Low Carbon Hotels Towards Sustainable Tourism in Koh Chang and Neighbouring Islands, Thailand

Rachnarin Nitisoravut, Nalikatibhag Sangsnit, Jaraspim Dhiralaksh, and Vilas Nitivattananon

Abstract— *Tourism is considered as one of the most growing economic sectors, and also one of the emerging concerns faced by policy makers and stakeholders due to its potential implications to environment and climate change. Efforts should therefore be made to balance the economic benefits of the tourism industry and protection of the environmental values. This paper presents the results of a research, which developed guidelines for low carbon hotels in Koh Chang and its neighboring islands, under the full support by Designated Areas for Sustainable Tourism Administration (DASTA), Thailand. The guidelines include criteria and indicators for measuring resource use and carbon emissions of hotels and related enterprises, with participation of local stakeholders. Primary data were collected through field survey and unstructured interviews with key stakeholders. In addition, secondary data were gathered from review of related literature and existing supporting documents used in developing the guidelines. The analysis revealed nine categories ranging from policy and administration to carbon emissions, with each having several supporting indicators and criteria in the proposed guidelines. The results suggest that the success of implementing the low carbon guidelines depends primarily on management support and development of supporting systems such as monitoring and auditing, documentation and database, and capacity strengthening for staff and related personnel. Real experiences from on-going pilot applications of the guidelines are expected to improve effectiveness and efficiency of actual implementation of the guidelines, before it can be adapted as a formal low carbon standards for Koh Chang, and other tourism areas.*

***Keywords*— Carbon Emission, Criteria, Guidelines, Indicators, Low Carbon Tourism.**

1. INTRODUCTION

Nowadays, tourism sector is growing at a rate that potentially makes it a significant source of carbon emissions and environmental degradation due to its high demand on energy and other natural resources. Hotels as a part of tourism sector are major energy end-users [1]. With the concerns of hotels and carbon emissions, , the concept of Low Carbon Hotels (LCHs) is guided and applied in this study for solving aforementioned problems which is broadly accepted as a significant implementation to reduce carbon emission in hotels.

An LCH is a hotel based on low energy consumption, low pollution, and low CO_2 emission. Its core principle is to use energy efficiently, use clean energy technology and pollute less [2]. This LCH research can be implemented through the collaboration of different stakeholders and decision-makers including relevant government ministries and their line agencies, monitoring and evaluation experts, hotel owners and customers, and communities dependent on the hotel and tourism industry. The cooperation formed by these stakeholders would aim to achieve the activities of energy saving, conservation of natural resources and environments, community income, community development and sustainable tourism through the LCH guidelines developed in this study based on the natural and comminity features of Koh Chang and Neighbouring Islands. Koh Chang and Neighbouring Islands are designated as sustainable tourism destination in Thailand by the Designated Areas for Sustainable Tourism Administration (DASTA). In addtiion, there are some good hotel examples in Thailand applying the concept of Sufficiency Ecconomy which also leads the hotel towards sustainable tourism.

DASTA [3] was established as a public organization mandated to serve as a coordinator of sustainable tourism operation and integrated administration of valued tourism areas. DASTA provides mechanism that enables flexibility and promptness in joint-operations of government agencies or state enterprises. Consequently, DASTA is a major supporter for this study.

Koh Chang and its surrounding areas (Koh Mak, Koh Kood and other smaller islands) are regarded as the jewel of the Gulf of Thailand. This group of islands is located in Trat Province, Eastern Thailand, which is expected to become a world-class ecotourism destination. As of 2011, there were 147, 18, and 23 hotels in Koh Chang, Koh Mak, and Koh Kood, respectively.

To qualify as an LCH, the hotel needs to be assessed using an evaluation guideline that makes use of selected indicators and criteria such as, carbon footprint, energy consumption, total green area, building design, policy, administration management, pollution control, transportation, carbon emission, water consumption, and purchasing.

The aim of this paper is to present the results of

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developing the guidelines for implementing LCH management system for a growing tourism destination of Koh Chang and its neighboring islands in Trat Province, Thailand. The scope of the paper also covers the process of setting up the cooperation for developing the guidelines among key stakeholders involved in energy and environmental management, local culture, and international sustainable tourism; indicators and criteria for assessment of the LCH; results of a pilot assessment with adjustments; and recommended procedure for implementing the LCH management system. The LCH management system was developed to be implemented as a pilot initiative for the study area under the support of DASTA.

2. LITERATURE REVIEW

Hotel operations are one of the major carbon dioxide emitting industry through its large consumption of energy, water and non-renewable resources. Many studies posit that sustainable development and management can help reduce CO_2 emissions through effective energy and environmental management policies [4], and related standards/indicators/guidelines can also help reduce carbon emissions.

Likewise, a green hotel indicates an eco-friendly hotel operation through good practices in water and energy use conservation, environmentally purchasing policies, and waste minimization. While low-carbon activity is defined as a smallest output of greenhouse gas (GHG) emissions into the ecosphere, especially CO_2 [1].

Low-carbon tourism, an offspring of low-carbon economy, is a form of eco-tourism based on low pollution, low power consumption, and low emission. Its aims are to improve the quality of tourism services, to protect local nature and cultures, and to make positive contributions to local population [2].

