Chapter 4
Energy Transition Toward a Low-Carbon Economy in Malaysia:
Do We Need a Liberalizing Electricity Market?

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ABSTRACT

Some studies have found that liberalized electricity market led to acceleration of the development of renewable energy sector, particularly with community-based financing for local renewable projects in place. The idea of liberalization of electricity market focuses on the fair competition especially among the key players which subsequently entice more investment on infrastructures and reduce electricity tariff. Energy liberalization has dramatically enhanced monopoly utility governance, competition, innovation prospects, and the policy for environmental emissions management by creating trading mechanisms. This chapter discusses the practices of power liberalization, especially in Europe, regarding the benefits and challenges. Moreover, the chapter examines Malaysian practices in pursuing renewable energy programs to attain sustainability and energy security goals, which is also vital to support a more competitive energy sector.

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INTRODUCTION

Climate change has become a global issue with profound implications for the economies and societies simultaneously directed countries to enforce policies to minimize carbon dioxide emissions to secure long-term economic growth and development (Ponce et al., 2020). However, high reliance on natural gas might impede the transition to an economy with minimal carbon emissions. Natural gas is not only known as a part of a climate change mitigation strategy but rather a transitional resource (Najm & Matsumoto, 2020). The development of affordable and sustainable energy solutions and measures requires technological advancements, increased energy efficiency, competitive economies, enhanced energy security, and a focus on addressing climate change (Kabeyi & Olanrewaju, 2022). Employment, poverty, pollution, and ecosystem concerns, directly and indirectly, connect to the energy sector. The nation is still underdeveloped and suffers from widespread hunger due to its limited access to energy (Büyüközkan et al., 2018). On the other hand, self-electrification in rural areas has significantly increased this access to electricity due to the remarkable expansions of renewable energy in the power sector (Kitchen & O'Reilly, 2016).

To maximize the potential of these renewable resources and ultimately get towards Target 7 of the Sustainable Development Goals (SDG 7), comprehensive and effective renewable energy legislation and regulations are essential. By ensuring that everyone has access to affordable and clean energy, especially concerning electricity, the world can address issues like poverty, climate change, health, and unsustainable urban development (Mustafa et al., 2022). In Southeast Asia, in particular, the region's energy mix can be significantly improved by utilizing renewable energy sources (Mustafa et al., 2022). Nevertheless, it will need more effort, especially for a developing country. Therefore, a country must find ways to expand its generation capacity while maintaining and maybe even increasing its share of renewable energy in order to meet the difficulties posed by the consequences of climate change (Santos et al., 2021).

Electricity is a primary driver of economic growth for all countries worldwide, and Malaysian economic progress will be significantly reliant on providing excellent infrastructural services, particularly in the power sector (Nerini et al., 2018). Electricity infrastructure is not only critical for development but also has a significant impact on global competitiveness and economic growth (Paryono et al., 2020). To promote the growth of physical and social infrastructures and to eradicate poverty, existing energy infrastructures should be enhanced. Centralized and decentralized energy infrastructures are preferred to meet Target 7 of the Sustainable Development Goals (SDG 7), as more than a billion people have insufficient access to energy (Nerini et al., 2018). Issues related to access to energy can only be resolved through meticulous infrastructure planning that is transparent and focused, as well as long-term project implementation (Paryono et al., 2020).

With the increasing movements towards private ownership and competition through power liberalization, many countries can rationalize the sector's development by treating electricity as a commodity that needs optimal allocation (Bryne & Mun, 2003). Although energy and power infrastructure are critical for economic development, thus, the legal framework is required to construct and implement nationally and internationally. Nevertheless, various challenges concern using renewable energy sources and the execution of laws and policies (Schwartz, 2009). He et al. (2016) argued that policies must be revised to promote renewable energy development. For example, profits on liberalized electricity markets must be increased to stimulate private investment in renewable energy production. Thus, diverse economic instruments are required in order to make renewables a profitable investment (Zipp, 2017). Moreover, variable renewable energy needs direct reliance on natural resources, which may cause an interruption in generation as they cannot supply demand at any moment (Pietzcker et al., 2014; Zipp, 2017).

Figure 1. Conventional electricity sector structure

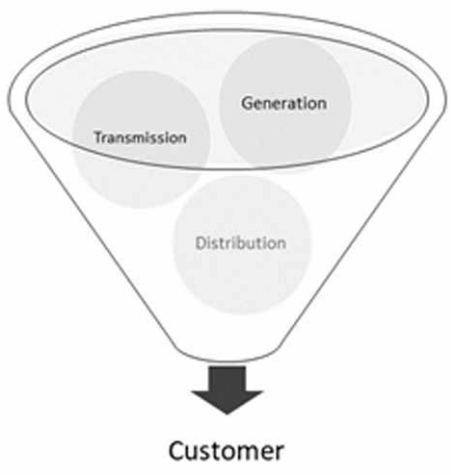


Figure 1 shows the conventional electricity structure in which a vertically integrated utility in the power sector owns and operates all aspects of the electricity supply chain, including generation, transmission, and distribution. This model has been used for all countries; as a company engages in more activities along a single supply chain, it may result in a market monopoly. One significant drawback of monopoly is the absence of regulation and enforcement; there will be limited electricity production, and the electricity rates will increase as they have no competitor supply to the customer in the territory (Belyaev, 2010). Energy market liberalization promotes fair competition among companies to encourage more infrastructure investment and lower electricity tariffs. This chapter discusses the practices of power liberalization, especially in Europe, regarding the benefits and challenges.

