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ENERGY EFFICIENCY MANAGEMENT TOWARDS SUSTAINABLE DEVELOPMENT: THE NEED FOR AN ENERGY EFFICIENCY LEGAL FRAMEWORK

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ABSTRACT

Issues on the ever-growing demand for energy, limited fossil fuels, difficulties in obtaining viable, sustainable energy for sustainable development, and adverse impacts on global climate change have driven the international community towards the use of cleaner and more sustainable energy sources. In addition to the sustained availability and utilisation of renewable energy sources, many countries have developed and implemented energy policies to address the above issues as well as to conserve energy in line with Goal 7 of the Sustainable Development Goals (SDGs). This doctrinal analysis is performed to identify the extent to which energy efficiency and conservation imperatives in Malaysia have been implemented and explore the need to enact a legal framework for energy efficiency in this country. The aim of this paper is to detail the prospects of energy efficiency in Malaysia and discuss efforts made to enable energy efficiency practices with a view toward the

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sustainability of energy supply for future use. The outcomes of this study demonstrate that the implementation of energy efficiency in the country is consistent with one of the core agenda items for the economies to progress as recommended by the United Nations General Assembly through SDG 7. Nevertheless, without specific legislation for the implementation of energy efficiency, efforts to strengthen the management and implementation of energy efficiency in Malaysia will not be possible.

Keywords: Energy Efficiency, Sustainable Energy, Conservation of Energy, Sustainable Development.

PENGURUSAN KECEKAPAN TENAGA KE ARAH PEMBANGUNAN MAMPAN: KEPERLUAN UNTUK RANGKA KERJA UNDANG-UNDANG BAGI KECEKAPAN TENAGA

ABSTRAK

Isu-isu mengenai permintaan yang semakin meningkat untuk tenaga, bahan api fosil yang terhad, kesukaran mendapatkan sumber tenaga yang berdaya maju, tenaga mampan untuk pembangunan mampan, dan kesan buruk terhadap perubahan iklim global telah mendorong masyarakat antarabangsa ke arah penggunaan sumber tenaga bersih dan lebih mampan. Di samping ketersediaan dan penggunaan sumber tenaga boleh baharu yang berterusan, banyak negara telah membangunkan dan melaksanakan dasar tenaga untuk menangani isu di atas serta untuk memulihara sumber tenaga selaras dengan Sasaran 7 di Matlamat Pembangunan Mampan (SDGs). Analisis doktrin ini dilakukan untuk mengenal pasti sejauh mana kecekapan tenaga dan keperluan pemuliharaan tenaga di Malaysia telah dilaksanakan dan meneroka keperluan untuk menggubal rangka kerja undang-undang untuk kecekapan tenaga di negara ini. Matlamat makalah ini adalah untuk memperincikan prospek kecekapan tenaga di Malaysia dan membincangkan usaha yang dilakukan untuk membolehkan amalan kecekapan tenaga ke arah kemampanan bekalan tenaga untuk kegunaan masa hadapan. Hasil kajian ini menunjukkan bahawa pelaksanaan kecekapan tenaga di negara ini adalah konsisten dengan salah satu agenda teras bagi ekonomi untuk memajukan dunia seperti yang disyorkan oleh Perhimpunan Agung Pertubuhan Bangsa-Bangsa Bersatu melalui SDG 7. Namun begitu, tanpa perundangan khusus untuk pelaksanaan kecekapan tenaga, usaha memperkukuh pengurusan dan

pelaksanaan kecekapan tenaga di Malaysia tidak akan dapat dilaksanakan.

Kata Kunci: Kecekapan Tenaga, Tenaga Mampan, Pemuliharaan Tenaga, Pembangunan Mampan.

INTRODUCTION

Malaysia has been actively developing renewable energy (RE) sources as part of the ratification of the Paris Accords and several joint global efforts to address the impacts of the energy sector on climate change and safeguard the country's energy supply to meet the growing demand, particularly from the industrial sector. To show its commitment towards the utilisation of these renewable energy sources, the National Renewable Energy Policy and Action Plan was introduced in 2009 while the Renewable Energy Act came into force in 2011. However, Malaysia's energy policy differs from other countries as most countries had introduced energy conservation or efficiency Acts before shifting to the RE sector. Urbanisation causes a greater migration of rural people to the cities, resulting in increased energy demand and consumption. The spike in energy demand will lower energy efficiency and lead to energy waste due to the disparity in living conditions between urban and rural inhabitants.[1]

Generally, a reduction in energy usage saves cost, meets energy efficiency targets while simultaneously minimising greenhouse gas emissions, and subsequently supports greener growth and sustainable development in industrialised countries.[2] Most countries around the world have adopted energy efficiency measures to combat issues related to energy security, environmental degradation, and economic sustainability. Malaysia has shown its commitment to comply with the United Nations Framework Convention on Climate Change 1992 (UNFCCC) through the establishment of the National Greenhouse Gas (GHG) Inventory under its 1995 Guidelines. Various measures have

[1] Zakari, Abdulrasheed, Irfan Khan, Duojiao Tan, Rafael Alvarado, and Vishal Dagar. "Energy efficiency and sustainable development goals (SDGs)." *Energy* 239 (2022): 122365.

[2] Paramati, Sudharshan Reddy, Umer Shahzad, and Buhari Doğan. "The role of environmental technology for energy demand and energy efficiency: Evidence from OECD countries." *Renewable and Sustainable Energy Reviews* 153 (2022): 111735.

also been engaged such as analysing and updating the assessment of vulnerability to climate change and preparing its initial National Communications for the Conference of Parties (COP).[3] In addition, the main climate change regime, the UNFCCC also stated that energy efficiency (EE) is a potential measure to respond to the growing energy consumption. In 2015, Malaysia signed a legally binding global climate change agreement at the Paris Climate Conference (COP21) which sets out a Global Climate Action Plan to avoid catastrophic global climate change.

Following the establishment of these international commitments, RE and EE have become pillars for creating a sustainable energy sector. With the increase in electricity generation from renewable sources, the exploitation of conventional energy sources such as oil and natural gas can be gradually reduced. Among the indicators for the Sustainable Development Goals (SDGs) is Goal 7 which is to ensure access to affordable, reliable, sustainable and modern energy for all. The targets comprise a substantial share of RE in the energy mix, EE and clean energy technology deployment. Therefore, the implementation of policies with appropriate legislation on EE plays a significant role in providing more economical and environmentally friendly energy resources. Besides, issues with high electricity tariffs can be minimised through energy efficiency-related policies.[4] Moreover, an EE policy also acts as an effective measure to reduce the costs associated with electricity generation and support economic growth, particularly for developing countries.[5]

In this study, the development of EE policies in Malaysia is evaluated in the context of EE regulation. Specifically, this study aims to discuss the importance of enacting specific laws to regulate EE according to the preservation principles adopted based on the current

[3] Bulkeley, Harriet, and Rafael Tuts. "Understanding urban vulnerability, adaptation and resilience in the context of climate change." *Local environment* 18, no. 6 (2013): 656.