In comparison between the green hotel indicators and low carbon activity and tourism's definition, the principle of low-carbon is more concentrated on low energy consumption which means through many methods to consume less energy, for example, using the local raw materials to reduce the transportation from outside, etc. Therefore, in this study, it is focused on the principle of LCH which leads the hotels and areas towards sustainability.

Related Guidelines and Standards

There are several international and national studies related to the development of sustainable hotel guidelines. Some guidelines are set up as a program for any interested stakeholders, some are set as an initiative to proceed to any advanced level of awards, and some are conducted as like a benchmarking for comparison purpose. However, the related guidelines and standards are summarized in following paragraphs.

The Energy Conservation and Carbon Reduction (ECCR) was developed and adapted for the hotel industry in Taiwan by Teng, et al. [4]. The development of ECCR involved interviews with the senior hotel managers, environmental specialists and governmental officials to identify the framework, structures and determine weights of criteria through a questionnaire survey. Such collaboration among specialists from different fields is a good combination to scrutinize the indicator's framework and weights based on their expertise. The ECCR consists of 7 categories: (i) communication and participation; (ii) top management commitment; (iii) energy; (iv) water; (v) waste; (vi) building; and (vii) purchasing which cover most of the major concerns in this study. There are thirty-two (32) indicators were used to identify and prioritize ECCR contributions. The results revealed that top management commitment is the most significant factor in determining the success of ECCR implementation. It means that the success of passing ECCR standard mainly depends on the executives' responsibilities, actions and policies which will be perceived to all subordinates through their, especially, actions.

EarthCheck [5] is conducted mainly for benchmarking environmental and social performance. This is applied as like a benchmark to identify the level of each case in terms of environment and social aspects. Using its own set of indicators, it compares whether these indicators are lower, equal or better than baseline level. Indicators can be divided into eight categories: (i) policy; (ii) energy; (iii) water; (iv) waste; (v) community; (vi) paper; (vii) cleaning; and (viii) pesticides. However, it can be seen that the EarthCheck does not cover the building, communication, and purchasing aspects.

The Green Key Eco-Rating Program [6] was designed to recognize hotels, motels, and resorts that have outstanding sustainable initiative improvement. The full online assessment contains 160 questions divided into five main areas: (i) corporate environmental management; (ii) housekeeping; (iii) conference and meeting services; (iv) food and beverage services; and (v) engineering and maintenance. This guideline is quite interesting about online assessment which makes more channels for approaching by any stakeholders or participants to do the assessment. Moreover, it is convenient for the program to update news or communicate to the program attendants.

The Green Seal Environmental Standard [7] is a guidance process for lodging properties seeking Green Seal certification. Some requirements are needed to meet its initial certification level, such as organization and regular compliance. Other requirements are listed to pass bronze level, silver level and gold level, respectively, using the following major indicators: waste minimization, reuse and recycling; energy efficiency, conservation and management; management of freshwater resources; wastewater management; hazardous substances; environmentally and socially sensitive purchasing policy; continuous improvement plan; and any three (3) of the following: energy reduction; sustainable building; renewable energy; greenhouse gas reduction; zero waste; green cleaning; water conservation. For the overall of this Green Seal Environmental Standard, it covers most of all related factors according to the environment and energy aspects which is a good reference for LCH case to review.

The Green Building Initiative [7] consists of many categories, which covers for major scopes such as

energy; water; resources; emissions, effluents and pollution controls; indoor environment, and environmental management system. This initiative is concentrated on environmental aspect more than energy point of view.

The Green Tourism Business Scheme (GTBS) [8] includes the criteria of management; communication; hydro energy; waste; purchasing; transportation; wild life; and landscape.

On the other hand, the Certification for Sustainable Tourism (CST) [8] covers for only 4 categories: physical-biological environment; hotel facility; customers; and socio-economic environment. It shows that the CST emphasizes on tourism especially for the hotels.

The Leadership in Energy & Environmental Design (LEED) for Existing Buildings [8] includes 5 categories: sustainability; water; energy; materials and resources; and indoor environment.

The Nordic Swan Label [8] is a unique of eco-labeling used by Nordic Countries, which covers the areas of energy, water; chemicals; consumables and raw materials; finishing and fixtures; waste management; and transportation.

Green Globe 21 [8] is a global certification, which is based on the following international standards and agreements: Global sustainable tourism criteria; Global partnership for sustainable tourism criteria; Baseline criteria of the sustainable tourism certification network of the Americas, Agenda 21 and principles for sustainable development endorsed by 182 governments at the United Nations Rio de Janeiro Earth Summit in 1992, ISO 9001/14001/19011 (International Standard Organization).

The Green Leaf Standard [8], [9] was established as a guidance to protect and conserve the environment for hotel tourism in Thailand. The criteria are classified into 18 categories: policy and communications; human resource development; committee; target and plan; waste management; efficiency and energy consumption; water consumption; kitchen and restaurant; laundry; purchasing; indoor air quality, air and noise pollution; water and its quality; spa and healthy massage; fitness center, swimming pool and outdoor activities; security; environmental impact; corporate social responsibilities within the community; and cultural support. This guidance is a good study to review in terms of supporting to conserve the environment which can be applied for its principle to the LCH study.