Moreover, the chapter examines Malaysian practices in pursuing renewable energy programs to attain sustainability and energy security goals, which is also vital to support a more competitive energy sector. The chapter is divided into seven parts. Following this introduction, the landscape of the Malaysian electricity sector in the second part of the chapter. The third part explained the concept of Liberalization in the Electricity Sector by referring to Europe. Within the fourth part, the authors discuss the benefits and drawbacks of the liberalized electricity market. In Part 5, the chapter further elaborates on the impacts of renewable energy in the liberalized power sector. In the next section, the author discussed the Malaysian position in developing renewable energy as well as moving towards the liberalized electricity market.

ELECTRICITY SECTOR IN MALAYSIA

Generally, vertically integrated utilities in the power sector consist of three stages of electricity services: generation, transmission, and distribution, which these utility companies were frequently state-owned monopolies. Even when private ownership was present, corporations operated as monopolies supervised by governments that set rates and investments (Byrne & Mun, 2003). Moreover, in the traditional power sector, they have primarily relied on large-scale power plants and substantial transmission and distribution networks to deliver electricity, which has led to environmental, social, and economic issues (Byrne

& Mun, 2003). Nevertheless, in the early 1990s, a set of institutional reforms, including unbundling, privatization of ownership, and the introduction of competition into the generation sector, were presented to solve the problems in the power sector (Zhang et al., 2008). Privatization in the generation sector might lead to competition in the wholesale supply through transmission access, but the distribution network could remain a natural monopoly, with consumers having access to retail options (Panda & Patel, 2011).

In a regulated power market, a utility company may control the whole process, from generation through distribution to end buyers. But in Malaysia, utilities needed complete control over the generation industry. Every energy stakeholder in Malaysia has a critical responsibility to play in ensuring uninterrupted electricity supply. Historically, the Central Electricity Board was established in Malaysia and began operating on 1 September 1949. The Board of Directors, through the Electricity Supply Department, considered establishing three more major projects in April 1946, including Connaught Bridge Power Station, Cameron Highlands Hydroelectric Project, and National Grid Development (Kumar et al., 2021). In 1965, the Central Electricity Board was renamed the National Electricity Board, and the national grid was established as the main electricity transmission network that connects the generation, transmission, distribution, and consumption of electricity in Malaysia (Kumar et al., 2021). In 1988, the Prime Minister announced the government's decision on privatization policy. Two laws were passed to replace the existing Electricity Act and provide for the establishment of a new corporation. Tenaga Nasional Berhad (TNB) was established on 1 February 1990 under the Companies Electricity Supply Act 1990 to replace the National Electricity Board (Kumar et al., 2021).

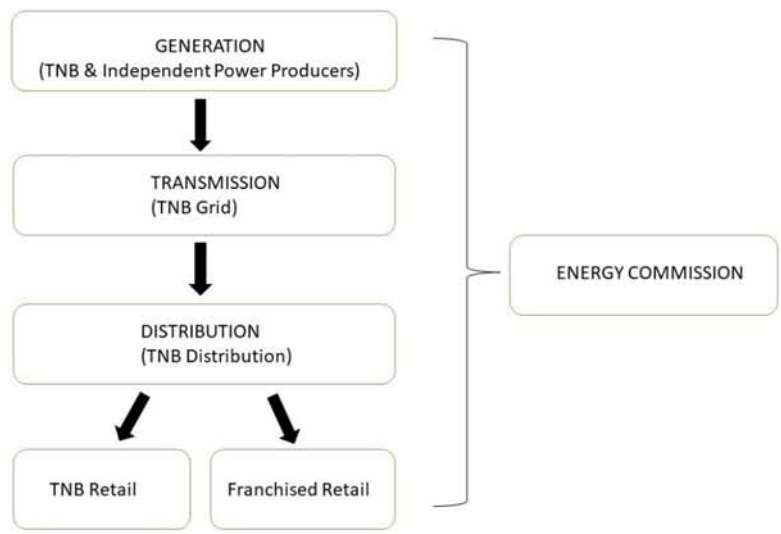
The new privatization policy through the New Economic Policy (NEP) focused on reducing the government's financial burden, improving the effectiveness and quality of public services, and encouraging the spread of private entrepreneurship in the public sector (Kumar et al., 2021). The current Malaysian power market is segmented by power generation source, transmission and distribution, and end-user (residential, commercial, industrial, transport, and agriculture). The Malaysian power market is moderately fragmented. Some of the key players in the market include Tenaga Nasional Berhad, Korea Electric Power Corporation, Sunway Construction Group Bhd, LYS Energy Group, and Cutech Green Ventures (Mordor Intelligence, n.d.).

Tenaga Nasional Berhad has been registered under the Companies Act 1965 and is the sole service provider (generate, transmit, distribute, and sell energy) in Peninsular Malaysia, as in Figure 2. The operation and maintenance of electricity installation for generating, transmitting, and distributing electricity are governed by the Electricity Supply Act, the Licensee Supply Regulation 1990, and the Electricity Regulations 1994. A similar application in Sabah whereby Sabah Electricity Sdn. Bhd., a subsidiary of Tenaga Nasional Berhad and is 20 percent owned by the State of Sabah. It provides reliable generation, transmission, and distribution services in Sabah and Labuan. However, Sarawak Energy Berhad was incorporated under the Sarawak Electricity Supply Corporation (Successor Company) Ordinance, 2004. As a Sarawak's wholly owned company, SEB is responsible for generating, transmitting, and distributing electricity for Sarawak.

