THE LIFESTYLE CHANGE SOLUTIONS TO REDUCE THE INDIVIDUAL GREENHOUSE GAS (GHG) EMISSIONS FOR LOW CARBON CITY IN KHON KAEN, THAILAND

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Abstract

The low carbon city is the urban management to meet the target of city greenhouse gas (GHG) emissions reduction. There are two main solutions for low carbon city, technical solution, and lifestyle change solution. The first solution depends on knowledge of science and technology in the high budget. By the other solution does not depend on technical knowledge and high budget. It can proceed immediately by the people in the urban community. We proposed that human can change GHG emissions behavior in their lifestyle and these changes will be the significance solution for low carbon city at present and future. The objectives of this study were to investigate the conditions of the individual GHG emissions reduction behavior and propose the solutions to reduce the individual GHG emissions for low carbon city in Khon Kaen Municipality, Thailand.

This study was conducted by qualitative research. The finding indicated that there are six main conditions of the individual GHG emissions reduction behavior; personal characteristics, knowledge, attitude, motivation, role model, and equipment support. By these conditions, we provided the solutions to reduce the individual GHG emissions for low carbon city in Khon Kaen Municipality. Our solutions suggested to (1) provide the media that support people's knowledge and attitude improvement for GHG emissions reduction, (2) provide the activities that support people's motivation, (3) promote and reward for people who are outstanding for GHG emissions reduction, and (4) provide the equipment that support people to reduce GHG emissions.

Keywords: Low Carbon City, Lifestyle Change, Individual GHG emissions

1. Introduction

Article 2 in the Paris Agreement shows that international try to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and increase the ability for low greenhouse gas (GHG) emissions development. (United Nations [UN], 2015) The cause of the increase in the global averaged temperature since the mid-20th century is the increase in anthropogenic GHG concentrations. (Intergovernmental Panel on Climate Change [IPCC], 2007) In 2014 globally, more people lived in urban areas than in

rural areas, with 54% of the world's population and will be 66% in 2050. (UN, 2014) In the energy sector, urban areas account for 67-76% of global energy use and 71-76% of global energy-related carbon emissions. (IPCC, 2014) May, conclude that the first priority solution for solving global warming problems is GHG emissions reduction in urban areas.

One of the solution to reduce GHG emissions in urban areas is a low carbon city that is the urban management to meet the target of city GHG emissions reduction. The concept of low carbon city planning does not depend on only one discipline, it unavoidably uses the whole planning idea and method transition. (Cao and Li, 2001) The solutions for decarbonization in any urban areas will require the combination of technological development, infrastructure investments, and behavioral change. (Milner, Davies, & Wilkinson, 2012) Behavior, lifestyle, and culture have a high potential for GHG reduction, people can reduce GHG through the change in consumption patterns (e.g., mobility demand and mode, energy use, choice of longer-lasting products, and reduction in food wastes). (IPCC, 2014) The lifestyle change is the significance solution for fossil energy reduction within the next two decades. (Moriarty & Wang, 2014) So we can conclude that there are two main solutions for low carbon city, technical solution, and lifestyle change solution. The first depends on science or technology knowledge and high budget and also relate to many stakeholders. But the second does not depend on knowledge and budget like the first or depend on only a few budgets moreover, it can proceed immediately.

Even though human's everyday life is dominated by consumerism cause of individual losing but this dominance is not complete. A human has the potential and tactics that scramble for the benefits from the structure of society. (Certeau, 1984) The almost all activities in human's everyday life concern to GHG emissions more or less. Therefore, they can change, GHG emissions behavior in their everyday life and these changes will be the significance solution for low carbon city at present and future.

Khon Kaen is a center of commercial, investment, and transport in Greater Mekong Sub-region. It is determined to be a MICE city (Meetings, Incentives, Conferencing, and Exhibitions) and ICT city (Information and Communications Technology) so that economic growth and population in urban areas are more and more. Besides, the goal of the Khon Kaen Municipality in their master plan (2017-2020) is a low carbon city. (Khon Kaen Municipality, 2016) The GHG emissions behavior of each person may like or different, it depends on their context. Thence, if we understand the conditions of the individual GHG emissions reduction behavior, these will be an important tool to develop an appropriate solutions to change the individual GHG emissions behavior for low carbon city.

