Unlocking The Potential for Wind Energy in Southeast Asia: Evidence from Indonesia, the Philippines, and Thailand

Alessandro BORDOLI, Joséphine GLORION, Joël RUET, WANG Xieshu

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Abstract

In the post-Paris agreement on Climate change era, and after the COP22 confirmation of the role of actors to fulfil the Intended Nationally Determined Contributions (INDCs) and create new markets and industries, South East Asia is a region that deserves more attention. However, it suffers an analytical deficit. As a region that includes several Mid-Range income economies, it has a larger transformative potential than low growth developed economies but a somewhat lesser 'perceived' impact or industry relevance than larger emerging economies – even if with a smaller average income for the latter. Furthermore, the mid-income economies in the region are in a more advanced stage of their demographic transition compared to least developed countries where the risks of a failed transition loom larger. However, given the regions advancing demographic, the window of opportunity should be considered thin. For these reasons, we argue, Thailand has serious potential but time is of essence to unlock it.

The objective of this paper is to provide an overview of the wind energy market in Southeast Asia and bridge the analytical gap. The region is in the midst of an uncertain energy transition, and still faces a number of challenges. These include rapidly rising energy demand, undiversified energy production despite some interesting but insufficiently supported projects, infrastructure challenges, and regulatory schemes that need to be rapidly updated to encourage further development of renewables. Despite these elements of the current picture, Southeast Asia holds great potential in the renewable energy space, the vast majority of which remains untapped.

This paper explores the issues surrounding unlocking this potential by focusing on wind (an energy which is less analysed these days than solar for instance), and on three economically important and wind-potent countries from the region: Indonesia, the Philippines, and Thailand. Each country faces its own unique set of challenges, and the potential for renewables varies widely. We take on these issues by providing an overview of the current energy market and mix, discussing the regulatory environment within each (with a particular focus on feed-in-tariffs), and providing a number of case studies of individual projects among the three. In doing so, we hope to provide a complete picture of where wind energy currently stands in the ASEAN region, and where it is going in the future. This is a useful study for investors, wind energy companies, governments, and other stakeholders and we hope it has relevance for the whole renewables ecosystem beyond wind.

Keywords: Renewable energy; wind energy; Southeast Asia; feed-in-tariff

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1 Introduction

Southeast Asia is reaching a pivotal point in terms of its energy mix. During the next ten years, the region will continue to grow at a rapid pace. The Organisation for Economic Cooperation and Development (OECD) & ACE (2015) predict that the ASEAN countries will average 5.2% growth from 2016 to 2020. A large part of this growth will stem from increases in private consumption, which will be accompanied by a 50% rise in energy demand. Previous experience tells us that this growth will come with a new set of challenges, chief among them being the ability of countries in the region to expand access to energy while creating sustainable paths for the future.

There are several factors that make this region an interesting one to study. Along with rapid economic growth and increases in energy demand, it is also characterized by rising fossil fuel imports, growing environmental pressure, low rural electrification, and overall heavy reliance on fossil fuels (Ölz and Beerepoot 2010). In addition, the vast majority of the potential for renewables remains untapped today. This makes the countries in ASEAN good case studies for understanding how sustainability and development are linked and can both be pursued simultaneously.

There are three countries in the ASEAN area that are especially interesting to analyse: Indonesia, the Philippines, and Thailand. Among these, Thailand is expected to grow less quickly than the others, given that political instability has negatively affected tourism and exports. However, when viewed through an energy lens, the question should remain how this largely domestic issue remains despite military-led hurdles to trade and foreign investment. In short, how can a subject of national interest be sheltered from political instability? Indonesia and the Philippines, on the other hand, are fortunate to have more political stability and generally receive broad satisfactory levels of democracy; they are expected to be among the growth leaders in the region, at 5.5% and 5.7% respectively from 2016 to 2020 (OECD 2015). For these, the question lies in sustaining a predictable and efficient investment framework, resilient to elections. Since 2007, these three countries, along with Malaysia, Singapore, and Vietnam (known as the ASEAN-6) have represented more than 95% of energy demand in Southeast Asia. They are expected to account for more than 80% of energy demand growth from the current period to 2030 (Ölz and Beerepoot 2010).

Despite the increases in energy demand that have been observed to date, renewables accounted for only 9.4% of primary energy sources in ASEAN in 2014 (IRENA & ACE 2016). However, the region has set an ambitious goal of securing 23% of its primary energy from renewables by 2025. This will require an increase to approximately 250%

of current levels. The imperative is there (IRENA & ACE 2016). The region does not have sufficient fossil fuel resources to meet this increased energy demand, and policy frameworks have already been put in place in most countries to promote the growth of renewables.

Among the potential sources to fill this gap, wind energy should prove to be one of the most important. The main reason is that most of the potential in the region is not currently being utilized. That is only now beginning to change, with the Philippines becoming the largest wind power generator in ASEAN with an operational capacity of 400 MW (Mahapatra 2016).

This comes at a time when wind energy is advancing rapidly around the globe. The year 2015 represented another milestone in this march, as annual installations topped 63 GW, a 22% increase on the prior year. By the end of 2015, there was a total of 433 GW of wind power around the world (GWEC 2016). Asia remains the world's largest regional market for wind power, with China and India leading the way. So, even though the recent efforts of the Philippines are to be noticed, South East Asia still doesn't match its normal place in the world picture.

The needed shift is well in line with global trends. The target set by ASEAN matches what is required by the Paris Agreement, but much work remains to be done. The region faces a similar problem to many other areas in the world: how to implement the objectives set forth last year. It is to that question that we now turn.

2 Country Energy Markets and Potential for Wind

In this first section, we now turn our focus to the three specific country examples for this study: Thailand, the Philippines, and Indonesia. For each, we look first at current energy mixes and objectives in terms of renewables moving forward. This gives us a broad overview of the energy market in each country, and specifically what role wind energy has played historically. We then turn our attention to the *potential* for wind energy, attempting to size the market opportunity in this sector. This offers insight into what potential remains untapped, which can translate into opportunities for governments and the private sector.

2.1 Thailand

In response to growing energy demand in the country, Thailand's energy sector has become the engine of economic growth. Thailand's total primary energy consumption in 2014 was 2,053 barrels of oil per day equivalent (boepd), an increase of 2.6% from 2013 levels (Oxford Business Group 2016). Those numbers are expected to continue to grow at a rapid pace, representing an increase of 75% over the next two decades (Tarragó 2016).[1]

However, domestic energy demand continues to outstrip supply; total primary energy production in Thailand actually decreased by 0.4% from 2013 to 2014, to a level of 1073 boepd (Oxford Business Group 2016). Energy imports fill most of this gap. In fact, energy net imports increased by 4.4% from 2013 to 2014 to 1171 boepd. This translates into approximately 57% of primary industrial and commercial energy consumption coming from commercial energy imports (Oxford Business Group 2016).

It's difficult to understate how important it is for Thailand to meet its growing energy demand. The energy sector is fundamental for overall economic growth, as supply disruptions incur a high cost on economic activity and dissuade foreign investors from putting their money into the country. Currently, there are several risks to the country's overall energy security: (1) scarce and dwindling domestic resources, (2) uncertainty surrounding the reliability of energy imports, and (3) the rapid increases in demand presented above. As pressures grow to decarbonize significant aspects of the energy system, the challenge will only grow in scope (OECD/IEA 2016).

It's important to assess the current energy mix to predict the role wind power could potentially play in the future. Unfortunately, today Thailand fulfils most of its energy needs with conventional fossil fuels. According to the Oxford Business Group (2016), fossil fuels accounted for 98% of primary energy consumption in 2014. The Asian Development Bank (2013) calculated the energy mix as follows: petroleum products (36%), natural gas (45%), imported coal (12%), lignite (5%), and hydro (3%). According to this organization, in 2012 electricity derived from renewables made up only 4.8% of total domestic energy production. On the demand side, 60% of primary commercial energy demand came from imports in 2012, with 80% of that figure coming from crude oil (Asian Development Bank 2013).

More recent figures show few changes in this overall mix. Natural gas represented 44% of total primary energy usage in 2014. As a result, oil and gas exploration and production has become narrowly focused on natural gas production; the power generation sector now utilizes natural gas for over 50% of all of its power production (Oxford Business Group 2014). On the other hand, crude oil production has plateaued, as fields have matured, and Thailand has started to move away from this energy source other than in the transportation sector. Coal and lignite maintained an 18% share in the

[1] Even this figure might underestimate the true potential for growth in energy consumption. It is calculated by adopting a number of assumptions that many experts consider conservative: (1) the number of inhabitants will remain stable at 66 million until 2040, (2) GDP growth will remain at 3.4% until 2040, the lowest of the ASEAN countries, (3) the Energy Efficiency Programme will successfully reduce energy use by 30%, and (4) smart grid development will occur.

primary energy segment in 2014, while renewables continued to make up only 2% (Oxford Business Group 2014).