Figure 1 shows the electricity structure in Malaysia, where the Energy Commission (EC) has a vital role in implementing and monitoring the energy sector's activities in Malaysia. As a statutory body incorporated under the Energy Commission Act 2001 and which became operational in 2002, the EC has replaced the Department of Electricity and Gas Supply. The EC plays a significant role with respect to economic regulation, technical regulation, and safety regulation. The EC's roles and functions are to promote the economy by generating, transmitting, distributing, supplying, and using electricity. Its functions also include the reticulation and use of gas, promoting competition, enabling fair and efficient

market conduct, and preventing the misuse of monopoly or market power in the electricity and piped-gas industries. Section 3 (3) of the Competition Act 2010 (Act 712) excludes the jurisdiction of this Act on any commercial activity regulated under the Energy Commission Act 2011 (Act 610). Moreover, the EC has jurisdiction over matters stipulated under the Energy Commission Act 2001, the Electricity Supply Act 1990, and the Gas Supply Act 1993.

Figure 2. Electricity sector structure in Malaysia



LIBERALIZATION IN THE ELECTRICITY SECTOR: EXAMPLE FROM EUROPE

The Single European Act (1987) was the first major revision to the Treaty of Rome (1957), which sought to facilitate the free movement of products, people, services, and capital across European borders. The liberalization stream aims to gradually remove borders in order to build internal markets for electricity and natural gas, resulting in a competitive energy market (Diaz-Rainey et al., 2017). The early 1990s witnessed the global liberalization of power sectors, which altered the organizational and operational situation. Liberalization in the United Kingdom, in particular, has resulted in significant structural changes, the introduction of competition in the wholesale generating and retail supply sectors, regulatory reform, and the establishment of an autonomous regulatory body. These movements have increased technological efficiency (Jamasb & Pollitt, 2011).

Furthermore, energy liberalization has culminated in many advantages, although studies in many countries have shown a need for more direct household benefits. It has dramatically enhanced monopoly utility governance, competition, innovation prospects, and the policy for environmental emissions management by creating trading mechanisms (Pollit, 2012). Siksnelyte and Zavadskas (2019) listed four factors that led to European electricity market liberalization: cost efficiency, renewable energy development, increased investment, and social welfare. Similarly, Ponce et al. (2020) stipulated that the energy market's liberalization will be crucial for renewable energy generation.

The European Union (EU) has initiated European Commission Directives 96/92/EC and 2003/54/EC, advising all European countries to switch to market-based prices or to amend and improve proposed regulations due to flaws in market design (Guerci et al., 2010). While Directive 944/2019 demands that member states take appropriate actions to guarantee effective competition between suppliers and eliminate the remaining non-transitional forms of price control (Amenta et al., 2022). Apart from the three energy packages, the EU has introduced other policy instruments for more innovative and more sustainable EU electricity, such as Energy 2020, Energy Roadmap 2050, 2015 Energy Union Package, and 2016 Clean Energy for All Europeans (Siksnelyte & Zavadskas, 2019). Although the development of a common EU electricity market has been almost 30 years, the EU is still in progress. The reasoning behind this transition is that the liberalization of monopolistic energy structures should lead to the creation of sustainable and flexible energy ecosystems via an energy policy that supports sustainable development, energy security, and the promotion of renewable energy sources (Amenta et al., 2022; Vlados et al., 2021). The EU Commission advocates for the total liberalization of retail electricity markets to achieve more profound national market integration and a strategy of enabling all customers to take an active role in the energy transition (Stagnaro et al., 2020). The EU's internal energy market is being liberalized to create a competitive and sustainable market (Ponce et al., 2020).

Despite some unique aspects related to their socioeconomic environments, European countries found the liberalization of the domestic energy market to be an effective policy. As shown, the program was successful at the EU level and in high-income nations, considering other social and economic factors in addition to the economy's dynamization (Ponce et al., 2020). Since 2007, EU Member States have been required to allow all customers to change energy providers. As the European Union moves towards full liberalization, the United Kingdom has partially re-regulated its retail electricity market by instituting a transitional price-cap mechanism covering around 15 million users under a Standard Variable Tariff (Amenta et al., 2022). The government no longer governs the electricity markets in the EU member states. Instead, electricity is traded as a unique commodity under supply and demand market conditions and according to various laws and contracts (Bojnec & Križaj, 2021). Realizing that electricity is the most important energy resource for homes, the EU is committed to ensuring that its citizens have affordable and unrestricted access to this essential social benefit through a more decentralized electricity system (Halkos & Tsirivis, 2023). Following the UN's sustainable development goals, particularly SDG 7 for producing clean, affordable energy, the study by Halkos & Tsirivis (2023) examines the effects of renewable energy, economic factors, and the liberalization of electricity generation and supply market on household electricity prices.

The single-buyer model, competitive wholesale, and competitive retailing are the three fundamental models that may be used to regulate competitive markets, thereby raising the pace of liberalization. (Santos et al., 2021). The single-buyer models are a rapid method of luring money to the generation without significantly altering the status quo. A facility, typically state-owned, is given exclusive authority to purchase energy from producers and resell it to distributors (Santos et al., 2021). Nevertheless, in developing countries, the single-buyer model has significant loopholes as it encourages corruption, impairs payment discipline, and puts substantial contingent obligations on the government (Lovei, 2000). In comparison, the 2001 California crisis prompted the US Federal Energy Regulatory Commission to propose a common wholesale power market for adoption by all (Guerci et al., 2010). In this model, large customers can purchase energy directly from non-vertical generating companies in competitive wholesale models using one of two fundamental contractual methods, typically incorporating auction techniques.

According to this model, traders or distributors themselves continue to provide services to small businesses and households, who then purchase goods from the wholesale market (Santos et al., 2021).

The competitive energy retail market (retail wheeling), which is the most advanced stage of the liberalization process, is where the monopoly of energy commercialization for small business and residential users ends, and they may ultimately freely pick their providers. The United Kingdom opened its retail market to competition with the most significant industrial customers in 1990 and residential customers in 1998 (Littlechild, 2021). The most significant advances in the industry have been the liberalization of retail and wholesale markets, the segregation of production and transmission operations, and the formation of distinguished national regulatory instruments (Siksnelyte & Zavadskas, 2019). The drawback of this model is that the expenses of maintaining a retail market are higher and small customers must have access to all the information required to choose the goods and vendors that best meet their requirements. Many experts wonder if this model's veracity is due to the energy industry's complexity and all the disparities between major providers and small users (Santos et al., 2021).

