWF, Friend of the Earth etc.?

❒ Yes ❒ No

Appendix 2

Business Questionnaire

[Next page]

Business Survey

****

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Introduction

This research is a part of my doctorate. I am conducting the research into levels of energy consumption and sustainable practices associated with energy consumption in the tourism industry in order to integrate this part of study into the calculation of the ecological footprint. My study is funded by the Energy Policy and Planning Office, Ministry of Energy. All data from this survey will be analyzed and treated as confidential. Your help in completing this questionnaire is greatly appreciated.

Part I: About your business

1. Company Name ………………………Year of establishment …..…………………………..

2. Category of business

❒ Hotel (please go to question no.3)

❒ Tour operation (please go to question no.4)

❒ Restaurant (please go to question no.4)

❒ Others, Please indicates………………(please go to question no.3)

3. A number of visitor rooms ……………………

4. Occupancy rate ……………..% / year

5. A number of full time staffs ______________ and part-time staffs ______________

Part II: About the Energy Sources and Quantity of Main Fuel Using for Your Business

6. Energy source use by your business (it can be more than 1 source)

❒Electricity ❒Petrol

❒Diesel ❒LPG

❒NGV ❒Others, Please indicates………………

7. Average monthly energy consumption or energy bills (it can be unite of energy or the expenditures)

Energy Sources	Electricity	Petrol	Diesel	NGV	LPG for Vehicle	LPG for Cooking
Quantity	……kWh	…….litre	…….litre	…….litre	…….litre	…….Kg
Expense (THB)						

8. Number in total of car using for your operation ……………………………………………

Part III: Environmental Management Related with Energy Use

9. Waste management

9.1 Average waste quantity _______________ Kilograms per month

9.2 Waste classification ☐ Yes ☐ No

9.3 Recycling ☐ Yes (How? Please specific)

____

☐ No

10. Area size of swimming pool …………………………Cubic meter

11. Average water use ………… Cubic meter/month or water bill………………Baht/ month

12. Sewage management

12.1 Sewage quantity ______________ Cubic Meter per month

12.2 Sewage management ☐ Yes ☐ No

12.3 Reuse ☐ Yes (How? Please specific) ________________________

☐ No

Part IV: Business and Attitude Related with Energy and Climate Change

13. Please respond to the following statements (Tick one box only for each statement).

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. We consider more alternative energy sources such as sun light, rain water, etc.	❒	❒	❒	❒	❒
2. We are aware that we have to take responsibility for global warming and climate change.	❒	❒	❒	❒	❒
3. As the nature of business, we have to put the priority on tourist's demand rather than energy saving schemes.	❒	❒	❒	❒	❒
4. Saving energy does not only cut costs down but also helps to save global environment.	❒	❒	❒	❒	❒
5. Recently, we have adopted environmentally friendly practices into our business plan.	❒	❒	❒	❒	❒
6. The cooperation between government and tourism business in Koh Samui make the climate change policy possible.	❒	❒	❒	❒	❒
7. Energy footprint measurement is impossible due to cost and technical limits.	❒	❒	❒	❒	❒
8. Only law and regulation can control businesses to achieve emission control	❒	❒	❒	❒	❒
9. Offering better value for customers and making our product more competitive	❒	❒	❒	❒	❒

Appendix 3

Business Interview Schedule

[Next page]

Semi-Structure Interview

1. How do you respond to the view that "almost half of the Thailand's carbon dioxide emissions come from energy we use every day - at home and when we travel. By saving energy we can all help prevent climate change**.**" Please explain your view.

2. Have you taken any type of initiatives to reduce the amount of energy used by this establishment, for instance, using technologies to increase the efficiency of air conditioning system, environmentally friendly policy etc.? Please describe.

3. Do you think that more legislation is needed for more responsible towards the environment in business operation? Why?

4. To what extent do you believe that demonstrating a commitment to saving energy will increase your appeal in the market and attract a wider customer base?

Appendix 4

Energy Checklist Form

[Next page]

The Checklist Form of Energy Consumption for EF Calculation

Category of Energy Consumption	*Energy Consumption*	*Unit for Analysis*	*Data Sources*	*Emission Factor and Sources*
Accommodation				
1				
2				
3				
4				
Transportation				
1				
2				
3				
4				
Activity				
1				
2				
3				
4				
Waste Management				
1				
2				
3				
4				

Source: Author