Chapter 2

Renewable Energy Policies in Promoting Financing and Investment among the East Asia Summit Countries: Quantitative Assessment and Policy Implications

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Chapter 2

Renewable Energy Policies in Promoting Financing and Investment among the East Asia Summit Countries: Quantitative Assessment and Policy Implications[1]

Youngho Chang[2], Zheng Fang, Yanfei Li

Abstract

Many countries have implemented policies for renewable energy development ranging from setting power purchase agreements and the legislation of renewable energy requirements to providing incentives and imposing carbon taxes. The evaluation of the effectiveness of such policies, however, is fragmented, which raises a need for a comprehensive analysis. This chapter aims to assess whether and how policies promoting renewable energy investment have achieved the intended goals. It employs five broadly defined criteria – market, uncertainty, profitability, technology, and financial resources – to build an index to assess respectively if such policies have helped create a market for renewable energy, maximise potential profits, reduce risks relating to the investment, develop and adopt new technologies, and provide access to financial resources. Each criterion is reflected by three indicators. Values of each indicator are converted into ordinal values for analysis. The index not only scans comprehensively all relevant renewable energy investment policies in the developing East Asian countries, but also provides systematic and quantitative measures to compare the effectiveness of policies in these countries with respect to the creation of market, the degree of uncertainty, the potential of profitability, the development and adoption of technology, and the accessibility of financial resources.

Keywords: Renewable energy investment, financing, profitability, risks, policies

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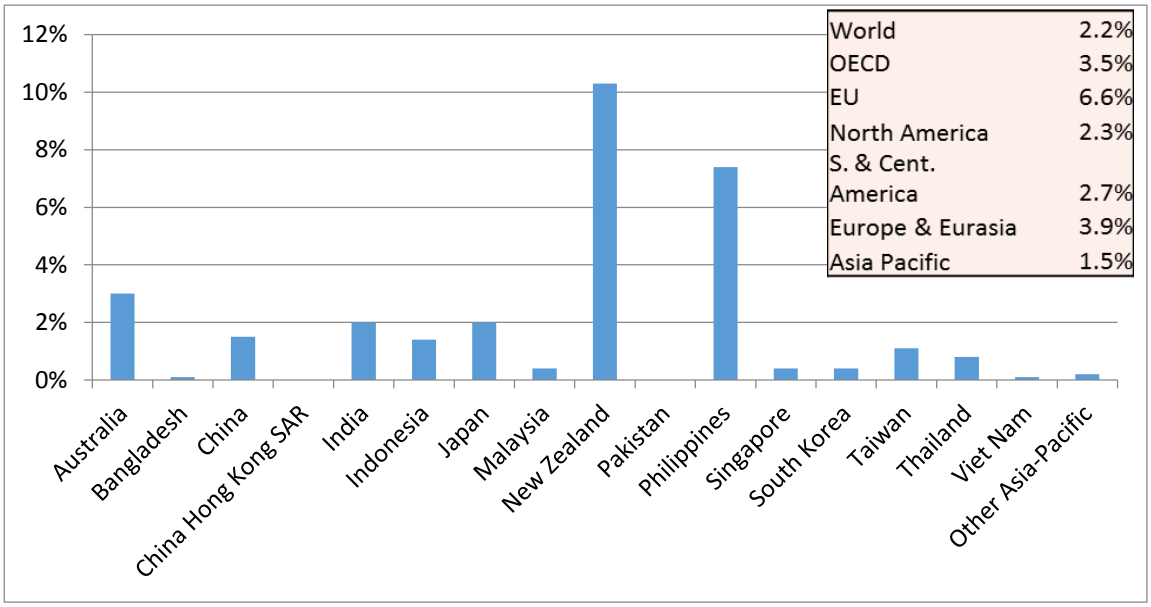
1. Introduction

Many countries have implemented policies for renewable energy development ranging from setting power purchase agreements (PPA) and the legislation of renewable energy requirements to providing incentives and imposing carbon taxes on fossil energy sources (see renewable energy policy reviews conducted by Shen and Luo, 2015 for China; Mekhilef et al., 2014 for Malaysia; Chen et al., 2014 for Japan, South Korea, and Taiwan; Lidula et al., 2007 for the Association of Southeast Asian Nations (ASEAN); Sarraf et al., 2013 for Cambodia; Schmid, 2012 for India; Blok, 2006 and Klessmann et al., 2011 for the European Union). However, the share of renewable energy in the total primary energy consumption in 2013 averages 2.2% across the world, and it is even smaller at 1.5% for the Asia-Pacific region. Within the Asia-Pacific region, New Zealand tops at 10.3%, followed by the Philippines at 7.4%, and Australia at 3% (Figure 2.1).

Figure 2.1: Share of Renewable Energy in Total Primary Energy Consumption, 2013

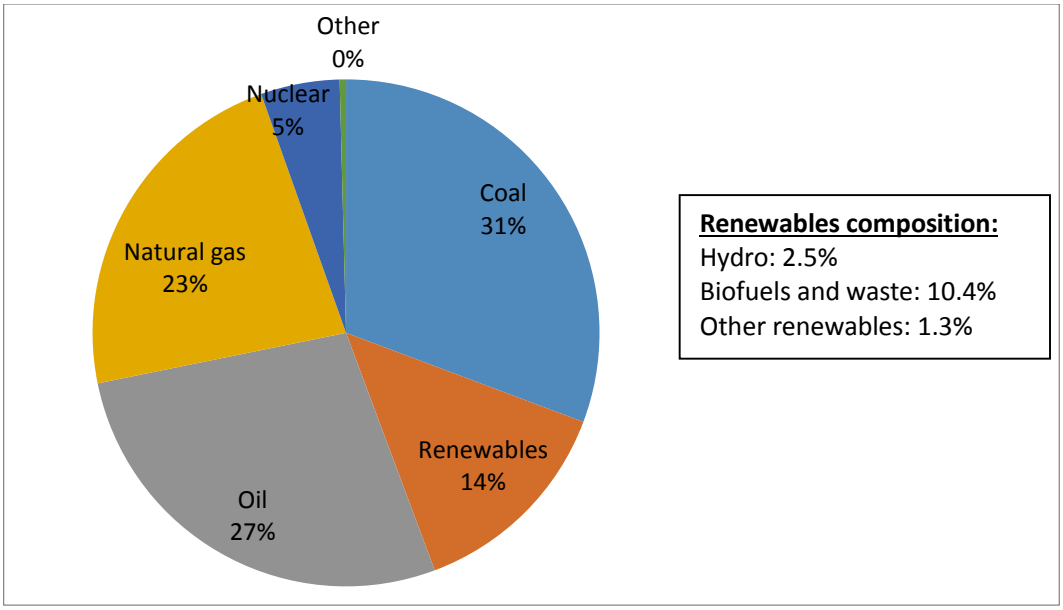


EU = European Union; OECD = Organisation for Economic Co-operation and Development; SAR = Special Administrative Region.