Based on a study by Siksnelyte and Zavadskas (2019) on the assessment of the sustainability of EU countries' electricity sector in 2017 following the assessment using the TOPSIS method, the electricity market of Slovenia was the most sustainable, followed by Luxembourg and Austria was in third. Lithuania ranked last (no. 28) due to its dependency on electricity imports from Russia and Belarus. The liberalization of European electricity markets resulted in lowering wholesale energy costs, providing more choices for customers as suppliers compete to lower prices and deliver better services (Siksnelyte & Zavadskas, 2019). However, there are still several challenges facing the EU, including import dependency, old infrastructure, limited investment, a lack of a properly functioning retail market, the need to combat climate change, and a shift towards a low-carbon economy (Siksnelyte & Zavadskas, 2019).

LIBERALIZED ELECTRICITY MARKET: DEBUNKING THE ADVANTAGES AND CHALLENGES

Generally, the goal of liberalization is to encourage competition among service providers in order to improve market efficiency and lower retail costs, as well as to drive technical innovation (Shin & Managi, 2017). Nevertheless, electricity market liberalization has sparked restructuring and competition, resulting in minor efficiency gains in production and distribution (Pollitt, 2012). Liberalization does not necessarily provide consumer advantages; for instance, the historic Californian power crisis of 2001, in which an insufficient supply of electricity severely impacted customers, sparked questions about failing regulatory architecture and the legal basis for the liberalization process (Shin & Managi, 2017). Electricity liberalization was contentious and challenging in the United States, Europe, and other nations (Joskow, 2022). While according to Itaoka et al. (2022), other drawbacks of this system include an inflexible energy system and downward price rigidity. The government's erroneous policy of power reform, and low standard transmission and distribution infrastructure, are part of the electricity problem. The role of the state will still be crucial, even though the privatization of plants raises questions about the motives for privatization, the impact of misguided liberalization has led to a transfer of ownership from the state to the private (foreign) party, which will amputate the state's power in controlling (Paryono et al., 2020). Apart from the existing challenges in the liberalized sector, governments face the challenge of implementing intense decarbonization commitments; policymakers are focused on meeting these goals

and the associated decarbonization trajectories from here to these endpoints on time and as economically as possible given the commitments that have been made (Joskow, 2022).

Liberalizing the energy market is an intricate process that must first consider several factors. The econometric research demonstrated that increasing household electricity prices might result from a decline in the market share of the biggest producer (Halkos & Tsirivis, 2023). Contrary to Stagnaro et al. (2020), consumers may gain significantly from retail competition in the power market, and these advantages may increase as technology advances. Effective supplier competition and strong demand-side participation are essential for customers to profit. A study by Bojnec and Križaj (2021) demonstrated that more significant industrial power usage led to higher industrial electricity costs and that deregulation of the electricity market and price liberalization did not cut electricity prices as anticipated. In Japan, market liberalization depicts the demand for a more decentralized energy system to mitigate energy insecurity issues and the possibility of catastrophic mishaps like the Fukushima nuclear plant tragedy 2011. It also reflects growing market competition with the recent growth of renewable energy, which coincides with the liberalization timeline, and further promotes decentralization (Itaoka et al., 2022).

Sector deregulation was primarily motivated by a desire to boost the energy system's efficiency and achieve the anticipated supply-side consequences, particularly to lower electricity rates. Energy sector entrepreneurship was made possible by the deregulation and liberalization of the power market, whereby the production of renewable electricity was positively impacted, which encouraged the completion of the market for energy derivatives (Bojnec & Križaj, 2021). Verbong and Geels (2010) elaborated that energy market liberalization and installing high-voltage transmission lines have enhanced international electricity flows. Furthermore, through liberalization, consumers can choose low-emission power producers inside the liberalized market, helping to reduce pollution (Itaoka et al., 2022). Additionally, this liberalization allows players to select the cheapest price generation source to balance electricity supply and demand in the short term (Limura & Cross, 2018).

Although the European electricity market liberalization process started more than 20 years ago, with most Member States of the EU having liberalized their electricity market, several remaining problems still need to be addressed (Pepermans, 2019). removed. Improved governance quality and power market privatization as appropriate accelerators toward power market sustainability in the short and long run, whereas any increase in electricity price may slow the pace of achieving power market sustainability in both the short and long run. Therefore, governments must issue strategy plans and roadmaps with defined visions and missions for power market sustainability (Taghizadeh-Hesary et al., 2022)

Enhancing the reliability and security of the electricity supply is one of the critical goals of electrical energy deregulation. Thus, a regulation must pay attention to the people's interest in affordable access to electricity rather than being co-opted by capitalism (Paryono et al., 2020). In a tandem progression of privatization, the competition aims to rationalize the development of the electricity sector by treating electricity as a commodity and bringing electricity problems into the realm of power politics. The capitalist system in the existing power sector operates internationally by multinational or transnational firms by carrying out activities in all emerging nations by influencing the country's electrical goods, which then invests in the country's electricity infrastructure (Paryono et al., 2020). With comprehensive regulation and an influential interventive role by the government, the philosophical idea of embracing liberalization that allows the market to compete while incentivizing operators to perform well and subsequently creating a market that is more efficient, affordable, and sustainable.