[4] Abdul Haseeb Ansari, *Energy Law in Malaysia*, (The Netherlands: Wolters Kluwer, 2011), 127-128.

[5] Nogueira, Luiz Augusto Horta, Rafael Balbino Cardoso, Ceres Zenaide Barbosa Cavalcanti, and Paulo Augusto Leonelli. "Evaluation of the energy impacts of the Energy Efficiency Law in Brazil." *Energy for sustainable development* 24 (2015): 59.

international law. The adoption of specific laws on EE is consistent with the goals of the UNFCCC and the Paris Agreement. Additionally, this paper also reviews the EE laws in other jurisdictions to provide legal frameworks that can be used as legal references in executing EE measures in Malaysia. Having this review, Malaysia can learn from the laws of other countries to illuminate issues of the great importance of EE management to achieve SDGs. Specific legislation for the implementation of EE is needed to promote the efficient consumption of energy by using less energy services. Thus, specific legislation for the implementation of EE is vital to enhance EE which is beneficial for the environment, economic and social development.

LITERATURE REVIEW

Herring defined EE as "the ratio of energy services out to energy input". Ideally, it aims to achieve the maximum use of every unit of energy purchased. It is mainly a technical (and historic) process caused by stock turnover, whereby old equipment is replaced by newer and more energy-efficient equipment". [6] Through a competent EE policy, economic productivity can be encouraged, thus positively affecting existing energy use and benefiting consumers.[7] EE is an intermediary to achieving a better quality of life as well as having the ability to deal with the transition from conventional energy to sustainable energy sources such as RE. Most importantly, EE measures must be multi-dimensional and fully synergised with other related policies to reduce carbon emissions.[8]

EE can be measured by several indicators such as energy intensity, or the ratio of energy consumption to the gross domestic product (GDP), and many more.[9] Recent years have seen a rise in the

[6] Herring, Horace. "Energy efficiency—a critical view." *Energy* 31, no. 1 (2006): 11.

[7] Ibid.

[8] Akram, Rabia, Fuzhong Chen, Fahad Khalid, Zhiwei Ye, and Muhammad Tariq Majeed. "Heterogeneous effects of energy efficiency and renewable energy on carbon emissions: Evidence from developing countries." *Journal of cleaner production* 247 (2020): 119122.

[9] Sustainable Energy For All Tracking Progress in Asia and The Pacific: A Summary Report 2015 (Metro Manila: Asian Development Bank, 2015) 1.www.se4all.org/sites/default/files/se4all-tracking-progress.pdf (accessed 5 October, 2017).

importance of regional energy treaties, many of which incorporated novel mechanisms that might be used to advance SDG 7. The Energy Charter Treaty (ECT) and its Protocol on Energy Efficiency and Related Environmental Aspects (Energy Efficiency Protocol), play a significant role to support the transition towards a low-carbon economy.[10] The ultimate purpose of this Protocol is to promote EE and environmental benefits through the adoption of a set of policy principles that support SDG 7. Although many countries have introduced policies on EE, there is inadequate enforcement at both the national and international levels. However, there is a positive trend in the application and enforcement of EE measures around the world, especially in the construction, electronics, and transportation sectors.[11] Generally, RE and EE are often placed in competition with each other. However, various policies focusing on RE and EE as a sustainable incentive in industries such as building and construction as well as various economic sectors have been developed.

EE and RE are priorities in many European countries whereby consistent with the EU's target to achieve a 20% reduction in carbon dioxide emissions by 2020.[12] Moreover, one of the critical aspects of the climate change conference in Paris in 2015 is that various parties have been incentivised to play an important role in promoting the use of green and RE technologies. One of the efforts undertaken by the G7 countries mentioned in the Climate Change Declaration is to overhaul their energy sector by 2050 and expedite access to RE in those countries[13]. Apart from climate change issues, energy security, supply shortages, and instability of fossil fuel prices have increased the pressure on many countries to diversify their energy sources.[14]

[10] The Energy Charter Treaty 1994 includes a wide range of commitments in support of SDG 7, such as free trade in energy goods and materials, open access to energy systems and pipelines, protections for investors, and dispute resolution procedures. It is also listed as a priority to promote clean fuels and renewable energy.

[11] *Renewables 2015 Global Status Report* (Paris: REN21 Secretariat, 2015), 115.

[12] *Renewables 2016 Global Status Report* (Paris: REN21 Secretariat, 2016), 25.

[13] Ibid.

[14] Deepa Badrinarayana et al., "Introduction to International And Domestics Climate Change Regulation," *in Climate Change and Indigenous Peoples:*

A dynamic climate protection policy needs to be established based on clear goals such as reducing the impact of climate change, exploiting RE sources especially for electricity generation, and implementation of EE measures.[15] For example, the EU energy policy has integrated three key elements that include energy security, environmental sustainability, and market competitiveness. Since climate change policies have a significant impact on the coordination of energy policies[16], the integration between climate change and energy security is vital in the discussion of issues ranging from energy to climate change. Efforts by the EU to mitigate the impact of climate change and promote EE have led to the promotion of technologically advanced, patented, and export-related enhancements.[17]

Harmsen et al. explained the significant role of RE in achieving Europe's 2020 primary energy savings target as well as highlighted that the focus on the RE sector may shift the attention away from energy-saving measures in major sectors, thus viewing it as a threat to the long-term climate policy.[18] This view was supported by Strambo et al. who indicated that the EU has focused on accelerating EE measures to reduce energy intensity through the introduction of the Energy Efficiency Directive (Directive2013/12/EU) and the Energy Performance of Buildings Directive (Directive 2010/31/EC).[19] The authors also argued that the current EE measures could create impediments to the development of RE. The EU is firmly committed to strengthening sustainable energy measures to reduce obstacles in

The Search for Legal Remedies. (Massachusetts: Edward Elgar Publishing Ltd.,2013), 37.

[15] Cem Özdemir, "The Need for Momentum in Europes Climate Change Policies: Experiences from Germany's Energiewende," *Global Policy* 5 (2014): 52, doi:10.1111/1758-5899.12154.

[16] Arno Behrens, "The Role of Renewables in the Interaction between Climate Change Policy and Energy Security in Europe," *Renewable Energy Law and Policy* 5 (2010), 5.

[17] Ibid.

[18] Harmsen, Robert, Bart Wesselink, Wolfgang Eichhammer, and Ernst Worrell. "The unrecognized contribution of renewable energy to Europe's energy savings target." *Energy Policy* 39, no. 6 (2011): 3427.