Source: BP Statistical Review of World Energy June 2014. Available at: http://www.bp.com/content/dam/bp-country/de_de/PDFs/brochures/BP-statistical-review-of-world-energy-2014-full-report.pdf

For the rest of the countries, the renewable energy share is no more than 2%. Looking from the supply perspective, only 14% of global total primary energy supply is from renewable energy, among which biofuels and renewable waste account for more than 10% and other renewable sources such as solar, geothermal, wind, and tide account for only 1.3% (Figure 2.2).

Figure 2.2: Fuel Shares in World Total Primary Energy Supply, 2013



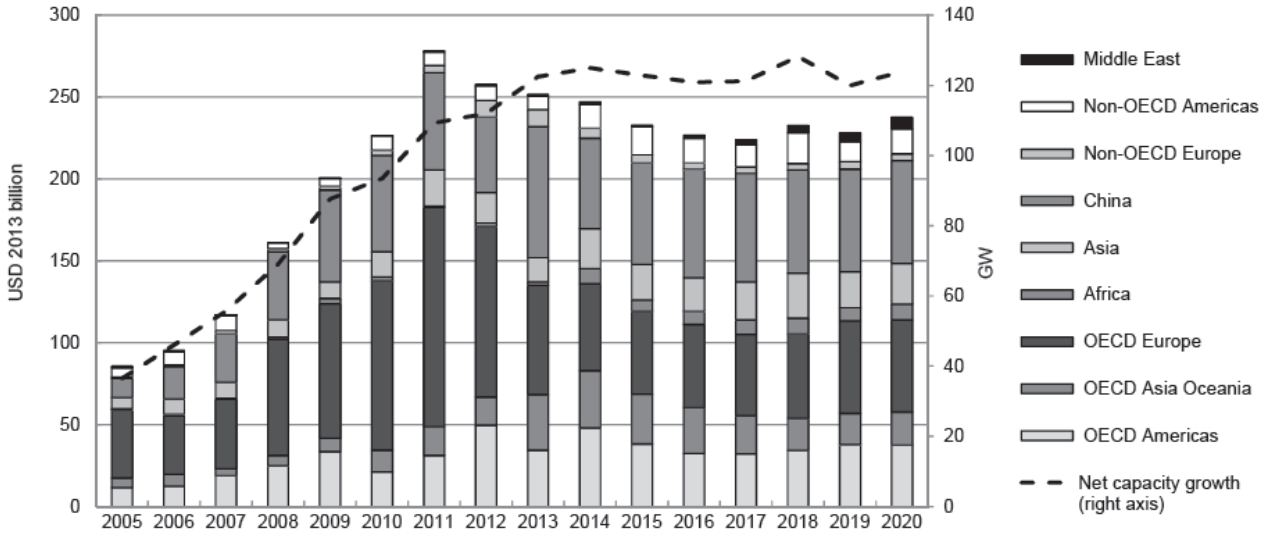
Source: International Energy Agency (2015).

Many countries invest heavily in renewable energy capacity. According to the International Energy Agency, since 2005 the global annual investment on renewable energy-based electricity generation has almost tripled, and in 2013, renewable energy accounted for about 60% of $400 billion investment in new power generation. As shown in Figure 2.3, Asia (including China) contributes to almost half of the world investment in new renewable power capacity. Figure 2.4 further shows that the growth of non-hydro renewable energy capacity in Asia in 2014 is mainly driven by big economies such as China, India, and Japan. All developing countries in this region, except for China, have a growth rate lower than the Asian average. In the meantime, it is noted that although some countries in Southeast Asia, such as Cambodia, Malaysia, the Philippines, and Viet Nam, had more than 10% growth rate, the accumulated capacities in these countries are still very small. Thailand is the leading country in Southeast Asia when measured by both growth

rate and accumulated capacity. However, the growth rate in Thailand is still far behind the Asian average.

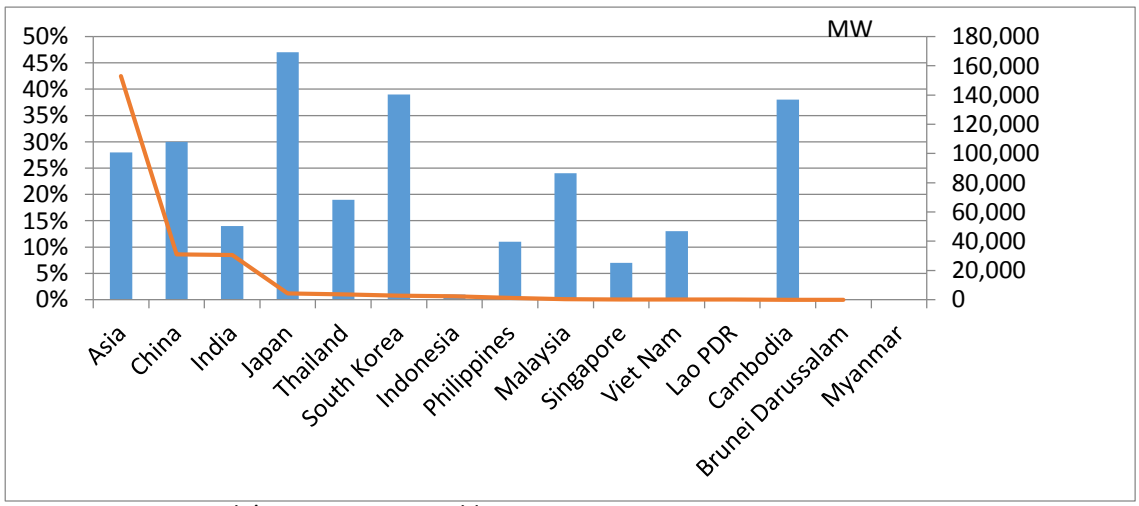
It is thus interesting to ask what the countries in East Asia have done right and what policy gaps are remaining in incentivising investment and financing of renewable energy projects. Specially, the evaluation of the effectiveness of such policies is so far mostly fragmented in the literature to our knowledge. This also raises a need for a comprehensive analytical framework for policy evaluation.

