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## Working Paper

# An energy policy for ASEAN? Lessons from the EU experience on energy integration, security, and decarbonization

ADBI Working Paper Series, No. 1217

### Provided in Cooperation with:

Asian Development Bank Institute (ADBI), Tokyo

*Suggested Citation:* Diaz-Rainey, Ivan; Tulloch, Daniel J.; Ahmed, Iftekhar; McCarten, Matthew; Taghizadeh-Hesary, Farhad (2021) : An energy policy for ASEAN? Lessons from the EU experience on energy integration, security, and decarbonization, ADBI Working Paper Series, No. 1217, Asian Development Bank Institute (ADBI), Tokyo

This Version is available at:

<https://hdl.handle.net/10419/238574>

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## **ADB Working Paper Series**

### **AN ENERGY POLICY FOR ASEAN? LESSONS FROM THE EU EXPERIENCE ON ENERGY INTEGRATION, SECURITY, AND DECARBONIZATION**

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No. 1217  
February 2021

**Asian Development Bank Institute**

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Suggested citation:

Diaz-Rainey, I., D. J. Tulloch, I. Ahmed, M. McCarten, and F. Taghizadeh-Hesary. 2021. An Energy Policy for ASEAN? Lessons from the EU Experience on Energy Integration, Security, and Decarbonization. ADBI Working Paper 1217. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/energy-policy-asean-lessons-eu-experience-energy-integration-security-decarbonization>

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This paper has benefited from comments received during presentations to the Otago Energy Research Centre (OERC) Seminar Series (Dunedin 2019) and the ADBI conference on Economic Integration in Asia and Europe: Lessons and Recommended Policies (Tokyo 2019). We are particularly grateful for comments received from Peter J. Morgan, Venkatachalam Anbumozhi, and Xunpeng Shi. The usual disclaimer applies.

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**Abstract**

The European Union (EU) has redefined the energy sphere in Europe over the last three decades. Transnational policies targeting liberalization and integration, energy efficiency, renewables, carbon pricing, and energy security have led to major steps forward in terms of a more secure, integrated, and environmentally friendly energy supply. This paper explores, through the lenses of a paradigm shift and transition pathways, how the Association of Southeast Asian Nations (ASEAN) grouping might advance its own energy trilemma through greater energy cooperation. We provide evidence that ASEAN has lagged behind in terms of energy transition, representing considerable risks in multiple forms – most notably, political and physical climate risks from failing to meet the Paris Agreement targets and the risk of stranded assets if accelerated transition is achieved. However, accelerated transition could come in many forms. By drawing on the EU experience, we argue that an *energy policy for ASEAN* should explicitly pursue a dual transition pathway strategy to yield the best outcome in terms of the energy trilemma. First, an ‘ASEAN Supergrid’ supported by a single energy market and by common carbon pricing would ‘green’ urban and industrial demand. Second, ‘Distributed Smart Grids’ would help reap the social and economic benefits of providing electricity to the rural/remotely located population that have hitherto not had access to electricity. This is a dual transnational and local approach that contrasts with energy transition defined at national level. This interconnected approach should yield security, environmental, and economic dividends.

**Keywords:** energy transition, EU, ASEAN, energy policy, carbon pricing, renewable energy, climate risk, smart grids

**JEL Classification:** O44, O52, O53, Q40, Q54

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# 1. INTRODUCTION

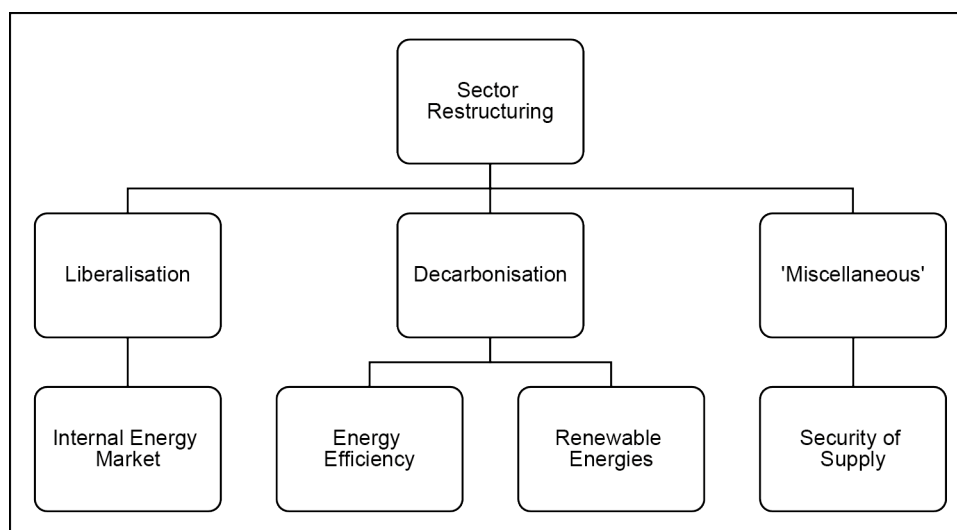
In this paper, we explore how the ASEAN grouping might advance its energy trilemma – the need for secure, affordable, and green energy – through greater energy cooperation and whether the EU's efforts on energy integration may hold lessons for ASEAN. This is particularly important since ASEAN countries have been described as climate and energy policy laggards (Razzouk 2018). To see whether EU energy collaboration holds lessons for the ASEAN grouping it is important to understand the historical context of EU energy integration.

With the birth of the European project attributed to the European Coal and Steel Community (1951), energy matters were at the heart of European economic integration at its inception (McGowan 1994). However, progress toward a European energy policy and a single European energy market has been slower than in other areas due to the determination of national governments and national interests to retain control over energy matters (Andersen 2000). Despite setbacks along the way, European efforts have persisted over time with the *Energy Policy for Europe* (EU Commission 2007) representing a watershed effort to increase European influence on energy matters. This policy set ambitious targets for energy efficiency, the adoption of renewables, and cutting greenhouse gas emissions, as well as continuing efforts to create integrated and liberalized European energy markets. Thus, the *Energy Policy for Europe* sought to integrate energy and environmental policy at the EU level, which had hitherto functioned largely separately.

The birth of EU environmental policy was marked by the European Council's 1972 declaration of the first Environment Action Programme (Gubb 2007). Subsequently, EU influence on environmental matters has grown as exemplified by the commitment to sustainable development in the Maastricht (1992) and Amsterdam (1997) Treaties and by the Lisbon Strategy (2000). Though there have been policy failures, such as the aborted proposals for an energy/CO<sub>2</sub> tax in the early 1990s (Andersen 2000), there have been numerous accomplishments. Of these perhaps the most prominent were the leading role the EU played in global environmental negotiations, like Kyoto, and the establishment of the EU Emissions Trading Scheme. Just as significant have been a raft of low-profile decisions, directives, and resolutions on a host of environmental issues, ranging from water quality to setting standards for waste disposal, and from protecting wildlife and fauna to increasing the energy efficiency of appliances and buildings (see Section 3.2). The EU is now on its seventh Environmental Action Plan, which runs until 2020.

Andersen (2000) reviews efforts at creating a European energy policy up to the turn of the century and identifies four distinct periods. The first covered the period 1946–1957 when energy cooperation, in particular concerning coal, drove wider political cooperation. This was followed by a period (1957–1972) when cheap imported oil replaced coal, resulting in energy policy becoming largely peripheral to the European project. The third period (1973–1985), heralded by the oil shocks of 1973 and 1979, created renewed interest in European energy cooperation, which ultimately failed (Andersen 2000).

Since 1985, the supranational influence of the EU in energy matters has steadily grown as the EU's environmental and competition policies have become increasingly established and pervasive (Andersen 2000). As reviewed in Section 3 of this paper, these efforts can be placed into a hierarchy of energy sector restructuring streams as illustrated in Figure 1.

