Effectiveness of Renewable Energy Policies in Promoting Renewable Energy Development:

The case of Feed-in-Tariff (FiT) and Renewable Portfolio Standard (RPS)

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List of Acronyms

COP21	Conference of Parties 21
FiT	Feed-in-Tariff
GDP	Gross Domestic Product
ISS	Institute of Social Studies
MW	Megawatt
OECD	Organization for Economic Cooperation and Development
RE	Renewable energy
RPS	Renewable Portfolio Standard
UN	United Nations
UNFCC	United Nations Convention on Climate Change
WEC	World Energy Council
WESP	World Economic Situation and Prospects
WGI	World Governance Indicator

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Abstract

With the renewed global motivation to develop cleaner infrastructure technologies, particularly on energy production, and to strengthen response to the threat of climate change, several countries have adopted various policies such as feed-in-tariff (FiT) and renewable portfolio standard (RPS) to promote the development of renewable energy. This paper therefore examines the effectiveness of FiT and RPS in promoting global renewable energy capacities using a panel data of 183 countries worldwide. Results suggest that, in general, FiT and RPS helps increase renewable installed capacities, both in cumulative and additional capacities, in various magnitude across different types of renewable energy sources (solar, wind, and geothermal). These findings were utilized to provide insights on potential implications in dealing with policy decisions towards a sustainable and progressive energy sector

Relevance to Development Studies

With the looming impacts of climate change brought about by harmful effects of carbon emissions on the environment, there is an urgent need to develop alternative ways to conserve and protect the environment. In view of this, creating an enabling environment for environmental policies to thrive is of paramount importance in order to sustain environmental resources for a longer period of time. As the excessive amount of harmful carbons are tagged as the main culprit for worsening condition of climate, it is only but necessary to develop innovative policies to promote cleaner alternative to energy production. Among the most notable renewable energy-specific policies to date are the feed-in-tariff (FiT) and renewable portfolio standard (RPS). Both policies share similar objective of stimulating the deployment of renewable energy capacity to finally shift away from utilizing traditional and harmful energy sources such as the fossil fuels.

This research hopes to shed light on the benefits of going cleaner in energy production without compromising reliability to sustain the growing demand for electricity of the population. Current efforts to maximize the potential of renewables however is not yet enough, hence, it becomes even more critical nowadays to further push for the promotion of these kinds of policies in order to attain a future without fossil fuels anchored on the overall protection and sustainability of the resources and environment.

Keywords

Feed-in-Tariffs, Renewable Portfolio Standards, Renewable Energy

Chapter I. Introduction and Background

Climate change has undoubtedly become a serious concern across the globe with its effects already being felt in many areas, especially the most vulnerable ones. Many experts have believed that the changing climate has been brought about by several man-made factors which have severely affected how the ecological environment has naturally existed . Several scientific studies, supporting the claim that the activities of humans were the main culprit of this adverse phenomenon, have been released with an objective of raising awareness to find alternative ways and means to production in an attempt to reverse, or at the least, mitigate the impacts of climate change. One particular area which has been identified to have significantly contributed to the worsening condition of the environment is the energy sector. The excessive amounts of carbon released in the atmosphere due to burning of fossil fuels to produce the world's energy requirement has severely degraded environmental quality which resulted into unusual weather patterns, among many others. In the context of climate change, the amount of carbon dioxide that have been emitted in the atmosphere for the last decade has doubled in comparison to what had been produced during the pre-industrial era, and the worse part of it is the fact that about half of the carbon dioxide that is burned stays in the atmosphere (Papyrakis, 2017). Scientific investigations suggest that the effect of such enormous level of pollutants, such as carbon, in the atmosphere is daunting, creating havoc that could potentially affect an entire economy significantly.

Recent data reveals that the biggest carbon emitters come from developed countries, i.e., United States, Russia, Japan, European Union, and other countries belonging to the Organization for Economic Cooperation and Development (OECD), wherein they produce above global average amounts of carbon dioxide (Papyrakis, 2017). As the said countries belong to the biggest economies which more or less controls majority of the global economic activities, the interventions to reduce carbon emission has never been more difficult. Nevertheless, many countries remain hopeful and have adopted various energy policies aimed at providing more sustainable and reliable energy supply and more importantly, minimizing the adverse impacts of climate change. In fact, as early as 1990s, there was already an explosion of energy policy changes around the globe driven by economic, environmental, security and social concerns, many of which have a profound influence on renewable energy, both from the policies explicitly designed to promote renewable energy and from others that indirectly influence incentives and barriers for renewable energy (Beck and Martinot 2004:365). As enumerated by Mendonca (2007) in his book, the transition from an energy system based on fossil fuels to renewable sources is indispensable due to the following reasons:

(i) Health and survival of humanity is dependent on the sustainability of the planet's natural resources and systems;
(ii) Energy dependence and security of energy supply helps promote global peace and security; and
(iii) The potential economic advantage of quickly developing existing renewables markets are enormous.

The most recent development relating to policy directives pertaining to renewable energy was the adoption of the United Nations Framework Convention on Climate Change (UNFCC). This has been viewed as a renewed global motivation to develop cleaner infrastructure technologies, particularly on energy production, to strengthen its response to the threat of climate change in order to sustain development in the years to come. This treaty led to the Kyoto Protocol, which is essentially sets emission targets for developed countries, specifically to reduce greenhouse gas emissions, based on the agreed fact that: (i) global warming exists, and (b) human-made carbon emissions have caused it. In fact, during the 21st annual session of the Conference of the Parties (COP21) to the UNFCCC held in December 2015, it has been collectively agreed upon by 195 member-countries to keep the global temperature rise well below 2 degrees Celsius above pre-industrial levels and to limit the temperature increase even to as low as 1.5 degree Celsius (UNFCC 2016). Said agreement prompted most countries to pave a path of low-carbon investments by committing to scale up renewables and energy efficiency following the emergence of a strong international consensus to transition away from traditional and harmful fossil fuels (REN21 2016). However, these actions may not be able to fully materialize without the presence of enabling environment that would mobilize these initiatives.

1.1 Status of Renewable Energy Use

Renewable Energy (RE) remains to be a secondary energy resource as they come next to the traditional non-renewable energy sources such as coal, oil, and gas. Based on the report by the World Energy Council (2016), the primary energy consumption over the past 15 years is consistently dominated by oil, coal, and gas. As of 2015, roughly 86 percent of the global total energy consumption comes from the three fossil fuels, while the remaining 14 percent is distributed among renewable sources, such as hydropower, wind, solar, and nuclear.

Though it appears that the hegemony of fossil fuels will likely persist in foreseeable future, its share on total energy consumption has been continuously declining over time (see Table 1). The World Energy Council in its most recent World Energy Resources Report indicated that renewable energy has been gaining momentum for more than a decade for most regions globally. Europe has registered the biggest leap on renewable energy use with a 14.1 percent increase from 2005 to 2015. This could probably be attributed to a number of European countries, e.g., The Netherlands, Germany, and France, etc., which are aggressively tackling environmental issues which pushes them to adopt alternative ways to generate cleaner energies. Positive developments in renewable energy utilization were also seen in Asia-Pacific, North America, and Africa regions. However, Latin America and Middle East remains lagging behind in shifting to cleaner alternatives to electricity production. Though this downward trend is not too surprising particularly for the Middle East as they are known for oil-producing region of the world, where the biggest global oil supplies are coming from. Nevertheless, the development of renewables in most parts of the world is continuously increasing, though at a slow pace.

Table 1. Share of Renewable Energy in Electricity Production

Region	Share of RE in Total Electricity Production (in percent)			Change
	2005	2010	2015	
Africa	16.9	17.4	18.9	2.00%
Asia	13.9	16.1	20.3	6.40%
Europe	20.1	25.7	34.2	14.10%
Latin America	59.3	57.7	52.4	(6.90%)
Middle East	4.3	2	2.2	(2.10%)
North America	24	25.8	27.7	3.70%
Pacific	17.9	18.6	25	7.10%

Source: Adopted from the World Energy Resources Report (2016), World Energy Council; and Enerdata (2016) Energy Statistical Yearbook.

The insignificant share of renewables in total energy mix pushes most countries to develop various renewable energy policies to further spike up its development and hopefully turn the technology to be cost competitive with traditional sources of energy. The need for enacting policies to support renewable energy is often attributed to a variety of barriers or conditions that prevent investments from occurring. Often, the results of these barriers is to put renewable energy at an economic, regulatory or institutional disadvantage relative to other forms of energy supply (Beck and Martinot 2004:366). Theoretically, substantial environment and economic benefits can be accrued from adopting renewable energy policies. However, these barriers always exist that discriminates renewable energy relative to other traditional sources of energy. Such barriers may include provision of subsidies for conventional forms of energy, high capital cost requirement, imperfect capital markets, imperfect information, poor market acceptance, financing risks and uncertainties, and a variety of regulatory and institutional factors (Beck and Martinot 2004:366).

1.2 Renewable Energy Policies

There are quite a number of energy policies that have been adopted by different countries, most of which caters to what is deemed required and needed consistent with their energy policies. Similar in other sectors, energy policies, particularly for renewable energy, are dynamic in nature due to the fact that there are no one-policy-fits all type of policy that could address all barriers within jurisdictions. The goal of most renewable energy-specific policies is to stimulate investments that would serve as the catalyst to further develop the use of renewables against other forms of energy sources. However, the enactment of one policy does not guarantee a clear-cut solution that could solve the existing impediments that puts renewable energy to a disadvantage relative to traditional energy sources.

Table 2. Summary of Renewable Energy-specific Policies

Policies	Description	Key barriers addressed	Specific policies
RE Promotion Policies			
Price-setting policies	Sets certain price to be paid for renewable energy	High capital cost, unfavorable pricing, risks and uncertainties	US Public Utility Regulatory Policies Act (PURPA), Feed-in-laws (FiT), RE Green Certificates
Quantity-forcing policies	Requires a fixed amount or share to be sourced from renewables	High capital cost, risks and uncertainties	Competitively bid renewable -resource obligation, renewable portfolio standards (RPS)
Public investment and market facilitation activities	Allocates public funds for direct investments or sovereign guarantees to stimulate investments	transaction costs, risks, lack of access to credit	US' System Benefit Charge (SBC)
Transport Biofuels Policies			
Biofuels mandates	Mandates specific share of transport fuel consumption from biofuels	Lack of fuel production or delivery infrastructure	Brazil's ProAlcool Program
Biofuel tax policies	Provides tax reliefs for biofuels	High capital costs	US Federal Ethanol Tax Credit
Emission Reduction Policies			
Cap and trade policies	Allows renewable to receive monetary credit for local pollutant emission reduction	Environmental externalities	Acid rain subprogram
Greenhouse gas mitigation policies	Allows renewable to receive monetary credit for greenhouse gas emission reduction	Environmental externalities	New Jersey Sustainability Greenhouse Gas (GHG) Action Plan
Cost Reduction Policies			
Subsidies and rebates	Reduction of initial capital outlay for RE systems	High capital cost requirement	Japan's Sunshine Program, Germany's Solar Roof Program
Tax Relief		Lack of energy production and investments	Personal tax incentives, pollution tax incentives

	Various tax incentives to spur RE development	

Source: Renewable Energy Policies and Barriers, Beck and Martinot (2004)

As several barriers exist in limiting the potential of alternative and cleaner sources of energy to prosper, it is only but fitting that countries adopt varying ways to address such challenges to further improve the development of renewables. Most common strategies that governments adopt are provision of state subsidies and/or guarantees to remove potential financial risks that prohibits private investments from cashing in (see Table 2 for the summary of various renewable energy-specific policies adopted worldwide). Another policy that is currently being used by several countries, particularly in East Asia, is the "Cap and Trade" policy which essentially monetizing the emissions of harmful elements produced by the countries. Sometimes termed as "green certificates', this type of policy allows renewable sources to receive monetary credit for local pollutant emission reduction initiative and, in turn, the certificates can be traded away in secondary markets as these are valued by the market.

While certain policies can be concluded as effective in one way or another, the continuous pursuit of governments to serve their agreed commitments to break free from the harmful environmental effects of fossil fuels prompts them to mold various ways and policies that would create an enabling environment to increase its renewable energy production. Among the most notable policies that countries utilize nowadays, regulatory policies such as the Feed-in Tariff (FiT) and Renewable Portfolio Standard (RPS) are emerging as the most popular options for promoting renewable energy generation (Komor 2004:23). Despite choosing to focus on the aforementioned two 2 (two) policies, this research does not put prejudice on the positive contribution of other similar renewable energy policies such as capital grants and direct public investments that certainly created achievements in promoting renewable energy production globally.

Table 3. Percent of countries by continent that utilizes FiT and RPS policies

Continent	% of countries that adopt FiT	% of countries that adopt RPS
Asia	29%	22%
Africa	15%	-
Europe	69%	76%
Central America	13%	-
South America	31%	8%
North America	67%	50%
Oceania	7%	7%

Source: Data are based on own calculations of the author

As previously mentioned in Table 2, Feed-in-Tariff and Renewable Portfolio Standard are perfect examples of a price-setting policy and quantity-forcing policy, respectively. FiT is a price regulation policy which provides price guarantees to electricity suppliers who utilizes renewables sources in its energy generation. The guarantees are typically sovereign in nature which are being paid by governments on a per kilowatt-hour basis of energy produced by electricity plant owners. Price setting often varies across countries as each adopts a different policy design that fits to the needs and goals of their priorities. Given that the objective of the FiT policy is to promote the use of renewables in energy generation, it can be expected that price guarantees shall be high enough that would be attractive enough for the private owners to invest in the technology. Similar to any new technologies, the low investment level on renewable energy can be mainly attributed to its high capital cost requirement and low revenue generation potential. A renewable developer seeks always competitive return in its investment commensurate with its business' risk and must obtain a long-term revenue stream to cover expenses and provide a reasonable rate of return on its investments (Alagappan et.al 2011:5100). This requirement can possibly be provided by a policy, such as FiT, that can give a form of guarantee which could solve the feasibility concerns on engaging in new technologies. The FiT price, however, can be subjected to adjustments (based either on foreign exchange rates or degression rates) at some point once economies of scale sets in thus making the technology cheaper and more feasible in the long run. On the other hand, the renewable portfolio standard is a command-and-control quantity regulation mechanism wherein the government dictates a minimum percentage share of total energy production to be sourced from renewable sources. Though essentially both policies share similar objective, differences could be seen on the fundamental mechanisms of achieving the goal where FiT tries to sustain the renewable market by government allocation of guarantees while RPS provides incentives to electricity suppliers through secondary market (Reiswig 2013:2).

