

Toward the pledge and sustainable implementation of Thailand NAMAs : Analysis of barriers to energy efficiency in designated buildings

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Thailand began to prepare Nationally Appropriate Mitigation Actions (NAMAs) as a pledge to the international community for sustainable implementation in 2012. Improvement of energy efficiency in designated buildings is one of the main countermeasures under the proposed NAMAs. In planning the NAMAs, Thailand faces the challenge of how to conduct countermeasures under the situation where the Energy Efficiency Development Plan 2011-2030 (EEDP) has not progressed as intended. This study thus analyzed the barriers hindering the promotion of energy efficiency countermeasures of designated buildings in terms of design, implementation, monitoring, data and information availability, and finances. It then examined the necessary policy instruments and countermeasures to reduce CO₂ emissions to achieve the NAMA targets. This study found that the regulatory measures have not been implemented steadily, as every instrument is implemented on an ad hoc basis. This causes a lack of sufficient and credible data and makes it difficult to gain an understanding of the existing situation, make future projections, and evaluate the progress and impact of policy instruments. Moreover, limited capacity to verify the submitted energy management reports from each designated building prevents the strengthening of ministerial regulations and updating of the energy efficiency performance standards of the designated buildings. This study concluded that Thailand's NAMAs target will not be achieved without the implementation of practical policy and countermeasures. There is an urgent need to provide intensive energy efficiency measures and a sequence of technical trainings for the relevant stakeholders toward the realization of cost-effective and sustainable low-carbon buildings.

Key Words: *Thailand's NAMAs, buildings' energy efficiency, policy analysis, barriers*

1. INTRODUCTION

Nationally Appropriate Mitigation Actions (NAMAs) are voluntary actions implemented by developing countries to reduce greenhouse gas (GHG) emissions relative to “business-as-usual” (BAU) emissions in 2020 in line with their national circumstances and capacities. This mechanism was introduced in the Bali Action Plan at the 13th Conference of the Parties (COP 13) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2007. It encourages developing countries to implement NAMAs in the context of sustainable development, supported and enabled by technology, financing, and capacity-building, in a measurable, reportable, and verifiable manner¹⁾.

Although it is a challenge for developing countries

to reduce GHG emissions, even voluntarily, due to their limited resources, the planning of NAMAs gives each country the opportunity to identify which GHG emission actions are achievable using its own resources as domestically supported NAMAs, and which GHG emission reduction actions will be difficult to implement no matter how great their potential to reduce GHG emissions due to high implementation costs and limited resources. NAMAs can provide a means for developing countries to implement such high-cost abatement actions through international financial and technological support as internationally supported NAMAs.

Thailand has not pledged its NAMAs. However, Thailand has already prepared its potential mitigation pledges and countermeasures for the approval by the National Climate Change Committee (NCCC) and

Cabinet. Thailand has discussed its NAMAs since 2012 centering on the Office of Natural Resources and Environmental Policy and Planning (ONEP) of the Ministry of Natural Resources and Environment (MNRE), which is the national focal point for the UNFCCC, and the Thailand Greenhouse Gas Management Organization (TGO), a public organization established in 2007 under MNRE. Both of these organizations are also appointed by the prime minister as co-secretariats of the NCCC.

As roughly 70% of CO₂ emissions in Thailand came from the energy sector²⁾, Thailand NAMAs have taken sector approach focusing on the energy and the transport sectors. The continuous discussion processes from 2012 in line with the outcomes of academic studies brought the consensus that Thailand will aim to reduce 7-20% GHG by 2020 from BAU, subject to support³⁾. The relevant stakeholders also came to a consensus from the outcomes of studies that improving energy efficiency in large commercial buildings, especially air-conditioning and lighting systems, is one of priority countermeasures. According to a study⁴⁾, it has the highest potential to reduce GHG by 5,909 kt-CO₂ through building energy code (BEC).

The main parties currently involved in implementing Thailand's draft NAMAs for the promotion of energy efficiency in the designated buildings are ONEP, TGO, and Department of Alternative Energy Development and Efficiency (DEDE) of Ministry of Energy. DEDE has the mandate to develop regulatory measures and voluntary program, implement and monitor the policy instruments to improve energy efficiency of building under the ECP Act and EEDP. DEDE thus will play the role of developing energy efficiency measures, while ONEP and TGO will select the energy efficiency measures to be integrated into the national NAMAs plan. All three parties will also undertake the role of developing measurement, reporting, and verification (MRV) methods for the proposed NAMAs that will be appropriate for their implementation and in line with the international requirements.

The challenge regarding energy efficiency of the designated buildings is how to determine the scope and implement the policy instruments to achieve the CO₂ emission reduction target through NAMAs. Thailand has enforced the Energy Conservation Promotion (ECP) Act from 2007, revising the initial Act of 1992, which aimed to promote energy management in designated building and factories⁵⁾. Thailand has also formulated Energy Efficiency Development Plan 2011-2030 (EEDP)⁵⁾. In commercial building sectors, the EEDP aims to achieve annual average energy saving of 1,100 ktoe, and annual average avoided CO₂ emission of 6 million

tons by conducting the above activities⁵⁾⁶⁾. It was approved by the Cabinet on 3 May 2011⁷⁾. In order to implement EEDP, Ministry of Energy also formulated the Energy Efficiency Action Plan (EEAP), which introduced the strategic approaches and measures spread over three periods between 2011 and 2030⁶⁾. EEAP was also approved by the Cabinet for full implementation in 19th March 2013⁷⁾.