**Figure 1: Hierarchy of Sector Restructuring Streams**

Source: Author's depiction.

The liberalization objective or pillar contains one stream (Internal Energy Market); the decarbonization objective is comprised of two streams (Energy Efficiency and Renewable Energies); a miscellaneous objective contains the Security of Supply stream.

As noted above, the *Energy Policy for Europe* attempted to integrate environmental and competition (liberalization and integration) pillars of energy and environmental policy. Further the policy sought to add an energy security pillar or objective by 'promoting EU energy solidarity' (EU Commission 2007). Though the EU has seen marked successes in the liberalization and environmental pillars of its energy policy, progress on energy security has been slower (see Section 4.1). Some might argue that a precondition to establishing a truly credible energy security policy is the creation of a broader foreign and security policy for the EU. If this is challenging for the EU then the challenge for ASEAN is even larger.

The EU and ASEAN share a number of similarities yet they have important differences that strongly moderate the strength of integration and cooperation in any sphere, including energy policy. Both seek to integrate their economies, are involved in trade agreements, have regular political and economic dialogue, and seek to promote peace (Koh 2017). However, ASEAN is an inter-governmental organization while the EU is a supranational organization where large elements of sovereignty have been 'pooled' at the EU level. The EU has a parliament with the power to legislate and a powerful quasi-executive body in the form of the EU Commission and the Council of the EU. Crudely put, the EU can pass legislation that requires implementation of laws and regulation by member states in specific areas, which include energy and environmental policy, while ASEAN has no such powers. These differences provide an important context for any lessons that ASEAN may glean from the EU's efforts to create an Energy Policy for Europe.

The rest of this paper is structured as follows. Section 2 introduces energy transition and its many potential forms or pathways. Section 3 reviews EU-level efforts on integration, renewables, energy efficiency, and energy security. Section 4 explores the equivalent context in ASEAN. Section 5 concludes by comparing and contrasting the EU and ASEAN experiences and drawing relevant conclusions and policy recommendations.

## 2. ENERGY TRANSITION PATHWAYS

In response to growing concerns about climate change and the need to meet the social and economic needs of energy demand, new energy production and consumption paradigms have been advocated worldwide. Despite contrasting visions, techno-market approaches dominate (EU Commission 2011; US DOE 2009; Verbong and Geels 2010), where the interaction between markets and technological innovation, such as smart appliances, smart grids, and electric vehicles, is envisaged. This approach emphasizes price signals as being central to directing change within the energy system, not only in altering the energy mix and moving supply from fossil fuels toward renewable energy, but also in creating more demand-responsive consumers.

There is a good deal of forward-looking work attempting to envisage the decarbonized energy system of the future as reflected with interest in ‘smart grids’ (e.g., Battaglini et al. 2009; EU Commission 2011; US DOE 2009). Smart grids can be understood as the marrying of ICT technologies and software (including artificial intelligence and blockchain) to the electricity grid in order to facilitate an electricity system that allows for demand-responsive consumers and effectively integrates renewable generation and new consumer technologies such as electric vehicles (see Section 2.1 for a fuller description of ‘smart grids’ and ‘smart energy systems’).

As noted above, a central tenet behind most visions of the ‘smart grids’ of the future is the price signals that energy markets will deliver to facilitate effective and efficient resource allocation. Hence, smart consumers will charge their electric vehicles when prices are lowest and feed back to the grid when they are very high. This vision intertwines energy systems with electricity market liberalization and competition (see Section 3.1 for a related discussion in the European context). Thus, energy transition represents a technology-driven *paradigm shift* that involves doing things in ‘new ways’ facilitated by technology and markets.

### 2.1 Paradigm Shift and Transition Pathways

Some of the key attributes of the ‘smart grids’ or ‘smart energy systems’ of the future include (see Lund et al. 2017; US DOE 2009; Valocchi, Juliano, and Schurr. 2010; Verbong and Geels 2010):

- **Integration of renewables:** In particular intermittent wind and solar photovoltaic (PV) generation, which has become cost-competitive relative to fossil fuels on a levelized cost of production (LCOE) basis. Indeed, in many countries that is now cheaper than fossil fuel generation (Merchant 2018).
- **Demand-side management and price-responsive consumers:** Enabled by technological innovations such as smart appliances and smart meters, as well as the aforementioned ‘aggregators’ and their new services.
- **‘Prosumers’:** Consumers, being also producers, provide small-scale generating technologies such as photovoltaic generation and small-scale wind turbines. The ability to be a ‘prosumer’ is enabled by technologies such as bidirectional smart meters.



- **New energy market participants and services:** An increased emphasis on energy services rather than energy consumption with new third-party market participants intermediating (often referred to as aggregators and/or energy services companies (ESCOs)) between the energy system/market and end users.
- **Integration of electric vehicles (EVs):** Increasingly EVs are seen not just as a drain on the system but as an integrated component for balancing due to the possibility of using EV batteries as a form of energy storage that can feed back into the grid (US DOE 2009). This is known as Vehicle to Grid (V2G) and is possible since vehicles spend the vast proportion of their time idle (parked), so if they are idle and they are connected to the distribution network they can be used as batteries in the network to smooth out peaks and thus reduce costs.
- **Energy storage:** Storage is again expected to be facilitated by technological innovation such as improved battery technologies.
- **Green hydrogen:** Although many facets of the energy system are likely to be electrified (e.g., light vehicles fleet) there will remain a need for liquid fuels to deal with long-range transport, industrial processes, and winter heating needs. Green hydrogen is ideally placed to meet these needs in the energy sector and indeed some countries will seek to pursue the hydrogen economy more broadly (Lund et al. 2017; Clark II 2008).

Most visions of the future share these attributes; however, there are contrasting configurations of the future end state of the energy system within the boundaries of these attributes (Battaglini et al. 2009; Foxon, Hammond, and Pearson 2010; Verbong and Geels 2010).

**Table 1: Alternative Visions for the Energy System in the Long Term**

Transition Pathway	Description	Network Change	Dynamic
TP1: Transformation or 'Hybrid Smart Grids'	Centralized generation continues to dominate but is complemented by renewables and small-scale distributed generation. Network infrastructure remains principally defined at the national level. Use of fossil fuels continues but Carbon Capture and Storage ensures system is decarbonized.	Medium	Economic: the market as an organizing force
TP2: Reconfiguration or 'Super Smart Grid'	Supranational/regional energy policy (e.g., EU) results in the creation of a transnational super grid that geographically diversifies away the intermittency problem of renewables, thereby allowing for a fully renewable-based system.	High	Economic and political: the market and international collaboration as organizing forces
TP3: Realignment or 'Distributed Smart Grids'	This TP can be seen as the opposite response to TP2 to energy policy challenges. There is an increased emphasis on energy conservation and local small-scale renewables generation. The national network is replaced by 'loosely coupled regional and local grids (micro grids)' (Verbong and Geels 2010).	High	Localism: A decentralized and localized response to energy policy challenges

Source: Adapted from Battaglini et al. (2009); Hojčková, Sandén, and Ahlborg (2018); Verbong and Geels (2010).

These contrasting visions have been articulated using evolutionary paradigm shift models (Verbong and Geels 2010; Foxon, Hammond, and Pearson 2010). For instance, Verbong and Geels (2010) apply the Geels and Schot (2007) multilevel approach with alternative transition pathways to energy sector paradigm change. Specifically, they identify three transition pathways (TPs), which are described in Table 1 and which are assessed with respect to the degree of '*network change*' they imply relative to the existing network configuration and the principal '*dynamic*' driving change.