RENEWABLE ENERGY IN THE LIBERALIZED POWER SECTOR

Europe has progressively switched to renewable energy sources for electricity generation and achieved significant progress over the last decade. In 2001, Directive 2001/77/EC set an indicative target of 22.1% of gross electricity consumption from renewables by 2010 (Diaz-Rainey et al., 2017). In 2007, the EU endorsed a mandatory target of a 20% share of final energy consumption from RES by 2020, ultimately becoming Directive 2009/28/EC. Emission reductions were expected to be achieved through increased use of renewable energy sources in electricity generation and transport (Diaz-Rainey et al., 2017). The EU's spirit of reducing carbon emissions is consistent with many international conventions on environment and climate change, notably the Kyoto Protocol and the Paris Agreement. In order to meet the goals of increasing the average global temperature to below 2 °C, the Paris Agreement calls for a significant reduction in greenhouse gas emissions through the Nationally Determined Contributions (NDC) made by signatories to the Paris Agreement. The Intergovernmental Panel on Climate Change (IPCC) noted that in order to meet the Long-Term Temperature Goal of the Paris Agreement, it is imperative to decarbonize energy systems, phase out coal for power generation by 2050, and increase the share of renewable energy (Shem et al., 2019). Likewise, Kabeyi and Olanrewaju (2022) pointed out that the three main breakthroughs in technology creating sustainable transition initiatives are energy savings and efficiency and substituting fossil fuels with nuclear and renewable energy sources. According to Abdmouleh et al. (2015), numerous important factors influencing RE implementation and aiding in creating a favorable environment for RE exploitation are financial, fiscal, legislative, political, technological, and environmental. They also emphasized the importance of clear regulations and legal frameworks to promote investor interest in the RE market (Abdmouleh et al., 2015). Other regions' experience, especially the Nordic, reveals that liberalized ESI aligns quite well in accommodating renewables and achieving efficiency, whereby depleting fossil fuels and energy demand are predicted to exceed traditional energy resource generation. Thus, increased penetration of renewables into the grid and more efficient energy use would be the silver bullet in mitigating the impact of depleting natural indigenous energy resources for the benefit of future generations (Aris et al., 2020).

With the advance of policy and the maturity of the renewable energy market, much research has been embarked on assessing the links between renewable energy, low-carbon development, energy supply security, and climate change. At the same time, there are studies on renewable energy's effects in a liberalized market. A study by Murshed (2020) examines the compatibility of national trade liberalization policies in promoting the widespread use of renewable energy resources in 71 countries from South Asia, East Asia, the Pacific, Central Asia, Latin America, Caribbean islands, and Sub-Saharan Africa. Panel data cointegration and regression studies are performed using annual time series data from 2000 to 2017. While a study by Blazquez et al. (2018) highlights the incompatibility between power liberalization and renewable policies, independent of nation, geography, or renewable technology. They further contend that Renewable deployment has plateaued in liberalized markets whereby the decentralized market's capacity has limited transparency which may hinder the complete decarbonization of the power sector. Ironically, electricity prices depend on conventional technologies and support renewable deployment and, as a result, indirectly towards decarbonization (Blazquez et al., 2018). Nicolli and Vona (2019) examined the impact of energy liberalization on renewable energy policy across a large panel of OECD countries. They found that energy liberalization improves public sentiment for renewable energy. Their study concluded that reducing the monopolistic dominance of state-owned utilities has influenced renewable energy policy when access to the grid is granted to a diverse range of players (Nicolli & Vona, 2019).

Research by Chapman and Itaoka (2018) explores the precedents, regulations, and elements crucial to a successful energy regime change that could be used in the Japanese liberalized electricity market by referring to Germany, Italy, and Spain. Newbery et al. (2018) propose a set of policy ideas for the market design of a future European electricity system with a high proportion of renewable energy sources. They addressed the market flaws that must be addressed to incorporate renewable energy in liberalized electricity markets, evaluated the progress of the EU's renewable energy regulatory instruments, and proposed policy suggestions based on economic concepts for wholesale market design (Newbery et al., 2018). In a study by Agyeman and Lin (2023), they applied the staggered difference-in-difference (SDID) design to 25 OECD member states from 1985 to 2015 to investigate the impact of deregulation on innovation in the electricity sector, with a focus on low-emission technology. Their empirical data suggest that only extensive market deregulation may encourage innovation in carbon capture and storage (CCS). Wang et al. (2021) empirically assessed how Germany, Denmark, and the United Kingdom successfully implemented free-market-oriented policies to attain their renewable energy policy. Since the Hayekian-Thatcherism free-market reform of 1979, the UK has maintained a comparatively low energy tax rate and opted for more pro-market measures. The research also discovered that Fredrich Hayek's theories have significantly impacted its energy liberalization reform agenda. Moreover, they found that energy companies are critical in providing better and more economical RE to home and industrial consumers (Wang et al., 2021).

With much research focused on Europe and the OECD, Ali et al. (2022), on the other hand, examined the effects of Singapore's and the Philippines' energy market liberalization processes on adopting renewable energy electricity generation from 2015 to 2020. They found that Singapore's energy market liberalization resulted in lower household and industrial electricity rates and increased RE share over the stipulated period. The liberalization process has yet to have a discernible influence on carbon emissions. Meanwhile, their results indicate that as the Philippines' energy market liberalization progressed, household electricity prices and carbon emissions increased (Ali et al., 2022). In the same vein, Aris et al. (2020) have also studied the progress of the Philippines and Singapore in liberalizing their electricity sector. Their study aims to identify best practices and problems in respect of legislative framework, implementation phases, market components, and impact on renewable energy penetration for Malaysia to learn.