There are two main insights to draw from these figures, and both are worrying in terms of energy security and sustainability. One is that Thailand has been forced to rely increasingly on energy imports to meet its growing demand. In addition, domestic supplies of natural gas are reaching their peak, which means the country will have to look for new sources of energy and increase the diversification in its overall energy portfolio.

Despite these historical trends, energy efficiency and renewables are poised to take on a crucial role in Thailand's future energy basket, and the government has already taken clear steps to move in this direction. The first piece of evidence for this appeared in the country's Power Development Plan of 2015 (PDP 2015), with subsequent shifts signalled in the Alternative Energy Development Plan (AEDP 2015) and the Energy Efficiency Plan (EEP 2015). For example, in the AEDP 2015, the Thai government sets the following objectives for power generation by 2040: biomass (13% or 11 GW), PV (9% or 8GW), wind (6% or 5GW), and hydropower (5% or 4GW) (Tarragó 2016). This plan also prioritizes 25% of energy consumption coming from renewable energy sources by 2021. The current number is only 8%. In PDP 2015, the government sets an objective of 22 GW of new capacity from renewables by 2036 (OECD/IEA 2016). These targets are both ambitious and necessary to meet Thailand's energy challenges.

In terms of wind power specifically, the Thai Ministry of Energy's Department of Alternative Energy Development and Efficiency (DEDE) has been conducting studies on potential wind power since 1975. The most recent was done in 2010, and indicates several geographic areas with potential for significant growth. The national target for wind energy is 1,800 MW by 2022, **and the active project pipelines include over 1,600 MW of potential production.**

2.2 The Philippines

If the need for an energy transformation is apparent for Thailand, the situation is even more urgent for the Philippines. This is because the growth in energy demand that the latter country will experience is several times larger than that in the former. This is mostly fuelled by the higher economic growth rates in the Philippines; in the next 15 years, the country is expected to grow at 7-8% of gross domestic product (GDP) (Palaña 2016). This will translate into a need for at least 10,000 MW of additional energy, which should require between $20 to $30 billion in investment. **The 400 MW addition mentioned above, is commendable for the region but remains insufficient; the touchstone will be that it becomes the first step of a learning curve, the main point to be observed in the coming years.**

This is despite the fact that the country currently has a surplus of supply over demand. There is about 16,000 MW of installed capacity today, while demand is only approximately 12,000 MW. However, with such high GDP growth rates, that demand for energy could skyrocket in the next decade and a half, perhaps climbing over 24,000 MW (Palaña 2016). The Philippine Department of Energy (DOE) projects average annual energy demand growth at 4.9%. In addition, the department has predicted that adopting new energy efficiency standards would only shave 9.5% of residential power demand (Asian Development Bank 2014).

It is instructive to look at the current energy mix in the Philippines before being able to predict the role of renewables going forward. The most recent numbers from the country's Department of Energy are from 2010. In that year, indigenous energy production represented 57.5% of the total energy mix, followed by imported oil at 33.6%, imported coal at 8.6%, and imported ethanol at 0.3%. Of the indigenous energy sources, geothermal represented the highest percentage (21% of total energy mix), followed by biomass (13.1%), coal (8.6%), natural gas (7.4%), hydro (4.8%), oil (2.3%), CME/ethanol (0.3%), and finally wind/solar (0.01%) (Philippine DOE 2010).

There are several risk factors surrounding this current energy mix. The first is that the heavy dependence on imported fuels produces a risk for energy security: the country is at the mercy of supply disruptions and price swings in the global market. In 2012, the Philippines spent $12.6 billion on oil imports, which was a 14% increase from the previous year (Asian Development Bank 2014**). Reliable electricity is critical for ensuring continued economic growth and investment, and the problem is exacerbated for the Philippines given that it has one of the highest electricity tariffs in Southeast Asia. This high price stems from a number of factors, including: (1) difficult geographic conditions (the country is a large archipelago made up of many different islands, (2) inefficient and small power generation systems in some areas, (3) relatively low investments in the energy sector, and (4) lack of government subsidies coupled with the presence of "cost-reflective" tariffs (Asian Development Bank 2014). This means there is pressure on the energy sector both in terms of cost and reliability. The strategic scope for renewables is all the more important because they are decentralized sources of energy.**

In spite of the difficult conditions, there have been promising signs that the energy mix is changing since the DOE published its last statistics in 2010. Much of this was prompted by effects that grew out of regulatory changes from the Renewable Energy Act of 2008. This provides a number of support mechanisms for renewable energy sources. As a result, the Philippines now meets approximately a third of its energy needs through renewable sources (Tan Hui Ann 2016). In just the last couple of years, the country has seen over 1100 MW of renewable energy installed in the wind and solar sectors alone.

This has been accompanied by investment of approximately $2 billion in an industry that was virtually non-existent in the Philippines in the past. **Over the next ten years, optimistic forecasts predict market growth of approximately 20 times current levels (Tan Hui Ann 2016). As a result, the Philippines has become a hot market for renewables and a pioneer in this area in Southeast Asia.**

As a result of these changes, the energy mix is evolving. The DOE's plan is for a new energy mix in the near future: coal (30%), renewable energy (30%), natural gas (30%), and oil (10%). Feed-in-tariff statistics (FIT) give us a clearer picture of where things will go in the future. As of now, FIT subscriptions for biomass include 11 plants with 94.25 MW of capacity, hydro has four plants with 26.60 MW of capacity, and wind has six plants accounting for 393.90 MW of capacity (Rivera 2016).

Amidst these changes, it begs the question what role wind energy can play for the Philippines. The country's potential for wind power is significant, especially on the islands of Luzon and Palawan. Meteorological and measurement data show "good to excellent" wind speed for utility scale applications (Vemuri 2015). The technical potential is estimated at 70 GW. Since 2013, capacity in wind technology has increased from 33 MW to 427 MW. In addition, there were 1,168 MW of contracts with the DOE as of 2015 (Vermuri 2015). However, whether the country meets this potential depends on large part on regulatory issues. This will be covered in subsequent sections.

2.3 Indonesia

Of the three countries covered in this report, Indonesia is perhaps the one that has made the least amount of progress in terms of renewables and specifically wind energy. It is a sheer paradox for a country that is at the same time part of relatively developed ASEAN and a long aspiring country to the club of large emerging economies. The country faces similar circumstances to both the Philippines and Thailand, but there are some characteristics that also make the country's energy situation unique. In 2014, Indonesia had a population of 253 million people, making it the most populous country in Southeast Asia and the fourth most populous in the world (EIA 2015). It also has the largest economy in Southeast Asia, with a GDP of $878.3 million in 2013. Throughout the 2000's, the country has had an average growth rate of between 5 and 6%, making it a rapidly growing economy (Tharakan 2015). **One of its greatest challenges is geographic in nature; the country consists of over 17,000 islands, out of which 4,000 are inhabited. This makes matching energy supply with demand a monumental task. This also means that if renewables should be *the* solution, would the Javanese elites put forth territorial development at the forefront of their agenda? Ultimately, Indonesia is most likely to be analysed through the lens of grasping what is the 'politically relevant' market size.**

As a result of these different factors, Indonesia is in the midst of several simultaneous transformations. One, which resembles the situation in the Philippines particularly, is the effect of rapid economic growth on living standards and creating a widening middle class. But one of the consequences of this is that energy demand is poised to continue to increase at a breakneck pace, and the country's infrastructure in this area is woefully inadequate. Daily blackouts are already commonplace in many parts of the country, and the government's objective of 90% electrification by 2020 is well behind schedule. Energy demand is expected to grow between 7 and 9% for the rest of this decade, which means the gap between supply and demand is only going to become larger (Wilcox 2012). More recent estimates predict an increase in demand from 206.5 TWh in 2013 to 442.5 TWh in 2022. Meanwhile, the country's power generation capacity would only go from 45 GW to 90.1 GW in 2022 (Oxford Business Group II 2016). A complex regulatory system plays some part in hampering further investment in the energy sector.

The second major transformation in the country is its transition from an export economy to one based more on domestic manufacturing and investment. This coincides with its economic growth. As of 2013, manufacturing (24%) and agriculture (14%) were Indonesia's two primary economic sectors (Tharakan 2015). The country also suspended its OPEC membership in 1998, although in 2015 it was still the world's largest exporter of coal by weight and fifth-largest exporter of liquid natural gas. It is set to reapply for OPEC membership this year as the country struggles to meet both its export obligations and growing energy demand at home (EIA 2015).