Figure 2.3: World Investment in New Renewable Power Capacity, Historical and Projected



GW = gigawatt; OECD = Organisation for Economic Co-operation and Development.
Source: International Energy Agency (2015).

Figure 2.4: Growth Rate and Total Capacity of Non-hydro Renewable Energy, 2014*



Lao PDR = Lao People's Democratic Republic; MW = megawatt.
*Note: the bar shows the growth rate and the line indicates the total existing capacity.
Source: IRENA (2015).

This chapter assesses whether and how policies, which are supposed to promote renewable energy investment, have achieved the intended goals. It employs five broadly defined criteria – market, profitability, legislative uncertainty, technology, and financial resources – to build an index of policies to assess if such policies have helped create a market for renewable energy, maximise potential profits, reduce risks relating to the investment, and develop and adopt new technologies, as well as provide more financing channels.

Each of the five aspects – market, profitability, legislative uncertainty, technology, and financial resources has several indicators. The market aspect examines whether policies helped create and extend a market for renewable energy. The profitability aspect presents whether policies provided the environment in which potential profits from renewable energy investment can be improved. The uncertainty aspect examines whether there are mechanisms, legislation, and regulations that reduce risks relating to the investment in renewable energy. The technology aspect shows whether and how policies helped develop and adopt renewable energy technologies. The financial resources aspect presents policies that could improve the availability of funds by addressing issues on the supply side, including public financing, financial institutions, financial markets, financial tools, and business models. The values of each indicator are collated and the cardinal values are converted into ordinal values for analysis. As the outcome, this research not only comprehensively scans all relevant renewable energy investment policies in the East Asia Summit (EAS) countries, but also provides systematic and quantitative measures to compare the effectiveness of policies in these countries with respect to the creation of market, the degree of uncertainty, the potential of profitability, the development and adoption of technology, and the accessibility of financial resources.

This chapter is structured as follows. Section 2 reviews relevant literature to lay down the theoretical background of our analytical framework and presents how the evaluation index is constructed. Sub-indices of the five aspects – market, profitability, legislative uncertainty, technology, and financial resources are explained in detail with examples. Section 3 analyses the index of 16 EAS countries and discusses results first by the region as a whole and then by individual countries separately. Section 4 concludes this study with policy implications.

2. Methodology

In this section, we first survey relevant literature and subsequently describe in detail how the evaluation index is constructed by explaining the sub-indices with examples.

2.1. Index of renewable energy policies

Previous studies that have used an index to assess the performance of renewable energy policies include the International Renewable Energy Agency (IRENA) reports and the Renewable Energy Country Attractiveness Index (RECAI). IRENA (2012) produced an index that covers the effectiveness, efficiency, equity, institutional feasibility, and replicability of these policies. IRENA (2012) provided a comprehensive review on the policies that could effectively reduce the risks involved in renewable energy investment and the major barriers in financing renewable energy. Compared to the IRENA report, our study focuses specifically on how policies could improve financial attractiveness and feasibility of renewable energy projects and thus facilitate investment on renewable energy, more from the investors' perspective. With this purpose, our study develops a consistent framework index to quantitatively evaluate the effectiveness of policies and thus provide policymakers with a tool for the assessment and identification of policy gaps.

RECAI is an indicator measuring each country's attractiveness in renewable energy business. It comprises three drivers: macro, energy market, and technology-specific drivers. The macro driver includes two aspects: macro stability and investor climate. The energy market driver includes the prioritisation and bankability of renewable energy projects. The technology-specific driver refers to project attractiveness. Sixteen parameters are used to measure each of these five sub-drivers. While conceptually well designed, the implications of RECAI are not policy-oriented and thus not clear regarding what policies could help and should be strengthened. Besides, attractive renewable energy investment opportunities exist to a different extent in almost every country. A country that appears to be less attractive in renewable energy development in general may still have some renewable energy projects with good potential. The question is how to mobilise funds from various sources into such businesses; how could policies make those projects that are not so financially attractive become bankable so that they are attractive to private investors. Our

study indicates clearly projects in which country are more attractive or financially viable due to its policies.

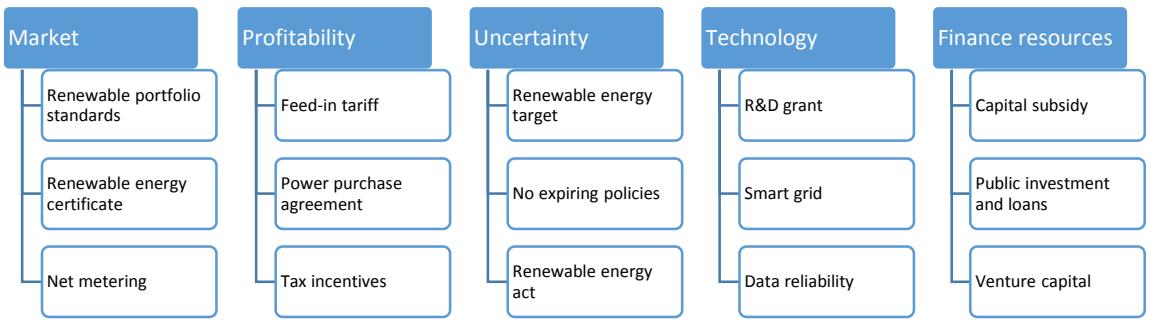
2.2. Index construction

This study chooses three most relevant indicators for each of the five criteria, so as to give balanced weight to each criterion when we evaluate the existing policies of a country. Specifically, we examine the following renewable energy policies (Figure 2.5):

- Market: Renewable portfolio standards (RPS), renewable energy certificate (REC), net metering
- Profitability: Feed-in tariff and/or feed-in premium, power purchase agreement (PPA), tax incentives
- Uncertainty: Renewable energy target, near expiry or frequent policy revisions, renewable energy act
- Technology: research and development (R&D) grant, smart grid, data reliability
- Finance resources: capital subsidy and/or rebate, pubic investment and loans, venture capital

In the following, the scoring process is explained for each of the indicators.