2. Objective

To investigate the conditions of the individual GHG emissions reduction behavior and propose the solutions to reduce the individual GHG emissions for low carbon city in Khon Kaen Municipality, Thailand.

3. Literature Review

The first time that the world knew the word “low carbon” when the Department of Trade & Industry, UK published a report “Our Energy Future Creating a Low Carbon Economy” in 2003. (Tao, 2011) And one of the solution to drive the “low carbon” in urban areas is a “low carbon city” The question is “what is the definition of low carbon city?” There were many researchers and policymakers proposed the concept and the framework of low carbon city but there were only a few who defined the word "low carbon city".

There was no universally applicable definition of a low carbon city because cities differ in their GHG emissions and cities place important the economic opportunities and quality of life for citizens more than focus on GHG reductions. The definition of a low carbon city should focus on how cities reduce their GHG emissions that do not compromise economic development and livability. (Baeumler, Vasquez, & Mehndiratta) There have not been any standard definitions of low carbon city, it can be defined as a city that includes of societies that apply sustainable green technology, green practices and compare the GHG emissions to the present day. (Kementerian Tenaga Teknologi Hijau Dan Air, 2011) The low carbon town is town or village that try to achieve the goal of GHG emissions reduction and has the clear plan for development. (APEC Energy Working Group, 2011) The connotation of low carbon city mainly includes three aspects; low carbon urban planning and construction, low carbon city lifestyle, and low carbon city operation system. (Ma, Li, & Wang, 2015) We concluded that the low carbon city is an area base management to meet the target of city greenhouse gas (GHG) emissions reduction.

There were six greenhouse gas (GHG) in the Kyoto Protocal; carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC_s), perfluorocarbons (PFC_s), and sulphur hexafluoride (SF_6). (United Nations, 1998)Carbon dioxide (CO_2) is the most important anthropogenic GHG and the primary source of CO_2results from fossil fuel use. (IPCC, 2007)

Greenhouse gas (GHG) emission are divided into 5 main sectors, which are groupings of related processes, sources, and sinks; 1) energy, 2) industrial processes and product use (IPPU), 3) agriculture, forestry and other land use (AFOLU), 4) waste and 5) other. (IPCC, 2006) Khon Kaen Municipality areas account 76.8%, 17.6%, and 5.6% of GHG emissions in energy, waste, and IPPU sector respectively. (Research and Development Institute Khon Kaen University[RDI KKU], 2012) The main solution to reduce the GHG emissions in Khon Kaen Municipality areas is energy saving. Thence, the conditions of the individual energy-saving behavior are the main part of the conditions of the individual GHG emissions reduction behavior.

Zhang, Luo, & Skitmore (2015) reviewed existing literature and concluded that household income, household size, age, education level, location, gender and rebound effects influence the household GHG emissions. These results were in line others study. Yue, Long, & Chen (2013) found that 5 personal characteristics (age, gender, income level, household structure, and educational background) influence the energy-saving behavior. Han, Nieuwenhijsen, Vries, Blokhuis, & Schaefer, (2013) found that personal characteristics,

knowledge, motivation, and context factors play important roles in energy-saving behavior. And Hori, Kondo, Nogata, & Ben (2013) found that global warming consciousness, environmental behavior, social interaction, income, and age affect energy-saving behavior. Besides, Hamamoto (2013) suggested that the psychological factors are important for energy saving behavior promoting.

There were researchers that studied the individual GHG emissions reduction or energy-saving behavior in Thailand. Werabenjapol (2012) found that people who had levels of different education, knowledge, awareness, and attitude had different adaptation behaviors on low carbon society in an energy consumption sector. Srithanyarat (1999) found that knowledge, attitude about electricity saving, and family's economic status influence electricity saving behavior. Muangklam (2001) found that attitude toward electricity using, self-esteem, future directing and self-control, social support, and perception of energy information had the positive correlation to electricity saving behavior. Kittisarawanno & Pimdee (2007) found that need for achievement, believe in internal locus of control of reinforcement, future orientation, self-control, social support, seeing a good example of electricity saving in families, good attitude towards the behavior of electricity saving, and knowledge about electricity saving relate positively to the electricity saving behavior. Theerawattanasiri (2012) found that attitude information contents, the frequency of participation, information senders, married status, gender, income, and information sources influence the electricity saving behavior.