According to Tharakan (2015), Indonesia's total primary energy supply in 2013 was about 1.61 billion barrels of oil equivalent (BOE). The majority of this came from fossil fuels: oil (46.08%), coal (30.90%), and gas (18.26%). The share of renewables was less than 5% of the overall energy mix, mostly dominated by hydropower (3.21%), geothermal power (1.15%), and biofuel (0.40%) (Tharakan 2015).

A recent report from the U.S. Energy Information Administration (2015) provides slight updates on these figures and examines trends over time in the mix. The country's petroleum (oil) share has been decreasing in recent years, although the report still put the 2013 share at 38%, the highest of all energy resources. Coal consumption, on the other hand, doubled in the decade leading to 2015, surpassing natural gas as the second most consumed fossil fuel (EIA 2015). Interestingly, the EIA puts biomass at 18% share of total primary energy consumption, although that share is on a downward trend.

In response to these challenges, the Indonesian government has set ambitious objectives moving forward. Based on the National Energy Policy, the target for renewable energy is 23% of the national energy mix by 2025. This includes: bioenergy (10%), hydro (3%), geothermal (7%), and other renewables (3%). This would be a significant change from business as usual, but it is worth mentioning that business as usual has long been based on hydrocarbons exports.

The positive news is that Indonesia has ample resources to meet its energy needs. In terms of fossil fuels, this translates into 120.5 billion tons of coal (146 years capacity at current production rates), 3.69 billion barrels of proven oil reserves (23 years), and 101.54 trillion cubic feet of proven gas reserves (59 years). The renewable energy resources are considerable as well: 75,000 MW for hydropower, 1,013 MW for mini/micro hydropower, 4.80 kWh/□2/□□□ of solar, 32,654 MW of biomass, 3-6 m/s of wind, and 28,000 MW of geothermal (this latter category represents 40% of the global reserves) (Tharakan 2015).

However, developing this capacity is a whole separate issue for Indonesia, and current efforts are facing a number of remaining obstacles. The undeveloped potential for geothermal was 96% as of 2012, and the numbers for other renewables are similar: 94% for hydropower, 99% for biomass, and 99% for wind (Wilcox 2012).

That trend appears to be changing in a positive manner, at least for now. The government has recently set up a number of schemes to increase investment in renewable energies, and the country attracted over $327 million in the first quarter of 2016 alone (Mahapatra II 2016). Even that progress has come under threat as we've moved later in the year, threatened by significant budget cuts in state spending in the energy sector (Sundaryani 2016).

The potential for wind energy specifically remains largely unexplored. Recent estimates show an even higher potential than previous ones, and Vestas has recently made moves to supply the country's first wind projects. This means there is a lot of work to be done in this area to match this potential.

3 Regulatory Environment

Although it's important to assess a country's energy mix and potential for developing wind energy, the next logical step is to understand how and if this potential will be utilized. One of the main factors that influence this second stage of analysis is the regulatory environment. In developing countries, public policies play an outsized role in determining the development of renewable energies, often serving as either a major obstacle or a catalyst for change. It is thus crucial to understand how the regulatory environment in each of our case countries functions, and analyse specifically which policies exist for energy.

3.1 Energy Regulations in Thailand

Before looking at specific policies, we should first understand the basic regulatory framework in place. In Thailand, policies related to energy are drafted and proposed by the Ministry of Energy (MoE). In addition, the Energy Regulatory Commission (ERC) regulates policies that specifically deal with electric power and natural gas transmission. Within this system, there are a number of agencies and offices that operate underneath these two umbrella organizations. For example, the Energy Policy and Planning Office (EPPO), which exists under the Ministry of Energy, provides oversight for all energy-related policies covering any sectors. The National Economic and Social Development Board has jurisdiction over large infrastructure projects, and acts in an advisory role on general energy policy. The National Energy Policy Council (NEPC) has final approval over all plans. Often these agencies struggle between the dual objectives of protecting consumers and industry (REEEP 2014).

In addition to this array of agencies, there are several government offices that regulate the energy market. These include: the Electricity Generating Authority of Thailand (EGAT), which is a state-owned power utility and the largest power generator in the country; the Provincial Electricity Authority (PEA), which has responsibility for the generation, procurement, distribution, and sale of electricity in 74 out of 77 provinces; the Metropolitan Electricity Authority (MEA), which provides electricity for Bangkok, Nonthaburi, and Samut Prakarn; and the Energy Regulatory Commission (ERC), the main independent regulatory agency (Davies and Lemin 2016).

There is no single piece of legislation that governs all aspects of policy regarding renewables. However, there are two main statutes that those working in renewables should be aware of: the Energy Industry Act of 2007, which defines renewables for legal purposes and governs energy production and consumption in Thailand; and the National Energy Policy Council Act of 1992, which first established the National Energy Policy Council (Davies and Lemin 2016). **There are a number of plans that accompany this legislation in governing the energy sector. The most significant is the Power Development Plan, most recently updated in 2015 (PDP2015), which lays out a schedule for investments and generation that spans 21 years. Other important plans are the Alternative Energy Development Plan, the Energy Efficiency Plan, and the Gas Plan (OECD & IEA 2016). The main next question being how this is getting implemented, with or without continuity. This is dealt with in the next section.**

Historically, these plans have been developed independently of each other. More recently, though, the Thai government has decided to merge them into an Energy Master Plan. There seems to be some sense of continuity despite the alteration between democratic and military regimes on this policy (the military coup happened on 24th May 2014). Furthermore, this Energy Master Plan has been strongly supported by the ADB – Asia Development Bank since preliminary studies were carried out that date back as early as 1979. Nevertheless, this is a positive step, as it allows different agencies to develop the plans separately in parallel, and simultaneously ensures that together they help the country define its energy objectives. This has also led to increases in “transparency and inclusivity” (OECD & IEA 2016). In addition to this recent development, the Thai government included energy security among its core strategies in its Eleventh National Economic and Social Development Plan 2012-2016 (ADB 2013). This shows that there is an increase in emphasis being put on energy policy in overall government planning. Here again, it is to be noted that this had been initiated by the former democratic government, and the sincerity of the military regime is still to be checked on this; at the project level (see *infra*).

In 2007, the Thai government began the long process of liberalizing its energy sector. The original plan was to move quickly to a competitive power pool model, but that has yet to be realized. Instead, the country continues to have an “enhanced single buyer model”, that energy literature generally considers as risky about “regulatory capture”, furthermore when democratic stability is not ensured. EGAT owns about 50% of the Thai generation and high-voltage transmission network, as well as serving as the country’s central dispatcher of that generation (OECD and IEA 2016). The rest of the generation comes from the private sector in Thailand and neighbouring countries. In fact, EGAT has independent power producer (>90 MW), small power producer (10-90 MW), and very small power producer (>10MW) programs for this purpose. These first two allow private developers to “build, own, and operate” energy projects as well as sign power purchase agreements for a period of up to 25 years. The small and very small producers in renewables are also eligible for feed-in tariffs, and the Ministry of Energy plays an active role in advocating for decentralized energy distribution to support such projects (ADB 2013). **There are still discussions about moving to a more competitive model in the future, but these haven’t gotten far and remain just discussion for now.**

Altogether, if one looks at the transition from policy to regulation, one can say that despite clear policy, the regulation isn’t granted the independence it needs. One of the government’s main other objective is to diversify its energy mix, which includes increased support for renewables. However, several obstacles remain, many stemming from its regulatory structure. For one, the high costs of development of renewables have so far prevented sufficient investment from coming in to develop the country’s potential. In addition, many of the responsibilities of the main governmental agencies involved in the energy sector overlap, which often leads to confusion and policy misalignment (OECD & IEA 2016).

Despite this, Thailand generally gets high marks in its policy support for renewables, especially relative to other ASEAN countries. OECD & IEA (2010) assign a “High” level of support from the country’s regulatory system in three main categories: renewable energy targets, financial incentives, and non-financial incentives. **Many of the mechanisms that have created this favourable environment are described in the**

preceding paragraphs. We turn to one in particular at the end of this section: the feed-in tariff, and whether it does or does not enable real projects, which ultimately are the touchstone of real transformation.

3.2 Energy Regulation in The Philippines

Although the above mentioned changes on a rising renewables market represent good news, a closer look offers a more mixed picture of the role of renewables in the Philippines. The DOE has repeatedly emphasized that coal will remain a major source of energy in the country, and that natural gas will provide a "bridge" as the country continues to push for increased use of renewables (Rivera 2016). This reflects the country's growing needs for meeting energy demand.