Figure 2.5: Index Construction



R&D = research and development.
Source: Prepared by the authors.

Market

Renewable portfolio standards (RPS), 'renewable obligations', or 'mandated market shares', are a statutory obligation where a utility company or consumers must provide a percentage of installed capacity from renewable energy sources. RPS were in place in 25 countries in 2013 (REN21, 2014). Since the regulation to some extent ensures the existence of the renewable energy market, it is used as a market indicator. The indicator equals 1 if RPS exist, otherwise equals 0.

A renewable energy certificate (REC), a certificate given to the generation of one unit (typically 1 megawatt hour [MWh]) of renewable energy, is associated with RPS programmes. The REC market exists mainly because of the obligation with which power supply companies have to abide, while some RECs are used to meet the voluntary renewable energy targets. For instance, the Australian government has implemented a target of 20% electricity generated from renewable energy sources by 2020. The target is estimated to require 45,000 gigawatt hours (GWh). As 1 MWh of energy equals one REC, 45 million RECs will be generated to meet the 2020 target. Since the demand for and supply of REC indicates the existence of the renewable energy market, it is taken as an indicator of the maturity of renewable energy market. The indicator equals 1 if a REC exists, otherwise equals 0.

Net metering is widely used in the United States (US) and Europe. It is a regulated arrangement in which electricity customers only need to pay for the amount of total electricity consumption minus self-generated electricity. The net metering policies vary across states and countries, that is, whether excess power is allowed to feed into the grid, which price is applicable to excess power, how long one can keep the banked credits, among others. Unlike the US, the electricity meter in Singapore cannot spin backwards, so they have separate meters to record exported and imported electricity. Besides, electricity exported to the grid is compensated at a lower price than the electricity consumed in Singapore. According to REN21 (2014), up to 2013, there were 43 countries worldwide adopting net metering policies. The Philippines recently brought into effect the net metering policy legally established in 2008 and there is now a new set of interconnection standards. Net metering indicates the existence of a market for distributed renewable energy generation. The indicator equals 1 if net metering exists, otherwise it equals 0.

Profitability

Feed-in tariff (FIT) specifies a guaranteed price for every kilowatt hour (kWh) of electricity produced from renewable energy sources sold to the grid over a fixed period of time. It has been increasingly considered the most effective policy to encourage the development of renewable energy among academics and policy makers (Couture and Gagnon, 2010). Investors also have the same perception according to a survey of 60 professionals from European and North American venture capital and private equity funds (Bürer and Wüstenhagen, 2009). By offering long-term contracts and guaranteed pricing, FITs can significantly reduce the risks of investment in renewable energy technologies and renewable energy production, and provide a high degree of security to the investors on future cash flows. Most of the FIT policies are market independent, meaning there is a fixed or minimum price, while some of the FIT policies are market dependent, which are also known as feed-in premiums, as a premium is paid above the market rate. The indicator equals 1 if the country has a FIT policy, otherwise it equals 0. For instance, on 20 June 2014 the government of Viet Nam implemented the regulation on feed-in tariff support for waste-to-energy power plants; the tariff level is set to D2,114/kWh for power projects using solid waste for a period of 20 years. Therefore, the indicator for Viet Nam equals 1.

Power purchase agreements (PPAs) are legal contracts between power generating parties (the seller) and power purchase parties (the buyer) in which all of the commercial terms including schedules for delivery of electricity, payment terms, penalties for under delivery, and termination are well defined. Since a PPA can determine the revenue of a generating project, it is considered a sub-index for the profitability. The indicator equals 1 if the country has some form of PPAs in use, otherwise it equals 0.

Tax incentives could be in various formats, for example, investment tax credit, production tax credit, and value-added tax rebate, among others. Investment tax credit allows the deduction of tax obligations of firms that have invested in renewable energy, while production tax credit provides an annual tax credit to the qualified investor based on the amount of renewable energy used. Both tax credit schemes could help reduce the cost of investment and/or production and encourage the deployment of renewable energy projects. Besides these two, other tax incentives could also boost investment and attract investors in the renewable energy sector. For example, China in 2013 introduced a 50%

value-added tax (VAT) rebate for solar power plant operators and also put in place tax incentives for hydropower investors.[3] In India, the government allowed for accelerated depreciation at 80% for renewable energy investment in windmills installed before end March 2012 and accelerated depreciation at 15% afterwards. The indicator equals 1 if there exists any kind of tax incentive, otherwise it equals 0.

Uncertainty

A renewable energy target is a goal set by a state or national government to achieve a certain amount of renewable energy by a future date. China, for example, aims to increase the proportion of renewable energy in the total energy consumption from 5% in 2005 to 20% in 2020. The New Zealand government has identified clear goals for increasing renewable electricity generation through the *New Zealand Energy Strategy 2011–2021*, which specifies a target that '90% of electricity generation from renewable sources by 2025 providing this does not affect security of supply' (Ministry of Business, Innovation and Employment, 2011). The existence of a renewable energy target could give investors' confidence in the prospect of the renewable energy market, where it typically takes a longer time to reap the return of investment. The indicator equals 1 if any form of renewable energy target exists, otherwise it equals 0.