The Oregon Economic and Community Development Department [8] developed benchmarks and criteria for green hotel certification in Thailand. The initial phase of its project identified and compared existing certification programs in Thailand and other international certification programs, including the Green Leaf Program (from Thailand); Green Tourism Business Scheme (from Scotland); Certification for Sustainable Tourism (from Costa Rica); Energy Star (from U.S.); LEED for Existing Buildings (from U.S.); Green Leaf Eco-Rating Program (from Canada); Nordic Swan Label (from Nordic Group of Country); ECOTEL; Green Globe 21; and International Hotels Environment Initiative. Each program consists of different categories and indicators.

Green Building [8] under Thailand Energy Award 2011 is a campaign to promote energy conservation in buildings. The scoring criteria used are energy efficiency; renewable energy; water efficiency; environmental protection; indoor environmental quality; other green features and innovation. This award is specified for the standard of energy field, specially, in building.

Each guideline/standard covers to a various categories of indicators and criteria depend on their scope and purpose of interest, area to be apply for, etc. However, in this research, the categories, indicators and criteria will be applied from the mentioned related reviews, theories, and the definition of low carbon tourism, low carbon activity.

Certification and Auditing Process

Some standards and guidelines do not end up its qualification as only guidance, however, it can be developed further to certify or define it as a certification afterward. Hereinafter, there are some references that mentioned about certification and its auditing process. Each certification/program has different processes of auditing and weighting to judge a case. Some have various levels of certification depending upon the ability and capability of the attendant.

The Green Seal Environmental Standard [7] is divided into 3 levels: bronze; silver; and gold. It requires applicants to at least meet some basic requirements to qualify for the initial certification level. More challenging requirements are set to qualify for the higher certification level.

GTBS [8] has 3 levels of certification: bronze, silver, and gold, and each level requires for significantly higher reduction of environmental impacts.

Certification for Sustainable Tourism (CST) [8] is divided into 6 sustainability levels (from 0 to 5 by weight percentage), evaluated through a checklist questionnaire consisting of 153 questions. The range of weight percentage starts from less than 20 to more than 94.

LEED [8] certification levels are separated into 4 levels based on 100 possible base points: certified, silver, gold, and platinum. The scoring range varies from 40-49, 50-59, 60-79, and above 80, respectively.

ECOTEL Certification [10] consists of five areas or spheres: sustainability commitment; waste management; energy management; water management; employee education and community development. These areas encompass the processes, systems, and practices to ensure the sustainable operation in hotel through an audit under each of these globes based on checklist survey.

The ISO:19011 certification process [11] involves collecting data by appropriate sampling and verifying (audit evidence), evaluating against audit indicator (audit findings); reviewing; audit conclusion; preparing, approving and distributing the audit report; completing the audit; and conducting audit follow-up.

There are 3 processes of ECOTEL certification [10]: (1) property assessment, which is conducted through interviews, physical inspection, and data collection; (2) roadmap for certification, which is considered through

targets, technology, and workshop trainings; (3) and audit, which is the final process to conduct and award the certification.

The assessment process of ISO: 14015 [12] involves planning the assessment, collecting and validating information, evaluating the information, and reporting on the assessment.

The environmental auditing process of Green Leaf Hotels Standard [9] consists of 3 key steps: (1) the screening process in which 13 questions related to environmental restrictions are paneled; (2) the qualifying process through which environmental activities in hotels are identified; and (3) the grading process, which the environmental auditing in operational process of hotel are divided into 11 sections as mentioned earlier. There are 2 scoring standards. The first standard scores range from less than 45.34% to more than 77.99% and can receives from 1 leaf to 5 leaf certification. The second standard scores range from less than 52% to more than 66.5% and can receive from 1 leaf to 5 leaf certification.

The guidelines and standards can be developed or implement further to a process of certification which includes auditing process, scoring and certifying. This research project also ends up with recommended guidance for certification and auditing process.

3. METHODOLOGY

The overall methodology of the process in developing the guidelines is organized into 4 phases as follows:

Phase 1 consisted of the studies and literature reviews related to low carbon guidelines and standards, the survey, on-site observations, and interviews with the key stakeholder representatives such as the hotels or resorts, local goverments. This phase is the initial step in studying all related international and national literatures related to tourism, environment, low carbon, and energy. On-site observations of the study areas and interviews with key stakeholders, which included owners of tourism businesses and its related enterprises, policy makers and relevant local government officers were carried out in April and July 2012. Eight small and medium hotels in Koh Chang and Koh Mak were visited during those periods. The main objective of this phase is to acquire the baseline information about the study area, and the business owners' opinions about the future LCH research, the nature of their business, their knowledge and understanding about low carbon economy, and business constraints. The expected output from this phase is to obtain a preliminary draft of the LCH guidelines. It took 2 months for this phase (April to July 2012).