Under the EEDP, the potential electricity saving is calculated by the comparison between the reference case, which is the average energy consumption rate/floor area/year of individual building types at present, and such a rate in the case where the BEC is enforced in 2012⁵⁾. It also includes the case where a higher standard is enforced in the future followed by the enforcement of BEC⁵⁾. By updating the standard every three years, EEDP targets to achieve zero energy buildings by 2030, which aims to reduce the reliance on external energy supply to near zero by reducing energy demand and using on-site renewable energy. EEDP develops the strategic approaches and measures to achieve the target, spread over short, mid, and long terms⁵⁾⁶⁾. The barrier of EEDP in this sector is that while BEC was effective in 2010 under the 2007 ECP Act, and was expected to be enforced in 2012, it has not been fully implemented yet. In addition, energy management for existing designated buildings, which aims to promote energy management by reporting the outcome and verifying it by developing the third party energy management auditors system has also not been fully implemented, while it is stipulated in the 2007 ECP Act. Hence the implementation of regulatory measures in EEDP has been delayed.

It is thus necessary to analyze the barriers hindering the implementation of policy instruments to promote energy efficiency especially under the ministerial regulation of ECP Act. Without finding the ways to overcome them for the achievement of EEDP's goal, it is unlikely to get full participation from the relevant stakeholders for the pledge and sustainable implementation to achieve the target of NAMAs.

2. OBJECTIVES AND METHODS OF THIS STUDY

The objective of this study is to analyze non-technical barriers of existing policy instruments implemented in Thailand in order to examine the challenge and the alternative policy instruments in planning and implementing the NAMAs. The analysis uses the approach of theory-based policy evaluation for energy efficiency in the building sector⁸⁾⁻¹⁴⁾.

The structure of this study is as follows. Firstly, it introduces the energy consumption and overviews of existing policy and countermeasures in this sector. Secondly, it analyzes the barriers of existing policy instruments to improve energy efficiency in the designated buildings. This study especially looks at BEC and the energy management requirement in the designated buildings under the ministerial regulation and analyzes whether and how these regulatory measures have been implemented as the driving force to promote the energy conservation and energy efficiency of the designated buildings, and what makes the enforcement difficult. It also examines whether and how existing voluntary and information programs, such as energy efficiency standards and labeling and financial incentives, assist in implementing the regulation measures to promote energy efficiency and what barriers they face. It analyzes these barriers in terms of the institutional design, implementation and monitoring structure, and the resources, such as data and information availabilities, capacity, finance, and the administrative structure for the plan and implementation. Thirdly, it briefly proposes a few policy alternatives to overcome the barriers to promote energy efficiency by revising EEDP and reducing CO₂ emissions for the pledge and sustainable implementation of NAMAs in this field.

This study includes literature reviews of both internationally reviewed documents and those specifically targeted at Thailand in the field of the energy efficiency of commercial buildings. The reviewed literature included policy reports by the Thai government, academic research papers by both Thai researchers and others, and international organizations' project reports for Thailand. Information was also collected by conducting interviews with relevant officials involved in the NAMA development process in order to identify the situation in Thailand.

Although there have been a number of previous studies that analyzed the barriers to improving energy efficiency in commercial buildings at the global scale, the analyses of developing countries are limited in number⁸⁾⁽¹⁰⁾. There are also several previous studies related to the analysis of the energy efficiency of buildings in Thailand from the technical and engineering aspects¹⁵⁾⁽²¹⁾. On the other hand, the existence of non-technological drivers also influences energy consumption and CO₂ emissions. This influence is, in fact, greater than that of technological factors, because different non-technological factors also cause different levels of energy consumption even within the same technological setting¹⁰⁾⁽²²⁾.

Theoretically, it is expected that the policy instruments introduced in Thailand will have the potential to reduce energy-related CO₂ cost-effectively,

but if they are not well designed or if their implementation and enforcement are not stringently enforced coordinated, their effectiveness will not meet expectations.

This study points out that Thailand's NAMAs target will not be achieved without the implementation of practical policy and countermeasures that combine ministerial regulations, voluntary programs, financial mechanisms, and economic and market-based approaches. This is because a number of barriers are interrelated, thereby making it difficult to resolve the situation by a single policy instrument and agency. There is an urgent need to provide intensive energy efficiency measures and a sequence of technical trainings for the relevant stakeholders toward the realization of cost-effective and sustainable low-carbon buildings.