The implementation of FiT and RPS did not begin until late 1990s. The emergence of policy changes in 1990s driven mostly by environmental and social concerns have brought up the idea of aggressively dealing with how to turn the tide from decreasing carbon emissions worldwide. It has been a common knowledge that fossil fuels mainly causes the depletion of the environment through carbon emissions. Considering the fact that industrialized countries, e.g, United States, United Kingdom, Germany, France, Netherlands, etc., contribute mostly to the carbon levels in the atmosphere, the initiatives to adopt renewable energy-specific policies started with these countries. In fact, majority of the renewable energy policies in early 2000s were only adopted either in the United States or certain parts of Europe. It was only in mid-2000s that these policies began to transition to other parts of the world owing to the belief that protecting the environment is a global responsibility. Despite the late initiative of several countries apart from USA and Europe, the adoption of FiT and RPS policies have already been seen in Asian and African countries, though the latter has yet to take RPS as an effective tool in promoting renewable energy use in electricity production (see Table 3).

Table 4. Percent of countries that utilizes FiT and RPS policies, by classification

Classification	% of countries that adopts FiT	% of countries that adopt RPS
Developed	56%	61%
Developing	21%	7%

Source: Data are based on own calculations of the author.

In terms of country classification, it is evident that significantly more developed countries have adopted FiT and RPS than developing countries as seen in Table 4 above. This classification of countries is based on a 2014 study prepared by the World Economic Situation and Prospects (WESP) which essentially grouped all countries based on certain parameters to determine basic economic country conditions (e.g., income, population, etc.) of each countries. Note that in these classification, China and India remain to be categorized under developing economies despite their recent emergence as global economic powerhouse from Asia. Nevertheless, it is worth noting that in developed economies, RPS appeared to be more attractive than FiT while the situation is reverse for developing countries. This opposite scenario may likely support the evidences that RPS has been more attractive for countries who have adopted renewable energy-specific policies much earlier, while new and emerging countries who have started to adopt green energy policies fairly more recent sees FiT as a newer and more innovative way to develop their renewable energy sectors.

The climate agreements forces more industrialized countries to have greater commitment in terms of reducing its carbon emissions in comparison to less developed countries. This is illustrated on theory by the environment Kuznets Curve (inverted U-Curve) where it explains the behavior of developed countries in terms of its environmental policies. Less industrialized countries tend to disregard environmental concerns as it focuses more on ways and means to full develop its economies. The shift starts to turn as the countries begins to increase its income until it reaches full industrialization, where a positive consideration for environmental protection begins to be realized. The exact depiction of the said theory explains the differences between the adoption rate between developed and less developed countries. Nevertheless, there is optimism to see developing countries pulling their share towards protecting the environment by considering a glimmer of potential for renewable energy use. However, despite these developments, the existence of renewable energy policies may not always guarantee optimal policy outcomes as different policy choices produce different policy outcomes, thus it is important to understand the linkage between policy mechanisms and improvement in energy production (Dong 2012:476). This leaves a room for improvements to develop a more appropriate mechanism that would potentially maximize the expected outcome of such policies.

1.3 Research Questions and Contribution

The aggressive emergence of renewable energy policies globally has become apparent mainly in response to the impact of Climate Change in many sectors of the economies which, in turn, has adversely affected critical productive sectors brought about by utilization of what is deemed as unsustainable resource production particularly in infrastructure such as the power sector. In this regard, it has become widely important for policy makers to craft innovative policy solutions to such environmental dilemma to ensure sustainability in the longer period of time.

Hence, this research examines the effectiveness of FiT and RPS policies on energy development. There has been limited empirical studies that explored the impact and effectiveness of renewable-specific policies on renewable energy development, most of which focuses on the dynamic implementation mechanism of the policies. Hence, this research will try to significantly contribute to a body of empirical studies that estimates quantitatively the impact of renewable energy policies to energy production on a global scale.

The main objective of this research is to quantify the degree to which both RE policies (FiT and RPS) has helped improved the increase in renewable energy capacity of countries worldwide using country-fixed effects regression. A fixed effects regression is utilized using real values of FiTs and RPS to determine their effects on energy development (capacity). As the research data is comprised of several country-specific charateristics, a fixed effect regression is the most appropriate quantitative method in order to control for country fixed effects that may influence energy development. While renewable energy covers various components such as Wind, Hydropower, Biomass, Geothermal, and Solar, this research has deliberately chosen only three RE sources among all sources due to the limited resources to collect the necessary information for other RE resources. For the purpose of this research, *Wind*, *Geothermal*, and *Solar* were chosen as the focus RE sources used to quantify the effects of the RE policies.

This research was basically built on previous literature as it examined the effectiveness of FiT and RPS as renewable energy policies in promoting energy production through renewable sources. A closely similar studies by Dong (2012) and Jenner (2013) had been previously done, however, this research deviates in terms of the focus sector to be examined. As there has been no exhaustive econometric research done to compare the relative effectiveness of RE-specific policies for each RE resources development, this researech exploist on this gap.

The flow of the report commences by discussing the main theoretical framework and literature review that would provide the basis for dealing with this research. This theoretical section explains the following: (i) the fundamental differences between FiT and RPS and, (ii) how FiT and RPS are being implemented in practice across the world. A discussion of the available information on how effective are both policies in terms of promoting renewable energy use through either qualitative or quantitative means, and how both policies correlates with each other are also provided in this section. Considering that FiT and RPS are two separate policies that share a common objective of promoting renewable energy, it is important to look at experiences particularly whether both policies compliment each other whenever countries decide to adopt them simultaneously, or rather when a country opts to implement one policy makes the other policy utilized on a lesser extent. This is particularly important as there are cases where countries make policy decisions based on several best practices and/or experiences of other neighbor countries. The theoretical section is then immediately followed by an illustration of the empirical model of the research where information about the detailed variables used within the model are likewise discussed. The type of data and its sources are then provided in the next section of the report as this mobilizes the working empirical model of the research. This is followed by the main discussion of results and findings from running the quantitative fixed effects regression models used. The report ends in providing a summary of the research findings and conclusion for the research based on findings.

Chapter II. Theoretical Perspectives and Literature Review

Conceptually, FiT and RPS are effectively mirror images of each other as they both seek the same goal but through different means (Davies 2011:42). They are both considered to be regulatory policies specific to the promotion of increased renewable energy production. Both policies share similar objectives wherein each attempts to stimulate deployment of renewable energy technologies, build economies of scale that reduce technology costs, and carve out space for renewables within the competitive electricity markets (Reiswig 2014:2). Considering that both policies carve different path in promoting renewable energy, it is essential to critically discuss how each policy works and their fundamental differences which basically lie on each of its own mechanisms on incentivising producers to supply more electricity from renewable means.

2.1 Feed-in-Tariff (FiT)

FiT is a "price-based" regulation policy which is focused on providing support in attracting development of new renewable energy infrastructure projects by offering long-term purchase agreements, typically from the government, for the sale of electricity produced through renewable sources. The FiT's main function involves "purchase agreements" which are fixed-rate guarantee payments being paid to eligible producers per unit of electricity from renewable sources that it transfers to the grid. In most cases, the length of purchase contracts between the government and the power producers ranges from 10 to 25 years. Though prices are fixed and guaranteed, the rates may change over time. Given that purchase agreements are guaranteed, there is an obligation for electricity utilities to purchase the power produced through renewable sources pegged at the rate set by the FiT law.

The introduction of FiT into the energy sector enables power generators to lower its risks of investing in renewable energy technology because the government assures the producers that it will buy its renewable electricity produce at guaranteed competitive rates, thus, making capital investment inexpensive and feasible. Although FiT could also be used to promote any kind of technology in relation to climate change mitigation measures such as carbon capture and sequestration, it is, in most cases, enacted through laws/legislations to promote renewable energy (Davies 2011:54).

2.2 Renewable Portfolio Standard (RPS)

RPS is a "quantity-based" regulation mechanism wherein the government places minimum targets and/or quotas for private power owners to produce a specified percentage of its electricity generation sold or capacity installed be produced directly from eligible renewable energy resources. An RPS essentially establishes a base level of demand but allows the market to determine which renewable energy resources will meet the demand (Cory and Swezey 2007:1).

In contrast to FiT system, RPS embodies a free-market mechanism as it seeks to promote the lowest-cost technologies and letting the market determine the most reasonable price for its renewable energy produce (Reisweg, 2014:2 and Dong 2012:476). Power suppliers can freely choose from among all eligble renewable resources where it deems the most feasible means to attain the required quota based on agreed RPS. In this way, RPS offers a different kind of certainty than FiT as it attempts to create certainty in terms of what should be accomplished consistent with policy goals, thus might deviate from being a pure investment incentives (Davies 2011: 57).

To be able to track the fulfillment of quantity quotas, certificates (usually called Renewable Energy/ Green Certificates in most countries) are being issued to energy suppliers for every unit of energy it produces from renewables which are then used to trade or sell along with its electricity produce to power utilities for distribution to customers. This certificates form part of the compliance mechanism of RPS to ensure that the law functions effectively. As stated by Davies (2011:57) in his study on renewable energy policies, RPS commonly dictates private energy utilities to satisfy the requirements of the law through three (3) possible means: (i) by building new renewable infrastructure facilities themselves, (ii) by purchasing renewable energy-generated power from other energy suppliers, and (iii) by obtaining the rights to renewable energy credits (or certificates) which represent power produced through renewable sources. Said certificates play an important role in ensuring compliance to the law by the private utilities. Considering the apparent high capital cost to merely put up a renewable energy power plants, renewable energy certificates offer utilities an alternative way comply with the mandates of the RPS law by allowing them to purchase certificates from other competing companies who are more capable of supplying the required renewable energy quota at a much lower cost. In such a way, small-scale energy suppliers will no longer be trapped from investment risk which could potentially lead to compliance failure.

2.3 Policy utilization

As discussed in previous section, FiT and RPS policies gained traction in the renewable energy sector two decades ago. Despite the seemingly popularity of the two policies, their attractiveness do not equally translate across jurisdictions. Davis (2011:59) claims that feed-in- tariffs appear to be legal instrument of choice for promoting renewable-based electricity generation, particularly in Europe. This conclusion, however, does not hold true to other big countries as RPS remains to be predominant in the United States despite the emerging success stories of other FiT-adopting countries. Davies, in his two scholarly articles (2011:59-60 and 2012:313) have provided a possible explanation for this behavior by the US in adopting the two policies together. According to him, one of the reason for their reluctance might have something to do with the potential constitutional implications once state-jurisdication opts to shift its focus to FiT despite the same economic effect that it may provide. He further said that the other reason curtails on a notion that environmental policy decisions are often only based on "zero-sum" options. Such is more or less directly applied in the US wherein environmental policy reforms are typically treated as "mutually exclusive alternatives", where one has to be picked over the other. This behavior appear to sound more like political in nature due to its traditional and conventional takes on the matter, rather than an economic perspective for the US.

Nevertheless, FiT has been gaining traction in other countries aside from the United States. If absolute count is to be considered, there are more countries who have adopted national FiT than RPS (see Table 4). It should be noted, however, Australia, Canada and United States rather adopts a state-level/regional FiT rates. Among regions in Australia which have adopted FiT include Queensland, New South Wales, and Western Australia, while provinces in Canada with specific FiT policies include Ontario, New Brunswick, and Nova Scotia. In the US, 39 states have been implementing RPS as a policy against only 6 states (California, Michigan, Hawaii, Vermont, Washington, Wisconsin and Tenessee) for FiT to date. This huge discrepency goes to show how RPS dominates the renewable energy market in the US in comparison to FiT. However, for the purpose of this research, the author deliberately excluded the three countries as this study only covers countries with national FiT rates.

2.4 Policy Effectiveness

Literature in the past related to FiT and RPS policies has mostly focused on qualititative comparisons, mostly case studies, based certain performance indicators. There has been limited prior research that provided strong quantitative analyses on the effectiveness of both renewable energy policies under study. The earliest literature that have been found which used econometric analysis in understanding the effectiveness of certain renewable energy policies came from a study conducted by Menz and Machon (2006). In their paper, they utilized a multivariate econometric methodology to assess the effectiveness of various RE-related state policies, including RPS to promote wind power generation, and confirms that RPS are effective in increasing the wind capacity in the thirty-nine (39) states in the US. The closest literatures that can be compared to this research are the studies done by: (i) Dong (2012) wherein he examined the relative effectiveness of FiT and RPS in promoting wind energy development globally, and (ii) Jenner (2013) which explored the strengths and weakenesses of FiT in the European Union countries. The said studies are considered to be one of the few literature which used econometric analysis as the method of analysis to examine the performance of various RE policies.

As mentioned above, several literatures have been done regarding FiT and RPS. However, these studies are not entirely capturing relative comparison in terms of effectiveness between the two highly-utilized policies in the RE sector possibly because not all countries are adopting both policies at the same time.

2.4.1 How efffective is the Feed-in-Tariff

Considering that feed-in-tariff has been a very popular a policy tool in Europe and starting to gain its stand in North America in terms of promoting renewable energy production, it must have catered a positive and successful impact on the sector. In fact, FiTs are increasingly considered the most effective policy at stimulating the rapid development of renewable energy sources and are currently implemented in more than 60 jurisdictions worldwide (Couture and Gagnon 2010:955). The effectiveness of FiT is commonly measured in terms of the change in renewable capacities. As one of the few studies which measured the effect of FiT in the RE capacity on wind power, Jenner et.al (2013:394) concluded that FiT drives onshore wind development and estimated that countries in Europe with FiT for wind energy increases their wind energy capacity by at least 43% on average, hence confirms that the said policy drives the renewable energy capacity development in Europe. The causal effect on renewable energy capacity development may not by entirely attributed to FiT policy as there are other potential factors that could play a role in the positive growth of renewable electricity (Smith and Urpelainen 2014: 387). In order to correct for this endogeneity, the same study utilized instrumental variables and revealed a positive causal relationship between FiT and renewable energy generation in twenty-sex industrialized countries.