Phase 2 involved the development of categories, indicators and criteria for the draft guidelines, with more detailed survey and interviews. This phase continues the process of data gathering started in phase 1, with more literature reviews, additional surveys adjusted to each study area, actual application, economic competitiveness, and other related concerns. The number of each category, indicators and criteria was taken into account for their scoring and weighing. The expected output from this phase is to obtain a detailed draft of the guidelines based on scoring and weighing of indicators and criteria. This Phase 2 took 3 months for developing the categories, indicators, and criteria.

Phase 3 was a pilot test of the developed guidelines (from phase 2). Adjustments were also made based on the lessons learned and inputs from the implementers and stakeholders. The guidelines developed from phase 2 were tested as a pilot on medium and small hotels because it is easier to approach the top management. The hotels do not have a large or complex organization of their management, therefore, there are better opportunities to meet, talk, discuss, and exchange some information, knowledge, and opinions with the top management or their representatives. Moreover, their feedback on this LCH research can be obtained through the actual actions, their mind and their responsibilities through a discussion and site observation. Based on the total number of hotels and time limitation, 12 cases in Koh Chang and 6 cases in Koh Mak were selected and then the test was conducted. Although the selected hotels are either small-sized hotels (less than 30 rooms) or medium-sized hotels (more than 30 rooms), each must possess working knowledge of energy consumption and conservation, having readiness and efficacy for continuous improvement, having interest and good understanding on energy planning for the organization, experienced in energy management, willing to network and exchange knowledge and experiences related to energy and environmental management. The pilot tests were carried out in September 2012 and conducted through a causal method as shown in Figure 1.

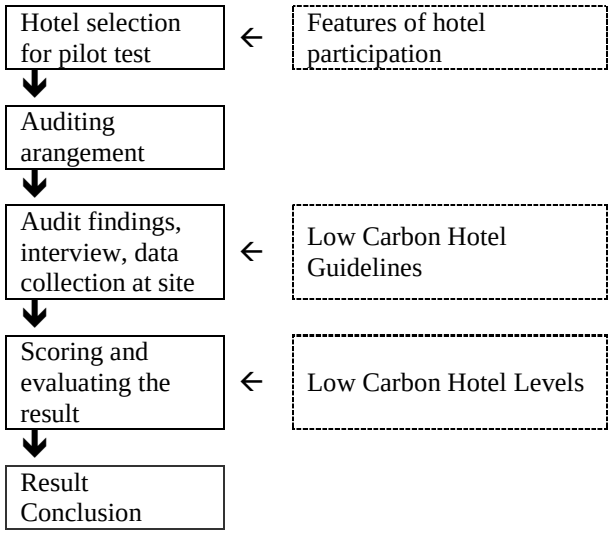

Fig.1. Causal Method for Testing the LCH Guidelines.

Phase 4 focuses on the dissemination of the LCH guidelines and implementation plan and procedure for LCH management system. The purpose of this phase is to present the final draft of the LCH guidelines from phase 3, and to get feedback/suggestions from the key stakeholders such as DASTA, the provincial government agencies, hotel owners/representatives, local governments to further improve the guidelines. A seminar was arranged in Koh Chang in November 2012, where to gather feedback and suggestions from key stakeholder-participants to improve the final draft of the

LCH guidelines. The agenda of the seminar focused on two main topics: (1) the appropriateness of the LCH guidelines in terms of indicators and criteria by case of Koh Chang and its neighboring islands; (2) the implementation plan and procedure for LCH management system. Moreover, the LCH research was also promoted and disseminated to all related key stakeholders during the seminar, and also through its website (www.lowcarbonhotel.webs.com) that provides some basic information about the research and updates for the research participants. It took 1 month for this phase.

4. RESULTS

Phase 1 - Literature reviews related to LCH guidelines and standards including preliminary survey and interview selected key stakeholders.

There are many different certifications, standards, and guidelines that were reviewed. A summary of categories containing each guideline is shown in Table 1. The result from phase 1 as mentioned in the section of methodology (phase 1) is the preliminary draft of LCH guidelines which contains the following categories: (1) policy and administration, (2) energy management; (3) transportation; (4) tourism activities and participation; (5) building and nearby area; (6) procurement and inventory management; (7) waste management; (8) water management; and (9) CO_2 emission. These categories were adapted from the literature as referred in Table 1. The draft of LCH guidelines can be revised after testing on-site. From site visit and stakeholder interviews, it revealed that the guidelines should be universally acceptable and can also promote the image of participating hotels as supporters of sustainable tourism. It also revealed that the guidelines' process should not be complicated in terms of hotel operation. Furthermore, the costs of certification should be reasonable and can be afforded and achieved by different sizes of hotels. Lastly, the guidelines should benefit to all related stakeholders, including tourists, hotel owners, and communities dependent on the hotel and tourism industry, and the environment.

From the site visit, the characteristics of the hotels in Koh Chang and Koh Mak were revealed to be different. The hotel businesses in Koh Chang are mainly focused on tourism business operation, while the hotels in Koh Mak are focused on alternative energy technology and its application, and family business operation.