The statistics speak for themselves. New coal and natural gas power plants built since the passage of the Renewable Energy Act of 2008 have much higher capacities than renewable energy projects built during the same period. This has negatively affected the share of renewables in the overall energy mix. There are 17 operated coal plants, with several more expected to become operational in the near future, and over 29 additional plants in the planning stages for the future (Maniego 2016). If all the planned projects are completed, coal will become the major source of energy for the Luzon island (over 75% to be precise) by 2030. This would be a major reversal for a country that has become the regional leader in renewables in Southeast Asia (Maniego 2016).

A lot of the causes behind these swaying trends can be traced back to the underlying structural issues identified in above subsection. Since the Philippines has such high electricity rates, any shifts in the energy mix that lead to even higher prices face enormous resistance from different interest groups. In addition, obstacles remain in terms of technology and financing to help the country reach its renewable goals.

3.3 Energy Regulation in Indonesia

The most important and most recent law for energy in Indonesia was passed in February 2014 and is referred to as the National Energy Plan (NEP14). It introduced a number of changes to energy planning policy in the country, with one of the main focuses being strengthening energy security by putting increased focus on the domestic market. In practice, this goes along well with the country's international commitments to increase renewables as a share of total energy mix, as the country continues to attempt to wean itself off oil and towards renewables, gas, and coal (IEA 2014). Another main focus is electrification, which continues to be a big problem in the country.

Most energy policy is directed and overseen by the Ministry of Energy and Mineral Resources, although the Ministry of Finance is involved in some of the financial mechanisms for energy projects. These agencies have been slower than some neighbouring countries in adopting supportive policies for renewables.

3.4 Analysis of Feed-In Tariffs

Countries from Southeast Asia are starting to position themselves as emerging markets in the field of wind energy. This trend is expected to continue to grow, even if some of these countries have limitations in terms of potential, or, conversely, have shown slow progress in tapping the potential. The majority of Southeast Asian countries have implemented feed-in tariff policy mechanisms to incentivize the production and utilization of renewable energy technologies (solar, wind, geothermal, biomass, etc.) and push private investment up for renewables. By guaranteeing a price over a determined period, FIT policies act as an "insurance" policy for a positive return on investment, which is supposed to thereby reduce risk and uncertainty for investors. Feed-in tariffs are to be the driving belt from regulation to real projects.

There are two general approaches for setting feed-in tariffs: (1) the tariffs are based on estimated production costs for the technology in question or (2) they are based on the benefits of the technology. Feed-in tariffs, as any economic tool of this kind, have to be assessed in two ways.

One is the overall social utility / economic efficiency per kWh (territorial and technological issues being possibly factored in). One problem for the first type of tariff-setting mechanism for **intermittent renewable energy sources** like wind is the fact that wind farms may not be producing energy all the time. This is especially the case during peak hours. In terms of cost of production, wind might be competitive, but this does not take into account the additional costs for the buyer to add capacity to cover peak periods. An additional issue for basing the FIT on production costs (again in terms of wind energy) is that the cost is highly dependent upon **the quality of wind**: where wind speeds are good, the production cost is low, but where they are poor, production costs are high.

The second issue to be assessed, and which is the most important at an infancy stage of developing a market is the incentives for such measures. Ex-ante, the feed-in tariffs must be attractive enough to cope with all uncertainties. Over time, as some uncertainties will always remain (technology / peak-base issues), some might lower due to the improvement of the market and environment. In a nutshell, out of the result itself of FIT attractiveness. **Thus, ex-post there might be a policy sense in revising them, and even possibly revising them downwards at least to new projects; but there should be utmost care in not single-handedly scrapping them ex-post. There is a thin line between constant regulatory optimization and regulatory capture.**

We try to grasp these second aspects of incentiveness in the few case studies we surveyed.

3.4.1 Thailand

Thailand, under the democratic liberal regime, was the first country in ASEAN to implement a feed-in-tariff for renewables, using the name "adder": a premium on top of the wholesale electricity price. The National Energy Policy Committee implemented this "adder", which was guaranteed for periods of 7 to 10 years. For wind energy, an adder of Baht 3.50 per unit was prescribed for ten years from COD (two examples mentioned in Section 4 of this report, the Had Kanghan & Subyai wind farms, benefited from this adder).

Even though we focused here on the potential for a large market creation, for the sake of record lets us mention that from micro-plants with total capacity of less than or equal to 50 kW (<= 50 kW), an adder of Baht 4.50 per unit was prescribed for ten years from COD.

In 2015, after the military *coup* (decided on December 15th, 2014), that mechanism was replaced by a FIT policy granted for 20 years instead of 10. An exception to this rule was power systems fuelled by landfill gas, which receive support for 10 years only. The FIT rates differ greatly depending on power plant size and fuel types, and different bonuses are granted for certain systems. The new FIT is composed of three components: **FIT(F)** - fixed portion of remuneration, **FIT(V)** - variable portion of the remuneration dependent on the inflation rate, and **FIT(P)** - feed-in premium that is split according to the fuel type, period of remuneration, and location.

With such a magnitude of change (doubling the period!), the question to be inevitably addressed is whether this is a policy of acceleration of market creation through the deepening of incentives period and fine-tuning of implementation (for instance, based on an evaluation that the former system had remained unattractive to investors, and/or on real technical issues of real project), or of misplaced policies (either too generous to help some vested interests, or too much of a 'gas factory', with three parts). In a nutshell, was it a welcome improvement of economic policy or a disturbing shift in political economy?

The fact is the National Energy Policy Commission revised down its feed-in-tariffs for 1GW of wind, rooftop solar and community ground-mounted solar systems on August 15th 2014.

The feed-in tariff for rooftop solar installations that became operational by December 2015 is covered in the following table:

Feed-in Tariff levels in BAHT/kWh						
Technology	**Capacity**	**Period**	**FIT(F)**	**FIT(V)**	**Total calculated FIT**	**FIT Premium**
Wind		20 years	6.06		6.06	
Rooftop solar	0-10 kW	25 years	6.85		6.85	
	10 - 250 kW		6.4		6.4	
	250 kW - 1MW		6.01		6.01	
Community ground-mounted solar		25 years	5.66		5.66	

Source: **IEA/IRENA Joint Policies and Measures Database**

Conversion in dollars for wind and solar (1 dollar = 35.5 baht)
Wind: 6.06 Thai Baht = $0.17
Solar: 6.85 baht = $0.19
6.4 baht = $0.18
6,01 baht = $0.17

The first obvious conclusion is that these tariffs are rather flat across technologies. It is unlikely they reflect the respective volatilities of the various energy sources, nor the contribution to peak, least to mention the complexity of wind projects compared to solar. Worse even, the 20 years for wind seem difficult to explain in comparison with a five years longer period for solar. At a time when solar becomes if not a commodity, at least a common product, the reverse might have been expected *across* energies, even if, again, *per se*, and *within* wind, the doubling from 10 to 20 years remains equally puzzling. On this latter element, credit on extension to 20 years may be given as this is the norm in the Philippines for instance.

More is to be seen through case studies.

3.4.2 FITs in the Philippines

In 2014, the FIT capacity cap for solar PV was increased from 50MW to 500MW.
In 2015, the feed-in tariff for solar PV was announced at the level of PhP 8.69/kWh.

Tariffs for other renewable installations did not change over this period.

Renewable source	Period of time	Feed-in tariff rate in PhP/kWh	Degression rate
Wind	20 years	8.53	0,5% after 2 years from affectivity of FIT
Biomass		6.63	0,5% after 2 years from affectivity of FIT
Solar		8.69	0,6% after 1 year from affectivity of FIT
Run-of-River Hydropower		5.90	0,5% after 2 years from affectivity of FIT

Source: **IEA/IRENA Joint Policies and Measures Database**

(Solar went from 9.68 to 8.69 php/kWh from 2012 to 2015)

Conversion in dollars for wind and solar (1 dollar = 49.74 peso)
Wind: 0.17 dollars/kWh
Solar: 0.17 dollars/kWH

FITs in the Philippines are categorized by type of technology used, and not by the size or other elements. They are subject to adjustments, based on inflation, currency exchange rates, etc. and have a prescribed digressive rate.

This rate factors in ex-ante what shall be the ex-post regulatory and environment economic efficiency improvements. It also makes an advantage to wind over solar in this digression (only minus 0.5% and this over two years vs. minus 0.6% straight from one year). Considering this perspective, the Philippines, an altogether more vibrant market than Thailand, has a more coherent, predictable tariff regulation.

Further, the funding mechanism is clear. All electricity end-users pay a uniform amount to a fund, which is then used to pay the FIT-eligible producers.