3. OVERVIEW OF EXISTING POLICY AND COUNTERMEASURES

(1) Energy consumption of the designated buildings

Energy consumption from commercial buildings sector in Thailand is growing rapidly⁵⁾⁽²¹⁾. Commercial buildings comprised the second largest energy consuming sector after the industrial sector in 2010⁹⁾. The energy consumption of the commercial buildings in 2010 was 3.71 times higher than that in 1990, while the country's GDP grew by 2.36 times during the same period⁵⁾. In 2011, the total energy consumption of the commercial buildings was 5,511 ktoe, accounting for 7.8% of Thailand's final energy consumption²¹⁾. The high rate of increase in energy demand in the designated buildings is due to rapid economic growth coupled with rapid urban expansion and real estate and condominium development⁹⁾.

The energy used during operational phase of a building typically accounts for 40% of its total energy consumption¹⁷⁾. Office buildings had the largest energy consumption, with a share of 37%, followed by Hotel, department stores, and supermarkets, with a share of 12%, respectively⁵⁾. The highest consumption of electricity is derived from air-conditioning, followed by lighting¹⁵⁾⁽²¹⁾, as a result of equipment intensity and long operating hours¹⁶⁾, as well as the pursuit of comforts by the occupants of buildings²⁰⁾.

There is no voluntary energy performance standard for the building sector in Thailand²³⁾. It is estimated that the average specific energy consumption (SEC) of the designated buildings and high-rise residential buildings is roughly 216kWh/m²/year, and that it is relatively higher than similar types of buildings in other Association of Southeast Asian

Nations (ASEAN) countries²³⁾.

(2) Overview of existing policy instruments

Although there are no specific strategies to improve air-conditioning and lighting systems to date, Thailand has implemented a number of policy instruments to improve energy efficiency in designated buildings, which consists of not only regulatory measures, but also voluntary action and information program, financial incentives and economic and market-based mechanisms. The main policy instrument and the overview for energy efficiency of designated buildings are summarized in Table 1.

Table 1 Existing policy instruments for designated buildings

(1) Regulatory measures
• Building Energy Code (BEC)
• Energy Management in the Designated Buildings
• Minimum Energy Performance Standards (MEPS)
(2) Voluntary actions and information program
• High Energy Performance Standards (HEPS)
• No.5 Energy Labeling Programs by Electricity Generating Authority of Thailand (EGAT)
• Demand Side Management Program
• Thailand Energy Award
(3) Financial incentives
• Energy Conservation Promotion (ENCON) Fund
• Energy Services Company (ESCO) Fund
(4) Economic and market-based mechanisms
• Thailand Voluntary Emission Reduction (T-VER) Scheme

(a) Overview of regulatory measures

The characteristic of regulatory instruments for the designated buildings in Thailand are that a set of five policy instruments has been stipulated under the Royal Degree on Designated Buildings in 1995, and amended in 2007, through (1) BEC, (2) energy management in designated buildings, (3) personnel responsible of energy (PRE), (4) energy management auditor, and (5) energy efficiency consumption standards for machines and devices²⁴⁾. Energy Conservation Promotion (ENCON) Fund has been established from 1995 under the ECP Act to support the energy conservation activities of designated buildings and factories²⁴⁾.

BEC has applied for new construction and retrofiting of three categories and nine types of buildings, in line with different peak time of energy use and the pattern of energy use: (1) offices and schools; (2) department stores, supermarkets and miscellaneous; and (3) hotels, hospitals, condominiums, and hostels, which have a floor space of 2,000 m² or more or with peak electricity demand of 1,000 MW or more¹⁷⁾²⁴⁾. It stipulates the necessity of compliance with the energy performance requirement of six standards system

including building envelope, lighting, air-conditioning, hot-water system, and the whole building's energy utilization and renewable energy generating system in order to get permission of constructing the new buildings¹⁷⁾¹⁸⁾²⁴⁾. Though Thailand has implemented BEC which stipulated the minimum energy performance requirement of building envelope, air-conditioning and lighting systems from 1995 in line with the initial ECP Act legislated in 1992, it was focused on existing buildings, and not linked to energy consumption and energy costs of the buildings¹⁷⁾. The improvement of energy efficiency from the design stage of building construction from BEC has thus been only recently initiated.

ECP Act also encourages the energy management through energy consumption report and verification in the large existing commercial buildings²⁴⁾, which have an approved electricity meter or one or more transformers with a capacity of 1,000 kW or 1,175 kVA or more, or annual electricity consumption of more than 20 million MJ, defining them as the designated buildings²⁴⁾.

The characteristic of regulatory design of energy management procedures of the designated buildings in Thailand is that the building owners are assigned the responsibilities of energy conservation and efficiency under the ECP Act. For instance, they need to conduct energy management by deploying PRE, informing DEDE of the appointed PRE, in order to improve energy management under the Ministerial Regulation Prescribing Qualifications established in 2009. The building owners also need to conduct audits and certify their energy management by the certified energy management auditor on the list provided by DEDE. The Ministerial Regulation²⁴⁾²⁵⁾ stipulates the eight steps of energy management procedures. It includes the appointment of an energy management working group, and the member must collect all relevant documents and evidence related to energy management in their building and submits the documents to the auditors. The auditors have the duty to develop energy audits to identify energy usage in line with the standards, criteria, and procedures identified in the Ministerial Regulation and submit the energy management inspection and certification report to the DEDE every March. DEDE is then supposed to check and approve the report, providing feedback for improvement²⁵⁾. DEDE also compiles data and information of energy management reports in their database¹⁷⁾.