Table 1. Certifications/Standards/Guidelines Summary versus Categories from the Literature

Category	Certifications / Standards/ Guidelines										
	ECCR	Earth Check	Green Key	Green Seal	Green Bldg.	GTBS	Nordic	Green Globe	GTZ	Thai Energy	Green Leaf
Administration-Management	✓			✓		✓					
Policy-Developing Plan		✓		✓							
Communication-Participation-Society	✓	✓				✓		✓			✓
Purchasing	✓			✓		✓					✓
Environment-Nature-Animals			✓		✓	✓		✓		✓	✓
Energy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water	✓	✓		✓	✓	✓	✓			✓	✓
Waste-Waste Water	✓	✓		✓		✓	✓	✓	✓		✓
Building-Indoor Environment	✓			✓	✓					✓	✓
Chemicals-Hazardous Substances-Flammable		✓		✓			✓				✓
Pollution (Air, Sound)					✓			✓			✓
Transportation						✓	✓		✓		
Resources		✓			✓		✓				
Cleaning-Household		✓	✓	✓							
Services			✓								
Indicator Calculation		✓		✓					✓	✓	

Phase 2 - Development of categories, indicators and criteria for a draft of the guidelines, with more detailed survey and interviews

After having draft LCH guidelines with its draft of scoring and weighting, it is used for detailed survey in Koh Chang and Koh Mak. The development of categories, indicators, and criteria for the LCH guidelines were carried out through the second phase by adjusting them with the results from site visit, interviews and through the scoring and weighing. Eight categories were developed for the guidelines: policy and administration;

energy management; transportation; tourism activities and participation; building and nearby area; procurement and inventory management; waste management; and water management. The last category is CO_2 emission, which necessitates further data collection and analysis. The results of scoring and weighing of categories, indicators, and criteria before and after the detailed survey are shown in Table 2.

Table 2. Developing categories, indicators and criteria for a draft of the guidelines (before and after the detailed survey)

Categories	Before detailed survey		After detailed survey	
	Indicator	Criteria	Indicator	Criteria
1. Policy and Administration	5	5/5/5/4/5	2	5/8
2. Energy Management	4	11/9/9/6	4	7/6/5/6
3. Transportation	1	5	2	6/5
4. Tourism Activities and Participation	3	3/4/5	2	1/5
5. Building and Nearby Area	1	9	3	5/7/7
6. Procurement and Inventory Management	3	4/3/3	2	5/5
7. Waste Management	1	10	4	10/5/6/5
8. Water Management	1	7	2	8/1
9. CO_2 Emission	4	1/1/1/1	3	1/1/1
Total	23	116	24	128

From Table 2, the details of each category are explained as following.

Category 1 Policy and Administration

Policy and administration of the hotel are important factors that help communicate policies developed from top management or hotel owners to its supervisors and personnel on ground that implement or observe the hotels' policy on low carbon hotel and environmental sustainability. Since some hotels do not have the official written policy (due to having staff from different countries, which may or may not be legally documented), policies are often communicated verbally. However, poor or miscommunication can easily lead their personnel's poor or wrong understaning and interpretation of the rules. Officially written policies in Thai, English and the migrant workers' own languages should be published by the hotel to ensure staff's correct attitude and approach on running and maintainig a low carbon hotel. Meanwhile, many small and medium-sized hotels that are family businesses have simple administration and management systems,. Thus, these type of businesses tend to avoid complicated actions, complex systems, and documentation.

Policy and administration is required in 2 indicators: (1) policies towards low carbon and environmental & social sustainability; and (2) personnel and organization development.

Category 2 Energy Management

Energy consumption is a major concern for establishing low carbon hotels. Electricity expenses remain as one of the largest costs in running a hotel business. Hence, energy management is a key knowledge and skill for hotel operators to effectively and efficiently manage their hotel, in terms of energy expenses, energy consumption control, energy efficiency improvement, energy technology, operation and maintenance, energy policy, and use of renewable energy. Some of the hotels the project visited were still using energy inefficient equipment. Installation of power meters in different areas of the hotels can save, monitor, control and manage energy consumption, and thereby also curb the hotels' CO_2 emission. Energy efficient policies and renewable energy technology should be promoted and campaigned to entice more establishments to follow the principles of a low carbon hotel.

Energy management can be identified into 4 indicators: (1) energy efficiencies; (2) energy consumption for air conditioning system; (3) energy consumption for electrical lighting system; and (4) energy consumption for other systems and use of renewable energy.

Category 3 Transportation

Transportation is directly related on how much carbon is emitted into the environment through vehicular consumption of oil and gas. Alternative fuels such as biofuel or gasohol can help reduce CO_2 emission. However, access to alterative fuel is limited to hotels operating in Koh Chang area since the islands are 8 to 82 kilometers away from the nearest coast. Some hotel operators are also concerned by quality of engine run by biofuels. In the meantime, mass transportation, walking, bicycling, and carpooling can help the hotel being LCH.

According to the guidelines, transportation requires 2 indicators: (1) transportation management; and (2) supporting and persuading measure for an optional reasonable transportation.

Category 4 Tourism Activities and Participation

Supporting tourism activities and participation depends on site area, landscape, and group of tourists. Initiating environmental conservation activities can encourage the growth of eco-tourists, and also may help reduce carbon dioxide emission. Such activities can be in the form of low carbon menu, mountain biking tours, kayaking, among others.