These study above show the factors or conditions that influence the individual GHG emissions reduction behavior.

4. Methodology

This study was conducted by qualitative research presented by applying the methods of field data collection and in-depth interview with 9 key informants (3 local government officers who are the secretary team of Khon Kaen low carbon city project and 6 community leaders who have had activities for GHG emissions reduction in Khon Kaen Municipality. They were asked the questions on the topic of characteristic, GHG emissions reduction activities, GHG emissions behavior, global warming attitude, and the conditions of the individual GHG emissions reduction behavior. Then, the data was analyzed to find the conditions of the individual GHG emissions reduction behavior and the solutions to reduce the individual GHG emissions for low carbon city. The Atlas ti program was the tool that assisted the analysis. The study areas include the Khon Kaen Municipality areas.

5. Results

5.1 The conditions of the GHG emissions reduction behavior

All key informants in this study have the GHG emissions reduction behavior in their lifestyle, some of the key informants explained:

"When I don't need to watch TV, I turn off at the switch and pull the plug off."

"There are only the efficiency electric lamps in my house."

"The technical come to my house to clean the air conditioner every 6 months."

"When we have to buy the food, we try to do not use the plastic bag."

"I separate my own waste and manage to be organic fertilizer."

There are six main conditions of the individual GHG emissions reduction behavior; personal characteristics, knowledge, attitude, motivation, role model, and equipment support.

5.1.1 Personal characteristics

Many types of research found that personal characteristics are the conditions of the individual GHG emissions reduction behavior. (Zhang, Luo, & Skitmore, 2015, Yue, Long, & Chen, 2013, Han, Nieuwenhijsen, Vries, Blokhuis, & Schaefer, 2013, Hori, Kondo, Nogata, & Ben, 2013, & Werabenjapol, 2012) These studies were in line our finding that personal characteristics especially income is important to change their GHG emissions reduction behavior, some of the key informants explained:

"It is hard to change the behavior of people to save the environment, such as energy saving, use a bicycle instead of a car. It depends on the personal basis. If they have more money, it is difficult to change."

Even though, it is hard to make a solution to change personal characteristics for GHG emissions reduction but we will use the personal characteristics; sex, age, education, and income to be the independent variables in the next study by a quantitative approach to find the factors that influence the individual GHG emissions reduction behavior because it is helpful for design the solutions that fit to each group of people.

5.1.2 Knowledge

All key informants have known the methods to reduce their GHG emissions by energy saving, use the efficiency equipment, maintenance, use the green products and services, and waste management, some of the key informants explained:

"I know the methods to save energy."

"I know the label no.5, it shows the saving equipment."

"I learned how to clean the air conditioner from youtube, so I clean it by myself."

"Reduce plastic helps to reduce global warming problem"

"I have known how to manage the waste to be organic fertilizer already, so we join the waste management activities in our community."

The knowledge has related to the GHG emissions reduction behavior. These findings were in line the previous study for example; Han, Nieuwenhijsen, Vries, Blokhuis, & Schaefer, (2013), Werabenjapol (2012), Srithanyarat(1999), and Kittisarawanno & Pimdee (2007). We classify the knowledge into 5 groups; energy saving, use the efficiency equipment, maintenance, use the green products and services, and waste management.

5.1.3 Attitude

The previous study showed that attitude is the conditions of the individual GHG emissions reduction behavior. (Hori, Kondo, Nogata, & Ben, 2013), (Hamamoto, 2013),

(Werabenjapol, 2012), (Srithanyarat, 1999), (Muangklam, 2001), (Kittisarawanno & Pimdee, 2007), (Theerawattanasiri, 2012) These study were in line our finding that attitude relate to the GHG emissions reduction behavior, some of the key informants explained:

"One of the Khon Kaen Municipality policy to drive the low carbon city is people attitude improving by plant the tree in the people mind, we believe it is more sustainable development."

"Mostly I work for the community, personal work is rarely done because I have been the volunteer."

"Global warming is very important. We do not look at our lives, but we look at our children's lives. I do not do it for only me, but do it for the next generation."