(b) Overview of voluntary actions and information program, financial incentive and economic and market-based instruments

Standards and labels for energy-efficient appliances are other means to improve energy efficiency of the designated buildings. In Thailand, the Mini-

imum Energy Performance Standard (MEPS) has been implemented to eliminate appliances with very low energy efficiency from the market²⁶⁾. High Energy Performance Standard (HEPS) is implemented as a voluntary program to promote further improvement of the MEPS and encourage participation in the market through energy labeling²⁷⁾. The energy label No.5 program for appliances has been conducted by the Electricity Generating Authority of Thailand (EGAT). The designated standards of energy efficiency range from level 1, the lowest, to level 5, the highest. Virtually the only product labels affixed to appliances are those for level²⁷⁾.

There are mainly three projects that have been implemented to replace higher energy efficiency air conditioners and lighting from the current ones: (1) utilize the high energy efficiency ratio (EER) air-conditioning system, through MEPS, HEPS, energy labeling, and the demand-side management (DSM) program to reduce the peak demand of electricity use; (2) replacement of the lighting system from T8 type to T5 or LED types through energy labeling and the DSM program; and (3) support the operation of energy services companies (ESCO)⁵⁾.

DEDE has organized the Thailand Energy Award since 2000 to commend the government and private agency that contribute to energy conservation²⁶⁾. The eligibility for the award includes the building sectors and the personnel, including PRE.

Regarding financial incentives, the ENCON Fund was established in 1992 under the ENCON Act to provide working capital, grants, and subsidies for designated buildings and factories to conduct and promote energy efficiency and energy-saving activities in both the public and private sectors in line with an energy efficiency plan, which is developed every four years⁷⁾. It is funded by the revenue from a tax of 0.04 baht per liter on all petroleum products sold in Thailand⁷⁾. On the other hand, the ESCO fund is a co-investment program. This provides a source of venture capital to stimulate joint investments between the public sector and private investors in energy efficiency and renewable energy projects⁷⁾.

In terms of GHG emission reduction, the remarkable feature to address CO₂ emission reduction in Thailand is that TGO plays the role of the implementing agency to promote GHG mitigation and functions as a GHG information center; it also supports the design of the GHG mitigation policy by ONEP from the technical aspects. In addition, in 2013, TGO has also just started Thailand voluntary emission reduction (T-VER), a domestic project-based GHG crediting mechanism. In energy sector, they have developed the methodology of lighting²⁸⁾.

4. BARRIERS OF EXISTING POLICY INSTRUMENTS

Although the policy instruments adopted in Thailand have the potential to reduce CO₂ emissions through installing higher energy efficiency air conditioning and lighting systems under NAMAs scheme, the effectiveness will not be enhanced under the existing situation where there are a number of barriers to the extant regulatory measures.

(1) Barriers of regulatory measures

a) Building Energy Code (BEC)

The necessary action to reduce CO₂ emissions by promoting energy efficiency in buildings is the enforcement of BEC as mandatory. The following five issues are important for successful implementation of the BEC: (1) regular updates; (2) consistency of regulations on appliance standards and building systems, such as those related to insulation; (3) effective enforcement including certification, inspection, and institutional arrangements, encompassing the central and local administrations; (4) integration of the local context into the BEC; and (5) enhancement of expertise at both the administrative and technical levels through regular training and capacity building⁸⁾¹³⁾.

Firstly, the implementation of regular updates of BEC is difficult without a monitoring system and penalty in the case of no compliance with BEC, although Thailand has planned to update the EEDP every three years toward its goal of zero-energy buildings in 2030. The penalty is just non-permission of the building's construction. However, there is no inspection system during a building's construction or after its completion²⁶⁾. Inspection on the level of energy efficiency in new buildings under the BEC is limited to submitted documents. There is thus no guarantee as to whether the building owners and developers would follow the energy standard specification after submitting the documents.

Secondly, there is no incentive that encourages the adoption of higher energy efficiency appliances and construction of buildings beyond the minimum energy performance requirement of BEC, although HEPs and the No.5 energy labeling program have been implemented, and a number of these appliances are available in the market. As the BEC in Thailand is designed not to be a burden with a high initial cost in constructing energy-efficient buildings¹⁸⁾²⁶⁾, the HEPS energy standard and labeling program have not necessarily been linked well. Although Thailand has adopted both a prescriptive approach that stipulates minimum energy performance requirements for each component of the buildings and a performance approach that assesses the overall energy consump-

tion in a building, a barrier of the existing approach is that the construction does not necessarily need to meet the minimum energy performance requirement of each component of the building, such as building envelope, air-conditioning, and lighting. In the current system, even the building designers may not meet the criteria of each building component, if they show that the overall energy consumption of the proposed building satisfies the benchmark compared with reference case¹⁷⁾. That is, the average energy consumption rate/space unit/year of individual building types and the construction of designed buildings is accepted as it passed the criteria of BEC¹⁷⁾²⁴⁾. While it gives building owners increased flexibility to meet the targets²⁶⁾, the transaction cost of the building's lifetime is not considered appropriately¹¹⁾. As there is no information disclosure system about the energy efficiency performance of newly constructed buildings, it would create unfair conditions for the building owners and tenants in encouraging energy management countermeasures.