As argued by Shen and Luo (2015), subsidy policies have positive effects only for a short term. To account for the uncertainty of such policies, we take expiring dates into consideration. Expiring policies indicate the uncertainty of renewable energy policies ahead; while policy revisions, especially frequent and unfavourable revisions, suggest the inconsistency of the renewable energy policies. Investors would like to avoid both these situations during decision-making. Evidence shows that investors react to these uncertainties negatively. For example, repeated expiration and renewal of the federal production tax credit in the United States have caused a boom–bust cycle in the wind power industry (Barradale, 2010). In 2012, in particular, before its expiration, many wind power developers were found to close projects in a hurry and as a result there was 13.1 GW installed wind power in that year, but 1 year later, the US ended with just over 1 GW

[3] See the Announcement of Value-added Policies for PV Generated Electricity declared by the Ministry of Finance in China, 23 September 2013. Available at: http://www.chinatax.gov.cn/n810341/n810765/n812146/n812323/c1080750/content.html

installed wind power in that year. If the legislation such as FIT, net metering, and tax incentives are to expire within the next 3 years (beyond which investors have time to react), or there are unfavourable revisions of unexpired legislations within 1 year, the indicator is set to 0, otherwise is set to 1 (so that 0 represents a bad situation, and 1 represents a good situation). For example, the 50% VAT rebate in China, with effect from 1 October 2013 will terminate on 31 December 2015. Therefore, the score for this indicator is 0 in China.

A renewable energy act is usually a part of energy law that relates primarily to the legal and policy issues at the development, implementation, and commercialisation stages of renewable energy, such as land use, siting, and finance issues encountered by project developers. The existence of a renewable energy act may help reduce the uncertainty of policies, protect the interests of stakeholders legally, and boost the confidence of investors. The Renewable Energy Law was enacted on 28 February 2005 in China. Following that, renewable energy investment and development sped up (Wang et al., 2010). According to REN21 (2014), China's investment in renewable energy increased from $2.4 billion in 2004 to $56.3 billion in 2013, more than the total investment in all Europe. As such, China has become the top investor in the renewable energy sector. The indicator equals 1 if any form of renewable energy act exists, otherwise it equals 0.

Technology

An R&D grant is a grant that is used specifically for the research and development of renewable energy-related technologies. For example, to foster a domestic market, South Korea is investing $20,000 per technology per year in R&D, which will amount to $100 million by 2030. Globally, according to Renewable Energy Policy Network for the 21st Century (REN21, 2014), R&D expenditure on solar energy has declined by 2% to $4.7 billion in 2013; wind and ocean power R&D investment also declined slightly, while investment in other renewable energy sources such as biopower, geothermal, and small-scale hydropower went up slightly, and R&D investment in biofuels was stable. The indicator equals 1 if any form of R&D grant for renewable energy technologies and their adoption exist, otherwise it equals 0.

As mentioned in Nature News 2010 (Lindley, 2010), 'renewable energy is not a

viable option unless energy can be stored on a large scale', and the smart grid technology could be one way of 'evening out the usual peaks and troughs in grid load'. A smart grid is an 'electrical grid that uses information and communications technology to coordinate the needs and capabilities of the generators, grid operators, end-users, and electricity market stakeholders in a system' with the aim 'to improve the efficiency, resilience, reliability, economics and sustainability of the production and distribution of electricity' (Santhosh et al., 2013). The indicator equals 1 if any smart grid initiatives exist, otherwise it equals 0. The South Korean government, for example, together with major players in the industry, has launched a $65 million pilot programme on Jeju Island, which includes a fully integrated smart grid system for 6000 households, several wind farms, and four distribution lines. Therefore, the indicator in South Korea is 1.

Reliable and easy access to data regarding detailed resource assessment for renewable energy is important in the decision-making of investors. The indicator equals 1 if reliable data or capacity building support exists, otherwise it equals 0.

Finance resources

Project developers raise as much capital as possible from the cheapest source before moving up to the next cheapest tiers. Capital subsidy is a kind of 'free money'. For example, in India, 90% of the project cost is provided to the implementing agency for eligible projects separating agricultural and non-agricultural feeders or strengthening and augmenting sub-transmission and distribution infrastructure. The indicator equals 1 if any capital subsidy exists, otherwise it equals 0.

Public loans, usually at low interest rates, could be used specifically for deployment of renewable energy projects. For example, in the Yokohama Smart City Project of Japan, there is a provision of low-interest loans for renewable energy and energy efficiency investments. The indicator equals 1 if any form of public loans exist, otherwise it equals 0.

Venture capital or private equity investment facilitates the provision of funding to firms in the industry with unproven and high-risk technologies (Gompers and Lerner, 1999). In the last decade, venture capital investment in clean energy has grown dramatically from $230 million in 2002 to $4.1 billion in 2008 in the US (Ghosh and Nanda, 2010). In Asia

excluding China and India, it grew from almost nothing to $201 million in 2014 mainly due to two deals with Lanzatech and Sunseap Leasing (Bloomberg New Energy Finance, 2015). In China, venture capital investment in renewable energy technologies reached $403 million in 2006 (Huang, 2009). The indicator equals 1 if venture capital investment exists, otherwise it equals 0. Recent developments in investment channels include project bonds, green bonds, yield companies, and asset-backed securities (Table 2.1). Examples and critical reviews can be found in Eckhart (2014).

Table 2.1: Emerging Investment Vehicles for Renewable Energy

	Description
Project bonds	Debt securities issued on an individual project
Green bonds	Debt securities issued by corporations to support green investments
Yield companies	Listed investment companies with equities that pay dividends based on underlying assets
Asset-backed securities	Debt securities that pool assets such as mortgages or auto loans

Source: International Energy Agency (2015).

3. Results and discussions

3.1. Overall analysis

Table 2.2 shows the scores of 15 indicators across 16 EAS countries. Looking at Table 2.2 vertically, we find that in the whole EAS region, eight countries have set RPS, while REC and net metering exist in only five or six countries. This indicates that the renewable energy market exists in the region, but could be developed further. Incentives such as FIT or tax reductions are prevalent, while PPAs are rare. As to legislation related with renewable energy, the establishment of renewable energy acts is one of many areas that the EAS region could work on. Besides, policies that may advance technologies are scarcely seen. Financing resources, on the other hand, seem to be in place; but emerging and innovative investment vehicles are to be explored. Overall, it seems that the renewable energy market exists, while legislation, financing resources, and profitability considerations when making renewable energy investment decisions are also not major concerns, but technology advancement and reliability is a critical area where policies should pay attention.