We classify the attitude into 2 groups; volunteer, and global warming attitude.

5.1.4 Motivation

Blokhuis, & Schaefer, (2013) found that motivation is important to energy saving. These studies were in line our finding that motivation relates to the GHG emissions reduction behavior, some of the key informants explained:

"First, we need to inspire them, but we do not know what will be the motivation for them to change. We need to find it so they felt that it is time to change."

"We can make money from the waste, instead of leaving to the bin."

"I use the most efficient lamp because I need to save money on the electric bill."

"If there are ways for bicycles, we will change the lifestyle of cycling, but now I do not because I think a lot about safety."

"Actually, I've been complaining that I am lazy to drive. If there is a nice bus to work, I like it. But now it's hot, tight, and slow."

"People may not see what do I get from this project, I feel proud of done it."

We classify the motivation into 5 groups; extra income, saving, safety, convenience, and self-esteem.

5.1.5 Role model

Kittisarawanno & Pimdee, (2007) showed that role model is the conditions of the individual GHG emissions reduction behavior. It was in line our finding that role model relate to the GHG emissions reduction behavior. People will see and understand what do they do and the benefits that they achieve and try to apply to do like them, some of the key informants explained:

"I Know and see many other people that he or she is interested in and do to reduce global warming problems."

So that the role model is important to the individual GHG emissions reduction behavior.

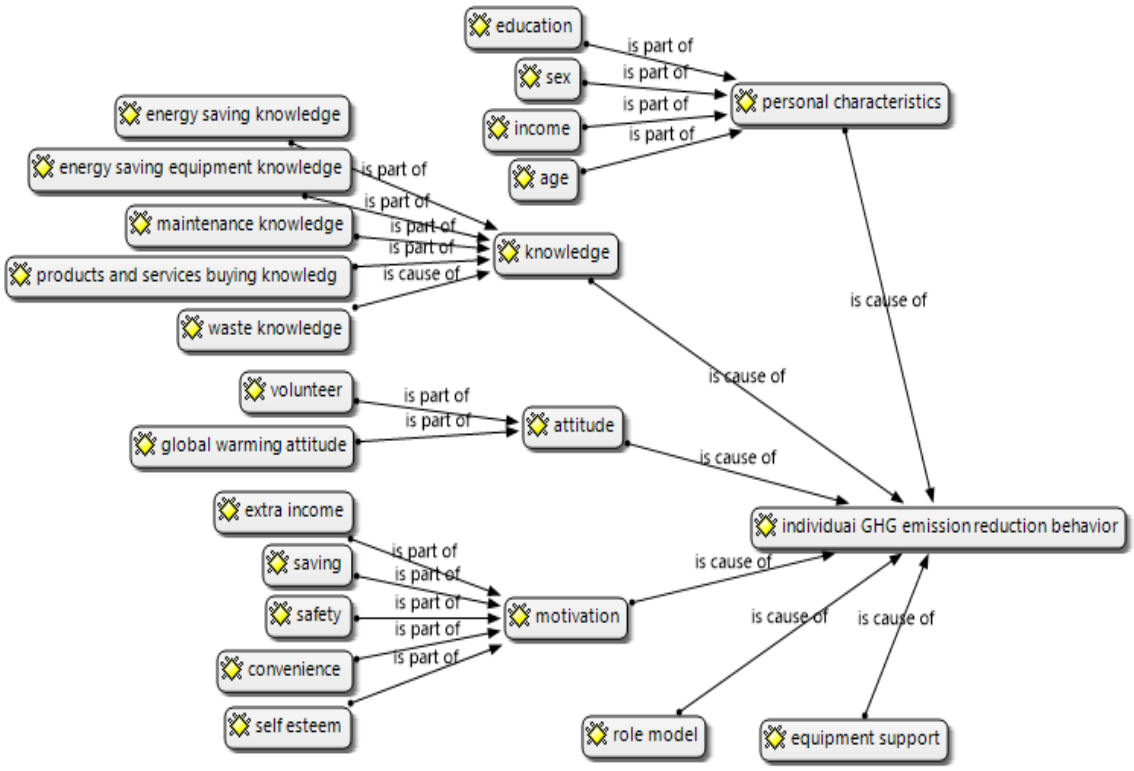
5.1.6 Equipment support

Muangklam, (2001), and Kittisarawanno & Pimdee, (2007) found that social support is important to the individual energy-saving behavior. And we also found that equipment support is the one of the individual GHG emissions reduction behavior too. Even though people need to change their lifestyle to reduce the GHG emissions or for their convenience but there is not any equipment support, for example, the ways for bicycles, nice transportation, and recycle bin, they cannot change their lifestyle, some of the key informants explained:

"Buses do not come into my community so we do not use it. If there is a tram that will occur in 2018, we will certainly use."