Thirdly, the institutional barriers, which did not clarify the differentiated responsibilities for the enforcement and compliance of BEC, have prevented the promotion of energy efficiency of designated buildings. While the development of BEC is only under the responsibility of DEDE under the ECP Act formulated by the Energy Policy and Planning Office (EPPO), it is supposed to be enforced by the Department of Public Work and Town and Country Planning (DPWTCP) as well as by local authorities²³⁾, because they are the agencies responsible for the permission of new building construction. Although DPWTCP checks building safety for the construction of new buildings under the Building Control Act²⁴⁾, the promotion of energy efficiency is not DPWTCP's mandate. The challenge is, as DEDE officials and academics have pointed out, that BEC has not been recognized as a law for enforcement, because the nature of BEC is to persuade people to save energy. Although DEDE has conducted the voluntary pilot project to implement BEC and provide technical support from DEDE and incentives such as tax incentives and ESCO Fund, together with the campaign through the Thailand Energy Award, there is no government authority for inspection after the buildings' construction. As the BEC has not been enforced by DPWTCP, it has also not approached the Bangkok Building Control Legislation, according to an official of Bangkok Metropolitan Administration (BMA).

In addition, the limited availability of the expertise to check the submitted construction permission report on the energy efficiency necessary to conform to the regulations causes a time gap in the actual implementation of these measures by the individual

owners of the designated buildings. According to one of committee member of TGBI, building designers are trained and are knowledgeable enough to design and prepare documents. The government officials have limited knowledge to inspect the building plans and the calculation sheet submitted by architects and engineers. Building owners complain that the process takes too long to approve a building plan. The long administrative approval process is not acceptable among building owners.

Fourthly, data and information availability to design cost-effective, higher energy efficiency buildings are also limited. This is partly because research and the funding to construct the higher energy efficiency buildings that integrated Thailand's local contexts are limited. Building designers, architects, and engineers generally have limited knowledge and do not understand the energy efficiency opportunities and techniques¹⁷⁾. Although there is training for building designers, as well as a computer program and handbook to comply with the building design, the building designers only have the responsibility of building design and the compliance of the BEC and building safety¹⁷⁾.

The building energy efficiency labeling program is one of several key policy instruments to enhance the effectiveness of the implementation of BEC⁸⁾¹³⁾¹⁴⁾. Its implementation is challenging in Thailand due to lack of budget, high transaction cost, and the number of certified domestic verifiers. Currently, there is no nationally authorized program for labeling of buildings. DEDE used to have its own energy labeling scheme called the Thailand Energy and Environmental Assessment Method (TEEAM)⁷⁾. It began in 2007; however, after 5 years of operation, DEDE could not implement the project due to lack of budget. DEDE tries to operationalize voluntary building labeling called Thailand's Rating of Energy and Environmental Sustainability (TREES) systems, which is developed to suit the situation in Thailand by the Thai Green Building Institute (TGBI) in 2010. However, TGBI is acting alone on green building labeling, without any financial support from DEDE. According to the committee of TGBI, this causes a drawback because building owners will not trust any local labeling scheme anymore. Some building owners have doubts about the sustainability of Thailand's building energy efficiency labeling system, and they have decided to use international rating schemes such as the United States' Leadership in Energy and Environmental Design (LEED) program. Hence, grade-A buildings with high energy efficiency standards will use LEED instead. That makes the use of BEC with the combination of the building energy efficiency labeling program difficult in practice.

b) Barriers of energy management in existing designated buildings

Under the situation in which there is an uncertain number of designated buildings that have complied with the BEC to date, strengthening energy management procedures in existing designated buildings in line with the building types, electricity usage pattern, and the level of energy consumption is essential to examine the ways of monitoring the achievement of energy conservation and CO₂ emission reduction.

A barrier of the existing energy management, including the reporting of designated building under the ECP Act, is also the lack of verification and monitoring system. While compliance with the submission of audit reports exceeds 80%, according to DEDE, there is little credibility with respect to the quality of the data because of the self-reporting system by each PRE. There is also no benchmark to identify their electricity consumption level compared with other similar types of buildings, analyze their achievement of energy management activities, or to develop strategies to further improve for each designated building. The follow-up mechanism in conjunction with energy management reporting on designated buildings that have not met the standard is also limited. Limited capacity to verify the submitted energy management reports from each designated buildings prevents the strengthening of ministerial regulations and updating of the energy efficiency performance standards of the designated buildings.

In order to overcome the problem and enhance energy management opportunities, the third energy management auditor system has been established under the ministerial regulation of the ECP Act. However, the system has not been implemented yet, because it has not determined the auditing and certification criteria, energy management auditors' criteria, and how to operate the officials' training courses. The task of increasing the number of qualified third-party energy management auditors is challenging, because the costs for capacity buildings and technical assistance is high due to the dispersed nature of energy end-use activities¹¹⁾.