Looking at Table 2.2 horizontally, we observe that India, Australia, China, Japan, and South Korea are among the top ranked countries in the East Asia Summit region in terms of renewable energy investment policies, while Brunei Darussalam, Cambodia, Lao PDR,

and Myanmar are far behind, with a score of only 1 or 2.Brunei Darussalam is rich in oil and natural gas reserves, and therefore renewable energy investment policies are not given enough importance and priority yet. The developing countries such as Cambodia, Lao PDR, and Myanmar, however, may face challenges in energy supply and need to boost their efforts to develop renewable energy in the future. Of course, this policy evaluation framework is better implemented within a more complete list of countries globally before we reach any concrete conclusions.

Table 2.2: Renewable Energy Policies in the East Asia Summit Countries

Country	Market			Profitability			Legislation uncertainty			Technology			Finance			Total
	RPS	REC	Net metering	FIT	PPA	Tax incentives	RET	Expiring policies	RE act	R&D grant	Smart grid	Data reliability	Subsidy	Public loan	VC	
Brunei Darussalam	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Cambodia	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Indonesia	1	0	0	1	1	1	1	1	0	0	0	0	1	1	0	8
Lao PDR	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Malaysia	1	0	0	1	0	1	1	0	1	0	0	0	0	1	1	7
Myanmar	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Philippines	1	0	1	1	1	1	1	0	1	0	0	0	1	1	0	9
Singapore	0	0	1	0	1	1	0	1	0	1	0	1	0	1	1	8
Thailand	0	0	1	1	0	1	1	0	0	1	1	1	1	1	0	9
Viet Nam	0	1	0	1	1	1	1	1	0	0	0	0	1	0	0	7
Australia	1	1	0	1	0	0	1	0	1	1	1	1	1	1	0	10
China	1	0	0	1	1	1	1	0	1	1	1	0	1	1	1	11
India	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	13
Japan	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	12
South Korea	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	13
New Zealand	0	0	0	1	0	0	1	1	0	1	0	0	1	0	1	6
Subtotal	8	5	6	10	7	10	13	11	7	6	4	6	10	10	6	
Total		19			27			31			16			26		

FIT = feed-in tariff; PPA = power purchase agreement; R&D = research and development; RE = renewable energy; REC = renewable energy certificate; RET = renewable energy target; RPS = renewable portfolio standards; VC = venture capital.

Sources: Bloomberg New Energy Finance (2015); REN21 (2014; 2015); and various sources.

If we take 80% of policy prevalence as a threshold to think that the renewable energy policies are attractive to investors, none of the five dimensions are reaching the satisfactory level from the perspective of the whole EAS region (Table 2.3). However, legislation uncertainty and risk, with a policy prevalence of 64.6%, seems to be not a big issue to investors in the region. Renewable energy policies to ensure profitability and accessibility to finance resources are not adequate. However, the region needs to catch up and emphasise the dimensions on stimulating the development and adoption of new technologies and creating a market for renewable energy.

Table 2.3: Ranking Index Dimension

Ranking	Policies dimension	Prevalence
1	Legislation uncertainty	64.6%
2	Profitability	56.3%
3	Finance resources	54.2%
4	Market	39.6%
5	Technology	33.3%

Source: Prepared by the authors.

Ranking countries by the index of renewable energy policies, Table 2.4 shows that three of the EAS countries (India, South Korea, and Japan) are doing well with a score above 12 or prevalence above 80%. They are followed by China and Australia and two ASEAN countries (the Philippines and Thailand), which have average performance in terms of the presence of policies to promote renewable energy investment and development. Indonesia, Singapore, Malaysia, and Viet Nam, as well as New Zealand are lagging. But the countries that need most improvement in the renewable energy sector are the four ASEAN countries, Cambodia, Lao PDR, Brunei Darussalam, and Myanmar.

Table 2.4: Country Index Rankings

Ranking	Ranking definition	Countries
Good	Above 80%	India, South Korea, Japan
Average	Between 60% and 80%	China, Australia, the Philippines, Thailand,
Poor	Between 40% and 60%	Indonesia, Singapore, Malaysia, Viet Nam, New Zealand
Need much improvement	Below 40%	Cambodia, Brunei Darussalam, Lao PDR, Myanmar

Source: Prepared by the authors.

3.2. Renewable energy policy analysis by country

In this sub-section, we examine the renewable energy policies in the individual countries in detail.

Brunei Darussalam: Brunei Darussalam is rich in oil and natural gas reserves, and therefore it has had little interest in the development of renewable energy. However, due to worldwide focus on renewable energy and also to diversify its energy sources, Brunei Darussalam, in its 2011 Energy White Paper, set a goal of generating 10% of electricity from renewable energy by 2035 and in its 2014 Energy White Paper, another goal of reaching 124 GWh of renewable power generation by 2017 and 954 GWh by 2035. FITs are also being planning.

Cambodia: Cambodia has many renewable energy resources such as hydropower and biomass. It is estimated that renewable energy has the potential to generate 67,388 GWh per annum, which is about three times the total energy consumption in the country. However, the installed capacity is low at only 85 GWh in 2004 (Mallon, 2006). As shown in Table 2.2, the lack of policy support is one of the main problems. Although the government has targeted to have 15% of electricity generated with renewable energy by 2015 and enable 70% of rural people to have reliable electricity services by 2030 (Sarraf et al., 2013), the government has a long way to go to make its renewable energy sector attractive to investors. Various policy measures to expand and improve grid accessibility, develop capacity building, and provide financial incentives should be taken simultaneously.

Indonesia: Due to its volcanic geology, Indonesia has a huge geothermal potential, which is estimated to be 28,000 MW accounting for 40% of the world's potential geothermal resources (Hasan et al., 2012). In addition, as Indonesia lies on the equator and has large coastal areas, it also has potential in wind and solar energy. Furthermore, Indonesia is the largest palm oil producer in the world and as a result it can use biodiesel as an alternative fuel. While it has potential, renewable energy contributes to only 3% of power generation (Jotzo, 2011) because of the lack of fiscal and financial incentives and technological barriers. The government should put the promotion of renewable energy as its priority (Gunningham, 2013). Recently the government has taken steps such as developing energy policy and regulations, targeting 17% renewable energy in the energy mix in 2025 and expanding FIT support (REN21, 2014) but it will take time to see the effect.