Pollit (2012) stated that liberalization has significantly improved regulation, competition, innovation, and emissions control. Nonetheless, liberalization per se is not significant in supporting the energy transition. Promoting renewables in liberalized electricity markets poses a paradox, as renewable energy deployment will inevitably be more expensive and less flexible. Furthermore, transitioning to a 100% renewable power industry is unachievable. Thus, they must coexist with fossil fuel technologies (Blazquez et al., 2018). Policy interventions and regulations can help to ameliorate a lack of competitiveness, although many possibilities remain niche uses due to perceived high costs (Verbong & Geels, 2010). Policy measures are required to direct the global electrical transition towards a sustainable energy and electricity system to remain technically possible and economically advantageous. Measures to increase the effectiveness of current non-renewable sources, which still play a significant role in cost reduction and stabilization, should be included in implementing renewable energy (Kabeyi & Olanrewaju, 2022). Many countries implement public funding options such as public investments, loans, grants, and subsidies, which are seen to be especially ideal for encouraging renewable energy at the early stages of technological development (Guliyev, 2023). For example, many countries have financially supported the deployment

of renewable energy through policy mechanisms such as Feed-in-Tariffs (FITs) and Renewable Portfolio Standards (RPS) to cover high installation costs and reduce investment risks (Limura & Cross, 2018).

Murshed (2020) found that increased trade openness is most successful in accelerating the transition to renewable energy in low-income economies, with the percentage of renewable energy in total energy consumption predicted to increase by 0.24%. Trade liberalization also contributes to higher renewable energy development regardless of the country's economic status (Murshed, 2020). Private investments, both domestic and international, are essential to advancing the present reform. The government will still play a crucial part in market planning and regulation. Through a stable and consistent system of regulations that favor meritocracy, significant private investments will be appropriately directed to the general societal benefit (Santos et al., 2021).

Aris et al. (2020) discovered that liberalization boosts public enthusiasm for renewable energy, but the same study indicated no significant association between RE uptake and energy market deregulation (Aris et al., 2020). Nevertheless, in several countries, an increase in electricity prices has been recorded in conjunction with an increase in renewable energy, even though the primary goal of electricity market reform was to deliver lower-cost electricity (Limura & Cross, 2018). Although liberalization in Singapore did not reduce carbon emissions from energy generation, it was an effective policy in lowering household and industrial electricity prices and increasing the RE share (Ali et al., 2022). On the other hand, the Philippines' energy market has yet to be fully liberalized, and energy market liberalization in the Philippines has contributed to carbon emissions from electricity generation. While liberalization did not stop the increase in carbon emissions, it did enhance the percentage of fossil fuel-generated power during the stipulated period. Rising carbon emissions are caused by the Philippines' over-reliance on fossil-fuel-generated energy and the government's failure to prioritize sustainability goals (Ali et al., 2022).

Regardless of whether liberalization supports renewable energy development, any measure taken toward decreasing reliance on traditional energy sources could be counted as progress toward a sustainable and accessible energy system. Such a move might make electricity more accessible to more people, more evenly divide the benefits and expenses of electricity generation, and reduce the power sector's ecological footprint (Bryne & Mun, 2003). The primary impediments to energy transition consist of the scant natural resources, insufficient expertise, and inadequate infrastructures required to support the use of renewable energy. Thus, it is frequently recommended that partnerships through international trade engagements and foreign financial flows play a crucial role in expediting the development of renewable energy (Murshed, 2020). Given that the regulation was implemented gradually, its advantages take time to become apparent. In order to increase the production and consumption of renewable energy sources, financial and operating facilities should be made available to renewable energy providers. Trade barriers that restrict effective resource usage should also be moderated as part of policies aiming at reducing emissions (Ponce et al., 2020). By virtue of liberalization, the government should ideally establish and enforce the regulation without meddling in the game itself or attempting to sway the result. A successful decentralized renewable energy system model depends on small private producers working in different market sectors (Guliyev, 2023).

ELECTRICITY LIBERALIZATION AND RENEWABLE ENERGY POLICY IN MALAYSIA

Taghizadeh-Hesary et al. (2022) suggested that countries in Southeast Asia accelerate privatization in the power sector through various measures, including financial assistance as well as interim tax exemptions. They also stressed the importance of the government's actions in providing private investors greater autonomy and incentives to participate in power markets (Taghizadeh-Hesary et al., 2022). The Philippines and Singapore are two ASEAN countries that have fully liberalized their electricity sector and have their energy markets. Since both have disparities in geographical location, economic development status, and overall population, these countries have undergone different experiences with electricity market liberalization. Singapore has a more seamless transition compared to the Philippines. At the same time, Malaysia is projected to be the next ASEAN member to join this liberalization (Aris et al., 2020). Singapore's electricity market is the region's first liberalized electricity market. The energy market in the country is distinguished by free access to its transmission and distribution networks, a distinction between contestable and non-contestable market segments, a wholesale bidding market, and full retail competition (Ali et al., 2022). The energy market authority (EMA) was established in 2001 to monitor the power business and advance energy market liberalization activities. The EMA's principal purpose as an independent regulator of the electricity business was to assure a dependable and secure electricity supply to its users at cost-effective rates (Ali et al., 2022).