Specific experiences of certain countries validated the effectiveness of FiT policy. Alagappan et.al (2011) tried to conduct a market review on the impact of FiT on fourteen markets within USA, Canada, Denmark, Germany, and Spain. In the said study, they found out that renewable generation has the highest percent of total installed capacity in markets that use FiT, and less successful than those markets who do not utilize the said policy. Spain even experienced an impressive growth in wind energy due to its abundant wind locations augmented by a generous FiT rates which led to high investment profitability (Del Rio and Gual 2007:1000).

Meanwhile, the successfulness of FiT is not absolute and guaranteed and could still depend on the conditions of the market (Alagappan et.al. 2011:5102-5103). For instance in the case of wind energy, one of the major barriers that limits the expansion of wind energy deployment is the difficulty to access the grid (del Rio and Gual 2007:1000). As such, the design parameters of a the feed-in-tariff should be conform to the nature of the target market. FiT design options are in utmost importance to ensure an effective and efficient sipport for a well-functioning FiT program (Huang and Wu 2011: 8114). As FiT is considered a price-based regulation, producers would lean on getting higher price guarantee to protect their investments and minimize its risks. The burden of paying, however, is captured by the consumer through higher taxes or higher utility prices which could prove to be unsustainable in the long run. Hence, despite the apparent success of FiT on markets with relatively higher FiT rates, the costly impact attributes to expected reductions in FiT rates in several countries in Europe, particularly in German, Spain, and Italy. For this reason, setting degression rates are quite important in developing an effective FiT design. In fact, Bakhtyar et.al. (2013:422) in their evaluation study of the implementatio of FiT in Indonesia and the Philippines, raised that the lack of degression rate, apart from lack of inflation calculation, for implementing the FiT program negatively affects investor's interest to engage in the renewable energy sector. Degression rate is essentially an adjustment mechanism being used by countries designed to let tariffs be reduced overtime due to expected cost reductions caused by technological advancement. The need for an appropriate degression rate was supported by Cory, K. et.al (2009:13) wherein they conclusively determined that if the low FiT rates will result to little new renewable energy development, and conversely, if tariffs are set too high, the FiT may provide unwarranted profits to developers. They further noted that the most effective FiT policy design requires simplisticity in nature sans too many bonuses, exemptions, and qualifications which may only hinder successful program implementation. As currently being pracrticed in most FiT-adopting countries, FiT policies have been continuously adjusted due to several reasons (i) costs change and markets shift due to technological innovation and (ii) increasing market maturity due to evolving market conditions as provided by Cory, K. et.al (2009:13).

FiT policy has also generated positive macroeconomic impacts. Cory, K. et.al (2009:13) claims that price guarantee and long-term policy certainty offered by FiTs have propelled some countries to the forefront of the global RE industry, creating hundreds of thousands of jobs and countless economic opportunities in new and emerging sectors.

2.4.2 How effective is the RPS policy

RPS have also given its own share of positive impacts on renewable energy generation. RPS polices are designed to increase the amount of renewable energy in the generation mix and these can be motivated by environmental benefits such as global climate change or reductions in air pollutants but also can be motivated by jobs and economic development benefits investment opportunities, and resource diversity (del Rıo Gonzalez, 2007).

Bird et.al (2005:1405-1406), in their study, explored the policies and market factors that drives wind power development in the United States. They found out that RPS have a positive impact on wind energy development especially on States with particularly strong wind resources. Based on their analysis, they strongly claimed that RPS or purchase mandates are the most powerful tool that a State can use to promote wind energy. It plays a leading role in several US states in stimulating wind energy development. In a follow up study done by Bird et.al (2011:2582), they further examined the impact of RPS and the cap-and-trade policy on the U.S. electricitty sector and concludes that RPS can provide long term stability to encourage technology advancement, and if combined with emission caps, could drive significant additional renewable energy generation in the long run. Apart from wind energy, RPS appeared to have also yielded positive impact on solar energy deployment in the US. Wiser (2011:3894, 3903) found that the state-level RPS programs specifically designed to support solar have already proven to be an important driver that can lead to the development of solar energy and to renewable resource diversity, in general.

Renewable-energy specific policies such as RPS targets reduction in traditional energy sources and ultimately the level of pollutants that causes environmental degradation. Palmer and Burtraw (2005) found that RPS can produce significant reductions in carbon emissions brought about by higher electricity prices and more importantly, by veering away from fossil fuel use. The study further claims that the RPS policy appears to be a superior approach for promoting renewables, and reasonably effective at achieving direct reductions in carbon emissions. This significant contribution of the implementing the RPS policy is the paramount outcome that one can achieve when adopting an environmental policy. The goal of improving the environemntal condition begins by reducing the harmful materials that causes its destruction, one of which is the level of carbon that dissipates in the atmoshpere.

2.4.3 Relative effectiveness of FiT and RPS

FiT and RPS are two distinct policies with specific similar objectives but different means to achieve its goals. Many countries are acknowledging the benefits that each policy could bring to their renewable energy sector had it been designed implemented properly. As such, researchers have been trying to objectively determine which between that two policies is more effective in bringing in development that the renewable sector needs most. While it has been determined in most literature that both policies induces positive impact on the renewable capacities of many countries, especially in the United States and Europe, the question remain at the helm whether both policies can maintain its effectiveness or rather conflict with each other had it been adopted and implemented simultaneously. Cory (2008:8) noted that it is equally important to note the main differences between FiT and RPS policies to understand their potential relationship to each other. In the case of the United States where RPS dominates the renewable energy market, she noted that FiT can be used in parallel and wholly separate from RPS policies, or rather can entirely replace the existing RPS mechanisms to further advance renewable energy development. Meanwhile, the studies of Rickerson and Grace (2007) and Grace et.al. (2008) argued that the design details of both policies are vital in securing their successfulness, but nevertheless, their findings ultimately suggest that the two policies can be structured to work together simultaneously.

Notwithstanding, the contention between the FiT and RPS matters more when actual policymakers weigh in on their decision which to choose to catalyze their renewable energy development. For instance, many analyst argues this emerging consensus in Europe: a well-designed FiT are more effective than RPS at meeting environmental targets and responding to climate change (Rickerson et. al. 2007:76). This implies that the preference of countries widely varies in terms of choosing which option is more appropriate and effective for them. Meanwhile, Savacool (2010:1790-1791) concluded in his paper that FIT is the best option for Southeast Asian countries wishing to endorse renewable electricity supply. The differences in policy choices among countries could also be attributed to political priorities as each policy can target different outcomes. In arecent study done by Sun and Nie (2015:260-261), FIT was found to be more efficient in increasing the quantity of renewable energy installed capacity while RPS policy is more efficient to reduce the carbon emissions. Both policies yielded positive impacts, however, on different goals.

In choosing policies, quantification is necessary to be able to determine which can provide maximum benefits with minimum costs for the government. Though in policy decisions, one should not be blinded with the positive externalities that a policy brings in the table as there could still be other perverse impacts which may lead to unintended dilemmas. In the case of South Korea, both FiT and RPS have been successfully implemented, however, there have been instances where electricity suppliers have abused the policies through seeking economic rents. These rents are basically excess profits that are being generated when policy designs are poorly crafted and information assymetry are present leading to market inefficiencies. Between FiT and RPS, more economic rents were generally generated under RPS than FiT which eventually increased the policy costs of implementing RPS (Kwon 2015:681; Ritzenhofen et.al.

2016:237). Such scenario often creates a competitive advantage for FiT, however, if it runs into the same trap, its implemetation could likewise be economically inefficient (Lesser and Su 2008:989).

Despite several differences in the mechanisms, effect, and target goals, it is still highly probable for FiT and RPS to be of complemetary to each other. Cory et.al (2009:13) looked into relative effectiveness, in terms of costs, between the two policies, as well as interactions and concluded that a FiT policy can be developed to work in concert with an RPS policy, which sets a goal or mandate of how much customer demand should be provided by renewables. For states that want to provide assurance to investors, drive more capital to the market, and get more projects built, a FIT can be a useful, complementary policy to an RPS. The findings of Cory et.al was supported by the study done by Davies, L. (2011:83) where he concluded that FiT and RPS do actually complement each other, and indeed by using the two policies in tandem, jurisdictions may be able to harness regulatory synergies that would not exist had the policies been taken on mutually exclusive paths. RPSs and FITs, if written properly, can work hand-in-glove, potentially better than either instrument alone. Dong (2012:484-485) also supported this claim in his study wherein it concluded that the interaction between FIT and other promotion policies, such as RPS, implies that they are complements rather than substitutions. Davies (2012:361), in a separate study, even strongly emphasized that a combined RPS-FIT would offer a number of advantages that neither law provides by itself today, not the least of which would be making RE promotion more effective, efficient, and transparent.

2.5 Research focus

As previously mentioned, this research deviates from previous literature for a number of reasons: (i) the author did not choose to focus on certain geographical area of countries, hence, a larger number of countries has been sampled which have been utilizing FiT and RPS policies, (ii) due to intricate and tedious collection of data for this kind of information limits past studies to use only binary numbers to represent whether or not each country has adopted these RE-specific policies, hence for improvement and better appreciation of results, this research has also utilized actual FiT and RPS values apart from dummy variables to be able to capture the variation across different renewable energy sources across the globe, and (iii) different explanatory variables were also being used to model the explain the impact and/or effectiveness of FiT and RPS in advancing the renewable energy development.

Chapter III. Empirical Framework

As aforementioned above, two renewable energy policies is examined in this research: FiT and RPS. Other alternative polices such as Green Electricity, Centralised Bidding System, Green Certificates were more or less still in place in certain countries, however, FiT and RPS are the most widely used globally nowadays, hence, being chosen as the main focus under the research. On the other hand, while the research chose to focus on wind, geothermal, and solar energies alone against other alternative reneweble sources, it is important to note that the interest of the policy interventions in focus (i.e., FiT and RPS) in actuality are for the increased use of all types of renewable energy sources, and not exclusively for mentioned RE sources.

3.1 Estimating effectiveness

Instruments can be assessed on the extent to which they encourage deployment of renewable energy (del Rio and Gual 2007:995). The effectiveness however depends on several factors which are necessary to be controlled for to reveal a more realistic relationship between the renewable policies and the changes in the level of renewable energy capacities. To be able to assess and quantify the effectiveness of the FiT and RPS policies, a fixed effects econometric framework is developed and utilized taking into account various socioeconomic and political variables that might have an effect on the renewable energy development. Fixed effects regression is chosen as the appropriate model for this study because it controls for unobserved coutry characteristics that may have a potential influence in the fluctuations of renewable energy development for each country.

3.1.1 Dependent Variable

Several dependent variables have been utilized in previous literature to represent renewable energy development. This research uses following dependent variables: (i) cumulative enewable energy capacity, and (ii) new installed renewable capacity (per year). As pointed out by Jenner (2013) in her study, renewable energy capacity is a better choice than renewable energy generation because the former determines the expected return on investment while the latter reflects the actual return on investment, which can be affected by several externalities which are unrelated to the amount invested to renewable energy sector. Yearly changes in renewable energy capacity will also be measured to determine the effect of the policy during the year in question, and isolating the effects on capacity development in the previous years.

3.1.2 Explanatory Variables

Separate regressions for each of the renewable energy resources is used used as both FiT and RPS policies are designed differently depending on the RE sector it caters to. By doing this, it will allow for the research to estimate the effect of technology-specific FIT and RPS policies on technology-specific capacity development. Interaction between the two policies will also be explored as some countries are adopting both policies simultaneously.

Economic development

Gross Domestic Product (GDP) is the most widely used indicator to measure the economic development of each countries. Higher GDP implies greater income, hence, a larger economic machinery to support and develop environmental policies. It is coherent to assume that as a country's income rises, concerns over perceived costs of environmental regulations are diminished and a larger share of income is devoted to pollution abatement and control (Reiswig 2014:18). Marques (2010:6883) further claims that the major effect on the commitment to renewables is the absolute economic size of a country and not the standard of living of its population, where larger income allows countries to handle the costs of developing RE technologies and it guarantees higher support for the costs of public policies in promoting and regulating RE.

Environmental conditions

The environmental conditions in every country differs mostly due to rapid industrialization. In actuality, environment suffers more in more developed countries as higher level of pollutants such as carbon are generated by these countries. As theorized by the Kuznets curve, developed countries tend to shift it focus on environmental protection once they have reached a certain maximum point of industrialization. On the other hand, developing countries would not care much about implications of Climate Change for as long they are still on the process of moving towards full industrialization. Thus, this research considers environmental condition (i.e., level of pollution) as a potential factor that can influence the decision of countries whether or not to adopt renewable energy-specific policies for the protection of the environment.

Governance

Various political and governance factors play a role in the promotion of renewable energy. Among the political factors, political motivations are considered to be the most relevant aspect to the promotion of renewable energy Marques (2010:6883). The capability of the government to support the renewable energy sector determines how well the sector will perform in terms of its development. According to the definition provided by the World Bank, governance consists of the traditions and institutions by which authority in a country is exercised, and such includes processes of government selection, monitoring and replacement, as well a the capacity of the government to effectively implement sound policies, among many others. The most common measure of governance indicator is the level of corruption for each country. It is expected that a more efficient, less corrupt, and more transparent government should provide a positive effect on the adoption of renewable energy policies. In addition to corruption, the World Bank explored other indicators which could further explain the governance situation of each country. Apart from the control of corruption, the other indicators considered are: (i) voice and accountability; (ii) political stability and absence of violence and terrorism; (iii) government effectiveness, (iv) regulatory quality, and (v) rule of law. For the purpose of this paper, the author chooses control of corruption and government effectiveness as the measure of governance for each country under consideration.