Lao PDR: Lao PDR is a fiscally poor country with three quarters of land being mountains. As a result, there is little financial assistance to renewable energy investment. The country is in the stage of setting up strategies. Grid electrification is currently the most important energy strategy and using renewable energy technologies such as solar home systems is an option to consider. Another off-grid electrification technology – pico-hydropower, a technology that generates ≤ 1 kW at the individual household level– has been well established but neglected (Smits and Bush, 2010). In addition, central Lao PDR has good wind potential and the Lao PDR government targets to have 30% of renewable energy in the energy mix by 2025 (REN21, 2014).

Malaysia: Renewable energy was first targeted to be the major contributor to the electricity generation in 2001 when the five-fuel diversification policy was announced in the 8th Malaysia Plan (2001–2005). The aim to generate 500 MW of electricity to the grid and account for 5% of the energy mix was not reached and it ended up with only 12 MW at the end of the plan (Mekhilef et al., 2014). In the 10th Malaysia Plan (2011–2015) FITs were introduced and the Malaysian government targets to generate a total of 985 MW electricity from renewable energy during this period. To promote renewable energy investment and utilisation, there are many fiscal incentives implemented such as the 'Pioneer Status' where companies are exempted from income tax on 100% of statutory income for 10 years, sales tax exemption, import duty exemption, and investment tax allowance, among others (Malek, 2010). However, whether the target can be met is a concern, given the absence of renewable energy markets and constraints of technological and financial factors (Table 2.2).

Myanmar: In Myanmar, the electrification rate was 13% in 2009 (IEA, 2013) and 26% in 2010 (REN21, 2014). The renewable energy generation is virtually all from hydropower projects, while only 10% of hydropower resources have been tapped (EPI, 2013). Given its economic and political status, there are few renewable energy policies in place except a memorandum of agreement signed in 2014 between the Ministry of Electric Power and ACO Investment Group and a US-based energy company, Convalt Energy LLC, which aimed to build two 150 MW solar facilities in the Mandalay region.[4]

The Philippines: The Philippines is characterised with a tropical climate, high rainfall,

[4]Myanmar government website. 'Myanmar kick-starts its renewable energy development', http://www.myanmarpresidentoffice.info/en/?q=issues/asean/id-4084 (accessed 28 August 2015).

and volcanic geography. As a result, it has great potential in hydropower, wind, and geothermal energy development. In fact, the Philippines has managed geothermal energy well in the past (Bakhtyar et al., 2013). The Renewable Energy Act of 2008 is in existence to accelerate renewable energy development. The government began implementing E1-mandated (1% ethanol blended with gasoline) delayed since 2011 and brought into effect the net metering policy that was established in 2008. The Philippines FITs are typically for a 20-year period. Although it does not have degression rates, it is subject to review should any changes occur and therefore leads to uncertainty concerns for private investors. Policies to support development of renewable energy technologies and facility building are mostly missing in the country (Table 2.2).

Singapore: Singapore has limited renewable energy options and the most viable renewable energy option seems to be solar energy given its average solar irradiance of 1,150 kWh/m^2 per annum.[5] Singapore is investing heavily in renewable energy, amounting to $228 million during 2007–2015 with a focus on photovoltaic systems (Dulal et al., 2013). It raised the cap on total power provided by variable renewable energy to 600 MW during peak demand. The government also provided funding for research and development to aid the industry's capability development on promising renewable technologies. Innovative financing and offsite PPA are being explored to create business opportunities in the renewable energy sector.

Thailand: Thailand introduced a new FIT for distributed solar energy and revised others. Furthermore, it extended subsidies for solar water heaters to 2021 and established a $121 million fund to encourage deployment of photovoltaic systems on buildings. According to the long-term 10-year alternative energy development plan 2012–2021, the target is to increase renewable energy consumption in the energy mix to 25% by 2021, and ethanol consumption will be increased to 9 million litres/day and biodiesel increased to 5.97 million litres/day by 2021 (IEA, 2013). In 2030 20,546.3 MW of electricity will be generated from renewable energy, which will be 29% of total electricity generation (Chingulpitak and Wongwises, 2014). The FIT policies have been comprehensive and contributed to private investment in the renewable energy sector in Thailand (Tongsopit and Greacen, 2013). However, to further promote renewable energy technology and

[5]Singapore Energy Market Authority website. 'Overview', https://www.ema.gov.sg/Renewable_Energy_Overview.aspx (accessed 27 August 2015).

utilisation, the market for renewable energy investment is yet to be expanded and legislation is to be launched (Table 2.2).

Viet Nam: In 2008 the government approved the National Energy Development Strategy, which sets targets to achieve 3% renewable energy in the energy mix in 2010, 5% in 2020, 8% in 2025, and 11% in 2050. Biomass and hydropower are the leading renewable energy resources in Viet Nam (Toan et al., 2011). It is estimated that renewable energy such as hydropower, biomass, and geothermal would become less costly for 2010–2030 (Nguyen and Ha-Duong, 2009) while wind and solar are unlikely to be commercially exploited in Viet Nam in the near future (Do and Sharma, 2011). To encourage the development of renewable energy, some of the key difficulties the government need to overcome are lacking awareness and reliable data on renewable technologies and potentials as well as inadequate policy and regulatory framework (Table 2.2).

Australia: The share of renewable energy in total primary energy supply was 6% in 2013, in which hydropower contributes 20%, biofuels and renewable waste account for 63.7%, and the remaining is from geothermal, solar, wind, and tide (IEA, 2015). It has increased only slightly from 5.9% in 1990. According to Bloomberg New Energy Finance (2015), investment in wind, solar, and other clean energy sources in Australia fell by 35% in 2014, which is the lowest level since 2009. This is primarily due to the government's review of the renewable energy target and the policy uncertainty causing concerns among investors.

New Zealand: New Zealand was among the first to exploit renewable resources, but over the last 20 years development of renewable energy is slow. The inadequacy of renewable energy policies as shown in Table 2.2 is a case in point. In 2013, renewable energy mainly hydropower contributes to 75.1% of the electricity generation. The figure is targeted to increase to 90% by 2025. What's more, a fully renewable electricity generation is proposed (Mason et al., 2010). Economic studies suggest wind and geothermal sources are the most likely candidates to support the achievement of the target and policies to address the development barriers and coordinating competing resource demands are needed (Kelly, 2011).