Although the TPs differ in terms of how radical they are with respect to network configuration, all three require large-scale investment (Verbong and Geels 2010, 1219). TP1 represents a nationally dominated energy transition, whereas TP2 represents a supranational solution. TP2 is appealing as it means that integrating renewables is easier because of generating portfolio and geographical diversification benefits – thus in the EU context, if the wind is not blowing in northern Europe, the sun is likely shining in southern Europe, so the south can send energy to the north via a pan-European HVDC (high-voltage direct current) network.

TP3, on the other hand, represents a subnational 'localized' vision of energy independence, which is appealing for rural communities that have hitherto not had access to electricity. Indeed, this highlights that TP2 and TP3 are not mutually exclusive. This is particularly relevant to ASEAN economies that (1) need to meet demand in large cities and connecting those cities across borders will allow for higher levels of renewables (TP2), and (2) at the same time the ASEAN regions need to reap the social and economic benefits of providing electricity to the rural/remotely located population (TP3). In the latter case, TP3 should be a cheaper approach to electrifying rural areas that under a national TP1 would require expensive building of transmission and distribution lines. Thus, an *energy policy for ASEAN* should explicitly pursue a dual TP2 and TP3 strategy.

### **3. EU ENERGY POLICY AND INTEGRATION**

As noted in the Introduction, energy integration has been at the heart of the economic integration of Europe. Traditionally, the European energy supply was based on national and regional markets with vertically integrated companies that could produce, transmit, and distribute energy to nearby consumers with natural, regional monopolies. Since 1987, the EU has begun to make progress toward greater European integration, allowing the free movement of goods, persons, services, and capital across European borders. The overall objective was to increase transnational competition within the EU, thereby exposing inefficiencies in firm operations and slowly phasing out inefficient firms. Consequently, there have been a large number of legislative acts establishing common rules for a single European internal market for energy, replacing the national- and regional-based structures for the energy supply (Jamash and Pollitt 2005).

In addition, as noted in the Introduction, the energy sector has been exposed to a number of environmental objectives aimed at reducing carbon emissions through policy and market mechanisms, such as the EU ETS. Thus, another major EU-led reform thrust that has built up particular momentum is related to the environmental objectives of the sector, or the 'greening' of the energy supply. In addition to the EU ETS, this reform thrust has focused on reducing demand through energy efficiency legislation and through policies that promote renewable energies. In addition to the liberalization and environmental policies, EU utilities have also been subject to a range of legislation related to the security of the energy supply. The following sections outline four distinct restructuring streams impacting the energy sector, which are depicted in Figure 1.

### 3.1 Liberalization Stream

The liberalization objectives of the energy sector are congruent with the overall goals of the EU community, namely to progressively create internal markets for specific sectors, removing all internal frontiers. The Single European Act (1987), the first major revision of the Treaty of Rome (1957), aimed to allow the free movement of goods, persons, services, and capital across European borders. The liberalization stream focuses on removing frontiers to gradually establish internal markets for electricity and natural gas, creating a competitive energy market. The removal of international barriers allows European energy utilities to create much larger customer bases throughout Europe. Nonetheless, it also exposes the energy utilities to potential reductions in demand, as competitors from other EU countries can now compete for incumbents' domestic customer market segments. A gradual approach to introducing EU-level competition was chosen, designed to enable the sector to adjust in a flexible and ordered manner to its new competitive environment.

Within the EU legislation to liberalize the energy sector, there were three major reform initiatives, referred to as the 'three packages.' *The first packages:* The first packages for electricity (Directive 1996/92/EC) and gas (Directive 1998/30/EC) were published in 1997 and 1998, respectively. The packages represent the first attempts to remove national barriers in the EU. The packages resulted in only minor liberalization of the energy sector and minor commitments from member states; only high-volume commercial consumers were able to switch suppliers (Eikeland 2011). The first packages provided no clear rules on the transmission of energy through existing networks but required revenue unbundling of vertically integrated companies, recording generation and retail revenue separately. Regardless, vertically integrated companies still possessed monopolies over retail networks and therefore were able to survive any wholesale price shocks, while nonintegrated companies became bankrupt (Jamasp and Pollitt 2005). This provided an economic incentive for nonintegrated companies to integrate generation and distribution through asset acquisition or merging. As a result, there was relatively little competition in the EU energy sector.

*The second packages:* Implementing the first packages was argued to have resulted in a variety of benefits, including increased efficiency, price reductions, higher standards of service, and increased competitiveness. However, the sector still lacked concrete provisions that ensured a level playing field in terms of generation and reduced the risk of market dominance. Further, member states' idiosyncrasies caused delays in restructuring implementation, allowing vertically integrated utilities to continue to impede fair competition (Eikeland 2011; Erdogdu 2014). The second packages (Directive 2003/54/EC; Directive 2003/55/EC) for electricity and gas were published in 2003, with the objective of creating a truly open market in the EU, which allowed consumers to freely choose suppliers and suppliers to freely deliver to customers across Europe. The second packages aimed to achieve 1) *legal* unbundling of transmission system operators (TSOs) and distribution system operators (DSOs) from the remainder of the industries, 2) free entry to generation, 3) monitoring supply competition, 4) a fully open market enabling household customers to switch suppliers, 5) promotion of renewable energy fuel sources, 6) strengthening of the role of the market regulators, 7) a single European market for energy, and 8) regulated access to energy grids (Jamasp and Pollitt 2005; Eikeland 2011). The rationale was that a legally independent transmission operator would charge equitable prices to competing generators, increasing the transparency of pricing. Further, a fully open market would allow consumers to freely choose energy suppliers.

*The third packages:* The third packages (Directive 2009/72/EC; Directive 2009/73/EC), published in 2009, were designed to address the unachieved liberalization objectives of the second packages (Eikeland 2011). The legislation highlighted that the legal and functional unbundling of vertically integrated companies did not lead to effective unbundling of TSOs. More than two-thirds of the European generation market share was owned by eight large utilities (Jamab and Pollitt 2005). This ownership structure resulted in continued misuse of networks, with competing energy generators complaining of unfair grid access and network fees (ACER 2013). A clear and effective way to solve the discriminatory network access obstacle was the unbundling of *ownership* at the transmission level for vertically integrated companies, separating transmission and generation companies into two distinct entities. Further, the legislation also proposed the modernization of distribution networks into 'smart grids' (see Section 2), encouraging decentralized generation and energy efficiency. Finally, the third packages addressed the issue that national regulators lacked independence from government, and had insufficient powers and discretion to effectively regulate the sector.

To ensure restructuring legislation was enforced, market monitoring agencies were established to act as independent regulatory authorities. In 2003 and 2005 (Regulation 1228/2003; Regulation 1775/2005), fair rules for cross-border exchanges in electricity and gas were established. The European Regulators' Group for Electricity and Gas (EREG) (Commission Decision 2003/796/EC) was established as a temporary solution to address failures of fair grid access. EREG sought to ensure that EU-level legislation was consistently applied, facilitating independent regulatory authority, consultation, coordination, and cooperation between regulatory bodies within member states. Despite EREG's positive contribution, criticisms of discriminatory access to networks continued. As a result, in 2009, the Agency for the Cooperation of Energy Regulators (ACER) (Regulation 713/2009) was established in conjunction with the third package. ACER monitors regional cooperation and seeks to ensure operational transparency and efficiency.

In summary, a variety of legislative changes relating to sector liberalization have been published over the last two decades. The sectors are becoming increasingly liberalized despite resistance from big utilities. Further, regulatory agencies have been established to counteract sector domination by some energy utilities. The EU experience in trying to create a single European energy market holds some valuable lessons for ASEAN. The process is challenging and slow but can benefit from supranational legal authority and perseverance (in the EU, it took three legislative packages over several decades to make meaningful progress). Also, to ensure a level playing field, the sector needs to be restructured, and ideally independent supranational regulatory agencies need to be created.