3.2 Econometric model specification

Fixed effects model with actual/real FiT and RPS values

To be able to capture a more realistic effect of FiT and RPS on renewable energy development, the actual FiT (in US dollars) and RPS (in percentage) are used in the model as certain variations of these values can provide a more meaningful relationship among variables included in the model. Fixed effecct regression models are run for each type of RE source (wind, solar, geothermal).

$$\text{Cum RE Capacity}_{it} = \beta_0 + \beta_1 FIT + \beta_2 RPS + \beta_3 lnGDPpercap + \beta_4 Pollution + \beta_5 Corruption + \beta_6 GovEff + u_{it} \quad (1)$$

$$\text{New RE Capacity}_{it} = \beta_0 + \beta_1 FIT + \beta_2 RPS + \beta_3 lnGDPpercap + \beta_4 Pollution + \beta_5 Corruption + \beta_6 GovEff + u_{it} \quad (2)$$

$$\text{Total RE}_{it} = \beta_0 + \beta_1 AFIT + \beta_2 RPS + \beta_3 lnGDPpercap + \beta_4 Pollution + \beta_5 Corruption + \beta_6 GovEff + u_{it} \quad (3)$$

Hypotheses

Each main variables (FiT and RPS) of the regression model are expected to yield positive values after running the regression. FiT and RPS are specific policies which aim to further induce the development of renewable energy production, thus, their positive coefficients is expected. On the other hand, the coefficient of pollution (as explained by the level of carbon emission) is expected to be negative as higher levels of carbon emmissions may mean degredation of environmental conditions for countries, thus, further excarbate the downfall of renewable energy capacities of countries, on average. Meanwhile, governance effectivity and corruption are expected to yield an inverse relationship with the development of renewable energy sector, hence, both could reduce the capacity of renewable energy sources in countries where corruption is prevalent and inefficiencies and ineffectiveness in governance perist.

Chapter IV. Data

A total of 183 countries across all continents are taken as samples for this study and considering the timeframe of ten (10) years from 2007-2016 which makes the total observation per variable to 1,183. As in most qualitative data collection especially with this magnitude, it is quite impossible to come up with a clean and complete information. As such, the author applied a minor extrapolation method for missing data to be able to derive a more balanced panel data set without compromising the reliability of the data set.

All the countries under the sample have either: (i) adopted FiT or RPS policies within their jurisdictions or have been implementing both policies at the same time, or (ii) did not adopt either of the policies. What makes this research as potentially more valuable and meaningful is the fact that the number of countries is relatively bigger than the previous studies in the literature due to the fact that the focus of this research is bigger in scope in terms of spatial coverage. The list of countries are very exhaustive and covers both developed and developing economies. However, there are certain countries, i.e., United States, Canada, and Australia, that have been categorically excluded in the sample despite being one of the earliest to adopt FiT and RPS policies, and the reason for such is discussed in succeeding sections of this paper. In addition, few other countries have been left out as well due to severely insufficient data that could potentially skew the results had they been considered. Table 5 shows the summary statistics for all the variable used in this research.

4.1 FiT rates and RPS quotas

The main variables being studied in this research are the FiT and RPS. Currently, there are no institution that collates FiT and RPS values per country worldwide. As such, an exhaustive and comprehensive data gathering was done in order to collect as much information as possible on the level of FiT and RPS as well their date of adoption and implementation. Various websites, country energy reports such as the Renewables Global Status Report (REN21) and other country-specific renewable energy reports that can provide readily available information, among many others, were consulted to determine the actual status and values of FiT and RPS quotas per country. Given the limited time, the author utilized the list of countries used in previous studies on similar in nature to easily determine which among the countries have already adopted the said RE policies. It may also be important to note that while the data coverage involves all countries worldwide, information on few countries (i.e., USA, Canada, and Australia) have been excluded from the sample due to the fact that FiT values and RPS levels in these countries vary across its states and/or regions, hence, there is a difficulty to obtain these data as of the moment. FiT rates are measured in US dollar per kilowatt-hour, while RPS quota are in nominal percentages. While generally in most countries, RPS must be able to meet its standard by the year 2020, it should also be noted that other countries adopt a policy requirement where the minimum quota should be met between the year 2020-2025.

Table 5. Variable definition and summary statistics

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
Dependent Var						
CumInstCapGeo	Cumulative Installed Geothermal Capacity (MW)	1,830	45.05985	211.3252	0	1966
CumInstCapSolar	Cumulative Installed Solar Capacity (MW)	1,830	527.0019	3602.813	0	78070
CumInstCapWind	Cumulative Installed Wind Capacity (MW)	1,830	1119.797	6709.943	0	148640
NewInstCapGeo	New Installed Geothermal Capacity (MW)	1,830	1.685942	16.35506	-183	248
NewInstCapSolar	New Installed Solar Capacity (MW)	1,830	136.7992	1144.673	-2	34540
NewInstCapWind	New Installed Wind Capacity (MW)	1,830	173.5837	1290.067	-37.5	32970
CumInstCapRE	Cumulative Installed RE Capacity (MW)	1,830	1691.859	9770.394	0	226737
NewInstCapRE	New Installed RE Capacity (MW)	1,830	312.0688	2216.453	-181	53840
Explanatory Var						
FiTGeo	Geothermal Feed-in-Tariff (in 2010 US$)	1,830	0.0205246	0.0603067	0	0.39
FiTSolar	Solar Feed-in-Tariff (in 2010 US$)	1,830	0.0725027	0.1535626	0	0.88
FiTWind	Wind Feed-in-Tariff (in 2010 US$)	1,830	0.0340929	0.0649904	0	0.41
RPS	Renewable Portfolio Standard (percent)	1,830	0.0423443	0.1023359	0	0.68
GDPpc	per capita Gross Domestic Product (constant 2010 US$)	1,830	13538.91	19007.26	218.2835	111968.3
CO2	Carbon dioxide emissions (metric tons per capita)	1,830	4.696232	6.156195	0.0224624	53.19099
Corruption	Corruption index	1,830	-0.00328	0.9779594	-1.68673	2.53038
Government Effectiveness	Governance effectiveness index	1,830	0.0114279	0.9512638	-2.057204	2.43131

4.2 Cumulative RE capacities

One of the three dependent variable taken under this study is the cumulative/total wind/solar/geothermal capacities installed at the end of each year per country. Data for this variable is obtained from the BP Statistical Review of World Energy (2017). All data are measured in megawatts. Obviously, one country differs from another in terms of size. For this reason alone, data may yield a huge variation in actual cumulative renewable energy capacity for all countries in sample as bigger countries are expected have larger capacities while smaller countries may produce little capacities. In order to avoid comparison of countries with unequal country characteristics, cumulative renewable energy capacities (for geothermal, solar, and wind) of each country were then divided by its own level of economic development (Gross Domestic Product) and the level of population. By doing this, it takes away the influence of the size and level of economic development on the independent variable. Information regarding the Gross Domestic Product (GDP) were taken from World Bank national accounts data, while the total population were gathered from the United Nations Population Division- World Population Prospects, census reports, Eurostat Demographic Statistics, United Nations Statistical Division's Population and Vital Statistics Report as collated by the World Bank.

For geothermal cumulative capacity, the largest contributor remains to be the United States, Philippines, and Indonesia at 3596 MW (26.8%), 1929MW (14.4%), and 1590 MW (11.8%), respectively. This accounts for more than half (52 percent) of the total global geothermal installed capacity. However, as aforementioned above, United States had been omitted from the sample, hence, only 74% of the total geothermal cumulative capacity have been taken into account in this study. While USA has the biggest production of geothermal energy worldwide, bulk of the installed geothermal capacity comes from Asia (World Energy Resources, 2013). Asia produces a substantial share of geothermal energy due to its many active volcanoes, which increases its geothermal reserves beneath its territorial ground. Curiously, some countries such as Japan is still lagging behind in terms of installed geothermal capacity in comparison to its leading Asian neighbors despite the existence of many volcanoes in its territory that could yield enormous geothermal energy potential. This could be attributed to low utilization rate of geothermal in the country to generate power due to certain policies that inhibits them to maximize it geothermal energy potential. Active volcanoes in Japan are located inside the national parks, which have long been constraining the development of its geothermal resources.

On the other hand, solar energy installed capacity has been dominated by China (78,070 MW), Japan (42,750MW), Germany (41,275MW), and USA (40,300MW). These five countries accounts for approximately 70 percent of the total photovoltaic installed energy capacity. Major solar installations has been in regions with relatively less solar resources, e.g., Europe and China, while potential in high resource region, e.g., Africa and Middle East, remain untapped (World Energy Resources Report 2016). Similar to geothermal energy, the Asian region dominates the solar energy capacity in the world, providing approximately 48 percent of the total solar capacity in the world, followed by Europe (35 percent), then North America (15 percent). Countries closer to equatorial line are expected to receive bigger amounts of photovoltaic power, hence, the Asian region wherein most of its countries are located where solar energy are abundant, accounts for biggest share of solar installed capacity. Meanwhile, for wind cumulative capacity, the top three countries which has the largest wind installed capacity are USA, Germany, and Spain, which holds a total global share of approximately 17.6 percent, 10.6 percent, and 4.9%, respectively. In terms of regional wind share to total wind energy capacity, Asia remains dominant providing 40 percent of the global wind energy capacity, followed by Europe and North America with 34 percent and 21 percent share, respectively.

4.3 New Installed RE capacities

New installed RE capacity is essentially the change of installed capacity per year. This is calculated by taking the difference between the cumulative or total installed capacity of the current year from the previous year's. Similar to cumulative installed capacity variable, the values are all measured in megawatts. Based in Table 5, it is interesting to note that there are certain countries which exhibited a decrease in installed capacity as seen by the negative minimum value for all types or renewable energy resource. There are also countries without new installed renewable energy capacity considering the fact that not all countries generates renewable energy. This variable is taken as the second dependent variable for this paper to be able to examine how renewable energy policies affect the installation of new capacities through renewable sources. This is quite an important aspect to look at because it is possible that renewable capacities are constantly increasing every year, but the marginal change or the new installed capacities that have been added in the total capacity is diminishing, which could render significant policy implications.

4.4 Total cumulative and installed RE capacities

Apart from the installed capacities for each renewable energy source, this paper also taps on the total cumulative and installed capacities of all renewable energy source, i.e., solar, wind, and geothermal, combined. This explains its larger maximum value in comparison to separate renewable sources. This dependent variable has been considered in the study because it can explain the observed impacts of renewable energy policies on the renewable energy capacities as a whole, regardless of source. The implications to be gathered from this variable can also be vital in the sector as majority of the renewable policies do not specifically target a certain renewable source. It is therefore equally important to observe aggregate impacts as well in order to provide a more balanced analysis on the effects of the chosen renewable energy policies.

4.5 Other explanatory variables

Gross Domestic Product (GDP) per capita was gathered from the World Bank. The values are in constant 2010 US dollar. Similar to the study by Dong (2012), GDP per capita is used as an indicator to distinguish whether a country can be categorized as a developed or developing economy. This is also a good representation of the income of a country. With higher GDP per capita, it is expected that the coefficient will turn out to be positive as countries get richer, they revert their environmental policies more on its protection and sustainability, thus, should increase renewable energy capacities. However, as developing economies such as China and India are catching up, this indicator is expected to be insignificant (Dong 2012:479).

CO_2 (carbon dioxide) emission is a proxy variable that represents the level of environmental condition of every country. This data is gathered from the World Development Indicators of the World Bank, and the values are measured in metric tons per capita. It is interesting to note that the mean value of the level of carbon dioxide is more or less at 4 metric ton per capita, the maximum value went up as high as 53 metric tons per capita. This huge variation suggests that there are few countries which experiences an enormous amount of pollution within their jurisdiction.

Control of Corruption and Government Effectiveness are two of the chosen measures to indicate the level of governance of every country. The World Bank (2017) Worldwide Governance Indicator (WGI) project released a report, the most recent of which was in 2016, regarding aggregate and individual governance indicators for over 200 countries and territories over the period of 1996-2016 for six governance dimensions as discussed in section 3.1.4 of this paper. The decision in choosing the said indicators are based on the impression that among other indicators, governance effectiveness and corruption are the most likely to influence the development of renewable energy sector. The values for both indicators ranges from negative to positive numbers, wherein nominal scores ranges from -2.5 to 2.5. Negative values expresses low governance confidence for countries, while positive values suggest otherwise. Based on Table 5 above, it is likewise interesting to note that the mean value of control corruption revealed a negative number which only shows that, on average, the majority of the countries under sample are weak in controlling its corruption cases. On the other hand, the mean value of governance effectiveness turns out positive which indicates that most of the countries under the sample follows better performance in governance. However, its minimum value (-2.05), in comparison to corruption score, indicates otherwise as it shows that there may be one or few countries with perhaps extremely ineffective governance reforms as explained by its very low score, even closer to the lowest minimum score possible (-2.5) in the rating scale used by the World Bank (2017).

Chapter V. Results and Discussion

As discussed in previous chapters of this paper, four models specifications for each renewable energy source considered under this research, i.e., geothermal, solar, and wind, are used to examine the effectiveness of FiT and RPS on the development of renewable energy sector. For instance, the regression model for solar energy source uses four different dependent variables with similar explanatory variables. The same follows in other RE sources. The dependent variables used are as shown in Table 6, as follows:

Table 6. Dependent variables used for each renewable energy sources

Dependent Variable	Formula used
Solar	
CumInstCapSolar1	Cumulative Installed Solar Capacity / GDP
CumInstCapSolar2	Cumulative Installed Solar Capacity / Population
NewInstCapSolar1	New Installed Solar Capacity / GDP
NewInstCapSolar2	New Installed Solar Capacity / Population
Wind	
CumInstCapWind1	Cumulative Installed Wind Capacity / GDP
CumInstCapWind2	Cumulative Installed Wind Capacity / Population
NewInstCapWind1	New Installed Wind Capacity / GDP
NewInstCapWind2	New Installed Wind Capacity / Population
Geothermal	
CumInstCapGeo1	Cumulative Installed Geothermal Capacity / GDP
CumInstCapGeo2	Cumulative Installed Geothermal Capacity / Population
NewInstCapGeo1	New Installed Geothermal Capacity / GDP
NewInstCapGeo2	New Installed Geothermal Capacity / Population

To reiterate, the purpose of dividing the cumulative installed capacities and new installed capacities with Gross Domestic Product (GDP) and Population is to eliminate the influence of the size of the country on the level of development in the renewable energy sector. This is an important factor that has been considered in the empirical model as not doing so might over or underestimate the effect of the FiT and RPS policies on the renewable energy development.

