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Abstract

論文内容の要旨 (博士)

Title of Thesis 博士学位論文名	Study on Urban Energy Consumption in Padang City of Indonesia: System Dynamics Modeling Approach (インドネシア・パダン市における都市エネルギー消費に関する研究)
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(Approx. 800 words)

(要旨 1,200 字程度)

Indonesia with a population of more than 241 million, or the fourth largest country in the world, challenges to achieve energy sustainability. Furthermore, as a developing country, Indonesia faces rapid economic growth. With real gross domestic product (GDP) reached at the average of 6.5% per year during the last 5 years, Indonesia has to address the increasing energy demands for growing economies, as well as address the potential impact of emissions and climate change. To fight against climate change and increases of energy consumption, particularly fossil fuels, urban sectors should be put on the priority.

The main objective of this research is to analyze the urban energy consumption and emission in the city of Indonesia. This objective further follows to several investigations, which are thus (a) based on the case study of Padang, to investigate the residential energy consumption, (b) based on best practice from other countries, to investigate the opportunities to reduce electricity consumption that can be applied in Indonesia, (c) based on existing condition of energy consumption and emission trends in Indonesia, to develop a model to investigate the fuel consumption and emission impact in the road transportation of local city of Indonesia, and (d) based on best practice from other countries, to investigate the opportunities to reduce fuel consumption and emissions that can be applied in Indonesia.

From the study on residential energy consumption under Chapter 2, it was found that lifestyles and daily life activities of household members will have a positive impact on energy consumption and emissions level. Although this topic has been widely discussed, most studies focus on developed countries. As one of the developing countries, very few studies were found discussing the residential energy consumption in Indonesia.

Despite that there are many of energy saving technologies being widely used; the problem is in the “bad habits” of household members in the use of technology. Therefore, this study used cross-section analysis and on-site measurement methods that were focused on each household’s

lifestyle using life schedule data. This study stressed the investigation of lifestyle and residential energy consumption based on the ownership of home appliances, income levels, occupations, family patterns and different residential areas

In view of finding from Chapter 2 and the fact that currently Indonesia still facing the energy crisis, the purposes of this Chapter 3 is to investigate the opportunities to reduce electricity consumption. The study emphasizes the cities' action around the world that has approached the challenge of controlling and reducing the residential electricity consumption.

In Chapter 3, we explore the “unwisely habits” of household's lifestyle that unconsciously wasting electrical energy. Leaving the lights on during the daytime, leaving the “appliances on” while not used, low awareness of environmental impacts still being “unwisely habits” that should be changed.

In chapter 4, a practical and reliable method to predict fuel consumption and emission level by using System Dynamics was developed in line with limited availability and supporting data. The model was estimated the fuel consumption and emissions data for the case of Padang city, one of the fastest growing cities in Indonesia. Results show that Padang, with the existing vehicles' growth rate, the total fuel consumption and emissions only from road transportation is predicted to be 65 times higher than that of 2013. From the above test scenarios, it is concluded that the main driving forces of road fuel consumption and emissions is the private vehicles which include passenger cars and motorcycles. Hence, these results should be prioritized in the future context to reduce private vehicle usage and encourage people to move to public transportation. Nevertheless, an integrated public transportation system is one of the key points to reduce fuel consumption and emissions from road transport.

Every country has taken differences action towards controlling fuel consumption and emissions. The Government of Indonesia commits to reduce a greenhouse gas emissions by 26% by own efforts and reach 41% if received international assistance in 2020 from the condition without an action plan. Increasing of energy consumption, particularly energy from fossil fuel has responsible for the increased concentration of air pollution in urban areas. Hence, in the Chapter 5, several strategies that have been taken by government around the world to reduce fuel consumption and emission from road transport were observed. Clean fuels, tighter emission standard for vehicles, tax incentive and other emission regulation were executed in order to achieve the reduction goals. Indonesia and local city can gain from the existing international experience of taking potential actions to reduce fuel consumption and emissions level in the future.

As a growing city, Padang will certainly face the same problems with the big cities, so with these studies expected to be input for making long term sustainable planning programs. Effort only local government is not enough, but regardless of all cities, society, center government, and also other countries must work together to change our lifestyle to save energy and to reduce emissions for future generation.