It may be effective to conduct an energy audit with subsidy⁸⁾¹³⁾¹⁴⁾. Currently, there is no subsidy for the energy audit in Thailand; it adopted the energy audit system from 1996 to 2005¹⁷⁾. Initially, it was implemented with subsidy from the ENCON Fund in order to raise awareness of energy conservation and identify the necessity countermeasures in collecting the data and information from the submitted reports. The implementation of the energy management audit by external consultants increased the reliance on them without identification of the necessity of energy management by building owners and other occupants. The revised energy management procedure

under the ministerial regulation thus ended the subsidy for energy audit and developed the system to conduct energy management by employing PRE and appointing the energy working group. It is thus necessary to examine how to develop the internal capacity of energy management in providing the subsidy for energy audit.

Energy management of the designated buildings in line with the ministerial regulation has not been fully implemented, even in the designated government buildings²⁹⁾. While there were 803 designated government buildings as of 2010, roughly 30% of the agencies had not employed the PRE²⁹⁾. Some buildings had also not developed the energy conservation policy or implemented energy countermeasures, because some staff lacked understanding about the importance of PRE and the implementation of countermeasures due to limited cooperation from the administrators and the budget²⁹⁾. The case study shows the importance of capacity and awareness building across the government agencies and the necessity of displaying commitment from government agencies to provide the public leadership to the private sector.

(2) Barriers of energy efficiency standard and the labeling program

Energy efficiency standards and the labeling program are among the most effective and cost-effective policy instruments as along with the BEC, if standards are set appropriately and periodically strengthened⁸⁾¹³⁾¹⁴⁾.

The barrier of the energy efficiency standard and the labeling of institutional design is, firstly, that they are conducted largely on a voluntary basis and are not mandatory. They are not effective compared with mandatory measures. Moreover, only 3% of lower efficiency appliances are subject to elimination from the market²⁷⁾. It is thus difficult to control and eliminate the insufficient lighting and air conditioning. On the other hand, 20% of high efficiency products are promoted as HEPS²⁷⁾. In addition, EGAT's DSM program has not contributed to the updating of labels. This is partly because EGAT is a state enterprise that does not possess the relevant legal authority and has a rate-of-return incentive structure that passes costs on to the customer, so there is little incentive for it to invest in energy savings³⁰⁾.

The institutional barriers also make it difficult to implement and disseminate the higher efficiency appliances. As for MEPS, while the draft standard is set by DEDE, it is regulated by the Thailand Industrial Standards Institute (TISI) of the Ministry of Industry. Many bureaucratic processes are involved, and the acceptance of all stakeholders must be obtained through several consultation processes for the

approval of MEPS and HEPS. In the case of the registration of HEPs, it takes 2-3 years to be approved³¹⁾. Hence, while the higher energy performance appliances have existed, appliances have been disseminated in the market in a timely way.

Compared with the promotion of the energy efficiency lighting program, promotion of higher energy efficiency air conditioning had limited success³²⁾. Firstly, there are more than 55 manufacturers of air conditioners, but they are mostly small manufacturers. Incremental costs are high for them³²⁾. Secondly, while air conditioning manufactured in Thailand is mostly exported, those used in Thailand are mostly imported³¹⁾. As there are only four testing laboratories operating in Thailand, it is difficult to conduct performance rating tests³¹⁾.

(3) Information barriers

The lack of accurate energy consumption data for each of the designated buildings, as well as baseline data and information for improving energy efficiency in the designated buildings³³⁾, are fundamental barriers hindering the promotion of energy efficiency activities, whether by regulations, standards, or energy efficiency activities on a voluntary basis.

The lack of easily accessible information on energy efficiency in the designated buildings also hinders the ability to make improvements. Although DEDE has developed average energy consumption baselines for different designated buildings, there are no benchmarking guidelines. A lack of sufficient data to gain an understanding of the existing situation makes future projections and evaluations of the impact of GHG reduction difficult.

(4) Financial barriers

In Thailand, 31% the designated buildings were constructed before the 1990s. 42% of buildings were completed in the 1990s³⁵⁾. The equipment and appliances in these decrepit buildings consume more energy. However, there are limited funds available for the designated building. ENCON fund is not only for the commercial buildings, but also for industry, and commercial facility owners, ESCOs, and project developers⁷⁾. ENCON fund, direct subsidy, and tax incentives are ineligible for the installation and replacement of air conditioners and lighting. Money from the ENCON Fund is transferred from the oil fund under the ECP Act⁷⁾. Hence, only ESCO Fund and utility fund for DSM program are main funding for air-conditioners and lighting.

The activities conducted through the ESCO scheme are limited for the designated buildings to date. ESCO fund is co-funded, so private companies want more support from the ESCO fund. The building owner will not see the value of ESCO companies

if the level of saving on energy costs is small due to cheap energy prices, while investing in appliances and materials for energy efficiency is expensive. Investment in appliances with high energy efficiency for energy savings is not the primary duty of building owners, and the energy bills are a relatively small part of a building's total operating costs¹¹⁾.

Presently, revolving fund, which was operated by DEDE from 2003, has been merged with the ESCO fund. Revolving fund aimed to mobilize commercial investment for energy efficiency projects. It was helped by eleven participating commercial banks that provided low-interest loans, so as to fund projects for energy efficiency at preferential interest rates⁷⁾.