In addition, total renewable energy capacity is used in the study as another dependent variable. This new variable is essentially just the summation of all renewable capacities regardless of source. For the purpose of this study, the total installed renewable capacity only covers the three main RE sources (i.e., solar, wind, and geothermal). Similar to the above dependent variables, the total renewable energy capacity variable is also divided by GDP and population for the same reason as mentioned. A similar fixed effect regression model is used for this variable with more or less the same set of explanatory variables as used in other regression models. The only difference is the FiT rate used for this model as we know that the rates varies across different types of renewable sources. As a compromise, average FiT rates across RE sources were instead calculated and used as the explanatory variable for this model to represent the FiT variable to be able to capture a closer to actual rates while considering all RE sources at hand.

5.1 Solar Energy

Table 7 below shows the summary of regression estimates on the dependent variables cumulative installed capacity and new installed capacity for solar energy.

Table 7. Regression results for solar energy

Variables	(1) CumInstCap-Solar1	(2) CumInstCap-Solar2	(3) NewInstCap-Solar1	(4) NewInstCap-Solar2
FiTSolar	-0.473	-0.00165	0.397	0.00138
	(1.988)	(0.00693)	(0.371)	(0.00129)
RPS	0.564	0.00196	0.135	0.000471
	(0.415)	(0.00145)	(0.137)	(0.000479)
GDP per capita	0.314	0.00109	0.108	0.000376
	(0.231)	(0.000804)	(0.0956)	(0.000333)
CO2 emission	-0.000945	-0.00000329	0.00741	0.0000258
	(0.0191)	(0.0000665)	(0.00756)	(0.0000264)
Corruption	0.0175	0.0000610	0.0221	0.0000771
	(0.0507)	(0.000177)	(0.0144)	(0.0000503)
Government Effectiveness	0.0795	0.000277	0.00226	0.00000788
	(0.0607)	(0.000211)	(0.0164)	(0.0000573)
Constant	-2.645	-0.00921	-0.960	-0.00335
	(2.049)	(0.00714)	(0.854)	(0.00298)
Observations	1,830	1,830	1,830	1,830
R-squared	0.035	0.035	0.042	0.042

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Based on the results, the sign of the coefficients of the main explanatory variables came out opposites with each other for the cumulative installed capacity variable. The coefficient of FiT turned out to be negative while the coefficient of RPS shows otherwise. The coefficient of FiT implies that as FiT rates increases by 1 cent, the cumulative installed solar energy capacity decreases by 0.473 MW yearly in per capita terms, on average. On the other hand, the positive coefficient of RPS variable suggests that an RPS requiring 1 percent of electricity being sourced from renewable sources would increase the cumulative installed solar capacity by approximately 0.5 MW per year per capita, on average. In short, cumulative installed solar capacities are being increased by RPS, but not by FiT after controlling for all other factors. Both coefficients turned out to be not significant.

Meanwhile, the coefficients of FiT and RPS for new installed solar capacity dependent variable came out a little different particularly for FiT. In contrast to the previous specification, the coefficient of FiT turned out positive, though remains insignificant. This implies that FiT and RPS are both increasing the additional installed solar capacity per year worldwide, on average. For GDP per capita, the sign of the coefficients are consistently positive across all specifications. This implies that income also determines the growth of solar capacity wherein as one country improves its economy, it also drives solar capacities to increase though not substantially.

The level of carbon dioxide emission does not appear to drive growth in cumulative renewable energy capacity as exhibited by its negative coefficient. The effect of pollution, however, on new installed solar capacity became positive which creates an impression that higher levels of carbon dioxide induces growth in additional solar capacity in the energy mix. While this appears to be confusing, this relationship could probably still makes sense as the high level of pollution perhaps drives more countries to shift to cleaner technologies such as by increasing its renewable energy utilization.

Governance indicators all came out with positive coefficients. As previously discussed, corruption and government effectivity scores indicate how efficient the governments are in managing their own jurisdictions. A negative score implies high corruption incidence and low government effectiveness while a high score corresponding to better governance. Thus, the positive coefficients suggest that as countries become more efficient and effective in governance, the

It is important to note that, in general, the impact as exhibited by the actual coefficients of these variables are too small, hence may provide an impression that the effects on the dependent variables are not too significant. The inclusion of all countries regardless of whether they have adopted the policies or not have played a role for the coefficients to appear negligible. Out of the total countries included, below half of the sample have actually implemented FiT and/or RPS in their jurisdictions, therefore reduces the actual impact of the policies on the renewable energy capacities. Same explanation applies to other model specifications moving forward.

5.2 Wind Energy

The regression results for wind energy development is summarized under Table 8. In contrast to solar energy, the effect of FiT on the deployment of renewable energy has been reversed particularly for the additional new installed capacity. For this type of renewable energy source, the feed-in-tariff even effectively reduces the installed solar capacities both for cumulative and new capacities. While it is difficult to validate the negative effect of FiT on wind energy development with the available information, possible reason could be attributed to the failure of FiT policy to counterweigh or overcome other potential factors that could have negatively affected the development of wind energy. FiTs could have failed to provide comparable positive influence on renewable deployment due to the effect of several factors, including difficulty accessing the grid brought about by weak grid infrastructures as well as some administrative procedures from bad bureaucracy (del Rio and Gual 2007:1000). On the other hand, RPS appears to drive growth in wind energy development as exhibited by the positive coefficients across specifications. For a percentage increase in quota requirement for RPS further induces growth in wind capacity by as much as 0.94 MW per capita, though the effect is statistically insignificant.

Table 8. Regression results for wind energy

Variables	(1) CumInstCap-Wind1	(2) CumInstCap-Wind2	(3) NewInstCap-Wind1	(4) NewInstCap-Wind2
FiTWind	-0.652	-0.00227	-0.0950	-0.000331
	(0.510)	(0.00178)	(0.0789)	(0.000275)
RPS	0.943	0.00329	0.108	0.000378
	(0.758)	(0.00264)	(0.103)	(0.000357)
GDP per capita	0.728	0.00254	0.105	0.000367
	(0.542)	(0.00189)	(0.0833)	(0.000290)
CO2 emission	0.0202	0.0000704	0.00639	0.0000223e
	(0.0393)	(0.000137)	(0.00638)	(0.0000222)
Corruption	-0.0143	-0.0000497	0.00211	0.00000736
	(0.0590)	(0.000205)	(0.00921)	(0.0000321)
Government Effectiveness	0.00121	0.00000421	-0.000763	-0.00000266
	(0.0429)	(0.000149)	(0.00873)	(0.0000304)
Constant	-6.241	-0.0217	-0.915	-0.00319
	(4.820)	(0.0168)	(0.742)	(0.00258)
Observations	1,830	1,830	1,830	1,830
R-squared	0.057	0.057	0.041	0.041

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Interestingly, the existence of pollution creates a positive development in wind energy utilization. Policy-wise, highly-polluted countries, especially developed ones, may tend to shift its focus to cleaner and alternative energy use with the objective of eventually reducing the carbon dioxide emission that causes deterioration of the environment which explains the positive relationship between the two variables. However, it is highly cautioned that this explanation can be subjectively argued given the limited information available.

Meanwhile, similar to solar energy, having a strong corruption control influences a growth in additional installed capacity for wind energy, though the effect is not statistically significant. On the other hand, the positive impact that an effective governance brings is felt on the development of cumulative installed solar capacity.

5.3 Geothermal Energy

Table 9 summarizes the results of the regression run for geothermal energy. Looking at columns 1 and 2, the coefficients of FiT and RPS are both greater than zero which means that both policies are effective in promoting geothermal energy though both effects are again statistically not significant. The coefficient of FiT in column 1 suggests that it only increases cumulative installed geothermal capacity by 0.004 MW per capita while the coefficient of RPS only induces growth in solar capacity by 0.003 MW per capita, on average.

Table 9. Regression results for geothermal energy

Variables	(1) CumInstCapGeo1	(2) Cum- InstCapGeo2	(3) NewInstCap Geo1	(4) NewInstCap Geo2
FiTGeo	0.00402	0.0000140	0.00184	0.00000641
	(0.00802)	(0.0000280)	(0.00209)	(0.00000730)
RPS	0.00317	0.0000111	-0.000150	-0.000000523
	(0.00389)	(0.0000136)	(0.000212)	(0.00000073)
GDP per capita	0.00404*	0.0000141*	0.000733	0.00000255
	(0.00221)	(0.00000768)	(0.000587)	(0.00000205)
CO2 emission	-0.0000386	-0.000000135	0.0000267	0.0000000929
	(0.0000793)	(0.000000276)	(0.0000280)	(0.0000000977)
Corruption	-0.00159*	-0.00000554*	-0.0000364	-0.000000127
	(0.000920)	(0.00000320)	(0.000326)	(0.00000113)
Government Effectiveness	0.00109	0.00000379	0.000110	0.000000383
	(0.000856)	(0.00000298)	(0.000285)	(0.000000994)
Constant	-0.0303	-0.000105	-0.00627	-0.0000218
	(0.0192)	(0.0000668)	(0.00505)	(0.0000176)
Observations	1,830	1,830	1,830	1,830
R-squared	0.025	0.025	0.005	0.005

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Comparing the regression results to solar and wind energies, there are two variables in the geothermal energy specification that came out significant. The significant coefficients are GDP per capita and control of corruption. The coefficient of GDP per capita in column 1 means that income drives growth in geothermal energy development and the impact is statistically significant at 10 percent level. For a dollar increase in GDP per capita by a country increases the cumulative installed geothermal capacity by 0.004 MW per capita per year, on average, holding other factors constant. Curiously, the coefficient of corruption is negative which implies that stronger control of countries for corruption even reduces the geothermal capacity, both cumulative and added installed capacities. This result is somewhat different from the hypothesis. However, when critically examined, geothermal energy supply are dominated largely by Philippines and Indonesia (excluding USA), which are both developing countries that likely have low control for corruption score. In view of such, the negative impact of this indicator could have been derived by the dominant effect of the said two countries which, in effect, could have pulled down the growth on geothermal energy development.

5.4 Total Renewable Sources

Another specification was run using the combined cumulative and additional installed capacities of all the renewable sources to form the total renewable energy capacity as the dependent variable. In a sense, this model specification has been considered to be able to examine the effect of FiT and RPS policies on total renewable energy capacities regardless of the type of renewable resource. At the outset, it may be important to note that the total renewable energy does not comprise the complete list of all renewables as hydropower, biomass, and other types were categorically excluded from the scope of this research. Hence, the statistical results of the regression run may potentially yield underestimated effects of FiT and RPS on renewable energy deployment. Nonetheless, the resulting signs of the coefficient shall be given greater weight in this case rather than the magnitude of the impact of the said policies.

The regression results for this specification is provided for in Table 10 below. Based on the estimates in the table, it is found that most of the coefficients of FiT and RPS for all specifications are statistically significant. However, despite the positive impact of FiT on new installed capacity (see columns 3 and 4), the coefficients came out insignificant. Meanwhile, the coefficients of FiT under columns 1 and 2 are less than zero which suggests that there is a negative relationship between the economic outcome and the implementation of FiT policy. By examining more closely, the coefficient of FiT implies that the adoption of FiT rates even reduces the renewable energy capacity by 0.008 MW and 0.0002 MW per capita per year, on average, and both impacts are statistically significant at 10 percent level. RPS, on the other hand, appears to spur the development of renewable energy as exhibited by the its positive coefficients. The impact of RPS on the renewable energy development is highly significant with 99 percent confidence (see column 2).

Meanwhile, the other explanatory variables are also shedding light on their empirical evidences to explain their relationship with the renewable energy development worldwide. First, income drives growth in renewable energy use. Countries with abundant assets and resources are capable of squeezing in more investments to ensure sustainability and reliability of their electricity supply without compromising the health of the environment. Theoretically, relatively new technologies are characterized as highly capital intensive requiring expensive investments with equally high risky returns. The uncertainties brought by renewable energy sources, specifically on providing steady supply while assuring demand, puts pressure on its price to move upward creating disconnects that hinders few energy producers particularly the small scale ones to buy in on the new technology. The failure of the market now forces the government to step in and provide interventions, typically on price, to generate demand and lower down risks for energy suppliers. Subsidies or guarantees in the form of FiT best explains this phenomenon wherein the financial implication requires cash infusion to help investments kick in. Apart from the Kuznet's curve theory, this possible reason further justify why relatively high income countries fair better in adopting cleaner technologies despite its uncertainties than its low-income counterparts.

Table 10. Regression results for all renewable sources

Variables	(1) CumInstCapRE1	(2) Cum-InstCapRE2	(3) NewInstCap RE1	(4) NewInstCap RE2
FiT	-0.00804*	-0.000285*	0.00113	0.00000816
	(0.00467)	(0.000160)	(0.000818)	(0.0000182)
RPS	0.00830**	0.000219***	0.000918*	0.0000256**
	(0.00322)	(0.0000660)	(0.000526)	(0.0000129)
GDP per capita	0.00460***	0.0000842***	0.000668**	0.00000486
	(0.00135)	(0.0000243)	(0.000316)	(0.00000477)
CO2 emission	-0.000516***	-0.0000179***	0.0000110	0.000000152
	(0.000178)	(0.00000578)	(0.0000307)	(0.00000104)
Corruption	-0.000653	-0.0000198	0.000434*	0.00000892
	(0.000534)	(0.0000131)	(0.000251)	(0.00000612)
Government Effectiveness	-0.0000908	-0.0000126	-0.000332	-0.00000283
	(0.000752)	(0.0000169)	(0.000237)	(0.00000462)
Constant	-0.0350***	-0.000585***	-0.00558**	-0.0000376
	(0.0115)	(0.000197)	(0.00268)	(0.0000380)
Observations	1,830	1,830	1,830	1,830
R-squared	0.114	0.174	0.017	0.011

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Lastly, the hypothesis on the effect of pollution on the deployment of renewable sources is consistent with the results. The negative coefficient implies that carbon emission pushes down the level of renewable energy capacities, effectively negating the potential benefits that renewable energy adoption might provide. The negative impact of pollution on the economic outcome are both highly significant at 1 percent level.