[19] Strambo, Claudia, Måns Nilsson, and André Månsson. "Coherent or inconsistent? Assessing energy security and climate policy interaction within the European Union." *Energy Research & Social Science* 8 (2015): 6.

energy markets and establishing time-bound goals for member states to fulfil through national plans contributing to the achievement of SDG 7. By 2030, the EU intends to increase both its RE contribution and its EE by 27%.[20] International trade and investment treaties help in progressing toward SDG 7 by supporting investments that encourage all cross-border investments, including those in RE and EE.[21] Moreover, Xunpeng posited that the promotion of EE alone was not sufficient in the ASEAN region. Nevertheless, he believed that the combination of EE measures, RE promotion, and regional cooperation was vital to support the green policies of the region.[22]

The Kyoto Protocol provided avenues for the international community to reduce the impact of greenhouse gases by adopting policies to increase EE, create a safe and sustainable energy system, promote sustainable agriculture, promote research on green technology and RE as well as reduce the emission of carbon dioxide and environmental pollution.[23] While according to the Paris Agreement, each member country must submit a National Determined Contribution (NDC) every five years as stated in Article 4 (9). This NDC demonstrates the commitment and effort of each country in reducing the impact of global climate change.[24] One of the approaches adopted in the NDC is the implementation of EE policies to reduce greenhouse gas emissions. As of 2015, at least 146 countries had implemented several types of EE policies and at least 128 countries had adopted one or more EE targets. There were also several policies which incorporated EE and energy generation from RE sources that were aimed at increasing the global energy supply.[25] Driven by changes in the energy sector structure and increased EE implementation measures,

[20] Ibid.

[21] Bruce, Stuart, and Sean Stephenson. "SDG 7 on Sustainable energy for all: Contributions of International Law, Policy and Governance." *Policy and Governance (August 2016)* (2016).

[22] Shi, Xunpeng. "The future of ASEAN energy mix: A SWOT analysis." *Renewable and sustainable energy reviews* 53 (2016): 672-680.

[23] Hermann E. Ott, "The Kyoto Protocol: Unfinished Business," *Environment: Science and Policy for Sustainable Development* 40:6 (1998): 17, doi:10.1080/00139159809604595.

[24] Wilhite, Harold, and Arve Hansen. "Will the Paris Agreement save the world? An analysis and critique of the governance roadmap set out in COP 21." Oslo Academy of Global Governance Working Paper 2016.1 (2016).

[25] Ibid.

global energy intensity rates have declined more than 30% between 1990 and 2014. However, energy demand is expected to increase with global economic growth and globalisation.[26] All nations are putting their best effort into developing new energy sources and focusing more on RE. As the economy expands, so does the need for energy, bringing new challenges in terms of generation and imposing pressure on utility infrastructure. To provide both the quality and quantity of energy services,[27] it is expected that energy security will be a huge concern in the next 20 years. This regard, the development of efficient technologies and infrastructure in the energy sector becomes a guarantor of sustainable development to meet the demands of future generations to provide a safe and reliable energy supply.[28]

Figure 1: Relationship between energy efficiency, sustainable energy supply and consumption, energy security, and sustainable energy sector.[29]

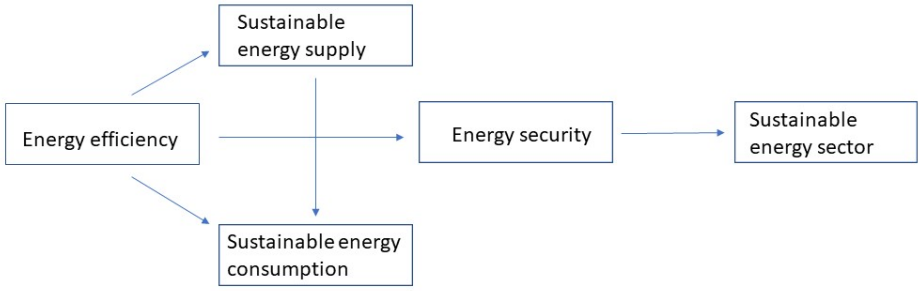

Figure 1 shows the relationship between EE, sustainable energy supply and consumption, energy security, and the sustainable energy sector. EE assists in enhancing national energy security by reducing overall energy demand as well as reducing the likelihood of supply

[26] Ibid.

[27] Chien, Feng Sheng. "The mediating role of energy efficiency on the relationship between sharing economy benefits and sustainable development goals (Case of China)." *Journal of Innovation & Knowledge* 7, no. 4 (2022): 100270.

[28] Shabalov, M. Yu, Yu L. Zhukovskiy, A. D. Buldysko, B. Gil, and V. V. Starshaia. "The influence of technological changes in energy efficiency on the infrastructure deterioration in the energy sector." *Energy Reports* 7 (2021): 2665.

[29] Authors

interruptions. As energy security is vital for supporting a sustainable energy sector, a large number of developed and developing countries have set EE targets and amended their existing laws to adopt and practice the implementation of EE measures as well as expand the coverage of labelling standards and programmes especially for electrical appliances. Clean energy and efficient energy usage are critical for the environment and the economy. EE is the key to mitigate the impacts of externality produced by excessive energy consumption.[30] It was suggested that the national development plan should govern the implementation of programmes that limit or reduce energy use with special features including obligatory energy management practises and an optimal energy-health initiative to enable the transition to low-carbon and clean energy.[31]

In addition, some developed countries have also introduced new financial incentives to channel additional funding toward empowering the implementation and promotion of EE. Cagno et al. identified several initiatives to support EE measures which include a long-term energy strategy, clarity of information, cost reduction from lower energy use, and public investment subsidies.[32] These initiatives work as a stimulus to improve overall EE. Additionally, while agreeing on the importance of the long-term energy strategy, the authors insisted that the implementation of voluntary agreements would hinder the successful implementation of the long-term energy strategy.[33] Besides, to support the fulfillment of SDGs, a well-established financial structure with domestic and external investments is required as EE

[30] Matahir, Hylmee, Jain Yassin, Herniza Roxanne Marcus, Nur Aima Shafie, and Nor Farizal Mohammed. "Dynamic relationship between energy efficiency, health expenditure and economic growth: in pursuit for SDGs in Malaysia." *International Journal of Ethics and Systems* (2022).

[31] Ibid.

[32] Cagno, Enrico, Andrea Trianni, Giovanni Spallina, and Federico Marchesani. "Drivers for energy efficiency and their effect on barriers: Empirical evidence from Italian manufacturing enterprises." *Energy efficiency* 10, no. 4 (2017): 859.

[33] Ibid.

incorporates environmental, social and governance factors that need sustainable finance for long-term development.[34]

Papastamatiou et al. described the importance of optimising energy use and its management as these factors subsequently lead to a significant reduction in carbon emissions.[35] The authors developed a Smart City Energy Assessment Framework tool (e-SCEAF) that focused on EE measures and energy management to support both short- and long-term energy goals.[36] On the other hand, there are also several strategies to reduce energy consumption and promote EE specifically for buildings that have been implemented through various instruments such as regulatory measures, soft instruments, and economic incentives.[37] Nevertheless, specific technical knowledge is required to assess such a legal framework as specific laws on EE are crucial for reducing energy loss. Additionally, the law will become more effective through extensive public awareness and engagement as well as regular reviewing of efficiency limits and increasing the number of regulated equipment in the efficiency monitoring programmes.[38]

METHODOLOGY

This study was mainly performed using a doctrinal research methodology to understand the concept EE and to determine if the existing laws and policies in Malaysia are sufficient for the enhancement of EE applications. The doctrinal analysis employed in this study focuses on the content of the laws and sub-legislations. Additionally, other reference materials and secondary sources such as

[34] Ziolo, Magdalena, Sandra Jednak, Gordana Savić, and Dragana Kragulj. "Link between energy efficiency and sustainable economic and financial development in OECD countries." Energies 13, no. 22 (2020): 5898.