China: China has abundant renewable energy resources. Since 2005 when the Renewable Energy Law was enacted, the government has launched a variety of policies to promote the development of renewable energy. Shen and Luo (2015) evaluate the effects

of many renewable energy policies such as transfer payments, tax preferential policies, price control, and compulsory allocation. Due to the huge financial support from the government, China led the world in new renewable capacity installations in 2013 and 2014 (REN21, 2015). However, as shown in Table 2.2, the market appears to be incomplete and technologies such as a smart grid are still lagging (though it is said that the government will invest $240 billion to the smart grid project between 2016 and 2020).

India: India has been ranked the fifth most attractive market in the latest Renewable Energy Market Attractiveness Index. Schmid (2012) found that the Tariff Policy 2006, state-level policies, quantity-based instruments, and participation of the private sector contributed significantly to installed capacity from renewable energy power using a sample of nine Indian states from 2001–2009. The Electricity Act enacted in 2003 is a major boost for renewable energy promotion in India since it empowers the regulators to promote renewable energy and make specified policies (Huang, 2009). The 2006 National Tariff Policy sets a deadline for implementing renewable energy measures. In 2008, RPS (or the Renewable Purchase Obligation) was set to produce 15% of the electricity with renewable energy sources by 2020. Along with the RPS, RECs were launched in 2010. With all these renewable energy policies, electricity generated from renewable energy accounts for around 16% of the total production of electricity (IEA, 2014).

Japan: Japan is a country lacking domestic fossil energy sources; however, more than three quarters of primary energy supply in Japan is from fossil fuel (Chen et al., 2014). As a result, the country depends heavily on imported fuel, which has caused substantial concerns on energy security domestically. On the other hand, the Fukushima nuclear catastrophe in 2011 has drawn public attention to energy safety. Both forces have led to the growing renewable energy market. As shown in Table 2.2, Japan scores highly in the renewable energy policies. For example, RPS has been in practice since 2003, net metering for wind and solar energy was in place in 1992, and the solar FIT scheme began in 2009. In addition, the Energy Act has been updated over time, from the 1997 New Energy Act to the 2009 Non-Fossil Energy Act. One area the government may need to consider is policy support for more R&D activities and smart grid operation.

South Korea: South Korea has huge renewable energy potential of 2.3 million tonnes of oil equivalent (MTOE) theoretically (Chen et al., 2014). South Korea targeted to use 5% renewable energy sources in total primary energy supply by 2011 in the 2nd Basic

Plan for New and Renewable Energy Technology Development and Deployment and in the 3rd Basic Plan in 2008 raised the target to 11% by 2030.The government also supports R&D of green energy technologies aggressively (Ministry of Trade, Industry and Energy, 2011) and launched the Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy 2011 on top of the Energy Act 2006. However, due to the financial burden, the government discontinued FITs in 2011 and replaced it with an RPS programme.[6] Most of the renewable energy policies that encourage new investments are in place but how to make them sustainable and more attractive is the next challenge.

4. Conclusions and policy implications

This study attempts to build a framework to quantitatively assess renewable energy investment policies from the investors' point of view or that of financing of projects. Using five criteria – market, profitability, legislative uncertainty, technology, and finance resources, and three indicators under each criterion, this study compares the policies in the 16 East Asia Summit countries and derives implications for the region as a whole.

The market aspect examines whether policies helped to create and extend a market for renewable energy. The profitability aspect considers whether policies provided the environment in which potential profits from renewable energy investment can be improved. The uncertainty aspect examines whether there are laws that reduce risks relating to investment in renewable energy. The technology aspect shows whether and how policies helped to develop and adopt renewable energy technologies. The finance aspect presents policies that could improve the availability of funds by addressing issues on the supply side, including financial institutions, financial markets, financial tools, and business models.

The values of each indicator are collated and the cardinal values are converted into ordinal values for analysis. As the results for the 16 EAS countries show, India, Australia, China, Japan, and South Korea are among the top-ranked countries in the EAS region in terms of renewable energy investment policies, while Brunei Darussalam, Cambodia, Lao PDR, and Myanmar are far behind. By examining the whole EAS region, the renewable energy market exists, but could be developed further. Incentives such as feed-in tariffs or

[6] However, some local governments such as Seoul and Gyeonggi-do still have FITs in force for photovoltaic facilities less than 50 kW.

tax reductions are prevalent, while power purchase agreements are less common. As to legislation related to renewable energy, the establishment of renewable energy acts is one of many areas the EAS region could work on. Besides, policies that may advance technologies are scarcely seen. Financing resources (especially traditional vehicles), on the other hand, are already in place.

Through comprehensive quantification of the renewable energy investment policies in the EAS region, this study presents a systematic and quantitative measure to compare the effectiveness of policies in these countries and therefore policy implications could be easily drawn. For instance, the index can be used to help policymakers identify the weakness or gaps of their policy design and implementation, learn from the best practices of other countries, and also strengthen policy design and implementation. Furthermore, the index framework can be easily expanded.

Upon the construction of the index and analysis of the collated information, this study presents the following policy implications:

- In the EAS region, a weaker form of the renewable energy market exists. Policies such as REC and net metering should be implemented further to realise its potential.
- Renewable energy acts, which are commonly lacking in the region, could be the next step that individual countries and the whole region should work on to ensure the consistency and continuity of policies related to renewable energy investment.
- The development and advancement of renewable energy technologies have not been given enough emphasis, and policies targeted specifically at technology such as smart grids, as well as reliable, timely, and regularly updated data, and capacity building should be implemented.
- Policies related to the profitability and financial resources are prevalent in the region. Policy stability and predictability, especially in developing countries, becomes more important to ensure the investors' confidence to leverage the finance instruments such as preferential loans and grants available to carry out long-term renewable energy projects.
- ASEAN countries in the EAS region still lag in all the five aspects of renewable energy investment policies. ASEAN should focus on creating a market through legislation and introducing FIT or RPS so as to catch up with the international renewable energy markets.

The methodology and framework adopted in this study is scalable to capture more details and features of policy design and implementation in the region, provided that

relevant data are available. The next steps in this stream of studies should be to build a policy database as detailed and as updated as possible and provide a more accurate assessment of how effective renewable energy policies are from the financing of projects point of view.

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