Chapter VI. Conclusion, Limitations, and Policy Implications

6.1 Conclusion

The bulk of the literature studying FiT and RPS were mostly focused on developed countries in North American and European regions. Understandably, the maturity of FiT and RPS in terms of the length of implementation is longer and considerably more established in the countries located in those regions than in any other parts of the world. Nonetheless, recent evidences have shown that other countries have been slowly catching up in adopting these policies as perhaps a result of success stories from the pioneering ones. As such, it has been quite compelling to undertake a more comprehensive and exhaustive study on FiT and RPS on a much wider scale in order to capture a more realistic and up-to-date understanding of the role of FiT and RPS on the development of renewable energy capacities. In view of this, this paper has tried to examine the effectiveness of the two most popular policy interventions, namely FiT and RPS, in promoting renewable energy development worldwide. As previously emphasized, what gives more value to this paper is the scale of the spatial dimension being covered under the research to be able to provide a more objective assessment of the policies in relation to the historical movements and trends in renewable capacities worldwide.

Table 11 shows the overall summary of the effects of FiT and RPS on the global renewable energy development. The results suggest that, in general, FiT and RPS both effectively produces more renewable installed capacity across countries with the positive effects overshadowing few negative relationships between the policies and the development of renewable energy across all specifications.

Table 11. Summary of the effects of FiT and RPS on RE development

Type of RE	FiT		RPS	
	Cumulative Installed Capacity	New Installed Capacity	Cumulative Installed Capacity	New Installed Capacity
Solar	-	+	+	+
Wind	-	-	+	+
Geothermal	+	+	+	-
All RE	-	+	+	+

Note: The figures were based on the actual signs of the coefficients under the results of the regression runs.

On a more specific note, it has been found out in this paper that FiT helps countries increase their renewable capacities by adding new power plants that uses renewable sources. The results indicate that FiT produces at least 0.001 MW more renewable power, in per capita terms. While the actual effect appears to be too negligible, it is quite important to note that the resulting figures are in per capita terms, hence the real effect of FiT on renewable energy development for one country is considerably larger in actuality than what the number shows. On the other hand, RPS likewise stimulates growth in renewable capacities, wherein the positive effect is even more consistent across renewable types and model specifications. However, comparing the magnitude of the impact between FiT and RPS, the former generates more additional renewable power and new installations than the latter. The difference could be explained by historical context as FiT has longer history and is more mature than RPS (Dong 2012:484). Nevertheless, this claim cannot be generalized in all countries as experiences in one country can differ from another, for instance in the case of the US where RPS is way more established as an effective renewable policy than FiT.

Intuitively, there are other indirect factors that triggers renewable capacities to move up or down apart from engaging economic policies. Few of these factors are then controlled for in the regression model to be able distinguish the effect of one explanatory variable from another, otherwise the resulting estimates will likely be overestimated. For the purpose of this research, three factors were controlled for in the model: (i) income (as represented by GDP per capita), (ii) pollution (carbon dioxide emission), and (iii) governance indicators (control for corruption and government effectiveness). After controlling for these factors, it was found out that income and pollution are also responsible in the changes in installed renewable capacities around the world, though on varying effects. Income constantly established a positive relationship with renewable energy development which implies that as more investment trickles down in the renewable sector, more capacities will be produced. On the other hand, pollution is responsible for the reduction in the renewable capacities around the world. This evidence is consistent with the expectation that negative externalities, such as pollution, further justifies the widening the gap between traditional energy sources and renewables in the energy mix. The continuous use of fossils fuels and other harmful energy sources heightens up the pollutant levels in the environment, and its costs can overpower the benefits that renewable energy can provide. Although recent evidences (as claimed by the World Energy Council) point out that the trajectory of renewables looks to be promising in the years to come, big challenges remain to finally break the barriers and fully commit to cleaner and healthier technologies.

6.2 Limitations of the study

Like in any other researches, this paper also has its own limitations. First and foremost, there has been no institution which exhaustively collates information on actual FiT rates and RPS quotas across countries around the world. With the absence of a credible source, it can be quite difficult to validate the accountability and reliability of the said information gathered in this research.

In addition, there may be other explanatory variables, e.g., climatic conditions (renewable potentials/factors, latitude), neighbor effects, and other overlapping support policies, etc., that have been excluded from the model which can also directly or indirectly influence the development of renewable energy. These factors should have been controlled for in the regression model, however, with the lack of time and readily available data, the research has failed to take these into account which could probably has resulted to measurement errors.

Furthermore, while the number of samples used in this study are already large enough, certain countries, which can prove to be critical, were explicitly take out from the scope of the study due to lack of data. These countries are United States, Canada, and Australia. The reason for excluding these countries is the due to the fact that they have not been using a single FiT rate as a country, but rather have been implementing regional FiT rate mechanism which varies across different jurisdiction within their own territories. As discussed in previous section, the share of these countries on the current renewable energy capacities are quite substantial, hence, it is important that they have been included in the sample to draw a much closer to reality and objective observations.

6.3 Policy implications and future research

With rapid globalization, growth of industries are downright indispensable but along with it comes at an expense, most of which is absorbed by the environment. This phenomena has been widely recognized globally thus giving birth to various multilateral cooperation commitments to ensure sustainability and protection of the environment. Energy-wise, the perverse effect of maintaining the status quo appears daunting, hence, it compelled countries to get their acts together to find a consensual solution to mitigate the looming impacts of changing climate brought by environmental abuse. One of the major policy decisions that emerged is the transition from the traditional energy sources to a cleaner alternative energy sources, called renewables. For more than a decade, various programs and policies have already been introduced and implemented by several countries to be able to move away from over-reliance on fossil fuels and finally shift to green energy. Several success stories on adopting renewable energy policies have been recorded in literatures despite its apparent difficulty due to complicated barriers but the development of renewables remained very low, thus, prompting policy-makers to continue crafting dynamic ways to create achieve significant improvements in renewable energy deployment.

Arguably, two of the most recognized energy policies that promotes the utilization of renewable energy sources are the Feed-in-Tariffs and the Renewable Portfolio Standards. In most empirical studies, FiT and RPS are indeed increasing the renewable energy development in several countries, and these same findings are being supported by this paper. As the results indicate in this paper, both FiT and RPS are pushing positive impacts in increasing renewable energy use towards full realization of zero fossil fuels. The effect, however, remains insignificant to turn the tide soon as it has been envisioned to be. If the results of this paper are to be taken, the following policy implications could be drawn to further improve what has been done in relation to renewable energy development:

(i) RPS has been generally found to be more effective than FiT in increasing the renewable energy capacity despite the latter being more mature in historical context as it has been widely implemented in a number of countries for a longer period of time. This opens up new opportunities for governments to infuse more resources and investments to these new policies and think of complimentary ways to integrate both policies in a way that could induce more deployment in renewables than by rather choosing which to implement between the two policies;

(ii) In addition, apart from more investments needed, it is equally important to take into account political will and support from the all stakeholders and actors in order to achieve the goal of mitigating the impacts of climate change through reduction of carbon use. As it is widely observed that the economy of traditional energy sources are well-established across many countries, it becomes more difficult for renewables to penetrate this markets without interventions and efforts from the government and other stakeholders in the sector. A big push from the government could be necessary to negate the barriers and open up the market for renewables;

(iii) While it is acknowledged that FiT and RPS policies have been relatively successful in many countries in terms of renewable energy development, the adoption rate remains low. Thus, succeeding efforts to further develop these policies may require a more dynamic approach in order to develop appropriate designs and more effective mechanisms that would hopefully attract more countries to integrate these policies in their environmental agenda; and

(iv) Lastly, the effect of FiT and RPS appeared to be not equally positive across all renewable sources. It may therefore be more convenient to focus on certain sources first until its market fully matures to a point where subsidies, guarantees, or any form of government interventions are no longer necessary. From there, efforts may then shift to other renewable sources being left out and take best practices from previous success stories in order to turn around the seemingly negative effects.

For future studies, researchers may consider looking at other non-conventional cleaner energy sources such as natural gas/biogas and hydropower and its relationship with renewable energy development. In addition, the effect of FiT and RPS on developed and developing economies can be further examined separately in order to observe if there will be any relative differences once the status of the economy has been taken into consideration. It is noted that there is a difference between the adoption rate between developing and developed countries, as such, it is also interesting to delineate the effect of the renewable energy policies on energy production between developed and developing economies. Lastly, considering how huge the fossil fuel industry is today, it may also be equally interesting to study about the potential impact of shifting to renewables on economies whom heavily rely on the production or supply of fossil fuels. While the benefits of shifting to renewable energy is strongly acknowledged, there may also be accompanying economic and financial costs associated from dropping out the use of traditional energy sources.

Appendices

Appendix 1. Summary of FiT rates and RPS quotas in African countries

Counry Code	Region	Country	Year	FiT (Geothermal)	FiT (Solar)	FiT (Wind)	RPS
2	Africa	Algeria	2007	0.00	0.13	0.16	0%
2	Africa	Algeria	2008	0.00	0.12	0.17	0%
2	Africa	Algeria	2009	0.00	0.12	0.18	0%
2	Africa	Algeria	2010	0.00	0.13	0.17	0%
2	Africa	Algeria	2011	0.00	0.14	0.17	0%
2	Africa	Algeria	2012	0.00	0.14	0.16	0%
2	Africa	Algeria	2013	0.00	0.15	0.15	0%
2	Africa	Algeria	2014	0.00	0.15	0.15	0%
2	Africa	Algeria	2015	0.00	0.15	0.15	0%
2	Africa	Algeria	2016	0.00	0.15	0.15	0%
22	Africa	Ghana	2007	0.00	0.00	0.00	0%
22	Africa	Ghana	2008	0.00	0.00	0.00	0%
22	Africa	Ghana	2009	0.00	0.00	0.00	0%
22	Africa	Ghana	2010	0.00	0.00	0.00	0%
22	Africa	Ghana	2011	0.00	0.00	0.00	0%
22	Africa	Ghana	2012	0.00	0.00	0.00	0%
22	Africa	Ghana	2013	0.00	0.20	0.16	0%
22	Africa	Ghana	2014	0.00	0.20	0.16	0%
22	Africa	Ghana	2015	0.00	0.20	0.16	0%
22	Africa	Ghana	2016	0.00	0.20	0.16	0%
32	Africa	Kenya	2007	0.00	0.00	0.00	0%
32	Africa	Kenya	2008	0.10	0.10	0.10	0%
32	Africa	Kenya	2009	0.10	0.10	0.10	0%
32	Africa	Kenya	2010	0.10	0.10	0.11	0%
32	Africa	Kenya	2011	0.10	0.10	0.11	0%
32	Africa	Kenya	2012	0.09	0.10	0.12	0%
32	Africa	Kenya	2013	0.08	0.10	0.12	0%
32	Africa	Kenya	2014	0.08	0.10	0.12	0%
32	Africa	Kenya	2015	0.08	0.10	0.12	0%
32	Africa	Kenya	2016	0.08	0.10	0.12	0%
39	Africa	Mauritius	2007	0.00	0.00	0.00	0%
39	Africa	Mauritius	2008	0.00	0.00	0.00	0%
39	Africa	Mauritius	2009	0.00	0.00	0.00	0%
39	Africa	Mauritius	2010	0.00	0.55	0.37	0%
39	Africa	Mauritius	2011	0.00	0.55	0.37	0%
39	Africa	Mauritius	2012	0.00	0.55	0.37	0%
39	Africa	Mauritius	2013	0.00	0.55	0.37	0%
39	Africa	Mauritius	2014	0.00	0.55	0.37	0%
39	Africa	Mauritius	2015	0.00	0.55	0.37	0%
39	Africa	Mauritius	2016	0.00	0.55	0.37	0%
45	Africa	Nigeria	2007	0.00	0.00	0.00	0%
45	Africa	Nigeria	2008	0.00	0.00	0.00	0%
45	Africa	Nigeria	2009	0.00	0.00	0.00	0%
45	Africa	Nigeria	2010	0.00	0.00	0.00	0%
45	Africa	Nigeria	2011	0.00	0.00	0.00	0%
45	Africa	Nigeria	2012	0.00	0.45	0.17	0%
45	Africa	Nigeria	2013	0.00	0.45	0.17	0%
45	Africa	Nigeria	2014	0.00	0.45	0.17	0%
45	Africa	Nigeria	2015	0.00	0.45	0.17	0%
45	Africa	Nigeria	2016	0.00	0.45	0.17	0%
53	Africa	Rwanda	2007	0.00	0.00	0.00	0%
53	Africa	Rwanda	2008	0.00	0.00	0.00	0%
53	Africa	Rwanda	2009	0.00	0.00	0.00	0%
53	Africa	Rwanda	2010	0.00	0.00	0.00	0%
53	Africa	Rwanda	2011	0.00	0.00	0.00	0%
53	Africa	Rwanda	2012	0.00	0.00	0.00	0%
53	Africa	Rwanda	2013	0.00	0.00	0.00	0%
53	Africa	Rwanda	2014	0.00	0.00	0.00	0%
53	Africa	Rwanda	2015	0.00	0.00	0.00	0%
53	Africa	Rwanda	2016	0.00	0.00	0.00	0%
57	Africa	South Africa	2007	0.00	0.00	0.00	0%
57	Africa	South Africa	2008	0.00	0.00	0.00	0%
57	Africa	South Africa	2009	0.00	0.33	0.14	0%
57	Africa	South Africa	2010	0.00	0.33	0.14	0%
57	Africa	South Africa	2011	0.00	0.33	0.14	0%
57	Africa	South Africa	2012	0.00	0.29	0.12	0%
57	Africa	South Africa	2013	0.00	0.24	0.10	0%
57	Africa	South Africa	2014	0.00	0.24	0.10	0%
57	Africa	South Africa	2015	0.00	0.24	0.10	0%
57	Africa	South Africa	2016	0.00	0.24	0.10	0%
64	Africa	Tanzania	2007	0.00	0.00	0.00	0%
64	Africa	Tanzania	2008	0.00	0.09	0.09	0%
64	Africa	Tanzania	2009	0.00	0.09	0.09	0%
64	Africa	Tanzania	2010	0.00	0.09	0.09	0%
64	Africa	Tanzania	2011	0.00	0.09	0.09	0%
64	Africa	Tanzania	2012	0.00	0.09	0.09	0%
64	Africa	Tanzania	2013	0.00	0.09	0.09	0%
64	Africa	Tanzania	2014	0.00	0.09	0.09	0%
64	Africa	Tanzania	2015	0.00	0.09	0.09	0%
64	Africa	Tanzania	2016	0.00	0.09	0.09	0%
67	Africa	Uganda	2007	0.00	0.00	0.00	0%
67	Africa	Uganda	2008	0.00	0.00	0.00	0%
67	Africa	Uganda	2009	0.00	0.00	0.00	0%
67	Africa	Uganda	2010	0.00	0.00	0.00	0%
67	Africa	Uganda	2011	0.09	0.36	0.12	0%
67	Africa	Uganda	2012	0.09	0.40	0.11	0%
67	Africa	Uganda	2013	0.09	0.30	0.10	0%
67	Africa	Uganda	2014	0.09	0.30	0.10	0%
67	Africa	Uganda	2015	0.09	0.34	0.09	0%
67	Africa	Uganda	2016	0.09	0.30	0.10	0%