[35] Papastamatiou, Ilias, Vangelis Marinakis, Haris Doukas, and John Psarras. "A decision support framework for smart cities energy assessment and optimization." *Energy Procedia* 111 (2017): 802.

[36] Ibid.

[37] Allouhi, Amine, Youness El Fouih, Tarik Kousksou, Abdelmajid Jamil, Youssef Zeraouli, and Youssef Mourad. "Energy consumption and efficiency in buildings: current status and future trends." *Journal of Cleaner production* 109 (2015): 118-130.

[38] Nogueira et al., 60.

books, chapters in books, academic journals, reports, and other resources were also utilised in this research.

DISCUSSION

Overview of the Malaysian Energy Mix

Historically, the economic growth of Malaysia was initially driven by the export of rubber and tin. Subsequently, the country established itself in the global economy as the lead exporter of palm oil, electronic goods, and petroleum. Since 1970, the country has been progressing well with a predicted annual increase in the total income of approximately 6-7% up to the year 2000.[39] It is evident that the exploitation of new energy resources has provided an important stimulus to the economy of Malaysia.[40]

Energy plays a significant role in the development of Malaysia's economy as well as other parts of the world. As Malaysia is advancing towards attaining the status of a developed nation, its reliance on the energy sector is expected to increase correspondingly. Malaysia is blessed with a reserve of domestic energy sources such as oil and gas, and therefore, the development and improvement of the Malaysian energy sector will contribute significantly towards the industrialisation, socio-economic development, and foreign direct investment of the country.[41] However, during the colonial era, the government realised that Malaysian territories had very few commercially exploitable energy sources.[42] Although Malaysia possesses large reserves of domestic fossil fuels and energy sources, the increasing costs of

[39] Zainal Aznam Yusof and Deepak Bhattasali, "Economic Growth and Development in Malaysia: Policy Making and Leadership," Commission on Growth and Development (Working Paper No. 27, Washington, DC: The World Bank, 2008), 1.

[40] Means, Gordon P. "Energy Resource Development and Management in Malaysia." *Contemporary Southeast Asia* 5, no. 3 (1983): 333.

[41] Mustapa, Siti Indati, Leong Yow Peng, and Amir Hisham Hashim. "Issues and challenges of renewable energy development: A Malaysian experience." In *Proceedings of the International Conference on Energy and Sustainable Development: Issues and Strategies (ESD 2010)*, pp. 1-6. IEEE, 2010.

[42] Means, 334.

petroleum gas, coal, and other non-RE sources pose several a challenge in fulfilling the demand for sustainable energy use.[43]

The total consumption of electricity in the country was approximately 747 kilotonnes of oil equivalent (ktoe) in 1980 and this figure increased to 1714 ktoe by 1990, subsequently reaching 5263 ktoe by 2000. In 2010, the figure was 8993 ktoe, and by 2013, it increased to 10,590 ktoe. Thus, the demand for electricity was 14 times higher than the original amount consumed in 1980.[44] Malaysia's total installed electricity generation capacity was 24,361 megawatt (MW) in 2010 and approximately 34,000 MW in 2018, of which approximately 10,500 MW of electricity was generated from coal. The total electricity generation increased from 108,175 GWh to 150,375 GWh from 2010 to 2018, while electricity consumption increased by 30.17% for the same duration[45]. Natural gas, coal, and hydro are the primary fuels for power generation.[46] For electricity generation in 2017, coal and natural gas contributed 32.4% and 46%, respectively, while hydropower, diesel and fuel oil, and RE accounted for 14%, 3.7%, and 2.8%, respectively.

The natural gas reserves in Malaysia are the second largest in the Southeast Asian region and the 12th largest in the world, thus having the prospect of contributing significantly towards Malaysia's energy mix for the next 36 years if effective measures are duly taken.[47] Coal, being the second-largest source of energy production, provides around 30% of Malaysian primary energy needs[48] and assists in the generation

[43] Bradshaw, Michael J. "Global energy dilemmas: a geographical perspective." *Geographical Journal* 176, no. 4 (2010): 279.

[44] Petinrin and Mohamed Shaaban, 973.

[45] Basri, Nor Afifah, Ahmad Termizi Ramli, and Abubakar Sadiq Aliyu. "Malaysia energy strategy towards sustainability: A panoramic overview of the benefits and challenges." *Renewable and Sustainable Energy Reviews* 42 (2015): 1095.

[46] Hamzah, Norfadhilah, Koji Tokimatsu, and Kunio Yoshikawa. "Solid fuel from oil palm biomass residues and municipal solid waste by hydrothermal treatment for electrical power generation in Malaysia: A review." *Sustainability* 11, no. 4 (2019): 1060.

[47] Bradshaw, 280.

[48] Oh, Tick Hui. "Carbon capture and storage potential in coal-fired plant in Malaysia—A review." *Renewable and Sustainable Energy Reviews* 14, no. 9 (2010): 2699.

of approximately 41% of electricity globally.[49] Malaysia has significantly large coal reserves which are mainly located in Sabah and Sarawak, and are difficult to explore as these sites are mostly available in areas where the infrastructures are not properly built or developed.[50] Oil contributed up to 87.9% of Malaysia's energy mix before the international oil crisis in 1973 and 1979.[51]

These fossil fuels still constitute the main resources in Malaysia's energy mix. Hence, the gradual depletion of these fossil fuels will have alarming consequences on local energy security and global climate change.[52] Therefore, policymakers have taken initiatives to improve the infrastructures for sustainable and environmentally friendly energy supply to reflect the country's commitment towards achieving the SDGs.[53] Malaysia is fortunate to have adequate sunlight throughout the year to operate solar panels and PVs. Additionally, the country is blessed with the other natural environments as well as the adequacy of biomass/biogas from palm oil wastes. The availability of these resources has a positive impact on the exploitation of RE sources. Despite all these advantages and policy initiatives, the supply of RE accounts for only 1% of the total energy mix.[54]

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[49] Khanna, Nina Zheng, Nan Zhou, David Fridley, and Jing Ke. "Quantifying the potential impacts of China's power-sector policies on coal input and CO2 emissions through 2050: A bottom-up perspective." *Utilities Policy* 41 (2016): 130.

[50] Oh, Tick Hui, Shen Yee Pang, and Shing Chyi Chua. "Energy policy and alternative energy in Malaysia: Issues and challenges for sustainable growth." *Renewable and Sustainable Energy Reviews* 14, no. 4 (2010): 1245.