While an increase in the electricity price undermines achieving a sustainable power market in Southeast Asia, governments should introduce an electricity tariff classification (ETC) to assist vulnerable, low-income electricity customers (Taghizadeh-Hesary et al., 2022). Providing the most favorable electricity price lists to individuals, businesses, and industries would be a smart idea. Malaysia has effectively implemented such an approach, with the Malaysian multinational electrical utility, Tenaga Nasional Berhad, employing the ETC strategy, particularly during the COVID-19 pandemic (Taghizadeh-Hesary et al., 2022). Generally, the power sector structure mainly consists of generation, where the power is generated either from thermal power plants or innovative technologies, as well as transmission and distribution networks, which is the process of transporting electricity from the point of generation to the point of consumption. In Malaysia's context, only in the generation sector, where generators sell electricity to the Single Buyer (SB), does competition exist. There is no wholesale market; energy trading is commenced through bilateral agreements that are negotiated between generators and the SB. TNB, Malaysia's largest electricity supplier, is still a major player in the generation sector, with more than 50% of the generation capacity in Peninsular Malaysia (Aris et al., 2020). It continues monopolizing the transmission and distribution sectors and ultimately controls the retail sector. Since 2001, the Energy Commission (EC) has regulated the electricity sector. The EC is projected to continue acting as the regulator until the open electricity market is functioning, with the requisite definitions of the scope and maybe renaming or rebranding. Rebranding and redefining the regulator's scope are required to underline the regulator's independence from the government, modify public opinion, and clarify the updated scope of the EC (Aris et al., 2020).

Besides, Malaysia's Competition Act (Act 712) was enacted in 2010 and is regulated by the Malaysian Competition Commission (MyCC). According to this Act, anti-competitive agreements, including price-fixing, bid-rigging, market-sharing, and the misuse of a dominating position in any market for goods or services, are all prohibited. This is done to encourage healthy competition and ethical business practices and, in the end, to safeguard customers' interests. This Act applies to all economic activities in Malaysia, except sectors listed in the First Schedule of Section 3 of the Act; communication, aviation,

and energy, including the petroleum industry. The government has not made a decision on the steps to break the electricity supply service monopoly. In the current situation, there is no measure taken by the government toward liberalization of the power sector in Malaysia despite the calls for the government to break the monopoly of the national electricity supply service sector and to provide healthy competition among electricity suppliers, in addition to being able to offer tariff rate differences (Mutalib & Karim, 2022). the government's intention is to guarantee control of the electricity supply service sector, thereby ensuring that consumer demand can be met at all times. With the liberalization in place, the key players in the industry will increase and cause difficulties in the management of the whole energy service (Mutalib & Karim, 2022).

Energy demand is expected to rise as the nation develops. By expanding the share of RE in many industries, it will be possible to successfully meet the goals in climate plans. Effective management of natural resources, especially renewable and non-renewable energies, is indispensable (Pettitpierre,2015). With respect to the development of renewable energy in Malaysia, the government has made efforts to promote and develop RE as part of their agenda in accordance with the international accords to combat climate change and ensure sustainable development for energy as Malaysia is one of the signatories to the Paris Agreement and the Kyoto Protocol. The Ninth, Tenth, and Eleventh Malaysia Plans demonstrate this. The Small Renewable Energy Power Programme (SREP) was launched as part of the Ninth Malaysia Plan to encourage the use of RE resources (Ghazali, 2018). Following Malaysia's ratification of IRENA's statute in 2010, the RE Act 2011 was gazetted in June 2011 and served as the country's primary regulatory framework for boosting the production of renewable energy supported by a feed-in tariff mechanism. Present eligible sources for incentives under the FiT scheme run by the Malaysian Sustainable Energy Development Authority (SEDA) include solar PV, biomass, biogas, small hydro, and geothermal (Mustafa et al., 2022). While the New Energy Policy (2011-2015) and the Renewable Energy Act 2011 were the main emphases of the Tenth and Eleventh Malaysia Plans, they both aimed to increase energy security and speed the integration of renewable sources into Malaysia's electricity generation mix. In the Eleventh Malaysia Plan, introducing new renewable energy sources, improving technical expertise, and adopting net energy metering have been given priority (Ghazali, 2018).

The tariff system for renewable energy (RE) generation in Malaysia was introduced with the implementation of the Small Renewable Energy Project (SREP), which was to support small-scale renewable electricity, from 2001 to 2010. SREP focused on the development of solar photovoltaics, biomass and biogas, mini-hydro, and municipal solid waste. However, Malaysia has remained behind the target, although the tariff rate was revised in 2006 (Sovacool & Drupady, 2011). In 2019, the National Renewable Energy Policy and Action Plan in order to increase renewables share in the energy. The enactment of the first legislation on Feed-in tariff in 2011 in virtue of the Renewable Energy Act 2011 (Act 725) has enlightened this industry. In the same year, the Sustainable Energy Development Authority (SEDA) was established under the SEDA Malaysia Act 2011. SEDA is the crucial player in promoting RE development in Malaysia as in Section 15 (b) of the Sustainable Energy Development Authority Act 2011 (Act 726) and implementing and monitoring the FiT Program in Malaysia as per Section 15 (d) of the same Act. The renewable energy generator plants for feed-in approval holders will be linked directly to the national grid to provide clean electricity. The RE (in kWh) generated by feed-in approval holders will be sold at a fixed premium price (FiT Rate) to the "distribution licensee" or the holder of the license to distribute the electricity (Johari et al., 2013). FiT has been deployed by over 75 jurisdictions worldwide, including Germany, Denmark, Spain, and China (Yang et al., 2021).