So that the equipment support is important to the individual GHG emissions reduction behavior.

There are six main conditions of the individual GHG emissions reduction behavior; personal characteristics, knowledge, attitude, motivation, role model, and equipment support. The relation between these conditions and the individual GHG emissions reduction behavior shows in Picture 1.



Picture 1 The conditions of the individual GHG emissions reduction behavior

5.2 The solutions to reduce the individual GHG emissions

By the main conditions of the individual GHG emissions reduction behavior; characteristic, knowledge, attitude, motivation, role model, and equipment support, we provided the solutions to reduce the individual GHG emissions for low carbon city in Khon Kaen Municipality.

5.2.1 Provide the media that support people's knowledge and attitude improvement for GHG emissions reduction.

The general knowledge about GHG emissions reduction is common and easy to implement because most of this knowledge relates to the money that they pay in their life. More people always try to save money, so they try to know how to save money. Even though more people have known this knowledge already but, some knowledge is unforeseen for some people, for example, the air conditioner cleaning every 6 months can reduce the electric bill more than 10%, turn off TV only remote control TV to use electric. When people know about this knowledge, we believe that they try to save money by energy saving. So, improve people's knowledge how to reduce GHG emissions is important for the individual GHG emissions behavior changing.

People who have a good attitude in global warming and usually be a volunteer, have GHG emissions reduction behavior in their life. They do not only consider their life, but they care about other people and the next generation. If people are provided with their attitude in global warming and volunteer, we believe they will change their lifestyle for protecting the environment. So, encourage people to appreciate GHG emissions reduction is important for the individual GHG emissions behavior changing.

People's knowledge and attitude are important to the individual GHG emissions behavior changing. The question is how to improve their knowledge and attitude. One of solution that impacts to the mass, is public relations the knowledge or information to people by the media. The media will improve people's knowledge and attitude.

5.2.2 Provides the activities that support people's motivation.

Public relations knowledge and attitude are seen to be the abstract some people may not touch or believe it. Even though they are improved their knowledge and attitude already, but some do not know how they start to reduce GHG. One of the solutions to change their GHG emissions behavior that is not the abstract is the activities that support people's motivation, for example; the bicycle day activity, the campaign for coupons when they ignore the plastic bag, and the workshop for air conditioner cleaning. This activity is a tool for people's motivation building. People can touch the activities directly and easy to implement.

5.2.3 Promote and reward for people who are outstanding for GHG emissions reduction.

Increasing in role model make the more opportunity that people can see the role model. People will see and understand what do they do and the benefits that they achieve and try to apply to do like them. One of the solutions to increasing the role model is promoting and reward for people who are outstanding for GHG emissions reduction.

5.2.4 Provides the equipment that supports people to reduce GHG emissions.

Even though people need to reduce their GHG emissions, but there are not the equipment support, for example; the bicycle ways, the good transportation, the separate bin, and the channel to buy the "climate smart food". These make opportunity and convenience to implement easier.

6. Conclusions

There are six main conditions of the individual GHG emissions reduction behavior; personal characteristics, knowledge, attitude, motivation, role model, and equipment support. By these conditions, we provided the solutions to reduce the individual GHG emissions for low carbon city in Khon Kaen Municipality. Our solutions suggested to (1) provide the media that support people's knowledge and attitude improvement for GHG emissions reduction, (2) provide the activities that support people's motivation, (3) promote and reward for people who are outstanding for GHG emissions reduction, and (4) provide the equipment that support people to reduce GHG emissions.

Besides, the six main conditions from this study will be applied to be the independent variables in our next study by a quantitative approach to find the factors that influence the individual GHG emissions reduction behavior.

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