Tourism activities and participation category includes 2 indicators: (1) number of sustainable tourism activities; and (2) participation and support for implementation.

Category 5 Building and Nearby Area

The hotel building and its surrounding landscape are factors related to energy consumption inside building when it is occupied after construction. If the site area and landscape, including green area, are taken into account for building design, then, CO_2 emission can be reduced. Moreover, building management, material construction and technology application also affect energy consumption significantly through more effective and efficient heat insulation, proper window orientation and ventilation, building orientation, and building color and reflectiveness.

Building and nearby area consists of 3 indicators: (1) building design and technology applied for reducing energy consumption; (2) area and landscape; and (3) building management.

Category 6 Procurement and Inventory Management

Procurement and inventory management need a good logistics operation practices to reduce the environmental impact. More so since all of the goods and, most of the personnel, needed to run the hotel in Koh Chang are taken from the mainland. Sustainable purchasing and inventory or green procurement practices are necessary to take into account in achieving low carbon hotel status. This leads stakeholders to also realize how a sustainable hotel can help in maintaining low carbon emission.

Procurement and inventory management includes 2 indicators: (1) purchasing, materials and inventory management; and (2) reducing procurement and local procurement.

Category 7 Waste Management

Waste management is very important to relieve and reduce the environmental impact caused by wastes. Presently, there are many methods and solutions adapting to reduce the amount of waste, as like as, biogas, bio fertilizer, animal food, reduce, reuse, and recycle method.

Waste management is composed of 4 indicators: (1) Waste management efficiencies, (2) Waste reduction inside the room and bathroom, (3) Waste reduction in service center: kitchen, meeting room, conference room, outdoor activities), (4) Waste reduction inside the office and lobby.

Category 8 Water Management

Proper water management is required to address concern on metered water consumption and data collection, and water use efficiency. This helps hotels to manage and control water consumption of ground water resources in the island.

Water management indicator comprises of (1) water use efficiency; and (2) water consumption per tourist per day.

Category 9 CO_2 Emission

The eight (8) categories as aforementioned are the checklist questionnaire, however, category 9 on CO_2 emission, needs calculation and analysis of historical data from hotel (answerable via detailed questionnaire). CO_2 emission is calculated in accordance with: (1) Power and heat (electricity and fuel usages); (2) transportation (fuel consumption); and (3) waste management based on disposal methods.

Weighting Distribution of Guidelines' Indicators and Criteria

After scoring and weighing the criteria and indicators adjustment in according to the results of detailed survey and stakeholder interviews, the distribution of weight among categories are shown as a bar graph in Fig.2.

The highest weight was given to Category 2: energy management (20%), and Category 7: waste management (20%). Next is Category 9: CO_2 emission which has 15% distribution compared to other categories. Category 1: policy and administration, Category 4: tourism activities and participation, and Category 8: water management were weighted for 10% each. The remaining 3 categories have less significant weights to the total scores of all categories as 5% weight distribution that are transportation, building and nearby area, and procurement and inventory management.

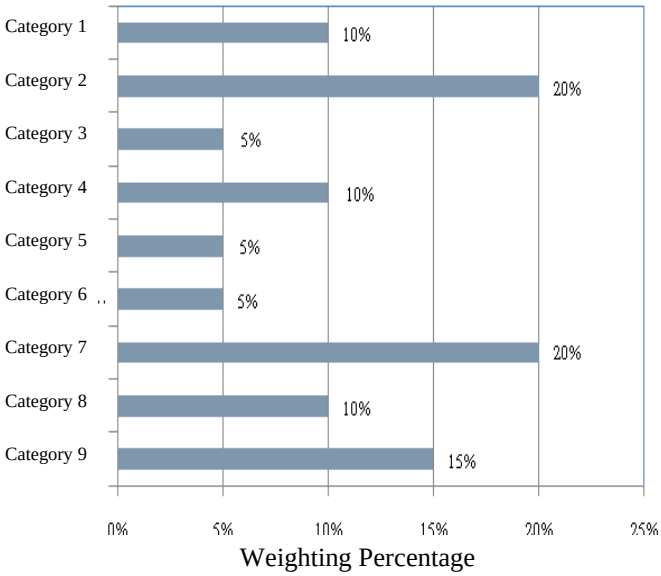

Fig.2. Weight Distribution among the Categories of Indicators

Phase 3 - Pilot test the developed Guidelines and adjustment per lessons learned

This is a pilot stage of the draft LCH guidelines. As mentioned, twelve (12) hotels in Koh Chang island and 6 hotels in Koh Mak island were selected and considered for the pilot tests in September 2012. In this study, the LCHs can be divided into possible 4 levels: Platinum, Gold, Silver and Bronze, and via 2 types of scoring.

Type 1 is based on the overall scores earned from categories 1-8 counting from each score of indicators as presented in Table 3. Indicator 9 was excluded from consideration because of the incomplete data during analysis so that a fare evaluation could be obtained for all participating hotels.