## **4. ENERGY EFFICIENCY STREAM**

Besides sector liberalization, a second theme that has gained prominence in recent years is the 'greening' of the energy supply. Agreed by EU leaders in 2007 (as part of the *Energy Policy for Europe*; see Introduction), environmental objectives aim, by 2020, to boost renewable energy use to 20% of total energy, reduce greenhouse gas emissions by 20%, and achieve a 20% increase in energy efficiency, commonly referred to as the '2020×3' targets. There are two methods aimed at achieving climate change objectives: the economic (incentives) approach and the regulatory approach. The EU applied both in environmental policy. In the former case, the EU ETS provided general economy-wide incentives to reduce emissions (we do not present a detailed discussion

on the EU ETS as it is well researched elsewhere; see, for instance, World Bank (2019)). The latter approach prescribes policies or forbids processes, products, and activities. These regulations and directives are the unsung heroes of energy transition in Europe and had a material impact on incumbents (see Tulloch, Diaz-Rainey, and Premachandra 2017). This section examines the legislation enacted to achieve greater energy efficiency while Section 3.3 highlights the legislation that promoted renewables over and above the incentives provided by the EU ETS.

The Energy Efficiency stream was designed to reduce the rate of growth of internal energy consumption. The Energy Efficiency stream was implemented in two ways. First, it aimed to encourage manufacturers to make more energy-efficient appliances by informing the public of the energy consumption of common electrical household appliances. The Energy Efficiency legislation systematically identified energy-intensive end user appliances and required comprehensive labeling of consumption. The labeling scheme implemented a standardized measure of energy efficiency, rating energy consumption. Appliances included space heating, air conditioning units, electric ovens, lights, washers, driers, refrigerators, and freezers. Legislation also set a maximum electricity consumption allowed per appliance. The rationale behind the stream was that end users, when faced with choices of similar appliances, would favour the appliance that consumed the least energy.

The second objectives of the Energy Efficiency stream were related to the energy consumption of buildings, which accounts for 40% of the EU's total energy consumption (Directive 2010/31/EU). The legislation required objective information on the energy characteristics of buildings to help improve the transparency of the property market and encourage energy efficiency. In an effort to reduce emissions, the legislation required that buildings were to be billed for heating, air conditioning, and hot-water costs based on actual consumption. Similarly to the appliance legislation above, home occupants were expected to self-regulate their own consumption and be incentivized by economic savings on fuel bills. Property legislation had a differential impact on old buildings compared with new buildings. Old buildings were to be improved through insulation, whereas new buildings were subjected to more regulation with the intention of being carbon-zero by 2020.

In summary, the energy efficiency legislation represents a change in the total end user demand for energy in the EU. The expectation is that the energy demand in Europe will fall by 10% to 20% by 2050 as a result of legislative changes (Delarue et al. 2011).

## **4.1 Renewable Energies Stream**

Similarly to the Energy Efficiency stream, the Renewable Energies stream also focused on reducing carbon emissions in the EU. However, the stream focused on the supply side. In 2001, Directive 2001/77/EC set an indicative target of 22.1% of gross electricity consumption from renewables (RES) by 2010. 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.

The typical electricity market design assumes that thermal or hydro plants will supply the bulk of services. The low marginal cost of RES and nuclear energy means these generators can sometimes outbid all gas- and coal-fired generation, especially during periods of low demand (Green and Vasilakos 2010). This has been magnified by the renewable energy legislation, which focused on providing grid priority for electricity generated from RES and biofuels (Directive 2001/77/EC). Grid priority ensured that renewable energy generators were able to sell and transmit electricity, in accordance with connection rules, whenever the renewable energy source (solar, wind, hydro, etc.) became available. Put simply, they were afforded first access to the grid ahead of combustion fuel generators. This grid priority was uncapped, allowing the renewable generators to utilize their maximum capacity (Directive 2009/28/EC), thereby reducing the number of operating hours for conventional generators.

RES support schemes, such as feed-in tariffs and premiums, green certification markets, also incentivize RES, and the EU has played a major role in their design and in ensuring there is a level playing field in their use. For instance, the EU Commission (2013) gave guidance on their design. The RES support schemes led to a rapid uptake of renewables in the EU (Davies and Diaz-Rainey 2011), with most large EU member states having implemented some form of support in the late 1990s.

Further, the renewable energies legislation focused on increasing technological improvements within energy utilities and, more importantly, setting targets for the electrification of neighboring sectors. The purpose of the objective was to reduce the EU's reliance on imported energy (primarily oil). Specifically, the EU has set a mandatory target for the overall share of energy from renewable sources (both biofuel and viable alternatives) for the transport sector. Transport fuel accounts for more than 30% of final energy consumption (Directive 2003/30/EC), and is expanding as the EU community expands. Additionally, road transport accounts for 84% of transport-related CO<sub>2</sub> emissions. The 2020 targets for the transport sector were 1) a minimum of 20% of conventional fuels being substituted by alternative fuels, and 2) a minimum of 10% of energy being derived from renewable energy sources, applicable across all member states. The renewable energy legislation also focused on decentralizing renewable energy technologies, which was expected to increase the utilization of local energy sources, increase the energy supply, and reduce energy transmission losses – increasing the overall efficiency of energy generation. Naturally, such a rapid expansion of renewable energy requires labor, thereby creating local jobs for EU residents – also expected to increase value through corporate social responsibility.

## **4.2 Security of Supply Stream**

The Security of Supply stream focused on reducing the harmful effects from difficulties in securing crude oil and petroleum products, for both energy and economic activity. The legislation requires member states to maintain minimum levels of crude oil reserves and petroleum products, determined by various levels of inland consumption (Kanellakis, Martinopoulos, and Zachariadis 2013). The intention was to release strategic reserves of oil into the international market in the event of a supply disruption that required market-level intervention to bridge the supply gap. Supply gaps could arise through a variety of situations, including, but not limited to, price developments in the commodity markets or disruptions in the supply of natural gas. Accordingly, the member states are obliged to maintain minimum stocks of crude oil and/or petroleum products, distribute these stocks to users, impose restrictions on oil consumption, and give priority of supplies to certain groups. The overall objective is to grant competent authorities the necessary powers to

partially regulate oil prices in order to prevent abnormal price rises (Council Directive 73/238/EEC).

A second major objective of the Security of Supply stream is to reduce the overall financial burden of energy costs on the final consumer (Council Directive 2009/119/EC). Typically, this has involved establishing one central stockholding entity per member state, set up for the purpose of holding sufficient supplies of oil stocks (Council Directive 2009/119/EC). The purpose of the central stockholding entity is to also allow fuel switching in the case of disruptions, using crude oil and petrol products in energy production (Council Directive 2009/119/EC). From 2004 to 2006, legislation (Council Directive 2004/67/EC; Directive 2005/89/EC) also began to focus on maintaining the security of supply of natural gas and electricity. Specifically, there is an emphasis on minimum targets for storage of natural gas and establishing long-term supply contracts, which is connected to the Internal Energy Market legislation. For electricity, the legislation focused on maintaining adequate generation capacity, a balance between supply and demand, and appropriate interconnections between member states. The legislation also established bilateral oil supply agreements between member states to ensure backup oil reserves were available when needed as well as the Gas Coordination Group, which facilitated the security of supply of natural gas at the community level in the event of major supply disruptions. To ensure compliance with the Security of Supply objectives, the 2009 legislation established an additional consulting agency comprised of representatives from member states: the 'Coordination Group' for oil and petroleum products.

Overall, the EU energy security stream has established reactive measures to energy security risks by ensuring that member states hold a minimum level of prudent reserves, via the ability to switch fuels and by partly regulating prices in terms of crises. These reactive measures are important but a far cry from a common EU foreign policy that could target energy security risks proactively (see related discussion in the Introduction).