[51] Ibid.

[52] Shafie, SMTMI Mahlia, Teuku Meurah Indra Mahlia, Haji Hassan Masjuki, and Andri Andriyana. "Current energy usage and sustainable energy in Malaysia: A review." *Renewable and Sustainable Energy Reviews* 15, no. 9 (2011): 4370-4377.

[53] Ong, H. C., T. M. I. Mahlia, and H. H. Masjuki. "A review on energy pattern and policy for transportation sector in Malaysia." *Renewable and Sustainable Energy Reviews* 16, no. 1 (2012): 538-539.

[54] Kardooni, Roozbeh, Sumiani Yusoff, Fatimah Kari, and Leila Moeenizadeh. "Public opinion on renewable energy technologies and climate change in Peninsular Malaysia." *Renewable energy* 116 (2018): 662.

Legal Framework to Govern Energy Efficiency in Malaysia

The Malaysian government has diversified its efforts and approaches to reducing energy costs and loads through the implementation of various EE measures.[55] One of the approaches introduced by the government, especially in the public sector, is to reduce the use of electrical and electronic equipment such as air conditioners.[56] Owing to the importance of energy conservation and efficiency in creating a sustainable energy sector, the government, through its agencies, has introduced various EE programmes such as the establishment of the Education and Training Centre in Renewable Energy and Energy Efficiency (CETREE) that aims to promote EE and generate electricity from RE sources.[57]

In the Seventh Malaysia Plan (1996-2000), there was an emphasis on the efficient use of energy including aspects of installation, approval, labelling, and the appointment of EE officers.[58] Similar efforts were continued in the Eighth Malaysia Plan (2001-2005), wherein various incentives were provided to promote EE.[59] The Ninth Malaysia Plan (2006-2010) witnessed the implementation of a comprehensive EE programme, which not only focused on the industrial and commercial sectors but also private sectors including residential areas.[60] This effort was part of the government's initiative to ensure the sustainability of energy supply and thus, cater to the rapid economic growth of the country. Additionally, amendments to the

[55] Ong et al., 538.

[56] Ibid.

[57] Abdul Rahman Mohamed & Lee Keat Teong. (December, 2004). Energy policy for sustainable development in Malaysia. Paper presented at the Joint International Conference on Sustainable Energy and Environment, Hua Hin, Thailand.

[58] Hashim, Haslenda, and Wai Shin Ho. "Renewable energy policies and initiatives for a sustainable energy future in Malaysia." *Renewable and Sustainable Energy Reviews* 15, no. 9 (2011): 4780-4787.

[59] Mohamed, Abdul Rahman, and Lee Keat Teong. "Energy policy for sustainable development in Malaysia." *energy* 1 (2004): 5.

[60] Vaka, Mahesh, Rashmi Walvekar, Abdul Khaliq Rasheed, and Mohammad Khalid. "A review on Malaysia's solar energy pathway towards carbon-neutral Malaysia beyond Covid'19 pandemic." *Journal of Cleaner Production* 273 (2020): 122834.

Electricity Supply Act 1990 as well as the regulations on electrical equipment labelling have also been implemented to promote EE at the domestic level.[61]

In 2010, the National Energy Efficiency Masterplan was introduced as a comprehensive guideline for enhancing energy conservation and energy measures in various sectors to achieve energy savings. The Tenth Malaysia Plan (2011-2015) focused on the exploitation of green technology, in line with the National Green Technology Policy.[62] Additionally, the introduction of the New Energy Policy (2011-2015) supported the implementation of EE to safeguard the country's national security and energy supply.[63] The Investment Promotion Act 1986 also provides a 70% tax exemption of up to five years for companies providing EE services. These companies also qualify for other tax exemptions under the Income Tax Act 1967.[64] The government, through the Ministry of Energy, Green Technology, and Water (currently known as the Ministry of Natural Resources, Environment and Climate Change), launched the National Energy Efficiency Action Plan (NEEAP) for the implementation period of 2016-2025 with four strategic thrusts, namely the implementation of the Energy Efficiency Plan, reinforcement of institutional framework, capacity development and training, the establishment of sustainable funding mechanism, and promotion of private sector investment in EE. Tables 1 and 2 show the projected benefits in terms of the expected energy savings from the implementation of the National Energy Efficiency Action Plan from 2020 to 2025.

Table 1: Projected benefits acquired from the implementation of the National Energy Efficiency Action Plan from 2020-2025[65]

[61] Ansari, 211.

[62] Bujang, Ahmad Safuan, C. J. Bern, and T. J. Brumm. "Summary of energy demand and renewable energy policies in Malaysia." *Renewable and Sustainable Energy Reviews* 53 (2016): 61.

[63] Chachuli, Fairuz Suzana Mohd, Norasikin Ahmad Ludin, Muhamad Alias Md Jedi, and Norul Hisham Hamid. "Transition of renewable energy policies in Malaysia: Benchmarking with data envelopment analysis." *Renewable and Sustainable Energy Reviews* 150 (2021): 111456.

[64] Ansari, 213.

[65] Ministry of Energy, Green Technology and Water. *National Energy Efficiency Action Plan*, 2015, 49.

Item	2020	2021	2022	2023	2024	2025
Cumulative Savings (GWh)	7,643	13,118	20,279	29,188	39,342	52,233
Demand Savings (GW)	617	893	1168	1453	1727	2021
Capacity Savings (GW)	771	1116	1460	1816	2172	2526
Benefits (RM/million)	1336	1947	2552	3173	3790	4401

Table 2: Projected energy sources savings from the implementation of the National Energy Efficiency Action Plan from 2020-2025[66]

Item	2020	2021	2022	2023	2024	2025
Total Fuel Savings (TJ)	57,609	74,600	91,892	108,786	125,289	540,045
Gas Savings (TJ)	26,500	34,316	42,271	50,946	57,633	248,421
Coal Savings (TJ)	23,620	30,586	37,676	44,606	51,363	221,418

An effective EE framework is crucial in creating a sustainable energy sector. As postulated in the above tables, the EE framework and enforcement can facilitate a reduction in energy demands especially from non-renewable sources such as gas and coal. Therefore, the authors suggest that the government should set a realistic EE target that is in line with current resources and capabilities. Likewise, the NEEAP should also "be going back to the basics with clearly defined and easy to understand policies, initiatives, and methodologies."[67] Promotions and programmes for EE should cover various levels of the primary sectors, including government agencies. Among the programmes that have been employed are the Malaysian Energy Efficiency Improvement Project (MIEEIP), Lower Energy Building (LEO), Zero-

https://www.pmo.gov.my/ms/2019/07/pelan-tindakan-kecekapan-tenaga-negara/

[66] Ibid.

[67] Abd Rahman, Nurul Asra, Syahrul Nizam Kamaruzzaman, and Farid Wajdi Akashah. "Scenario and strategy towards energy efficiency in Malaysia: a review." In *MATEC Web of Conferences*, vol. 266, p. 02012. EDP Sciences, 2019.