The lesson from the operation of the revolving fund is that information for improving energy efficiency in the designated buildings is needed for the officials of commercial banks in order to enhance the value to invest in higher energy efficiency buildings. Thailand's local banks have had only a limited understanding of energy efficiency projects, making it challenging for potential developers to access financing for such projects. As Cheng pointed out¹¹⁾, many banks are not familiar with energy efficiency technologies and the associated risks and costs.

5. POLICY INSTRUMENTS TO PROMOTE ENERGY EFFICIENCY IN DESIGNATED BUILDINGS UNDER THE NAMA

This study found that while Thailand has addressed energy efficiency in the designated buildings through ministerial regulations from the 1990s, together with voluntary actions and the information program and financial incentives, the policy instruments to promote energy efficiency for designated buildings have not been enforced steadily, as every instrument is implemented on an ad hoc basis. This is partly because the responsible agencies for the design of policy instruments and the executing agencies are different and available data, information, and finances are limited. Therefore, the energy management activities of the designated buildings have not achieved the desired positive impacts to date. In Thailand, the necessity of addressing legal and institutional barriers in order to overcome information barriers was particularly evident.

Since buildings generally stand for more than a decade, the design and materials of a newly constructed building, as well as the appliances initially installed, will influence the energy efficiency of the whole building over a long period³⁵⁾. A failure to invest today in the best available technologies and policy instruments will lock in intensive energy use and emission patterns for several decades. Such de-

layed action will further increase net CO₂ emissions, making it more difficult to meet the two degree target, reduce the impacts of climate change, and lower the cost of the response per ton of GHG reduction³⁵⁾. These outcomes will eventually result in a greater burden on society. It is therefore necessary to develop and implement a practical policy package combining regulatory measures, voluntary and information program and incentives, and economy and market-based instruments to enhance people's awareness and activate the market toward the systematic promotion of higher energy efficiency and low-carbon buildings.

Though EEDP has been implemented, there are no mandatory targets for energy performance³³⁾. There is thus high potential to improve energy efficiency of designated buildings and reduce CO₂ emissions by strengthening existing domestic policy instruments, such as BEC for new buildings and energy management programs for existing buildings using the framework of NAMAs. Opportunities to conduct NAMAs in this field mean that they will supplement and facilitate the achievement of the EEAP by conducting MRV of the proposed policy instruments, as no monitoring approach has been established under the EEDP.

Whether for the objective of promoting energy efficiency under the ECP Act or for counting the CO₂ emissions under the NAMAs, a key challenge is how to develop clear separation of responsibility among concerned agencies as well as the harmonization of works between cooperating agencies in the government and related agencies. For the sustainable operation, the challenge includes how to get participation, cooperation, and compliance from the targeted groups.

The implementation of NAMAs will create the means of developing an environment for promoting the targeted energy efficiency and CO₂ emission reduction in the designated buildings toward the realization of zero-energy buildings, if Thailand's government could coordinate the relevant institutions and develop a data and information management system for MRV. In order to realize the NAMA pledge and sustainable implementation, it is essential for the relevant government sections and a wide range of energy end-users to gain a consensus on the vision through a process-oriented, interactive style of policy-making, implementation, and monitoring.

This paper emphasizes that policy instruments to improve the energy efficiency of existing designated buildings, especially so that their specific energy consumption levels, are beyond the average level to meet the minimum requirement of the 2010 BEC, at least, and enhance the energy performance beyond the BEC as the mitigation action of NAMA in this

sector.

This paper highlights the following key countermeasures that promote energy efficiency and CO₂ emission reduction as NAMAs: (1) energy diagnosis service for the implementation of practical energy management; (2) mandatory BEC with post-construction evaluation; and (3) capacity buildings to establish and increase the qualified third-party energy management auditors for BEC compliance and energy management reports and the verification for sustainable implementation.

(1) Energy diagnosis service for the implementation of practical energy management

In order to promote energy conservation and efficiency of the designated buildings, it is necessary to enhance the advantage to conduct energy management and submit the energy management reports under the ministerial regulations of the ECP Act. One of the alternative policy instrument options for existing buildings is to promote energy conservation activities by providing energy diagnosis service, and providing their energy conservation chart data to assist identifying each designated building's electricity consumption level compared with other similar types of buildings' electricity usage pattern.

In implementing this, it is necessary for the government to establish clear guidelines for energy conservation and CO₂ emission reduction measures in line with the benchmark and the provision of the countermeasures' list. This guidance needs to show what each building owner and tenants can do for energy efficiency, what is cost-effective, and a display of energy-efficient buildings. These countermeasures can be also initiated by agreement between the building owners of designated buildings and the certified energy management auditors who received the mandate from government agencies, using the scheme of the ESCO Fund in Thailand. In developing an incentive policy, it is fundamental to develop and implement fair and transparent regulatory and policy frameworks to enhance the trust to government and participation from the targeted stakeholders of private sectors.