## 5. ASEAN ENERGY TRANSITION

### 5.1 ASEAN Energy Context and Cooperation

The ASEAN region is one of the fastest-growing economic regions in the world. With its growing populations and dynamic economies, the region has been facing challenges in addressing the increasing energy demand (Rakhmah and Li 2016; Shi 2016). Therefore, the ASEAN region adopted a VISION 2020 on energy cooperation in 1997 that aimed for an "ASEAN partnership in dynamic development aimed at forging closer economic integration within the region" (Tongsopit et al. 2016). The vision emphasized better energy cooperation via interconnected electric grid and gas pipeline networks across the region, depending more on renewable energy and promoting energy efficiency in the future. Hence, the *ASEAN Plan of Action for Energy Cooperation (APAEC)* 1999–2004 was formulated and was subsequently updated for 2004–2009, 2010–2015, and 2016–2025 (Tongsopit et al. 2016). Thus, current cooperation in the energy sector within the region is directed by *APAEC 2016–2025*. The theme of this plan is "enhancing energy connectivity and market integration in ASEAN to achieve energy security, accessibility, affordability, and sustainability for all." This document outlines seven priority programs with action plans, namely:

- ASEAN Power Grid
- Trans-ASEAN Gas Pipeline
- Coal and Clean Coal Technology
- Energy Efficiency and Conservation
- Renewable Energy
- Regional Energy Policy and Planning
- Civilian Nuclear Energy

APAEC strongly emphasizes ASEAN energy market integration and connectivity to accelerate the realization of the ASEAN Economic Community (Andrews-Speed 2016b). However, as intimated in the Introduction, these programs do not have the legal standing that equivalent EU directives and legislation have (see Sections 3.1 to 3.4).

The ASEAN Power Grid (APG) aims to facilitate multilateral electricity trading, while the Trans-ASEAN Gas Pipeline (TAGP) aims to connect liquefied natural gas (LNG) regasification terminals. In addition, *APAEC 2016–2025* encourages clean coal technologies, promotes strategies for energy efficiency and renewable energy sources, and focuses on nuclear capacity building for future energy security. It also offers an avenue for collaboration between ASEAN's dialogue partners (DPs), international organizations (IOs), businesses, and academics in an effort to share their expertise.

The APG has been a flagship initiative of APAEC 1999–2004 under the ASEAN VISION 2020 since 1997, aiming for an integrated regional power grid. However, due to regulatory, policy, and fiscal barriers, progress towards establishing integrated energy market has lagged behind expectations (Andrews-Speed 2016b). In September 2014, ministers from the Lao People's Democratic Republic (Lao PDR), Thailand, Malaysia, and Singapore agreed to initiate a pilot project to evaluate the likelihood of cross-border power trading. Andrews-Speed (2016b) notes that no initiative has been undertaken so far under this proposed pilot and blames the lack of liberalization of the ASEAN power sector for hindering the integration process. According to the *ASEAN Energy Cooperation Report 2017* (ACE 2017b), as of 2016 eight APG projects have been completed out of a planned 16 projects with a capacity of about 1,723 MW, thereby bringing the total capacity of the APG to 5,212 MW.

Another ambitious project that ASEAN has sought to promote is called the Trans-ASEAN Gas Pipeline (TAGP), which is an integrated natural gas pipeline network connecting regional gas reserves in the Gulf of Thailand, Myanmar, and Indonesia to the rest of the region (Sovacool 2009). The project aims to increase energy security and promote cooperation and dialogue among the regional counterparts. ACE (2017b) highlights that, so far, 3,673 kilometers of pipelines linking six countries and six liquefied natural gas (LNG) regasification terminals, with a total capacity of 22.5 million tons per annum (MTPA), have been built. However, these are the result of a bilateral approach as opposed to a more integrated and planned approach.

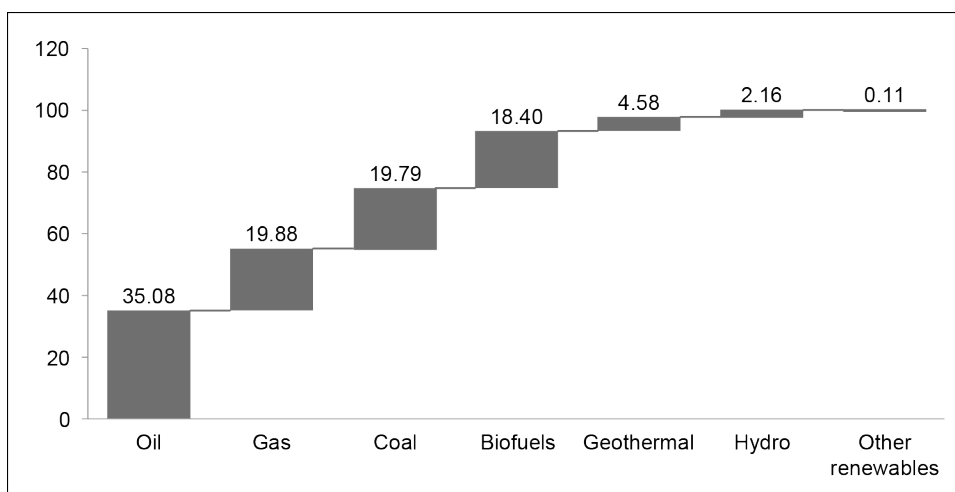
As noted earlier, the ASEAN region has been growing rapidly, meaning that meeting associated growth in power demand, particularly uninterrupted electricity demand, is a considerable challenge for ASEAN governments (Rakhmah and Li 2016; Shi 2016). The population, urbanization, and industrialization have kept energy demand high. To meet this demand, electricity installed capacity increased by an average of nearly 8% per year between 2005 and 2015. ACE (2015) estimates that energy demand is projected to rise by an average of 4.7% per year between 2013 and 2035.



Given this expected increase in energy demand, cooperation among ASEAN countries is important if this extra demand and existing demand are to be ‘greened’ via renewables – as noted in Section 2.1, a ‘Super Smart Grid’ in line with TP2 makes the integration of renewables much easier. This approach would thus support the growing power demand and limit greenhouse gas emissions. However, the current power supply path in the ASEAN region is not sustainable due to clusters of energy poverty (lack of access to electricity or clean cooking facilities) and a rising power demand met largely via fossil fuels (IRENA 2018; Shi 2016). Shi (2016) describes the ASEAN energy mix as brown and expects that CO2 emissions will double in coming decades under current trajectories. Further, although there are a rising number of interconnectors in the region, ASEAN energy market integration has been slower than planned and restricted to bilateral relations (see Andrews-Speed 2016a and Section 4.3 below).

The total primary energy supply (TPES) in the region is dominated by fossil fuels (Figure 2). In 2017, oil had the largest share of TPES with more than 35% for the ASEAN region, while gas and coal contributed approximately 20% each. Biofuels hold the highest share in renewable sources at 18.40%, followed by geothermal and hydro at 4.58% and 2.16%, respectively. Other renewable (solar, wind, etc.) sources were underutilized as they amounted to less than a 1% share.