Energy Office Building (ZEO), and Green Building Index (GBI).[68] The Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) was also launched in 2000 to promote EE and conservation efforts, particularly in the industrial sector and establish institutions to support the sustainability of EE implementation in Malaysia.[69] This initiative is a part of the joint venture programme between the Malaysian Government, Global Environmental Facility (GEF), and the United Nations Development Programme (UNDP).[70]

In addition, the Green Building Index (GBI) was introduced by the Malaysian Association of Architects and Consultants Association of Malaysia (ACEM) to assess the impact of new buildings from the perspective of environmental factors.[71] Based on the implementation of the EE scheme in Australia and Singapore, six EE criteria for new buildings were adopted, including environmental quality, sustainable site and management, materials and resources, water efficiency, and innovation.[72] Besides, some incentives were given to GBI's first owner and buyers that were valid from October 2009 to December 2014.[73]

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[68] Mekhilef, Saad, Meghdad Barimani, Azadeh Safari, and Zainal Salam. "Malaysia's renewable energy policies and programs with green aspects." *Renewable and Sustainable Energy Reviews* 40 (2014): 500.

[69] Sin, T. Ching, Suhaida Mohd Sood, and Leong Yow Peng. "Sustainability development through energy efficiency initiatives in Malaysia." *Paper of Green & Energy Management* (2011): 4-5.

[70] Oh, Tick Hui, Shen Yee Pang, and Shing Chyi Chua. "Energy policy and alternative energy in Malaysia: Issues and challenges for sustainable growth." *Renewable and Sustainable Energy Reviews* 14, no. 4 (2010): 1243-1244.

Shaikh, Pervez Hameed, Nursyarizal Bin Mohd Nor, Anwer Ali Sahito, Perumal Nallagownden, Irraivan Elamvazuthi, and M. S. Shaikh. "Building energy for sustainable development in Malaysia: A review." *Renewable and Sustainable Energy Reviews* 75 (2017): 1392-1403.

[72] Lim, Yaik-Wah, Eka Sediadi, Fatemeh Shahsavari, and Noor Azli. "Building information modelling for building energy efficiency evaluation: Integration with Green Building Index (GBI) in Malaysia." 4th Annual International Conference on Architecture and Civil Engineering, 25-26 April 2016, Singapore, 2016.

[73] Oh, Tick Hui, Md Hasanuzzaman, Jeyraj Selvaraj, Siew Chein Teo, and Shing Chyi Chua. "Energy policy and alternative energy in Malaysia: Issues and challenges for sustainable growth–An update." *Renewable and Sustainable Energy Reviews* 81 (2018): 3025.

Some examples of buildings that implemented EE initiatives are the LEO buildings, whereby 62% accounted for the energy consumption of air conditioning, 18% for lighting, and 20% for other equipment.[74] This is in contrast to the ZEO building which uses electricity from the generation of RE sources.[75] On the other hand, the GEO building, also known as the Green Energy Office, was equipped with a photovoltaic solar panel.[76] Lastly, the Diamond Building, which is also the headquarters of the Energy Commission of Malaysia, has been built based on the concept of sustainable buildings with an emphasis on EE, water savings, waste reduction, and quality standards of internal and external environments.[77]

The implementation of EE in Malaysia is necessary to offset issues involving the environment. Malaysia has diversified policies and incentives to reduce energy costs and provide instruments to mitigate the impact of greenhouse gases and carbon dioxide emissions in Malaysia. However, EE in the country has not yet reached its optimum level, especially with the suspension of primary energy sources such as oil and natural gas in day-to-day operations.[78] Consequently, the implementation of EE and RE utilisation in an integrated manner is particularly important in the construction sector. Buildings that utilise EE will be able to overcome problems related to energy shortages and negative environmental impacts. Buildings that use minimal energy and RE technologies are among some of the key drivers in EE programmes. In line with the global trend, the construction sector in Malaysia is moving towards the implementation of more environmentally friendly features.[79] Moreover, EE is also significant in

[74] Oh et al., (2010): 1244.
[75] Ibid.
[76] Ibid.
[77] *Overview of the energy commission*. (n.d.) Retrieved http://www.st.gov.my/index.php/en/about-us2/overview-of-the-energy-commission (accessed 9 March, 2017).
[78] Shaikh, Pervez Hameed, Nursyarizal Bin Mohd Nor, Anwer Ali Sahito, Perumal Nallagownden, Irraivan Elamvazuthi, and M. S. Shaikh. "Building energy for sustainable development in Malaysia: A review." *Renewable and Sustainable Energy Reviews* 75 (2017): 1394.
[79] Ibid.

the RE sector especially in solar photovoltaic (PV) systems, whereby a small portion of solar radiation is able to generate more power.[80]

Undeniably, there are some challenges regarding the implementation of EE programmes in the country. Although the formulation of these policies were much anticipated, there were numerous challenges due to (1) insufficient market forces including financial and technological constraints; (2) ununiformed, inefficient energy price-setting mechanisms that take into account financial implications for power producers, utility purchasing, and consumers; (3) lack of societal sharing of the cost burden of energy sectors, such as inefficient electricity tariffs to prevent a 'regulatory squeeze' being imposed on the utility company; (4) need for a proper regulatory framework that addresses specific market failures and constraints, and signals the Government's commitment towards increasing the deployment of sustainable energy technologies; (5) lack of strong governance that demotivated the participation of stakeholders, and the legitimacy of EE policies, and (6) lack of regulatory oversight and policy implementation as well as inefficient monitoring of progress and rectification of problems.[81]

Currently, both public and private sectors have begun to show interest in implementing EE programmes with easy access to financial assistance for their implementation.[82] EE requires a financing system to support building management systems, solar panel installations, and the associated facilities. The Energy Commission Act 2001 states some of the functions of the commission include promoting EE in the use of electricity and gas supply, promoting RE consumption, and preserving non-RE such as oil and natural gas. In the absence of a specific Act for EE, the Electricity Supply Act 1990 (Act 447) acts as the necessary legislation to support the implementation of EE programmes in Malaysia, which encompasses licensing regulations and methods for

[80] Rahman, Mohammad Mafizur, Md Hasanuzzaman, and Nasrudin Abd Rahim. "Effects of operational conditions on the energy efficiency of photovoltaic modules operating in Malaysia." *Journal of cleaner production* 143 (2017): 919.

[81] Chua, Shing Chyi, and Tick Hui Oh. "Review on Malaysia's national energy developments: Key policies, agencies, programmes and international involvements." *Renewable and Sustainable Energy Reviews* 14, no. 9 (2010): 2918.

[82] Ibid., 2919.

generating, transmitting, and distributing electricity. The Act consists of 56 provisions which include the duties and functions of the Commission, the license and the registration of any installation, electricity supply, and other matters.