3.4.3 Indonesia

Indonesia is less advanced than its neighbouring countries in terms of FIT policies.

At first, Indonesia implemented FIT only for small hydropower sources (in 2009) and biomass (2010).

The Ministry of Energy and Mineral Resources (MEMR) issued Regulation n°17 on June 12th, 2013, setting a ceiling feed-in tariff for solar photovoltaic power projects at $0.25/kWh, or $0.30 for projects using high level of local content (at least 40%). This tariff must be used in the PPA without further negotiation. Nevertheless, it is a base tariff that can change with indexation over time.

The Government of Indonesia is developing a Feed-in-Tariff (FIT) for wind energy, but it has not been issued yet. Thus, we do not include a table here.

FIT rates in Indonesia depend on the location, number of islands, and level of voltage, which makes sense for the archipelago, and might explain the delay in posting the FIT. This will be monitored by investors in the near future.

For geothermal FIT, the finance mechanism is as follows: $400 million from a co-financing fund from the World Bank.

The most important criteria for attracting investors in the renewable energy sector are: rate of FIT, period of FIT, and payment and profitability of each project.

Lack of a credible inflation calculation mechanism is one of the weaknesses in the planning of countries covered.

3.4.4 Comparison of FITs in France and China

Finally, to provide a benchmark comparison, we provide figures for FITs in France and China in this subsection.

France:

Onshore Wind Energy Tariff as of 2014: 0.82 euro/kWh ($0.87) for 10 years and between 0.28 and 0.82 euro/kWh for 5 years according to the site.
Solar Tariff since March 2011: Depending on the type of installations and the power, this varies from 0.12 to 0.46 euro/kWh for 20 years.

China:

Wind Energy Tariff: between 0.75 yuan/kWh and 0.85 yuan/kWh depending on site, installation type, and power (approximately $0.12-0.13/kWh
Solar Energy Tariff as of January 1, 2016: Depending on the solar resources zone the tariff is reduced to RMB 0.8, 0.88, or 0.98 per kWh (**in USD 0.12, 0.13, 0.14/kWh**)

Report - Potential and challenges in implementing feed-in tariff policy in Indonesia and the Philippines. - Bakhtyar, Sopian, Zaharim, Salleh, Lim

http://i-windenergy.com/sites/i-windenergy.com/files/page-

uploads/Indonesia%20Wind%20%20RooftopPV%20tariffs%20-%20English%20Final%20Report.pdf.
(*report: TARIFF SUPPORT FOR WIND POWER AND ROOFTOP SOLAR PV IN INDONESIA*)

4 Project Case Studies

As the industry is relatively new in the region, it requires a number of success stories in order to properly take off on a large scale. We looked through some actual projects to identify how our defined analytical sets (clarity of policies, political consistency of regulation, economic sustainability of feed-in tariffs), affect the projects (positively, negatively, neutrally).

As Thailand faced constant regulatory change, we surveyed 4 projects in the country that faced different issues. We additionally surveyed two projects in The Philippines and one in Indonesia.

4.1 West Huaybong 2 and West Huaybong 3 Wind Farms (Thailand) (2010-2013)

Location: Dan Khun Tod District and Teparak District, Nakhon Ratchasima province, Thailand

Capacity: 2 x 103.5MW

Characteristics: A Wind Energy Holding Company Limited (WEH) project located in an area where wind speed is six meters per second. While these are not the best wind resources, they still compare favourably with wind resources in Thailand's coastal areas where average wind speeds are around five meters per second or less. West Huaybong 2's 45 wind turbines are located 300 metres above sea level while West Huaybong 3's 45 wind turbines are located 100 metres above sea level.

Project led by: The West "Huay Bong 2 Project" is operated by K.R.Two Company Limited while the "West Huay Bong 3 Project" is operated by First Korat Wind Company Limited.

Investment Scheme: Both projects' shareholding structure comprises Aeolus Power Company Limited (60%) which is a subsidiary of WEH, Ratchaburi Electricity Generating Holding Public Company Limited (20%) and Chubu Electric Power Korat BV (20%) which is a subsidiary of Japanese group Chubu Electric Power. The total investment for both projects is 13,053 million baht2.

Technology provider: Each project comprises 45 2.3-megawatt wind turbines or 103.5 MW nameplate capacity, provided by Siemens Wind Power A/S.

[2] http://www.ratch.co.th/en/news/company-news/328/west-huay-bong-2-3-largest-wind-farm-in-sea-now-open

Functioning: West Huay Bong 3 started commercial operation in November 2012 while West Huay Bong 2 started commercial operation in February 2013[3].

Surplus of electricity Price: PPA contract of 90MW for each wind farm. Both wind farms have a 25-year non-firm power purchase contract for small power producer (SPP) with EGAT and receives 3.50 baht adder per unit for 10 years from the Power Development Fund, the Electricity Regulatory Commission (ERC)[4].

4.2 Petchabun Khao Kor Wind Farm (Thailand) (2008-2016)

This project consisted of 60 MW. It was launched by WEH, whose wind farm projects in the northern province of Nakhon Ratchasima, generated a combined 207 megawatts in 2014. At the time of the military coup, WEH had seven more projects in the pipeline with a total capacity of close to 650 megawatts alongside a plan to reach an Initial Public Offering (IPO) to fund further regional expansion. This case is relevant because it demonstrates how political instability can be a significant roadblock to the expansion of wind farms in the region.

Location: Khao Kor District, Province of Petchabun (North of Thailand)

Capacity: 60 MW

Characteristics: The initial 2008 project was designed to supply power to the northern part of the country, generating the sufficient energy to power approximately 36,000 Thai households for a year.

The Khao Kor wind farms were among the earliest projects in both Thailand and the region as a whole. Launched at an early stage for the growth of wind energy, they were designed with an ambitious goal: to be part of the Clean Development Mechanism as defined by the United Nations Framework Convention on Climate Change (UNFCCC) Article 12 of the Kyoto Protocol[5]. The actors involved in this specific project were from

[3] http://demco.listedcompany.com/newsroom/20130401-DEMCO-SET04-EN.pdf

[4] http://www.ratch.co.th/en/news/company-news/328/west-huay-bong-2-3-largest-wind-farm-in-sea-now-open

[5] This mechanism allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries. Such projects can earn salable certified emission reduction (CER) credits, each equivalent to one ton of CO2, which can be counted towards meeting Kyoto targets. It has been quite a successful mechanism as it allows countries without emissions targets to achieve sustainable development goals, while simultaneously offering countries with emission reduction targets the ability to achieve compliance by purchasing offsets created by CDM projects.

Thailand and France's EDF Trading Limited. The goal for EDF was to purchase all Certified Emission Reductions (CER) generated by the project.

In a study conducted by UNFCCC, the project was found to be in line with all relevant host country criteria (Thailand) and all relevant UNFCCC requirements for the Clean Development Mechanism (CDM). The project obtained approval from the Designated National Authorities of Thailand with the Letter of Approval (HCA) dated September 7, 2011 and from Designated National Authorities of France dated May 10, 2011[6].

The initial ambition of the Khao Kor wind farms is clear. However, its history is long and complex, shedding light on the risks of regulatory interference.

Project initial steps (2008-2014)

Project Led By: Khao Kor Wind Company Limited, 100% held by Sustainable Energy Corporation (SEC), which was first founded by WEH. In 2009, SEC became jointly held by Wind Energy Holding 60%, Ratchaburi Electricity Generating Holding (RATCH) 30% and Demco Plc. 10%[7].

RATCH is the top private power producer in Thailand, which was created from the privatization of the Ratchaburi power plant from the Electricity Generating Authority of Thailand[8]. WEH, a subsidiary of Renewable Energy Corporation (REC) which is now controlled by KPN Group, invests in wind farm development through its subsidiaries and its associates. Demco is one of the top five electrical engineering contractors and steel structure manufacturers in Thailand. It is the major customer and partner of WEH for its different projects.

Investment Scheme: Total project costs were estimated at USD 120 Million.

Technology Provider: Siemens Wind Power Co, a unit of Siemens AG. Siemens provided 26 turbines of its SWT-2.3-101 (power capacity of 2, 300 kW, diameter of 101 m) for the project[9].