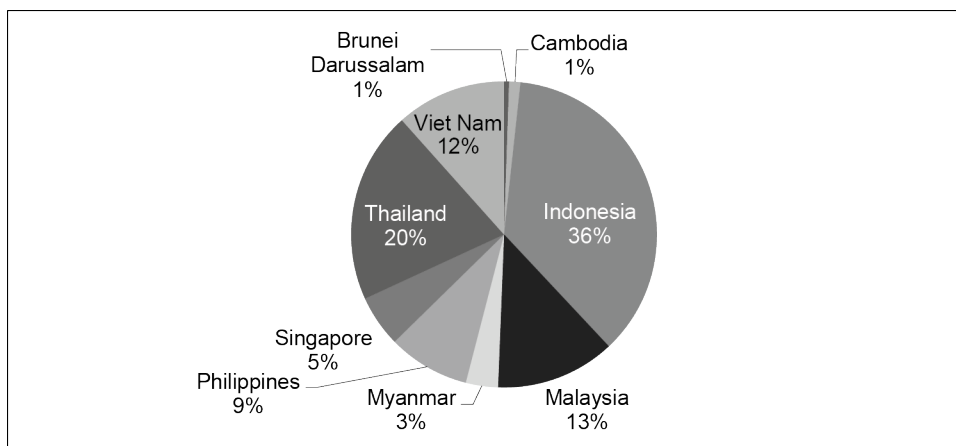
**Figure 2: ASEAN Primary Energy Supply Structure by Fuel (2017)**  
(%)



Source: Compiled from IEA 2019 World Energy Statistics and Balances.

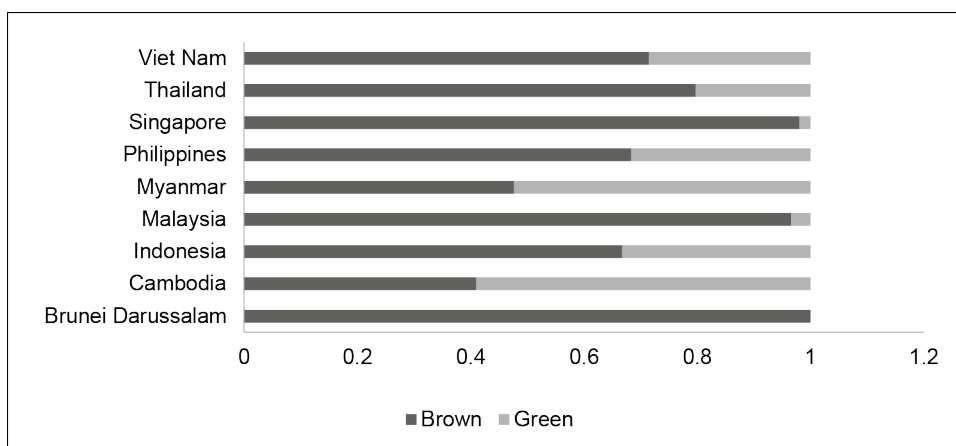
Indonesia, Malaysia, Thailand, and Viet Nam have the highest energy needs in the region (Figure 3). However, all four countries depend heavily on either oil, gas, or coal. On the other hand, a few countries, such as Cambodia and Myanmar, rely more on renewable sources (Figure 4), particularly on biofuels and waste. Malaysia and Viet Nam are leading the way in terms of hydro projects, and Indonesia has the largest geothermal sector, followed by the Philippines, in ASEAN. Energy trading has been growing in the region due to the rise of the People’s Republic of China (PRC) and India (Wu 2016). According to ACE (2017a), the key energy commodities for export are coal and gas. Malaysia and Viet Nam are the main exporters of gas, Indonesia exports considerable amounts of coal, and the Lao PDR is a hydropower exporter in the region, whereas Thailand and the Philippines import energy commodities, particularly oil and gas.

**Figure 3: ASEAN Primary Energy Supply Structure by Country (2017)**



Source: Compiled from IEA 2019 World Energy Statistics and Balances.

**Figure 4: ASEAN Primary Energy Supply Structure by Sources (2017)**



Source: Compiled from IEA 2019 World Energy Statistics and Balances.

Although ASEAN depends heavily on fossil fuels for energy production (Tongsopit et al. 2016), the region has abundant renewable resources, which could be harnessed to contribute to regional energy security (Huang et al. 2019). In 2015, the region announced an intention to increase renewable energy to account for at least 23 percent of the energy mix by 2025 (ACE 2017b). In line with our earlier argument in favor of a TP2-type architecture (see above and Section 2.1), Huang, Kittner, and Kammen (2019) and IRENA (2018, 156) note that the region can transition toward a low-carbon future cost-effectively by integrating renewable energy sources on an interconnected grid.

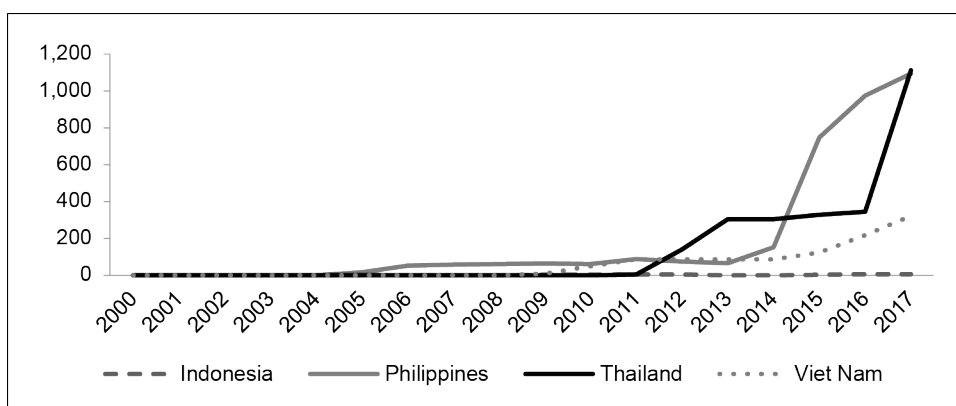
## 5.2 Renewables Diffusion and Policy

Wind and solar are the two key competitive ‘new’ renewables whose LCOE has dropped substantially around the world to make them increasingly competitive relative to coal and gas generation – indeed, in many parts of the world they are now cheaper than fossil fuel generation (see Section 2.1). As such, regions and countries experiencing rapid diffusion of these technologies will be making good progress in energy transition. Figure 5 and Figure 6, respectively, show the diffusion of wind and solar PV. From the figures it is

evident that the material level of diffusion started to come about in a limited number of countries from 2010 onward. Yet these are still extremely low levels of market penetration. For instance, from Figure 5 it is clear the Philippines (along with Thailand) is one of the leaders in wind energy in ASEAN with about 1,000 GWh, which represents about 1.2% of generation in 2016. To put this number into context, the UK generated around 12% and Denmark around 40% of its electricity from wind energy in 2016. A green finance gap may be contributing to this low level of diffusion (Sachs et al. 2019).

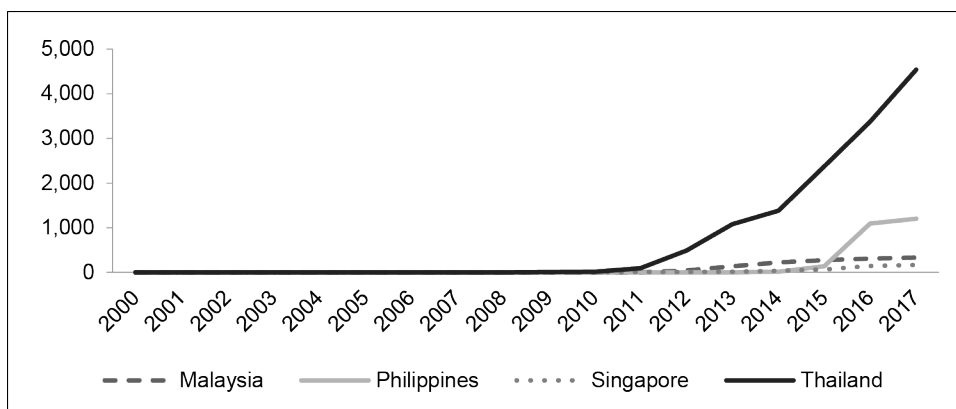
This low level of diffusion is not surprising given the low level of policy support (see Appendix 1). Appendix 1 shows that policies that are regarded as ‘key’ or substantial by the International Renewable Energy Agency (IRENA) did not start to appear in the region until 2011 and policies were nationally defined. This contrasts with the EU experience, which has seen a raft of policies at EU level since 2001 and a whole host of national policies well before then. Indeed, the focus of many EU renewable directives was to ensure a level playing field across Europe in terms of national policies (see Section 3.3).