In addition to the Electricity Supply Act 1990, the Electricity Regulations 1994 were enforced since January 1994 and play an important role in implementing EE. These regulations were introduced to regulate all matters relating to electrical installations, including registration, licensing, surveillance and testing, equipment and methods of installation as well as maintenance. In the absence of specific legislation for EE in Malaysia, the Efficient Electricity Management Regulations 2008 have played an important role in promoting EE. The rules encompass four main divisions, in which a registered electrical energy manager is required for each installation that uses 3,000,000 kWh of electricity or more for six months and subjected to rule No. 11 and 12. The task of the registered electrical energy manager is to study the amount of electricity usage and monitor the implementation of the procedures performed to ensure that it is effectively managed in accordance to rule No. 16. Under rule No. 4, the licensee must furnish information or documents with respect to the name and particulars of consumers whose use electricity over any period, not exceeding six consecutive months equal to or exceeding 3,000,000 kWh, not later than one month after the expiration of the period of six consecutive months from the effective date. License holders are also required to ensure that the information or documents provided are true, accurate, and complete, in which failure to do so is considered an offence under this rule.[83]

This guideline authorises the Energy Commission to give a notice instructing the licensee to appoint a registered electrical energy manager to produce written confirmation of the appointment of not more than three months from the date of the notice. Subsequently, he is required to submit a report in Form A and Form B of the Second Schedule within thirty days after the expiration of six consecutive months from the date of the notice and for every six months and beyond.[84] This rule also provides for penalties whereby a violation of a rule is liable to a fine not exceeding five thousand ringgit or

[83] Rule 4 of the Efficient Management of Electrical Energy Regulation 2008
[84] Rule 5 of the Efficient Management of Electrical Energy Regulation 2008

maximum imprisonment for a year, or both.[85] However, this rule does not have specific provisions for promoting implementation at various levels. A law is required to enhance the sustainability of the energy sector and act as a catalyst for sustainable energy development. Hence, it is necessary to integrate the reduction of energy use of primary energy resources and promote environmental conservation in line with the International Conference on reducing the impact of climate change in the context of the Malaysian energy legal framework. With this arrangement, Malaysia can prove to the international community that it is pursuing its international duties based on international environmental agreements.

The Malaysian Water and Energy Research Association (AWER) believes that there is no need to create specific laws to administer energy savings and EE in the country.[86] AWER noted the existence of overlapping current laws such as the Electricity Supply Act and Energy Commission Act. Besides, there is also an overlapping jurisdiction in regulating the implementation of EE in Malaysia. For example, both the Energy Commission and SEDA are responsible for administering and promoting EE-related activities. AWER indicated that the implementation of EE should only be administered by the Energy Commission[87] thus, regulatory and institutional frameworks as well as initiatives should be separated to evade overlapping responsibilities of entities involved.[88]

It is important to note that although the country possesses several laws in the field of energy, these legislations have never been effectively enforced by the Government to increase efficiency in a sustainable manner. Although the Government has attempted to increase EE and promote RE through Feed-in Tarrifs (FiT), such attempts were not successful due to the lack of public awareness.[89] In

[85] Rule 6 (6) and Rule 22 of the Efficient Management of Electrical Energy Regulation 2008

[86] S. Piarapakaran, "Parliament must push to close down Sustainable Energy Development Authority (SEDA)", 11 July 2013. http://www.awer.org.my/?pgid=home&cid=278 (accessed 3 July, 2017).

[87] Ibid.

[88] Abd Rahman et al., 2019.

[89] Wong, S. L., Norzita Ngadi, Tuan Amran Tuan Abdullah, and I. M. Inuwa. "Recent advances of feed-in tariff in Malaysia." *Renewable and Sustainable Energy Reviews* 41 (2015): 45.

the case of Malaysia, FiT failed to project a larger spectrum of RE generation as it seems to benefit only solar PV power producers and manufacturers. Unfortunately, other RE technologies have not received similar attention under the FiT programme. The FiT was found to be unsustainable in supporting RE development in the long run due to fierce competition among RE technologies.[90] Due to these unaddressed regulatory issues, the proposed targets pertaining to the utilisation of RE resources and increasing EE in Malaysia have never been achieved.

Nevertheless, the implementation of EE is still feasible even without the creation of a specific Act. For instance, proactive roles which include implementing strategic and authoritative measures can be achieved by the Energy Commission. Nevertheless, despite the absence of a legal framework, the implementation of more effective EE measures is still required. Hence, this paper proposes the enactment of EE laws to resolve the issues on energy security in Malaysia as the reduction of conventional energy use should be delicately balanced with the introduction of RE sources.

Practices in Japan, Thailand, and the Philippines: Lessons for Malaysia

Besides Malaysia, many countries have initiated measures for energy conservation including the implementation of EE. Table 3 shows the countries that have implemented laws for EE measures. For instance, India, Thailand, and Japan are among the Asian countries that have drafted specific laws to increase EE in their countries. However, the scope of the discussion in this paper covers only the jurisdiction of Japan, Thailand, and the Philippines.

Table 3: Countries with Laws on Energy Efficiency[91]

Countries	Year of Statute Enforcement	
Slovakia	2014	Energy Efficiency Act 321/2014
Singapore	2012	Energy Conservation Act (Chapter 92C)

[90] Youngho Chang and Yanfei Li, "Renewable Energy and Policy Options in an Integrated ASEAN Electricity Market: Quantitative Assessments and Policy Implications," *Energy Policy* 85 (2015): 46, doi:10.1016/j.enpol.2015.05.011.

[91] Authors' compilation

Indonesia	2009	Energy Conservation (Regulation No. 70/2009)
Russia	2009	Law on Energy Saving and Energy Efficiency Increase (Federal Law No. 261)
United States	2008	Energy Independence and Security Act of 2007
Turkey	2007	Energy Efficiency Law (Law No. 5627)
Romania	2007	Energy performance of buildings Law (No. 372/2005)
Canada	2002	Ontario Electricity Pricing, Conservation, and Supply Act
India	2001	Energy Conservation Act
Luxembourg	1993	Framework Law Concerning the Rational Use of Energy

Energy conservation has always been on the agenda in Japan since the early 1970s as the country has limited energy resources and high energy dependency on the industrial sector. In response to this issue, the government passed the Law Concerning the Rational Use of Energy in 1979 to promote efficient use of energy for both industrial and domestic users.[92] The purpose of this Act considers the economic, social and environmental aspects of energy usage of Japan, which a comprehensive promotion of the rational use of energy will contribute to the sound development of the national economy. Among the key components which were introduced by the Japanese government is the introduction of EE measures such as thermal power generation facilities, gradual evaluation systems, identification of benchmarking objects, and the use of unused heat sources.

After the Fukushima incident, the Japanese suffered from unstable political situations and opposition towards the use of nuclear power plants. This event has significantly affected the promulgation and enforcement of energy laws and policies in Japan. One crucial aspect is the integration of current policies into newly constructed

[92] Zaim, Osman, Tuğçe Uygurtürk Gazel, and K. Ali Akkemik. "Measuring energy intensity in Japan: A new method." *European Journal of Operational Research* 258, no. 2 (2017): 780.

buildings with energy-efficient features.[93] Subsequently, the Act on the Improvement of Energy Consumption Performance of Buildings (Building Energy Efficiency Act) was established in 2015 to regulate matters related to mandatory compliance with EE standards for large-scale non-residential buildings. This statute also serves as an incentive measure to comply with EE.