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[6] Sources:
https://cdm.unfccc.int/filestorage/V/D/T/VDTK8GF1L0IC6ME7Z5NY4WQ9UPSJ2O/5530%20FValR.pdf?t=cFN8b2h0Zm1ofDAFmgzgtu-fbcoRpFwupW39
https://cdm.unfccc.int/filestorage/Z/P/H/ZPHF19A25JQT7CNS4VO3YWG60E8LKD/5530%20PDD.pdf?t=bk58b2h0Zm16fDAfgGYK0jVohWtk40dY2mcs
http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php

[7] http://www.evwind.es/2010/03/20/wind-energy-holding-plans-800-mw-in-thailand/4756

[8] EGAT still holds 45% of RATCH in 2017

[9] http://www.thewindpower.net/windfarm_fr_2857_khao-kor.php

Shareholding changes and project delay

On 10 August 2010, Ratchaburi Energy, the investment subsidiary of RATCH, bought a 21% stake from Wind Energy Holding for 107.1 million baht (US$3.4 million)[10].
According to a Stock Exchange of Thailand (SET) document published in 2013, the actual shareholding was then RATCH 55.18%, WEH 34.16% and Demco 10.43%[11].

At this time, phase one was functional and proving to be sustainable. By 2012, based on a portfolio including Khao Kor and two other projects, WEH CEO Mr Nopporn Suppipat planned to scale up his company's business by launching an initial public offering (IPO) on the SET. The raised funds would support the construction of three further plants[12]. However, by 2014, the success of WEH's operations led Suppipat to expand his ambitions. He planned to launch an IPO to raise funds for WEH's farm production from its existing combined total of 207 megawatts, to fund seven more projects with a total capacity of close to 650 (additional) megawatts[13], on a multi-billion dollars' scale.

However, these plans were derailed by the military coup. After leading WEH for 6 years and preparing an IPO for 2 years, Mr. Suppipat went from being a leader in alternative energy and a rising star in Thailand's corporate scene, to having to flee the country after the military coup.[14] The situation also forced Suppipat to sell his company, with KPN Group identified as a suitable buyer. As a result of the change of leadership, the company's IPO was first put on hold.

In the above context, and even though only the scaling up of entrepreneurial know-how got stalled, the later history of the Khao Kor project and its new shareholders, conversely, seem to have benefited from the help of the regime: KWP contracted GE for providing wind turbines in December 2015 and only half a year later the project was already in commercial operation. Khao Kor Wind Power Company Limited (KWP), which after a series of shareholding changes then became controlled by Charoen Energy and Water Asia Co., Ltd owned by the Jairavanon family. Demco Pcl. still holds 14.29% of KWP[15].

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10 http://www.thaipr.net/energy/303628

11 http://www.set.or.th/set/pdfnews.do?file=http%3A%2F%2Fwww.set.or.th%2Fdat%2Fnews%2F201305%2F13029706.pdf

12 "The Wind Energy Holding to Tap SET, Nation Multi Media, Watcharapong Thongrung, 9th April 2012.

13 Suppipat mulling IPO after rapid expansion: Forbes Naazneen Karmali, June 4th 2014.

14 The Wall Street Journal, Warangkana Chomchuen and James Hookway, 18 December 2014.

15 http://demco.listedcompany.com/newsroom/280920161815510547E.pdf

Investment Scheme: KWP's managing director Surachet Tamaronglak said a total investment budget of 5 billion baht had been allocated for the wind farm project, which is expected to generate revenue of 700 million baht a year to help the company break even within 12 years[16].
Bangkok Bank of Commerce has provided $88.9 million commercial debt in 2015 for the project[17].

Technology Provider: GE Renewable Energy**.** The project will use 24 of GE's 2.5-120 wind turbines. Each of these turbines utilizes a 120 meter rotor diameter to provide 2.5 MW of power per unit. With its hub sitting atop a tubular steel tower 110 meters off the ground, the 2.5-120 wind turbine specializes in increasing power yields for low-to-medium wind speed regions, which matches the characteristics of the Petchabun province.

Functioning: The completed project has been commercially operational since 21 July 2016[18].

Surplus of electricity Price: The electricity is supplied to the Thai National Grid agreed in a power purchase agreement (PPA) with the national grid operator EGAT, under the SPP program. Under the PPA, they receive adder of Baht 3.5 per unit for 10 years from the Electricity Development Fund.

Two years down the line, it appears that the uprooting of Mr. Suppipat completely derailed WEH's expansion strategy – and thus suppressed hopes for the acceleration of energy transition to more renewable sources, that would have been in the national interest. Indeed, KPN have further delayed the WEH IPO with the cited reason being the need to "reorganize the company's structure and set up a new internal management system before launching an initial public offering (IPO)." It seems that after the military coup, the change of leadership at WEH had a direct impact on the expansion of the company, and therefore the transition to more sustainable sources of energy in Thailand[19].

4.3 Hadkunghan Project (Thailand) (2012-2016)

Location: Provinces of Songkhla and Nakhon Si Thamarat (Southeast of Thailand)

Capacity: 126 MW

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16 http://www.bangkokpost.com/print/784477/
17 http://ppi.worldbank.org/snapshots/project/khao-kor-wind-power-plant-8625
18 http://demco.listedcompany.com/newsroom/280920161815510547E.pdf
19 Wind Energy Holding Postpones IPO to 2017, Deal Street Asia, February 7th 2016

Characteristics:

The project was divided in three sub-projects[20]:

- Hadkunghan 1 - Capacity of 36MW - Located in Ranode Sub-District, Ranode District, Songkhla Province
- Hadkunghan 2 - Capacity of 45MW - Located Huasai Sub-District, Huasai district, Nakhonsithammarat Province
- Hadkunghan 3 - Capacity of 45MW - Kanabnok Sub-district, Pakpanang District, Nakhonsithammarat Province Province

Another project called "Hadkunghan 4" is currently being studied, with a potential capacity of 45 MW for December 2017.

Project Led By: Energy Absolute PCL (Public Company Limited). EA was listed on the Market for Alternative Investment (MAI) in 2013. As of March 2016, Mr. Somphote Ahunai was the major shareholder, holding approximately 43% interest in EA together with his family. The next is First Asia Investment Limited with 12.62%[21].

Investment Scheme:
The total investment value of the Projects is equal to approximately Baht 10,400 million which is consisted of the cost of imported equipment approximately USD 171 million (at the exchange rate of Baht 35.50/USD approximately), and the cost of domestic works approximately Baht 4,333 million. In 2015, Energy Absolute PCL established EA Wind Hadkunghan 3 Co., Ltd. ("EWHK3", new indirect subsidiary company) to be the project company which is responsible for investing in the Projects. The Company holds EWHK3 via EA Renewable Holding Co., Ltd. ("ERH") in the amount of 99.99 percent of ERH's authorized capital[22].

Energy Absolute PCL has also received $205.7 million commercial debt from Siam Commercial Bank in 2015 for the Hadkunghan 3 project, at a debt/equity ratio of 72:28[23].

Technology Provider: Vestas took care of supply, supervision of construction, and commissioning of the turbines. The project used 70 units of the V110-1.8 MW Vestas

[20] http://www.56-1.com/reports/EA/EA_13AR_en.pdf, http://www.energyabsolute.co.th/index.php
[21] http://www.trisrating.com/en/pdf/announcement/EA47-e-020616.pdf, Energy Absolute PCL 2015 Annual Report
[22] http://www.set.or.th/set/newsdetails.do?newsId=14592937857960&language=en&country=US
[23] http://ppi.worldbank.org/snapshots/project/Hadkunghan-3-wind-power-plant-8634

Turbine. Vestas also provided an AOM 4000 service package contract that guarantees a defined level of availability and performance[24].

Functioning:
- Hadkunghan 1 - Scheduled Commercial Operation Date 14/06/2016
- Hadkunghan 2 - Scheduled Commercial Operation Date 29/06/2016
- Hadkunghan 3 - Scheduled Commercial Operation Date 14/07/2016

Surplus of Electricity Price: The project benefited from the increased purchase price (Adder) for Small Power Production (SPP) from wind power at 3.50 baht per kilowatt-Hours for a period of 10 years from the Commercial Operation Date (COD).
The government's Adder scheme has granted the renewable power generators subsidies for the first ten year of operations, while the new Feed-in-Tariff (FIT) program will provide a flat subsidy rate for the entire period of the Power Purchase Agreement. Compared with the FIT program, the Adder offers a much higher subsidy, particularly for solar and wind power plants, and this means the solar and wind power generators will generate a higher internal rate of return (IRR), and can reach the break-even point for companies in a shorter period of time[25].

4.4 Subyai wind farm (Thailand) (2014-2016)

Location: Subyai District, Chaiyaphum Province (Northeast of Thailand)

Capacity: 90 MW

Characteristics: The Subyai project is an extension of the 7.5MW Theppana Wind Power Project in the same location, already financed by the ADB in 2013 (replication of the financing structure was used). The first development used turbines supplied by Chinese company, Goldwind. The scaling operation used GE technology.