**Figure 5: Wind Energy Diffusion in ASEAN Countries (GWh)**



Source: Compiled from IEA 2019 World Energy Statistics and Balances.

**Figure 6: Solar PV Diffusion in ASEAN Countries (GWh)**



PV = photovoltaic.

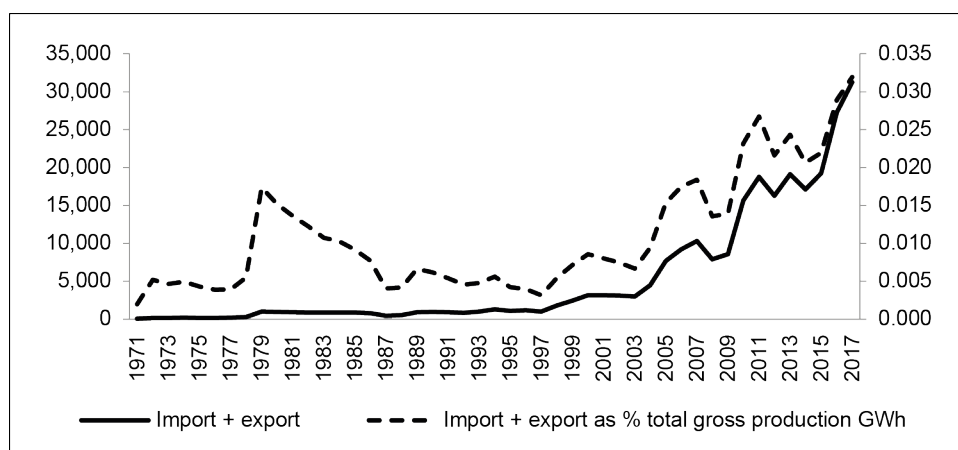
Source: Compiled from IEA 2019 World Energy Statistics and Balances. Note: Excludes countries that had less than 50 GWh in 2017.

### 5.3 Integration and the Asian Super Grid

A major element of energy transition in theory and practice is market coupling across borders (integration), since it permits higher penetration of renewables due to portfolio and geographical diversification (see TP2 in Table 1 in Section 2 and Section 3.4) but also leads to competition that drives cost-efficiency and innovation (Section 3.1).

Figure 7 provides a proxy of ASEAN countries’ electricity integration with neighboring countries (includes all interconnectors to ASEAN and non-ASEAN neighbors). The solid line aggregates for the ASEAN countries’ import and export (GWh). This is akin to the volume of electricity traded across borders. The dashed line divides this aggregate ASEAN total gross production (GWh), giving us a ratio of total import and export to total gross production. It is clear from the chart that in absolute and relative terms, ASEAN electricity systems are becoming more integrated, yet by 2017 import and export represented less than 2 percent of the total electricity consumption.

**Figure 7: ASEAN Electricity Integration**



Source: Compiled from IEA 2019 World Energy Statistics and Balances. Note: Left axis GWh, right axis (import+export)/total GWh aggregated for ASEAN.

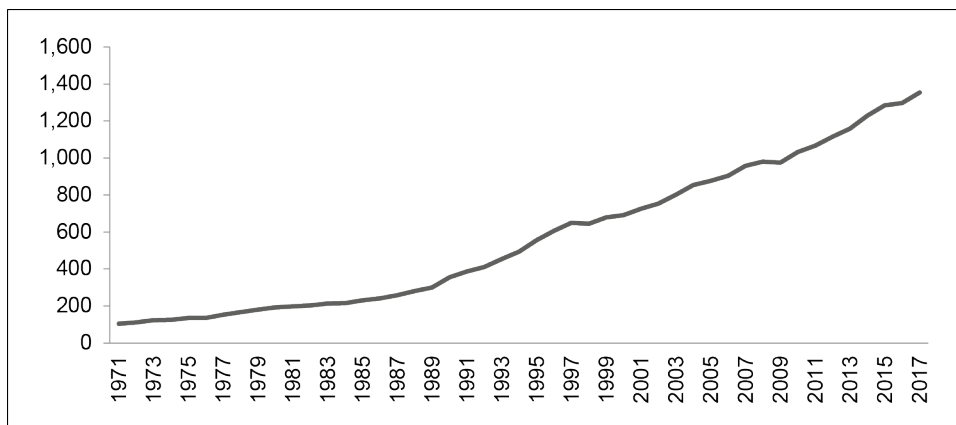
This increased integration may be attributed, at least in part, to ASEAN policy efforts in the guise of ASEAN Power Grid (APG) interconnections. Halawa et al. (2018, 12) note that heads of ASEAN power utilities/authorities have adopted a gradual and incremental strategy driven initially by bilateral agreements, but they believe this will evolve to a subregional and then to a regional basis. Efforts or proposals for integration, however, go beyond the ASEAN realm and cover Asia as a whole as articulated by the vision for an Asian Super Grid (that would interlink ASIA with HVDC links) and a potential Australian–Asian Power Grid that would bring Australian renewable power to Asia (via HDC links).

### 5.4 Carbon Pricing and Climate Risks to the Energy Sector

It is perhaps not surprising from the preceding discussion, especially Sections 4.1 and 4.2, that ASEAN energy-related CO<sub>2</sub> emissions continue to rise dramatically. This rise is depicted in Figure 8. Table 2 shows the absence of carbon pricing in the region, which undoubtedly will have contributed to this situation – there was no price on carbon until 2019 when Singapore implemented a weak carbon tax of \$4/tCO<sub>2</sub>e. Contrast that with

European carbon prices of 27 euro (\$30.7) in June 2019, which, in turn, could be far from the social cost of carbon.

**Figure 8: ASEAN Metric Tons of CO2 Emissions from Fuel Combustion**



Source: Compiled from IEA 2019 World Energy Statistics and Balances.

The above suggests that most ASEAN countries, if not all, are unlikely to meet their Paris Agreement targets. This poses a real political risk for ASEAN economies as they trade with nations that are taking much more proactive steps to mitigate emissions. Further, Asia is highly vulnerable to the physical risk of climate change and it is one of the regions contributing most to emission increases (Prakash 2018). This situation must change. Should ASEAN economies turn to accelerated transition to meet the Paris goal of staying below 1.5 °C warming, ASEAN energy systems and companies would find that the majority of their generating fleet would become stranded (Table 2).

**Table 2: Carbon Pricing and Climate Risk in the ASEAN Energy Sector**

	Carbon Pricing	Generating Units and Climate Risk			Units Incompatible with 1.5 °C Budget
		Current	Planned	Total	
Brunei Darussalam	no	55	7	62	88.7% (55)
Cambodia	no	155	13	168	94.6% (159)
Indonesia	no	2,478	287	2,765	89.0% (2,460)
Lao PDR	no	61	3	64	98.4% (63)
Malaysia	no	803	54	857	88.8% (761)
Myanmar	no	100	34	134	65.7% (88)
Philippines	no	1,303	195	1,498	83.3% (1,248)
Singapore	yes	149	5	154	81.2% (125)
Thailand	considering	541	130	671	52.8% (354)
Viet Nam	considering	198	116	314	86.9% (273)

Compiled from World Bank (2019); Caldecott McCarten, and Triantafyllidis (2018).

## 6. CONCLUSIONS: THE FUTURE OF ASEAN ENERGY COLLABORATION

The EU and ASEAN share a number of similarities yet they have important differences that strongly moderate the strength of integration and cooperation in any sphere, including energy policy. ASEAN is an intergovernmental organization while the EU is a supranational organization with a parliament and with the power to legislate, and powerful quasi-executives bodies in the form of the EU Commission and the Council of the EU. This power to legislate has led to EU directives and policies on integration, renewables, and energy efficiency that have set the EU on the path to decarbonization and have created a level playing field for EU nation states to cooperate and companies to compete.