Appendix 2. Summary of FiT rates and RPS quotas in Asian countries

Counry Code	Region	Country	Year	FiT (Geothermal)	FiT (Solar)	FiT (Wind)	RPS
4	Asia	Armenia	2007	0.00	0.00	0.10	0%
4	Asia	Armenia	2008	0.00	0.00	0.10	0%
4	Asia	Armenia	2009	0.00	0.00	0.09	0%
4	Asia	Armenia	2010	0.00	0.00	0.09	0%
4	Asia	Armenia	2011	0.00	0.00	0.09	0%
4	Asia	Armenia	2012	0.00	0.00	0.08	0%
4	Asia	Armenia	2013	0.00	0.00	0.08	0%
4	Asia	Armenia	2014	0.00	0.00	0.08	0%
4	Asia	Armenia	2015	0.00	0.00	0.08	0%
4	Asia	Armenia	2016	0.00	0.00	0.08	0%
11	Asia	China	2007	0.00	0.00	0.09	0%
11	Asia	China	2008	0.00	0.00	0.09	0%
11	Asia	China	2009	0.00	0.00	0.09	0%
11	Asia	China	2010	0.00	0.00	0.09	0%
11	Asia	China	2011	0.00	0.16	0.08	0%
11	Asia	China	2012	0.00	0.15	0.08	15%
11	Asia	China	2013	0.00	0.14	0.08	15%
11	Asia	China	2014	0.00	0.14	0.08	15%
11	Asia	China	2015	0.00	0.14	0.08	15%
11	Asia	China	2016	0.00	0.14	0.08	15%
26	Asia	Indonesia	2007	0.10	0.00	0.00	0%
26	Asia	Indonesia	2008	0.11	0.00	0.00	0%
26	Asia	Indonesia	2009	0.12	0.00	0.00	0%
26	Asia	Indonesia	2010	0.13	0.00	0.00	0%
26	Asia	Indonesia	2011	0.14	0.00	0.00	0%
26	Asia	Indonesia	2012	0.15	0.00	0.00	23%
26	Asia	Indonesia	2013	0.13	0.00	0.00	23%
26	Asia	Indonesia	2014	0.13	0.00	0.00	23%
26	Asia	Indonesia	2015	0.13	0.00	0.00	23%
26	Asia	Indonesia	2016	0.13	0.00	0.00	23%
27	Asia	Iran	2007	0.00	0.00	0.00	0%
27	Asia	Iran	2008	0.10	0.10	0.10	0%
27	Asia	Iran	2009	0.10	0.10	0.10	0%
27	Asia	Iran	2010	0.11	0.11	0.11	0%
27	Asia	Iran	2011	0.11	0.11	0.11	0%
27	Asia	Iran	2012	0.12	0.12	0.12	0%
27	Asia	Iran	2013	0.12	0.12	0.12	0%
27	Asia	Iran	2014	0.12	0.12	0.12	0%
27	Asia	Iran	2015	0.12	0.12	0.12	0%
27	Asia	Iran	2016	0.12	0.12	0.12	0%
31	Asia	Japan	2007	0.00	0.00	0.00	20%
31	Asia	Japan	2008	0.00	0.00	0.00	20%
31	Asia	Japan	2009	0.34	0.23	0.29	20%
31	Asia	Japan	2010	0.34	0.33	0.29	20%
31	Asia	Japan	2011	0.34	0.43	0.29	20%
31	Asia	Japan	2012	0.34	0.53	0.29	20%
31	Asia	Japan	2013	0.39	0.52	0.26	20%
31	Asia	Japan	2014	0.39	0.52	0.26	20%
31	Asia	Japan	2015	0.39	0.52	0.26	20%
31	Asia	Japan	2016	0.39	0.52	0.26	20%
37	Asia	Malaysia	2007	0.00	0.00	0.00	0%
37	Asia	Malaysia	2008	0.00	0.00	0.00	0%
37	Asia	Malaysia	2009	0.00	0.00	0.00	0%
37	Asia	Malaysia	2010	0.00	0.30	0.00	0%
37	Asia	Malaysia	2011	0.00	0.30	0.00	0%
37	Asia	Malaysia	2012	0.00	0.27	0.00	15%
37	Asia	Malaysia	2013	0.00	0.23	0.00	15%
37	Asia	Malaysia	2014	0.00	0.23	0.00	15%
37	Asia	Malaysia	2015	0.00	0.23	0.00	15%
37	Asia	Malaysia	2016	0.00	0.23	0.00	15%
41	Asia	Mongolia	2007	0.00	0.15	0.08	0%
41	Asia	Mongolia	2008	0.00	0.15	0.08	0%
41	Asia	Mongolia	2009	0.00	0.15	0.08	0%
41	Asia	Mongolia	2010	0.00	0.15	0.08	0%
41	Asia	Mongolia	2011	0.00	0.15	0.07	0%
41	Asia	Mongolia	2012	0.00	0.15	0.07	0%
41	Asia	Mongolia	2013	0.00	0.15	0.07	0%
41	Asia	Mongolia	2014	0.00	0.15	0.07	0%
41	Asia	Mongolia	2015	0.00	0.15	0.07	0%
41	Asia	Mongolia	2016	0.00	0.15	0.07	0%
47	Asia	Pakistan	2007	0.00	0.00	0.00	0%
47	Asia	Pakistan	2008	0.00	0.00	0.00	0%
47	Asia	Pakistan	2009	0.00	0.00	0.00	0%
47	Asia	Pakistan	2010	0.00	0.00	0.00	0%
47	Asia	Pakistan	2011	0.00	0.23	0.00	0%
47	Asia	Pakistan	2012	0.00	0.23	0.00	0%
47	Asia	Pakistan	2013	0.00	0.23	0.00	0%
47	Asia	Pakistan	2014	0.00	0.23	0.00	0%
47	Asia	Pakistan	2015	0.00	0.23	0.00	0%
47	Asia	Pakistan	2016	0.00	0.23	0.00	0%
49	Asia	Philippines	2007	0.00	0.00	0.00	50%
49	Asia	Philippines	2008	0.00	0.00	0.00	50%
49	Asia	Philippines	2009	0.00	0.00	0.00	50%
49	Asia	Philippines	2010	0.00	0.00	0.00	50%
49	Asia	Philippines	2011	0.00	0.00	0.00	50%
49	Asia	Philippines	2012	0.00	0.23	0.20	50%
49	Asia	Philippines	2013	0.00	0.23	0.20	50%
49	Asia	Philippines	2014	0.00	0.23	0.20	50%
49	Asia	Philippines	2015	0.00	0.23	0.20	50%
49	Asia	Philippines	2016	0.00	0.23	0.20	50%
58	Asia	South Korea	2007	0.00	0.00	0.00	0%
58	Asia	South Korea	2008	0.00	0.50	0.11	0%
58	Asia	South Korea	2009	0.00	0.48	0.11	8%
58	Asia	South Korea	2010	0.00	0.47	0.11	8%
58	Asia	South Korea	2011	0.00	0.45	0.11	8%
58	Asia	South Korea	2012	0.00	0.45	0.11	8%
58	Asia	South Korea	2013	0.00	0.45	0.11	8%
58	Asia	South Korea	2014	0.00	0.45	0.11	8%
58	Asia	South Korea	2015	0.00	0.45	0.11	8%
58	Asia	South Korea	2016	0.00	0.45	0.11	8%
60	Asia	Sri Lanka	2007	0.00	0.00	0.12	0%
60	Asia	Sri Lanka	2008	0.00	0.00	0.14	0%
60	Asia	Sri Lanka	2009	0.00	0.00	0.16	0%
60	Asia	Sri Lanka	2010	0.00	0.00	0.18	0%
60	Asia	Sri Lanka	2011	0.18	0.18	0.20	0%
60	Asia	Sri Lanka	2012	0.18	0.18	0.20	0%
60	Asia	Sri Lanka	2013	0.18	0.18	0.19	20%
60	Asia	Sri Lanka	2014	0.18	0.18	0.19	20%
60	Asia	Sri Lanka	2015	0.18	0.18	0.19	20%
60	Asia	Sri Lanka	2016	0.18	0.18	0.19	20%
63	Asia	Syria	2007	0.00	0.00	0.00	0%
63	Asia	Syria	2008	0.00	0.00	0.00	0%
63	Asia	Syria	2009	0.00	0.00	0.00	0%
63	Asia	Syria	2010	0.00	0.29	0.17	0%
63	Asia	Syria	2011	0.00	0.29	0.13	0%
63	Asia	Syria	2012	0.00	0.29	0.13	0%
63	Asia	Syria	2013	0.00	0.29	0.13	0%
63	Asia	Syria	2014	0.00	0.29	0.13	0%
63	Asia	Syria	2015	0.00	0.29	0.13	0%
63	Asia	Syria	2016	0.00	0.29	0.13	0%
65	Asia	Thailand	2007	0.00	0.27	0.12	25%
65	Asia	Thailand	2008	0.00	0.27	0.11	25%
65	Asia	Thailand	2009	0.00	0.27	0.11	25%
65	Asia	Thailand	2010	0.00	0.22	0.12	25%
65	Asia	Thailand	2011	0.00	0.16	0.12	25%
65	Asia	Thailand	2012	0.00	0.11	0.12	25%
65	Asia	Thailand	2013	0.00	0.05	0.12	25%
65	Asia	Thailand	2014	0.00	0.05	0.12	25%
65	Asia	Thailand	2015	0.00	0.05	0.12	25%
65	Asia	Thailand	2016	0.00	0.05	0.12	25%
69	Asia	United Arab Emirates	2007	0.00	0.00	0.00	0%
69	Asia	United Arab Emirates	2008	0.00	0.00	0.00	0%
69	Asia	United Arab Emirates	2009	0.00	0.00	0.00	0%
69	Asia	United Arab Emirates	2010	0.00	0.00	0.00	0%
69	Asia	United Arab Emirates	2011	0.00	0.00	0.00	0%
69	Asia	United Arab Emirates	2012	0.00	0.00	0.00	7%
69	Asia	United Arab Emirates	2013	0.00	0.00	0.00	7%
69	Asia	United Arab Emirates	2014	0.00	0.00	0.00	7%
69	Asia	United Arab Emirates	2015	0.00	0.00	0.00	7%
69	Asia	United Arab Emirates	2016	0.00	0.00	0.00	7%
71	Asia	Vietnam	2007	0.00	0.00	0.00	0%
71	Asia	Vietnam	2008	0.00	0.00	0.00	0%
71	Asia	Vietnam	2009	0.00	0.00	0.00	0%
71	Asia	Vietnam	2010	0.00	0.00	0.00	0%
71	Asia	Vietnam	2011	0.00	0.00	0.08	0%
71	Asia	Vietnam	2012	0.00	0.00	0.08	5%
71	Asia	Vietnam	2013	0.00	0.00	0.08	5%
71	Asia	Vietnam	2014	0.00	0.00	0.08	5%
71	Asia	Vietnam	2015	0.00	0.00	0.08	5%
71	Asia	Vietnam	2016	0.00	0.00	0.08	5%

Appendix 3. Summary of FiT rates and RPS quotas in Central American countries

Counry Code	Region	Country	Year	FiT (Geothermal)	FiT (Solar)	FiT (Wind)	RPS
16	Central America	Dominican Republic	2007	0.00	0.00	0.00	0%
16	Central America	Dominican Republic	2008	0.00	0.00	0.00	0%
16	Central America	Dominican Republic	2009	0.00	0.00	0.00	0%
16	Central America	Dominican Republic	2010	0.00	0.10	0.12	0%
16	Central America	Dominican Republic	2011	0.00	0.10	0.13	0%
16	Central America	Dominican Republic	2012	0.00	0.10	0.13	0%
16	Central America	Dominican Republic	2013	0.00	0.10	0.14	0%
16	Central America	Dominican Republic	2014	0.00	0.10	0.14	0%
16	Central America	Dominican Republic	2015	0.00	0.10	0.14	0%
16	Central America	Dominican Republic	2016	0.00	0.10	0.14	0%
24	Central America	Honduras	2007	0.00	0.00	0.00	0%
24	Central America	Honduras	2008	0.00	0.00	0.00	0%
24	Central America	Honduras	2009	0.00	0.00	0.00	0%
24	Central America	Honduras	2010	0.00	0.00	0.00	0%
24	Central America	Honduras	2011	0.00	0.00	0.00	0%
24	Central America	Honduras	2012	0.11	0.11	0.11	0%
24	Central America	Honduras	2013	0.11	0.11	0.11	0%
24	Central America	Honduras	2014	0.11	0.11	0.11	0%
24	Central America	Honduras	2015	0.11	0.11	0.11	0%
24	Central America	Honduras	2016	0.11	0.11	0.11	0%
44	Central America	Nicaragua	2007	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2008	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2009	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2010	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2011	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2012	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2013	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2014	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2015	0.05	0.05	0.05	0%
44	Central America	Nicaragua	2016	0.05	0.05	0.05	0%