Project Led By: Chaiyaphum Wind Farm Company (a special purpose joint venture firm, 90% owned by Electricity Generating Public Company (EGCO) and 10% by Pro Ventum, an international wind power developer based in Germany).

EGCO is Thailand's first independent power producer, and the second largest private power producer in the country. It was privatized by EGAT in 1992 and listed on the

24 https://www.vestas.com/en/media/~/media/57f073f6b77a42a8884005d73452a3c1.ashx
25 http://siteresources.worldbank.org/EXTRENENERGYTK/Resources/5138246-1238175210723/Thailand0Small0Power0Producer0Program0.pdf

Stock Exchange of Thailand in 1995. EGCO is now owned by EGAT (25.4%), 1 TEPDIA Generating (23.9%) and the public (50.7%)[26].

Investment Scheme:
The project has obtained in total $165.9 million bank investment in 2015, including $85.5 million from Asian Development Bank and $80.4 million from Bank of Ayudhya[27].

Under a public-private partnership, Chaiyaphum Wind Company benefited from a loan from the Asian Development Bank (ADB) with the following details[28]: currency loan of up to THB 1,807 million (equivalent of $55 million) and a $30 million loan from the ADB-administered Clean Technology Fund.

The ADB loan was accepted for several reasons

- The project integrates the country partnership strategy 2013-2016 of the Asian Development Bank (ADB) for Thailand (specifically in three areas: infrastructure, environmental sustainability, and finance sector development)
- Increasing power generation capacity and accelerating development of renewable energy generation is also part of the aforementioned strategy
- The project supports the government's long-term objective under the Thailand Clean Technology Fund Investment Plan to utilize ADB Clean Technology Fund resources to support renewable energy projects in the private sector. The project is expected to contribute to Thailand's initiatives to boost energy security
- The loan aims at accelerating and expanding private sector investment in clean energy infrastructure, according to Thailand's objectives.

Technology Provider: GE supplied 36 2.5-MW wind turbines to the project.

Functioning: The plant has been commercially functional since 16 December 2016[29].

Surplus of Electricity Price: The project will be implemented under a 5-year automatically-renewable Power Purchase Agreement (PPA) with the state-owned Electricity Generating Authority of Thailand (EGAT) under the Small Power Producers (SPP) program to provide clean electricity to the national grid. As for the Hadkunghan Project, the Subyai project will benefit from an increased purchase price (Adder) of 3.50 baht/unit for 10 years under the SSP program.

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[26] http://egco.listedcompany.com/misc/PRESN/20140901-egco-roadshow-thailand-focus2014.pdf
[27] http://ppi.worldbank.org/snapshots/project/chaiyaphum-wind-farm-8350
[28] http://www.windpowermonthly.com/article/1330850/adb-loans-85m-thai-wind-project, https://www.adb.org/news/adb-and-ctf-loans-boost-private-sector-wind-power-investment-thailand
[29] http://www.bangkokpost.com/business/news/1163661/egco-kicks-off-latest-wind-farm

4.5 Burgos Wind Project (Philippines) (2012-2015)

Location: The wind farm will cover an area of approximately 686 hectares across 3 barangays located in the Municipality of Burgos, Province of Ilocos Norte, Northern Philippines (500km north of Manila): Saoit, Nagsurot and Poblacion

Capacity: 150MW

Characteristics: The Burgos project is the Philippines' largest wind farm. The project is expected to generate 370 GW/h of electricity every year and offset about 200,000 tons of carbon dioxide emissions. The project also promotes energy diversification and reduction of the country's dependence on imported fossil fuels. It will also address 1.5% of the projected demand growth for electricity in the Philippines' Luzon (largest island) grid.

The components of the project are (i) installation of 50 3.0 MW wind turbine generators (WTGs) and ancillary plant equipment; (ii) construction of a 115-kilovolt transmission line, approximately 42 kilometers (km) in length; and (iii) construction of a substation in Burgos and the expansion of an existing substation in Laoag City, Ilocos Norte.

Construction of the project was undertaken in two phases. The first phase consists of the installation of 29 WTGs with a generation capacity of 87 MW, and the construction of the transmission line and substation. Phase 2 consists of the installation of an additional 21 WTGs with a generation capacity of 63 MW[30].

Project Led By: The project is owned and operated by EDC Burgos Wind Power Corporation (EBWPC), a special purpose company controlled by Energy Development Corporation (EDC) a publicly listed firm that is the largest geothermal energy producer in the Philippines and the largest integrated steam and geothermal energy producer in the world today[31].

A memorandum of agreement (MOA) was signed between the Local Government of Burgos and the Energy Development Corporation (EDC) on October 2008, stating the co-existence of a communal pasture land and a wind farm as beneficial arrangement for both parties.

Investment Scheme: The estimated total cost for the construction of the wind farm was US$450 million.

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[30] https://www.adb.org/sites/default/files/project-document/154786/48325-001-rrp.pdf
[31] https://www.adb.org/news/adb-help-finance-philippines-largest-wind-farm

According to World Bank database, at the beginning of 2013, a total of $169.29 million capital obtained from bank loans has been invested in physical assets for the first phase of the project[32].

In November 2014, EBWPC signed a US$315m financing agreement with a group of foreign and local banks for the second phase of the construction of the 150-MW Burgos Wind Project (BWP). The facility, which consists of US dollar and Philippine peso tranches, will mature in 15 years[33].

The Mandated Lead Arrangers for the foreign tranche are Australia and New Zealand Banking Group Limited (ANZ), DZ Bank AG, ING Bank NV, Malayan Banking Berhad (Maybank) and Norddeutsche Landesbank Gironzentrale, which provided dollar debt. EKF, the Danish Export Credit Agency's support to the transaction was critical to assist the international lenders with the 15-year loan tenor and country credit limitations.

The local tranche, meanwhile was arranged by PNB Capital and Investment Corporation and SB Capital Investment Corporation among a syndicate of local lenders namely BDO Unibank, Inc., Land Bank of the Philippines, Philippine National Bank, and Security Bank Corporation, which have provided local currency debt.

In January 2015, The Asian Development Bank (ADB) approved the loan of up to $20,000,000 to EBWPC for the 150-Megawatt Burgos Wind Farm Project[34].

Technology Provider: Vestas will provide the technology for the project. The Project will be built in two phases. The first phase includes installation of 29 wind turbine generators from Vestas with a generation capacity of 87 MW, the construction of a wind farm substation, and the construction of an approximately 42 km long transmission line. The second phase consists of the installation of an additional 21 wind turbines from Vestas with a generation capacity of 63 MW[35].

Functioning: BWP achieved successful commissioning on 5 November 2014 following its nomination by the Department of Energy (DOE) for Feed-in-Tariff (FIT) eligibility. Both Phase 1 and Phase 2 of the project, totalling 150 MW have been endorsed by the DOE to qualify for the FIT on 11 November 2014, which marked its officially commercial operation. On 18 December 2014, the Energy Regulatory Commission issued the Provisional Authority to Operate to BWP[36].

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32 http://ppi.worldbank.org/snapshots/project/burgos-Ilocos-norte-wind-farm-6095

33 http://www.acquisition-intl.com/2015-energy-development-corp-financing-for-burgos-wind-farm-project

34 https://www.adb.org/sites/default/files/project-document/154786/48325-001-rrp.pdf

35 https://www.adb.org/projects/48325-001/main#project-pds

36 http://www.acquisition-intl.com/2015-energy-development-corp-financing-for-burgos-wind-farm-project

Surplus of Electricity Price: The project will benefit from a price of 8.53 per kilowatt-hour (kWh) for 20 years under the FIT (Feed-In Tariff System).

The first FIT in the Philippines was established in the Renewable Energy Act of 2009, but the latest modification in FIT for wind in the Philippines was adopted in July 2012 by the Energy Regulatory Commission in the Decision Case No. 2011-006. This decision states that renewable energy should have a priority for grid connection, a priority purchase and benefit from fixed tariff to be paid over a fixed period of time (no less than 12 years)[37].

The project outcome demonstrates the feasibility and sustainability of large-scale private sector wind farms in the country under the new FIT regime, which will help the Philippines accelerate and expand private sector investment in renewable energy infrastructure. It also shows that international banks are prepared to take long-term risks with non-recourse project finance for renewables when they are supported by a FIT scheme (under new regulatory environment), rather than the traditional long-term Power Purchase Agreements.

4.6 Caparispisan and Balaoi Wind Farms (Philippines) (2013-2014)

Location: Barangay Caparispisan, Pagudpud town, Ilocos Norte region, Luzon Island, Philippines

Capacity: 81 MW

Characteristics: It was then the second and largest wind project in the Philippines. The installations are divided into 54MW on the Caparispisan site and 26MW on the Balaoi site. Power generated by the proposed project activity will be routed from the 115 kV transformer station at the Caparispisan site, to the National Grid Corporation of the Philippines" (NGCP) substation in Laoag City, via a 62 kilometers, 115 kilovolt transmission line. The net supply of power will be measured at this substation[38].