Table 3. Scoring Type 1

Level	Definition	Total Score (%) Of Category 1-8
4 – Platinum	Excellent Low Carbon Hotel	>90
3 – Gold	Good Low Carbon Hotel	80-90
2 – Silver	Medium Low Carbon Hotel	70-80
1 - Bronze	Beginning Low Carbon Hotel	60-70
0-Underweight	Need to improve	<60

Result of pilot test and scoring based on Type 1 is shown by bar chart in Fig.3.

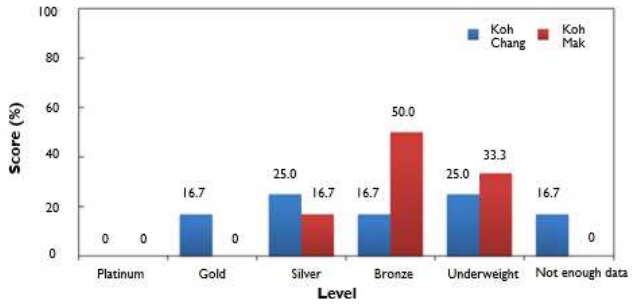

Fig.3. Result of Pilot Test based on Type 1

Based on scoring Type 1, the result showed that there is a normal distribution among the 18 pilot cases. None of the hotels can achieve the platinum level. The total score of hotels in Koh Chang that can achieve the gold level is 16.7%, but none of the hotels in Koh Mak can reach to this level. For silver level, there are 25% and 16.7% scores that the hotels in Koh Chang and Koh Mak can achieve, respectively. The highest score that the hotels in Koh Mak can achieve is 50% for bronze level, while hotels in Koh Chang achieved 16.7% score of hotels in the same level. However, there are some 25% and 33.3% scores of the underweight level of hotels in Koh Chang and Koh Mak, respectively.

Type 2 is based on selected categories for classification with a score of more than 75%, and a minimum score at 50% of each category (see Table 4). It should be noted that category 9 was again excluded based on the same reason. The result of the pilot test and scoring based on Type 2 is shown by bar chart in Fig.4.

No hotel in Koh Chang and Koh Mak was able to reach Platinum level and Bronze level. The highest scores are in underweight level - 41.7% for hotels in Koh Chang and 83.3% for Koh Mak. None of the hotels in Koh Mak was also able to achieve the Gold level while the hotels in Koh Chang were able to achieve Gold level up to 8.3%. For Silver level, the total hotels in Koh Chang and Koh Mak gained the scores of 33.3% and 16.7%, respectively.

Table 4. Scoring Type 2

Level	4 Platinum	3 Gold	2 Silver	1 Bronze	0 Underweight
Definition	Excellent Low Carbon Hotel	Good Low Carbon Hotel	Medium Low Carbon Hotel	Beginning Low Carbon Hotel	Need to improve
Category 1	++	++	++	+	+/-
Category 2	++	+	+	+	+/-
Category 3	++	++	+	+	+/-
Category 4	++	++	+	+	+/-
Category 5	++	++	+	+	+/-
Category 6	++	++	+	+	+/-
Category 7	++	+	+	+	+/-
Category 8	++	+	+	+	+/-
Category 9	++	++	++	+	+/-
++ more than or equal to 75%					
+ more than or equal to 50%					
+/- less than 50%					

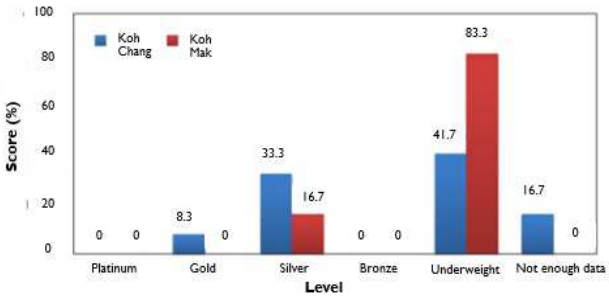

Fig.4. Result of Pilot Test based on Type 2

Phase 4 - Dissemination of the LCH guidelines and implementation plan & procedure for LCH management system

The purpose of this phase is to present the final draft of the guidelines and to get feedback and suggestions from key stakeholders. The potential is also to develop the implementation plan and also LCH certification process in the future. The seminar had participants comprising of 28 key stakeholders represented by hotel owners or representatives, DASTA, local government, and other agencies. The comments and suggestions can be generally aggregated into two main points:

(1) Appropriateness of indicators and criteria towards low carbon hotels. The feedbacks and suggestions are mainly about energy management concern on how to differentiate the break even point of efficient/saving appliances to electricity saving costs. Suggestions were also raised to consider not using any appliances which emit low carbon according to

categories of accomodation. Secondly, the guidelines should also be developed to be able to cover other business sectors such as restaurants. Lastly, in calculating the category of CO_2 emission, the benchmark used as reference for calculation shall be referred universally in the country which the results are able to be compared among each other without any bias.