In Thailand, there are several legislations that promote and implement EE. For instance, B.E. National Energy Policy Council Act 2535 (1992) mandates the establishment of the National Energy Policy Council (NEPC). It also empowers the NEPC to advise the government on matters relating to the development of national energy policies, issuing regulations on energy prices, and monitoring the operations of all committees with authorities and energy-related tasks, including government agencies, state enterprises, and the private sector. This Act is important for energy conservation as well as assisting governments in formulating energy policies for the development of Thailand.

The Energy Conservation Promotion Act (No. 2) B.E. 2550 (2007) was previously known as the Energy Conservation Promotion Act, B.E. 2535 (1992). Chapter I of this Act describes provisions for specific energy conservation for industrial plants. Chapter II of this Act describes energy conservation rules for the construction sector, while Chapter III specifically discusses energy conservation for the use of electrical machinery and equipment. Section 24 provides for the Conservation and Energy Promotion Fund as a means of supporting measures taken for energy conservation.

Additionally, the introduction of the Energy Development and Promotion Act of B.E 2535 (1992) has assisted the Department of Energy Development and Promotion in developing the energy transition framework towards RE for electricity generation, as well as promoting energy conservation. Under this Act, any production or increase of unlicensed energy production capacity from the Department of Energy Development and Promotion is strictly prohibited. Section 25 (2) and section 26 of the Act also extends the considerations for licensing, including its effects on the economy, environment, and energy security, the dangers arising from energy

[93] Huang, Beijia, Volker Mauerhofer, and Yong Geng. "Analysis of existing building energy saving policies in Japan and China." *Journal of Cleaner Production* 112 (2016): 1515.

production or expansion of energy, and technical experience in using raw materials.

In January 2019, the Philippines enacted the Energy Efficiency and Conservation Act. It is interesting to note that the law was first drafted in 1988 and finally approved after 30 years. The law was enacted, as per Section 3, to establish a framework for introducing and institutionalising fundamental policies on EE and conservation, including the promotion of efficient and judicious utilisation of energy, increasing the utilisation of EE and RE technologies, and the delineation of responsibilities among various government agencies and private entities.

The law also provides for the inclusion of Building Energy Conservation Design in the Building permit and has included provisions on the 'Local Energy Efficiency and Conservation Plan'. The Department of Energy is responsible for the implementation of the provisions stated in the law. Besides, in Chapter III, an 'Interagency Energy Efficiency and Conservation Committee' has been created to evaluate and approve government EE projects and to provide strategic direction for the implementation of the Government Energy Management Programme (GEMP) which aims to reduce government agencies' consumption of electricity and petroleum products.

Hence, issues on global warming and energy security have fostered the government to initiate measures to increase the use of RE sources to satisfy energy demands in the distribution system.[94] However, an increase in the use of RE itself will not suffice since the promotion of efficient energy use and reduction of energy wastage are equally as important as the development of the RE sector[95] as reflected in the laws and policies established in Japan, Thailand, and the Philippines.

RECOMMENDATIONS

Achieving green and EE goals requires the support and coordination of synergistic organisations. Malaysia has organised various initiatives to improve the use of sustainable energy resources. However, there is a corresponding need to coordinate the industry stakeholders, enterprises,

[94] Petinrin and Shaaban, 974.
[95] Ibid.

and business networks for supporting the proposed EE initiatives. Such arrangements also require a deeper understanding and combined efforts at various levels. It is imperative for the government of Malaysia to categorically execute the propelled tasks, plans, and policies successfully. It has been seen from historical encounters that there remains an immense mismatch in accomplishing the goals of energy policies. EE benefits the customer and the government as energy services have high costs and are cross-subsidised in Malaysia. EE can be delivered via building energy standards, minimum energy performance standards for appliances, and energy awareness programmes. Several programmes should also be considered by the government of Malaysia, including minimum performance standards for selected appliances and EE standards for buildings. These programmes would increase public awareness and thus enable the government to successfully achieve its goals for sustainable energy.

Additionally, to achieve public procurement of RE and enhance the output of technology, local research activities and innovations should be supported by the RE authorities. Without the localisation of imported technology, the essence and benefits of energy sources can never be fully utilised. Local innovations, demonstrations, and solutions for complex energy technologies play a significant role in creating public awareness of EE.

Lastly, the regulatory framework plays a significant role in the advancement and development of EE within the country's existing energy policy formation. The regulatory direction is necessary to enhance the competitiveness of the energy market. This regulatory framework is also vital to ensure that the stakeholders comply with the established rules and regulations for energy trading. Any deficiency in the regulatory structure may cause a threat to the market's liberalisation process. The proposed regulatory framework should also increase public awareness of energy technologies and incentive mechanisms to promote investment in the RE industry.

Although the National Renewable Energy and Action Plan and National Biomass Strategy 2020 should be considered as a strategic move to provide avenues for sustainable energy development, it is not in sync with the entire stakeholders' interest in the energy sector. Consequently, all the relevant stakeholders and agencies have not synchronised themselves to achieve their goals and action plans. Besides, the general public is disconnected from the EE concerns.

Another noticeable disconnection remains between the public and the private sector. A lot of attention is focused on the role of the public sector in achieving sustainable energy development goals. The role of the private sector should be broadly discussed to embrace greater corporate social responsibility, in addition to operational compromises resulting in longer payback periods when engaging in RE projects.[96]

CONCLUSION

The instruments of implementation for SDG 7 are heterogeneous. More critical studies, collaboration, and capacity building addressing international law, policy, and governance connected to sustainable energy, including EE are vital to achieve SDG 7. While the implementation of EE imperatives in Malaysia requires a holistic approach encompassing the involvement of every government agency, statutory body, industry, and private sector as well as society. A comprehensive approach and implementation can reduce energy consumption, reduce dependence on fossil fuels for importing countries, and increase the ability to protect the environment. The implementation and management of EE should be enhanced at all levels, covering all aspects from its formation to its final use.

Without specific legislation for the implementation of EE, efforts to strengthen the management and implementation of EE in Malaysia will not be possible. The existence of a legal framework can ensure a more resilient policy formulation and strategy formation in promoting the development of industries related to EE. This article highlights the need for the government to formulate specific legislation for the implementation and regulation of any activities that revolve around EE of the country, thereby providing a comprehensive regulatory framework that supports the sustainable implementation of EE measures at the national level. It is hoped that the implementation of the EE laws in Malaysia will facilitate the energy sector's transition towards a more sustainable system and thus improve energy security in the country.

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[96] Hellsmark, Hans, Johan Frishammar, Patrik Söderholm, and Håkan Ylinenpää. "The role of pilot and demonstration plants in technology development and innovation policy." *Research Policy* 45, no. 9 (2016): 1751.