The EU experience in trying to create a single European energy market (outlined in Section 3.1) holds some valuable lessons for ASEAN. The process is challenging and slow but can benefit from supranational legal authority and perseverance (in the EU, it took three legislative packages over several decades to make meaningful progress in liberalization and integration). Also, to ensure a level playing field, the sectors need to be restructured, and ideally independent supranational regulatory agencies need to be created.

Sections 3.2 and 3.3 highlight that carbon pricing may not be enough, suggesting that a mix of instruments best achieves the complex needs of energy policy (Diaz-Rainey 2009). Regulation and directives on energy efficiency and renewable energy are the unsung heroes of energy transition in Europe; their impact is evident by how they affected incumbents' stock market returns (see Tulloch, Diaz-Rainey, and Premachandra 2017). Regulation on energy efficiency has led to falls in demand, while regulation on renewables has ensured that renewables have grid access (and priority) to ensure that their environmental benefits are reaped. Section 3.4 highlights that the EU has implemented reactive energy security measures. These reactive measures are important but a far cry from a common EU foreign policy that could target energy security risks proactively (see the related discussion in the Introduction).

Sections 4.2 and 4.4 show that ASEAN is a climate and renewable energy laggard. While the EU has had carbon pricing since 2005 in the form of the EU ETS and EU-wide renewables targets since 2001 (see Section 3.3), ASEAN courtiers do not have a coordinated approach to carbon pricing and did not have any carbon pricing until 2019 when Singapore implemented a low-carbon tax (\$4/tCO<sub>2e</sub>) (see Table 2). However, Section 4.2 shows that the process of integration has advanced in ASEAN with a steady increase in the import and export of electricity in absolute and relative terms (see Figure 7); however, this is the result of bilateral relations (see Andrews-Speed 2016a), rather than that of an overarching ASEAN framework. Further, Section 4.4 highlights that ASEAN faces serious climate risks – most notably, political and physical climate risks from failing to meet the Paris Agreement and the risk of stranded assets if accelerated transition is achieved.

Informed by the EU experience, we argue the *Energy Policy for ASEAN* should explicitly pursue a dual transition pathway strategy to yield the best outcome in terms of the energy trilemma, that is, TP2 and TP3 as outlined in Section 2.1 and Table 1. First, TP1, as an 'ASEAN Super Grid' supported by a single energy market, would 'green' urban and industrial demand. Second, TP3's 'Distributed Smart Grids' would help reap the social and economic benefits of providing electricity to the rural/remotely located populations that have hitherto not had access to electricity. This is a dual transnational and local approach that contrasts with energy transition defined at national level

(i.e., TP1). This interconnected approach should yield security and peace dividends. As noted in the Introduction, the EU project was born out of energy cooperation and indeed the need to interconnect Europe so that conflict would not once more blight the continent. For all the contemporary criticism of the EU, it is beyond question that it has delivered peace and prosperity in the region. Energy integration has played a big part in this, with concomitant social, economic, and environmental benefits.

Thus, the articulation of an *Energy Policy for ASEAN* that envisions a dual TP1 and TP3 strategy is critical from a social, environmental, and economic perspective. Unlike in Europe, such a statement of intent in ASEAN would not have the supranational top-down legal architecture that the EU has in implementation – so the question remains, how could delivery of such a vision be ensured in an ASEAN context dominated by bilateral relations? The answer lies in multiple sources of internal and external pressures galvanizing around the vision.

Pressure will come from the Paris Agreement – other parties (countries) to the agreement and multination organizations will apply pressure to ASEAN countries to ratchet up their implementation plans and ambitions with respect to renewables and decarbonization. A cogent example of this is the UN Secretary General's recent call for Asia to overcome its 'coal addiction' (BBC 2019). Pressure will also come from ASEAN citizens as they start to feel the impacts of climate change – as noted in the Introduction, Asia is one of the most vulnerable regions in the world to the physical risks of climate change.

Another source of important pressure will be investors and multinational banks as they seek to 'green' their investment and lending activities. For instance, by 2019, investors managing approximately \$90 trillion worth of assets in the world had become signatories to the UN Principles for Responsible Investment (UNPRI), meaning that they will increasingly take into consideration climate change and the environment in investment decision-making. This applies as much to buying government bonds as it does to buying shares. ASEAN governments or energy utilities that are seen as not serious about energy transition will find raising capital increasingly difficult or expensive. Further, banks and investors are keen to invest in energy decarbonization via financing mechanisms such as syndicated loans and green bonds. But banks and bond investors will have a strong preference for liberalized electricity markets given the concerns about property rights and political risk in state-dominated electricity systems. Thus, electricity market liberalization is important to unlock investment in energy transition and will provide the price signals to drive integration (see Section 4.1 and Andrews-Speed, 2016b).

Following on from the above, the biggest driver of change will be market forces. Europe needed strong policies to drive integration and renewables because, when it started, energy transition-related technologies were not cost-competitive, so strong policies were needed then. This is no longer the case as renewables and related storage and grid technologies (e.g., HVDC interconnectors) have become cheaper. Renewables have reached, or are close to reaching, grid parity even in Asia and the Pacific (IRENA 2018). Economics and market forces will mean that households, companies, investors, and cities will help drive energy transition forward and apply pressure to national governments. The main role for ASEAN governments will be to coalesce around a shared vision of an *Energy Policy for ASEAN*, provide common energy efficiency standards to drive regional product innovation (see Section 3.2), and liberalize electricity markets so that market forces can drive energy transition.

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## APPENDIX 1: RENEWABLE ENERGY POLICIES IN ASEAN COUNTRIES

Year	Country	Title	Policy Status	Key Policy IRENA
1994	Thailand	Small and Very Small Power Purchase Agreements	In Force	
1996	Singapore	Tax Incentive for Energy-saving Equipment	In Force	
1997	Philippines	New and renewable energy programme (Exec. Order 462)	In Force	
2002	Philippines	Investment Priorities Plan (IPP)	In Force	
2004	Thailand	Strategic Plan for Renewable Energy Development: 8% Target	Ended	
2007	Singapore	Solar Pilot/Test-bedding programmes	In Force	
2007	Singapore	Clean Energy Research Programme (CERP)	In Force	
2007	Thailand	Feed-in premium for renewable power	Superseded	
2008	Singapore	Solar Energy Research Institute of Singapore (SERIS)	In Force	
2008	Thailand	Solar hot water hybrid system promotion project	In Force	
2009	Thailand	Renewable energy Development Plan (REDP) 2008–2022	In Force	yes
2011	Malaysia	Renewable Energy Act establishing feed-in tariff (FIT) system	In Force	yes
2011	Singapore	Floating PV Pilot	Ended	
2011	Viet Nam	National Power Development Plan 2011–2030 (RES targets and wind feed-in tariff)	Superseded	
2012	Philippines	Feed-In Tariff for Electricity Generated from Biomass, Ocean, Run-of-River Hydropower, Solar and Wind Energy Resources	In Force	yes
2013	Indonesia	Power purchase from solar photovoltaic plants (No. 17/2013)	In Force	
2013	Thailand	Feed-in tariff for distributed solar systems	In Force	
2014	Brunei Darussalam	Energy White Paper and Renewable Energy Target	In Force	yes
2014	Philippines	Accelerating Household Electrification through Regulated Solar Home Systems	In Force	
2014	Thailand	Feed-in Tariff for Very Small Power Producers (VSPP) (excluding solar PV)	In Force	yes
2016	Indonesia	Solar Feed-In Tariff of Indonesia (2016)	In Force	

Source IRENA Policy database.