EGAT's DSM program should also include an energy diagnosis service, particularly for the designated buildings that have difficulty in investing in the implementation of countermeasures of installing new appliances and replacing old appliances and equipment with No.5 energy labeling appliances and equipment under the ESCO fund.

The DSM program and the information and awareness campaign for air conditioning's set-point temperature should be strengthened. The increase of air conditioning set-points per 1 degree is expected to be a no-cost and high-potential CO₂ emission reduc-

tion. The study¹⁷⁾ points out that if the building is able to increase the temperature to 26 degrees from 24 degrees, there would be significant saving. Increasing the air conditioning set-point temperature per 1 degree in Thailand will reduce roughly 7% of mean energy consumption. If the air conditioning set-point temperature can be increased from 24 degrees to 26 degrees, there is potential to reduce global warming potential by 10.2% per year¹⁷⁾. It is the least costly policy instrument.

The buildings that achieve the minimum requirement level and beyond should be commended and certified using the scheme of the Thailand energy award. The award program needs to be visible by building owners and tenants who have limited interests in energy conservation due to a lack of information. The rating information about the participating designated buildings should be disclosed by developing the certification system to achieve the target. This will enhance the motivation and commitment of the participating designated buildings, assist them in doing what similar types of designated buildings are doing, and also encourage the other non-participating designated buildings to learn from the other designated buildings' examples and encourage them to participate.

Even if it is initiated as voluntary measures or as a pilot program in the beginning, it would be effective to implement under the regulatory framework as the means to achieve the EEDP target in order to increase the compliance and develop the market value of higher energy efficiency.

In developing an incentive policy, it is essential to establish a fair and transparent regulatory and policy framework to enhance the participation from the targeted stakeholders of private sectors. The government office buildings should conduct energy management reporting and disclose their performance of energy consumption, energy conservation, and CO₂ emission reduction as mandatory to show their compliance and leadership for private sectors.

(2) Mandatory BEC with the post construction evaluation

It is fundamental to enforce BEC as a mandatory measure to expand use of higher energy-efficient building under the ministerial regulation. In enhancing the compliance of BEC and moving beyond the minimum requirement, it is crucial to evaluate the building energy performance after the construction of the buildings and disclose the information. This is because the performance of energy efficiency is not necessarily improved by simply adopting the BEC¹¹⁾. In parallel, it is also necessary to address measures to reduce energy consumption by MEPS and HEPS for appliances and encourage consumers to choose ap-

pliances with higher energy performance standards.

The outcomes of the literature review that evaluated policy instruments to foster energy efficiency in building conducted by Boza-Kiss et al.³⁶⁾ present that BEC and building certification programs are cost and environmentally effective policy instruments in a number of countries. There are a number of studies that support that enforcement of BEC and cost-effectiveness are enhanced by building label and certification. As well, the combination of BEC, building certificate would generate net socio-economic benefits, especially by increasing the property value³⁶⁾.

However, the challenge of implementing BEC is that the cost-effectiveness will also be influenced by structural features of the market, such as construction rate, available technologies, and climate, rather than by the design of program and the implementation details, though it also depends on the level of stringency³⁶⁾. Furthermore, the implementation costs of BEC are high while administration costs are low¹¹⁾³⁶⁾. If BEC has not been implemented without coordination of a wide range of activities and stakeholders, actors, and experts, the cost, resources, and effort needed for actual implementation will be extremely high because the building sector consists of diverse energy end user¹¹⁾. It is thus fundamental to promote cross-sectoral coordination as well as cooperation among technical experts and practitioners to enhance the capability of energy management to achieve the CO₂ emission reduction target by improving energy efficiency in buildings.

(3) Capacity building to establish and increase qualified third party auditors

There is urgent need to provide a sequence of technical trainings for the relevant stakeholders to design and operate higher energy-efficient building and to verify and monitor the achievement of energy management and CO₂ emission reduction. The development of a national credential system for third-party energy management auditors will also assist in increasing job opportunities and the credibility of their work by providing professional feedback to the clients.

Introduction of MRV for CO₂ reduction will also bring additional costs to building owners if there is no incentive to implement the countermeasures under the NAMAs. Without incentive and capacity buildings for building owners, private companies are less likely to participate in the mitigation actions under the proposed NAMAs. International assistance will be required to provide technical assistance and training for the countermeasures, as it is costly to provide these services in the dispersed nature of the building sector.

6. CONCLUSION

This study analyzed the barriers of existing Thai policy instruments hindering the promotion of energy efficiency in the designated buildings, focusing on BEC and their energy management requirements under the ministerial regulations of the ECP Act, as these have not been fully implemented as expected. It then examined the three alternative policy instruments to overcome the barriers and assist planning and implementing the proposed NAMAs pledge of Thailand.

CO₂ emission reductions activities will not be enhanced until a wide range of energy end users are aware that higher energy efficiency buildings have market value in Thailand. It is a challenge to establish GHG information and data management center for the building sector while there are no responsible government agencies or cross-cutting institutions that can develop, implement, and monitor the law, regulations, and policies comprehensively. However, Thailand still has a timeframe in which to resolve such energy efficiency barriers, not only for the target year 2020, but also for post 2020 in a sustainable development manner.

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