Project Led: initially by Northern Luzon UPC Asia Corporation, founded in 2013 by the UPC Group from the United States.

In December 2013, the developer was changed into the joint venture North Luzon Renewable Energy Corporation (NLREC), which was held by Ayala's energy investment

[37] http://www.iea.org/policiesandmeasures/pams/philippines/name-43253-en.php

[38] https://cdm.unfccc.int/filestorage/L/H/8/LH82B6WZKJYEFV0ADCTR9U5PIMGX43/Balaoi%20GSP%20PDD%2020July2010.pdf?t=R218b2pwejcxfDC10vlmVqchJVcoYxkDZOid

arm, AC Energy Holdings Incorporated 64%, the Philippine Investment Alliance for Infrastructure (PINAI) 32%, and the UPC Renewables 4%[39].

AC Energy Holdings, Inc. is a wholly-owned energy-focused holding company of Ayala Corporation, with investments in solar, wind, hydro and conventional energy sources. PINAI is a 26 billion fund dedicated to equity investment in the Philippine infrastructure assets. PINAI is managed by the global fund Macquarie Infrastructure and Real Assets. UPC Renewables is a subsidiary of UPC Group and has been actively developing and acquiring primarily wind and solar projects in Europe, North Africa and Asia.

In September 2015, Ayala sold part of its stake in Luzon Wind Energy Holdings BV (which owns part of Ayala's stake in NLREC) to a unit of Japan's Mitsubishi Corp., trimming its interest in the wind farm project to 36%. AC Energy still remains the largest owner of NLREC[40].

Investment Scheme: According to the World Bank database, a total capital of $236.5 million has been invested up to 01/01/2012[41].

Technology Provider: The project consists of 27 of Siemens' SWT-3.0-101 turbines and called for the construction of a 62km transmission line which was constructed between the site and a substation located in Laoag, the capital of Illocos Norte[42].

Functioning: Started commercial operation on 11 November, 2014

Surplus of Electricity Price: The project will benefit from a price of 8.53 per kilowatt-hour (kWh) for 20 years under the FIT (Feed-In Tariff System)[43].

4.7 Jeneponto I & II (Indonesia) (2015-till today)

Location: 70 km South East of Makassar in the Province of South Sulawesi

Capacity: 62.5MW for Jeneponto 1 (and 100MW for Jeneponto 2)

Characteristics: The project will be tied to the South Sulawesi electricity grid, and is expected to produce a net annual energy yield exceeding 200 gigawatts per hour –

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39 http://interaksyon.com/article/99520/solution-to-power-crisis-ilocos-norte-inaugurates-81-mw-wind-farm, http://www.gmanetwork.com/news/story/317515/money/companies/ayala-s-ac-energy-partner-upc-philippines-to-develop-wind-farms-for-luzon-grid

40 http://www.philstar.com/business/2015/09/04/1495617/ayala-trims-ownership-luzon-wind-energy

41 http://ppi.worldbank.org/snapshots/project/caparispisan-and-balaoi-wind-farms-6221

42 http://www.upcrenewables.com/projects/caparispisan-81mw-philippines/

43 http://www.manilatimes.net/ayalas-wind-farms-get-fit-certification/176460/

enough electricity to supply to more than 450,000 people and help avoid 120,000 tons of carbon dioxide emissions a year[44].

Project Led By: PT Energi Angin Indonesia – a subsidiary of Indo Wind Power Holdings Pte Ltd that is wholly owned by Asia Green Capital Partners. Asia Green Capital Partners Pte Ltd, is a Singapore-based clean energy developer.

Investment Scheme: Jeneponto 1 will cost from $120 million to $135 million, according to Edgare Kerkwijk, managing director of Asia Green Capital. The project is funded 25% by equityfrom IFC (through its global infrastructure development fund InfraVentures) and Asia Green Capital and the remainder from loans from the IFC, the Asian Development Bank, Denmark's export credit agency EKF, and other banks[45].

Technology Provider: The project is expected to use ten Vestas V126-3.3MW and nine Vestas V117-3.3MW turbines[46].

Functioning: The project is divided between Jeneponto 1 and Jeneponto 2. On August 17, 2015, PT Energi Angin Indonesia and the Government of South Sulawesi signed a memorandum of understanding to develop the Jeneponto 1 wind farm. Its construction began in May 2016 and is expected to finish in 18 months. Jeneponto 2 is still in the early stages of development: a four-year wind data monitoring phase[47].

Surplus of Electricity Price: Asia Green Capital is still negotiating its Power Purchase Agreement with the government-owned electricity company PLN (Perusahaan Listrik Negara) for this project but expects to sign by the end of 2016 (no news yet).

5 General Conclusion: Visionary policies and Feed-in tariffs through the reality check of politics

We started this paper by highlighting the vast potential for wind energy in Southeast Asia, and we will end it on that point as well. We have provided here an overview, which we have attempted to make as comprehensive as possible, of that potential and the challenges that remain to unlock it. Although this report focuses on three countries,

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44 http://ifcext.ifc.org/ifcext%5Cpressroom%5Cifcpressroom.nsf%5C0%5C294FBBF1D975039685257EA400191D6B

45 https://www.bloomberg.com/news/articles/2015-10-22/indonesia-s-largest-wind-farm-project-seeks-up-to-135-million

46 http://www.windpowermonthly.com/article/1409408/vestas-supply-indonesias-first-wind-projects

47 http://www.agcp.com.sg/index.php?option=com_content&view=article&id=85&Itemid=536

Indonesia, the Philippines, and Thailand, its analytical structure can be extended to the other countries in the region.

This paper first presented an introduction of the energy mixes and potential for energy transition through wind in the three focus countries. It then turned its focus to the regulatory environment within each country focused on renewable energy. Finally, it detailed cases of some of the most prominent wind projects. This structure was intended to make the analysis as comprehensive as possible given the available data. There is a mix of qualitative and quantitative points to further complete this picture.

To conclude, we look to the future. Potential is only converted into impact when the major stakeholders involved take action, and when this action is secured. The potential is well understood, especially by development agencies and by entrepreneurs. However, the sub-regional concern still is that, if governments have on paper understood the need to establish regulations, including sustainable feed-in tariffs, the region is not devoid of regulatory capture risks; nor are the minority shareholders exempt from swift and not always economically explained consequences, as the example of post-military Thailand shows. As a result, several ambitious projects have been stalled.

As recently as 1st of February 2017, the the Thai wind sector has faced yet another unplanned setback. Not content with the already existing upset the military government has provided, it appears now that wind farm projects in Chaiyaphum and Nakhon Ratchasima province, which have been built on leased agricultural land will be reviewed and possibly terminated[48]. This will have an affect on 19 operators in this area alone. It is interesting and no doubt progressive that the country has provided provision for projects that use leased lands with agricultural interests, to provide shared interest between farmers. However, the way the matter is addressed is that allocation decisions go through land reform offices which then may (or may not) be upheld by local administrative courts. This is what happened there with a time gap of… 8 years, initial allotment having occurred in 2009[49]. This raises a classical issue in property right economics since the Coase theorem (1960) that, with transaction costs, property –and onus of properly using access to it – does matter. One could assume that, after such a long time, and even with a justice taking its due time, a relief plan could still be inflicted onto the companies (after all profitable) for the farmers, so as to safeguard the national interest of the projects. This is the reverse, and after projects got stalled, relief plans are talked about to safeguard the economics of companies that would scrap their projects – perfect waste of public money and in no case a good news either for stalled companies or for farmers getting nothing out of their case. It appears that, instead of redistributing economical projects, the law has it better to stall them for the sake of its own respect. In

48 http://www.bangkokpost.com/news/general/1191645/wind-farm-contracts-to-be-reviewed
49 http://www.bangkokpost.com/news/general/1190792/court-revokes-wind-farms-lease-of-alro-land

short, Thailand, an early riser in wind power which could have set the tone for the region, has been stalled by its government and now its courts.

Conversely, in the Philippines, the continued checks from the ADB have enabled the sector to stabilise, and ultimately foreign players to enter the scene. In Indonesia, despite the potential, the realisation is slower to emerge; hopefully the country will learn from the best practices in the region and get inspired in avoiding chaotic revisions, Thai-style.

Scaling up being the outcome of consistent and sustained achievement of potential perception, regulation setup and regulatory implementation, our hope is that this happens soon rather than later with wind energy in Southeast Asia.

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