(2) The implementation plan and procedure for LCH certification. Some organization should be established to handle, promote, and sustain this project in order to persuade parties who are interested in achieving LCH status. As of now, the LCH research is promoted through www.lowcarbonhotel.webs.com. The benefits of participating in the certification process should also be promoted and identified, especially, in terms of global marketing. The project should have a trial that runs for at least 1 year before starting to formally apply and implement it on more hotels, on larger scale (i.e., national and international). DASTA can monitor the feedback and results continuously. When the project starts running, DASTA's responsibities would cover assigning commitee for different sectors and roles that the hotel owners can also attend. The goverment sector should issue supporting policies and lend assistance in some activities related to the LCH concept, together with a training course or seminar.

5. RECOMMENDED IMPLEMENTATION PLAN FOR LCH MANAGEMENT

After getting feedback and suggestions on guidelines, the implementation plan and procedures is recommended by dividing into 2 main terms:

(1) Overall implementation plan and procedure for LCH as shown in Fig.5. It is divided into 3 steps as follows:

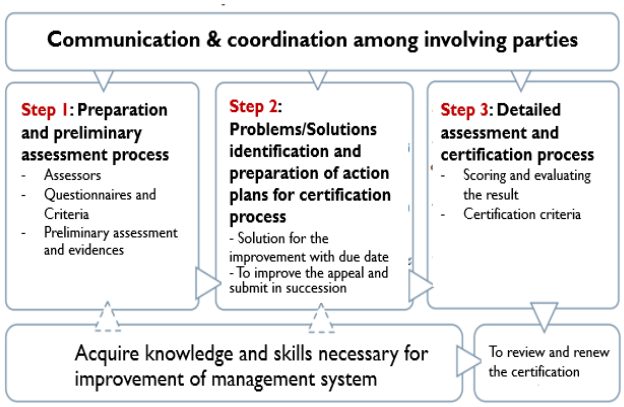

Fig. 5. Proposed Overall Implementation Procedure for LCH Management System.

Step 1: Preparation and preliminary assessment process is a preliminary stage for the hotel owner to handle the assessment process by themselves. This can be done by appointing staff to take responsibility towards LCH to prepare documents needed by the questionnaires, and to have an internal assessment of the hotel based on the questionnaires.

Step 2: Problem/solution identification and preparation of action plans for certification process is according to step 1. Regarding to the internal preparation and assessment, the hotel owner or hotel representatives can find the problems, faults, and solutions through the guidance of the questionnaires and also put up recommendations at the same time when all evidences and documents are submitted to the LCH committee before having a detailed auditing.

Step 3: Detailed assessment and process is implemented by an external committee who handle the LCH auditing and assessing the hotel participant, and then, scoring and evaluating the results for certification. Monitoring system will be taken regularly after certifying the hotel with LCH.

(2) The supporting process requires 4 main elements: format and supporting system; auditor; evidences, data and documents; and auditing and monitoring.

In addition, Fig.6 provides key steps to be taken for auditing, according to the suggestions from the dissemination seminar. Therefore, the implementation of monitoring, scoring, and auditing process in this study should be applied and developed further.

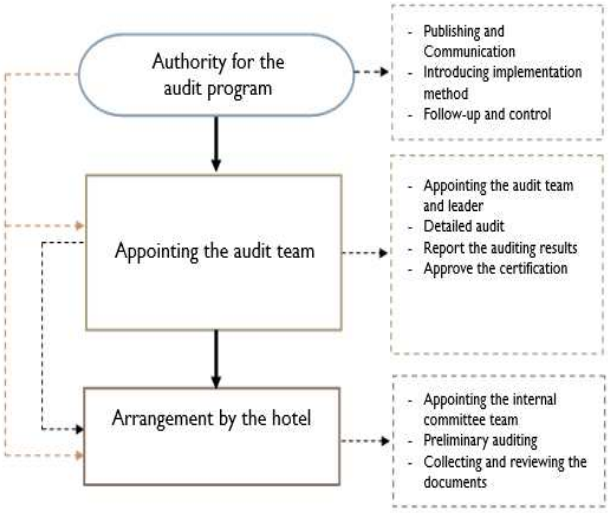

Fig.6. Recommended LCH Auditing Steps

6. CONCLUSION AND RECOMMENDATION

The development of LCH guidelines for tourism business in Koh Chang and its neighboring islands lead to a total of 9 categories, with 24 indicators, and 128 criteria, covering policy and administration to CO_2 emission calculation. The guidelines are based on those key factors, and also on good practices indicating low carbon emission within hotel operations and management, such as corporate commitment towards sustainability of tourism industry, energy management, water & waste management, and CO_2 emission to the environment. It is a simple yet effective set of guidelines that will benefit not only to the hotel owners, in terms of cost saving for business promotion and marketing, increase competitiveness and earned recognition, but also to the

environment.

The aim of developing the LCH guidelines for the future implementation is to reduce operation expenses, increase hotel competitiveness, and improve environmental quality. These aims need the participation of key stakeholders, in combination if adequate support in terms of legal and institutional frameworks for LCH. DASTA should be the main authority to announce and publicize the LCH research as a pilot project for a period (approximately 1 year) with potential and willing hotels, so improving indicators and criteria according to the practical use that can be achieved. The LCH guidelines and recommended supporting system developed in this study should be applied in the study area and may be adjusted and/or improved further to be more applicable in the area and other tourism destinations for possible improvement towards sustainable tourism.

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