Figure 3. Feed in tariff in Malaysia

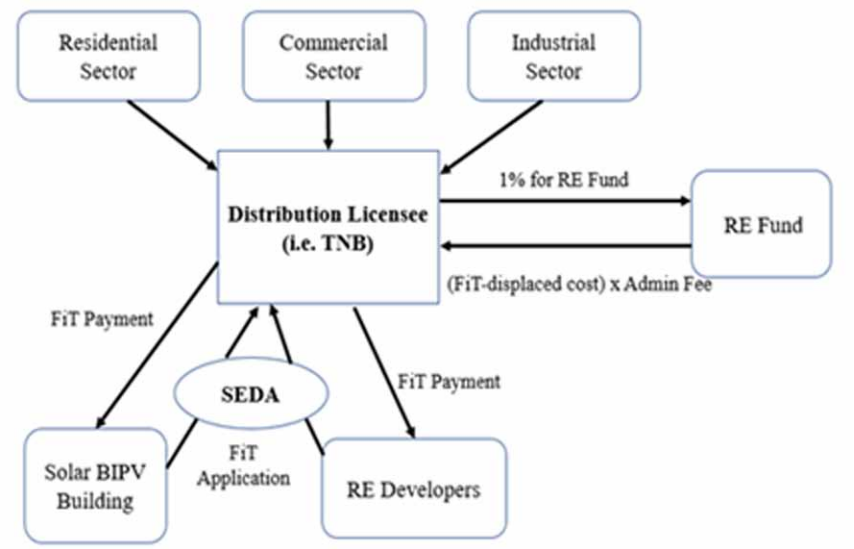


Figure 3 shows how the FiT mechanism works in Malaysia. SEDA will regulate FiT implementation, including FiT application. Under this mechanism, qualifying individuals or non-individuals can sell electricity (up to 30MW) generated from RE resources to power utility firms at a fixed premium price. Although FiT has been implemented in various jurisdictions, this mechanism is appropriate for the early stages of the renewable energy industry's development. Once the industry matures, the integration of FiT and renewable energy portfolio standard (RPS) are needed to ensure a competitive and sustainable renewable energy sector (Yang et al., 2021). Apart from FiT, the government also introduce renewable energy auctions for Large Scale Solar (LSS) Photovoltaic Plant. Section 50C of the Electricity Supply Act 1990 (Act 447) empowers the Energy Commission (EC) to issue guidelines on a Large Scale Solar Photovoltaic Plant for Connection to Electricity Networks. In auctions, the government will offer contracts that guarantee subsidized remuneration for renewable energy producers. Through this mechanism also, price discovery and competition have resulted in generation prices that are far lower than expected (Matthäus, 2020). Although competition in auctions provides an incentive to innovate and provide low-profit margins, this mechanism may only support mature technology such as solar photovoltaic and wind energy (Del Río & Kiefer, 2022).

Moreover, the Malaysian Investment Development Authority (MIDA) has played an active role in promoting green technology development by instituting the Green Investment Tax Allowance (GITA) and Green Income Tax Exemption (GITE). These incentives will allow small and medium-sized businesses (SMEs) to expand the renewable energy industry and encourage potential investors and industry participants to engage in renewable energy, energy efficiency, green building, green data center, and integrated waste management. In the absence of liberalization in the Malaysian power sector, the renewable energy sector is still progressing. However, renewable energy expansion may be impeded due to a lack of appropriate technology and infrastructure. However, by encouraging technological advancement and innovation, economic complexity can help overcome technical barriers to renewable energy development, resulting in new industries and technologies that facilitate the transition to a more sustainable

energy system (Wang et al., 2023). Furthermore, financial globalization allows the transfer of technology and best practices between countries in order to overcome technical limitations in the development of renewable energy (Wang et al., 2023).

CONCLUSION

Liberating and breaking the national electricity supply monopoly will lead to various problems, affecting the continuity of services to consumers. This transition incurred high indirect costs and thus can affect the tariff rate of electricity supply to consumers. Additionally, this liberalization may not necessarily be capable of reducing the electricity supply price to consumers. Malaysia is likewise making good progress in terms of greater renewable penetration even in the monopolistic power sector. There is no apparent indication that the liberalized electricity market has impacted growing renewable energy adoption. In most circumstances, most governments rely on more than electricity liberalization to boost renewable energy development. Other initiatives are also supporting renewable energy development. Nevertheless, government intervention is also required to fulfill the goals of the liberalized power sector. Power producers or generators should have a large market for the products they create to earn the best possible price, and the government may assist in enacting the required legislation to support this.

Power utilities in regulated markets that restrict competition may have limited capacity to develop renewable energy technologies, so the liberalization of the electricity market theoretically affects the search space for these technologies. By allowing new competitors to enter the market who are not reliant on the incumbents' core competencies and generation paradigm, the liberalization of the energy market can aid in breaking this route dependency. Nevertheless, the government has a crucial role in promoting renewable energy technology in order to emphasize the necessity of a competitive electricity market for clean energy innovation. Moreover, environmental policies that highlight low-carbon initiatives have greater significance. Through these low carbon policies, the government's roles do not diminish despite the fact that the power sector shifts from a monopoly to a competitive one. As completely new technologies emerge, certain market participants may be unable or unwilling to change their core generation paradigm since the energy market depends on capital-intensive infrastructures. Continuous investments in electricity supply are required, and this cannot be accomplished without a regulator to monitor market activity and guarantee that the market operates efficiently.

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KEY TERMS AND DEFINITIONS

Carbon Footprint: The total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our activities.

Distribution: Provides the necessary link between producers and consumers, within, and across borders.

Generation Sector: An industry in which the process of generating electric power from sources of primary energy or is an industrial facility for the generation of electric power.

Liberalization: The process or means of the elimination of control of the state over economic activities. It provides greater autonomy to business enterprises in decision-making and eliminates government interference.

Low Carbon Economy: Also known as a decarbonized economy; is an economy that has a minimal output of greenhouse gas (GHG) emissions into the environment's biosphere. In this context, it usually refers to the emission of carbon dioxide and methane.

Renewable Energy: Energy produced from sources like the sun and wind that are naturally replenished and do not run out. Renewable energy can be used for electricity generation, space and water heating and cooling, and transportation.

TOPSIS Method: The Technique for Order of Preference by Similarity to the Ideal Solution is a multi-criteria decision analysis method based on the fundamental premise that the best solution has the shortest distance from the positive-ideal solution and the longest distance from the negative-ideal one.

Transmission: Means a facility for transmitting electricity and includes any structures, equipment, or other facilities used for that purpose.