Appendix 4. Summary of FiT rates and RPS quotas in European countries

Counry Code	Region	Country	Year	FiT (Geothermal)	FiT (Solar)	FiT (Wind)	RPS
1	Europe	Albania	2007	0.00	0.00	0.00	0%
1	Europe	Albania	2008	0.00	0.00	0.00	0%
1	Europe	Albania	2009	0.00	0.00	0.00	0%
1	Europe	Albania	2010	0.00	0.00	0.00	0%
1	Europe	Albania	2011	0.00	0.00	0.00	0%
1	Europe	Albania	2012	0.00	0.00	0.00	0%
1	Europe	Albania	2013	0.00	0.00	0.00	38%
1	Europe	Albania	2014	0.00	0.00	0.00	38%
1	Europe	Albania	2015	0.00	0.00	0.00	38%
1	Europe	Albania	2016	0.00	0.00	0.00	38%
5	Europe	Austria	2007	0.11	0.54	0.12	0%
5	Europe	Austria	2008	0.12	0.51	0.13	0%
5	Europe	Austria	2009	0.12	0.51	0.13	34%
5	Europe	Austria	2010	0.13	0.51	0.14	34%
5	Europe	Austria	2011	0.12	0.41	0.14	34%
5	Europe	Austria	2012	0.10	0.32	0.13	34%
5	Europe	Austria	2013	0.09	0.22	0.12	34%
5	Europe	Austria	2014	0.09	0.22	0.12	34%
5	Europe	Austria	2015	0.09	0.22	0.12	34%
5	Europe	Austria	2016	0.09	0.22	0.12	34%
6	Europe	Belgium	2007	0.00	0.00	0.00	4%
6	Europe	Belgium	2008	0.00	0.00	0.00	5%
6	Europe	Belgium	2009	0.00	0.00	0.00	6%
6	Europe	Belgium	2010	0.00	0.00	0.00	8%
6	Europe	Belgium	2011	0.00	0.00	0.00	9%
6	Europe	Belgium	2012	0.00	0.00	0.00	13%
6	Europe	Belgium	2013	0.00	0.00	0.00	13%
6	Europe	Belgium	2014	0.00	0.00	0.00	13%
6	Europe	Belgium	2015	0.00	0.00	0.00	13%
6	Europe	Belgium	2016	0.00	0.00	0.00	13%
7	Europe	Bosnia and Herzegovina	2007	0.00	0.00	0.00	0%
7	Europe	Bosnia and Herzegovina	2008	0.00	0.00	0.00	0%
7	Europe	Bosnia and Herzegovina	2009	0.00	0.00	0.00	40%
7	Europe	Bosnia and Herzegovina	2010	0.00	0.09	0.00	40%
7	Europe	Bosnia and Herzegovina	2011	0.00	0.09	0.00	40%
7	Europe	Bosnia and Herzegovina	2012	0.00	0.09	0.00	40%
7	Europe	Bosnia and Herzegovina	2013	0.00	0.09	0.00	40%
7	Europe	Bosnia and Herzegovina	2014	0.00	0.09	0.00	40%
7	Europe	Bosnia and Herzegovina	2015	0.00	0.09	0.00	40%
7	Europe	Bosnia and Herzegovina	2016	0.00	0.09	0.00	40%
9	Europe	Bulgaria	2007	0.00	0.64	0.18	0%
9	Europe	Bulgaria	2008	0.00	0.59	0.14	0%
9	Europe	Bulgaria	2009	0.00	0.54	0.12	16%
9	Europe	Bulgaria	2010	0.00	0.51	0.12	16%
9	Europe	Bulgaria	2011	0.00	0.48	0.12	16%
9	Europe	Bulgaria	2012	0.00	0.49	0.13	16%
9	Europe	Bulgaria	2013	0.00	0.51	0.13	16%
9	Europe	Bulgaria	2014	0.00	0.51	0.13	16%
9	Europe	Bulgaria	2015	0.00	0.49	0.13	16%
9	Europe	Bulgaria	2016	0.00	0.48	0.13	16%
12	Europe	Croatia	2007	0.23	0.66	0.11	0%
12	Europe	Croatia	2008	0.23	0.63	0.11	0%
12	Europe	Croatia	2009	0.23	0.57	0.11	20%
12	Europe	Croatia	2010	0.23	0.50	0.11	20%
12	Europe	Croatia	2011	0.22	0.38	0.12	20%
12	Europe	Croatia	2012	0.22	0.20	0.12	20%
12	Europe	Croatia	2013	0.22	0.15	0.13	20%
12	Europe	Croatia	2014	0.22	0.15	0.13	20%
12	Europe	Croatia	2015	0.22	0.15	0.13	20%
12	Europe	Croatia	2016	0.22	0.15	0.13	20%
13	Europe	Cyprus	2007	0.00	0.00	0.13	0%
13	Europe	Cyprus	2008	0.00	0.32	0.15	0%
13	Europe	Cyprus	2009	0.00	0.37	0.17	13%
13	Europe	Cyprus	2010	0.00	0.42	0.20	13%
13	Europe	Cyprus	2011	0.00	0.47	0.22	13%
13	Europe	Cyprus	2012	0.00	0.49	0.18	13%
13	Europe	Cyprus	2013	0.00	0.51	0.13	13%
13	Europe	Cyprus	2014	0.00	0.49	0.13	13%
13	Europe	Cyprus	2015	0.00	0.51	0.17	13%
13	Europe	Cyprus	2016	0.00	0.47	0.18	13%
14	Europe	Czech Republic	2007	0.27	0.36	0.18	0%
14	Europe	Czech Republic	2008	0.27	0.40	0.18	0%
14	Europe	Czech Republic	2009	0.28	0.52	0.16	13%
14	Europe	Czech Republic	2010	0.29	0.64	0.14	13%
14	Europe	Czech Republic	2011	0.30	0.30	0.12	13%
14	Europe	Czech Republic	2012	0.30	0.27	0.11	13%
14	Europe	Czech Republic	2013	0.30	0.37	0.13	13%
14	Europe	Czech Republic	2014	0.30	0.37	0.13	13%
14	Europe	Czech Republic	2015	0.30	0.37	0.13	13%
14	Europe	Czech Republic	2016	0.30	0.37	0.13	13%
15	Europe	Denmark	2007	0.11	0.31	0.02	0%
15	Europe	Denmark	2008	0.11	0.35	0.02	0%
15	Europe	Denmark	2009	0.11	0.32	0.03	30%
15	Europe	Denmark	2010	0.11	0.29	0.07	30%
15	Europe	Denmark	2011	0.11	0.25	0.10	30%
15	Europe	Denmark	2012	0.11	0.22	0.12	30%
15	Europe	Denmark	2013	0.11	0.22	0.13	30%
15	Europe	Denmark	2014	0.11	0.22	0.13	30%
15	Europe	Denmark	2015	0.11	0.22	0.13	30%
15	Europe	Denmark	2016	0.11	0.22	0.13	30%
18	Europe	Estonia	2007	0.09	0.09	0.09	0%
18	Europe	Estonia	2008	0.12	0.12	0.12	0%
18	Europe	Estonia	2009	0.11	0.10	0.11	25%
18	Europe	Estonia	2010	0.10	0.09	0.10	25%
18	Europe	Estonia	2011	0.09	0.07	0.09	25%
18	Europe	Estonia	2012	0.08	0.06	0.08	25%
18	Europe	Estonia	2013	0.07	0.04	0.07	25%
18	Europe	Estonia	2014	0.07	0.04	0.07	25%
18	Europe	Estonia	2015	0.07	0.04	0.07	25%
18	Europe	Estonia	2016	0.07	0.04	0.07	25%
19	Europe	Finland	2007	0.00	0.00	0.13	0%
19	Europe	Finland	2008	0.00	0.00	0.13	0%
19	Europe	Finland	2009	0.00	0.00	0.13	0%
19	Europe	Finland	2010	0.00	0.00	0.12	0%
19	Europe	Finland	2011	0.00	0.00	0.12	0%
19	Europe	Finland	2012	0.00	0.00	0.14	0%
19	Europe	Finland	2013	0.00	0.00	0.15	0%
19	Europe	Finland	2014	0.00	0.00	0.15	0%
19	Europe	Finland	2015	0.00	0.00	0.15	0%
19	Europe	Finland	2016	0.00	0.00	0.15	0%
20	Europe	France	2007	0.18	0.40	0.12	0%
20	Europe	France	2008	0.19	0.48	0.13	0%
20	Europe	France	2009	0.18	0.44	0.09	23%
20	Europe	France	2010	0.20	0.38	0.11	23%
20	Europe	France	2011	0.22	0.32	0.12	23%
20	Europe	France	2012	0.24	0.22	0.13	23%
20	Europe	France	2013	0.26	0.13	0.13	23%
20	Europe	France	2014	0.26	0.13	0.13	23%
20	Europe	France	2015	0.26	0.13	0.13	23%
20	Europe	France	2016	0.26	0.13	0.13	23%
21	Europe	Germany	2007	0.17	0.55	0.13	0%
21	Europe	Germany	2008	0.17	0.51	0.15	0%
21	Europe	Germany	2009	0.18	0.41	0.08	18%
21	Europe	Germany	2010	0.13	0.41	0.08	18%
21	Europe	Germany	2011	0.09	0.40	0.08	18%
21	Europe	Germany	2012	0.04	0.26	0.07	18%
21	Europe	Germany	2013	0.04	0.12	0.07	18%
21	Europe	Germany	2014	0.04	0.12	0.07	18%
21	Europe	Germany	2015	0.04	0.12	0.07	18%
21	Europe	Germany	2016	0.04	0.12	0.07	18%
23	Europe	Greece	2007	0.11	0.47	0.11	0%
23	Europe	Greece	2008	0.12	0.64	0.13	0%
23	Europe	Greece	2009	0.14	0.83	0.13	18%
23	Europe	Greece	2010	0.17	0.60	0.13	18%
23	Europe	Greece	2011	0.20	0.38	0.13	18%
23	Europe	Greece	2012	0.20	0.26	0.13	18%
23	Europe	Greece	2013	0.20	0.13	0.12	18%
23	Europe	Greece	2014	0.20	0.13	0.12	18%
23	Europe	Greece	2015	0.20	0.13	0.12	18%
23	Europe	Greece	2016	0.20	0.13	0.12	18%
25	Europe	Hungary	2007	0.13	0.13	0.13	0%
25	Europe	Hungary	2008	0.17	0.17	0.17	0%
25	Europe	Hungary	2009	0.15	0.12	0.15	13%
25	Europe	Hungary	2010	0.14	0.12	0.14	13%
25	Europe	Hungary	2011	0.12	0.12	0.12	13%
25	Europe	Hungary	2012	0.12	0.12	0.12	13%
25	Europe	Hungary	2013	0.12	0.12	0.12	13%
25	Europe	Hungary	2014	0.12	0.12	0.12	13%
25	Europe	Hungary	2015	0.12	0.12	0.12	13%
25	Europe	Hungary	2016	0.12	0.12	0.12	13%
28	Europe	Ireland	2007	0.00	0.00	0.14	0%
28	Europe	Ireland	2008	0.00	0.00	0.09	0%
28	Europe	Ireland	2009	0.00	0.00	0.13	16%
28	Europe	Ireland	2010	0.00	0.00	0.13	16%
28	Europe	Ireland	2011	0.00	0.00	0.13	16%
28	Europe	Ireland	2012	0.00	0.00	0.13	16%
28	Europe	Ireland	2013	0.00	0.00	0.13	16%
28	Europe	Ireland	2014	0.00	0.00	0.13	16%
28	Europe	Ireland	2015	0.00	0.00	0.13	16%
28	Europe	Ireland	2016	0.00	0.00	0.13	16%
29	Europe	Israel	2007	0.00	0.00	0.00	0%
29	Europe	Israel	2008	0.00	0.00	0.00	0%
29	Europe	Israel	2009	0.00	0.24	0.24	0%
29	Europe	Israel	2010	0.00	0.24	0.18	0%
29	Europe	Israel	2011	0.12	0.23	0.12	0%
29	Europe	Israel	2012	0.12	0.34	0.14	10%
29	Europe	Israel	2013	0.12	0.40	0.16	10%
29	Europe	Israel	2014	0.12	0.40	0.16	10%
29	Europe	Israel	2015	0.12	0.40	0.16	10%
29	Europe	Israel	2016	0.12	0.40	0.16	10%

Appendix 4 continued..

30	Europe	Italy	2007	0.32	0.74	0.30	17%
30	Europe	Italy	2008	0.32	0.72	0.35	17%
30	Europe	Italy	2009	0.28	0.57	0.31	17%
30	Europe	Italy	2010	0.24	0.43	0.28	17%
30	Europe	Italy	2011	0.21	0.49	0.24	17%
30	Europe	Italy	2012	0.17	0.31	0.21	17%
30	Europe	Italy	2013	0.14	0.12	0.17	17%
30	Europe	Italy	2014	0.14	0.12	0.17	17%
30	Europe	Italy	2015	0.14	0.12	0.17	17%
30	Europe	Italy	2016	0.14	0.12	0.17	17%
33	Europe	Latvia	2007	0.00	0.00	0.00	0%
33	Europe	Latvia	2008	0.00	0.18	0.21	0%
33	Europe	Latvia	2009	0.00	0.23	0.15	40%
33	Europe	Latvia	2010	0.00	0.27	0.11	40%
33	Europe	Latvia	2011	0.00	0.32	0.06	40%
33	Europe	Latvia	2012	0.00	0.31	0.06	40%
33	Europe	Latvia	2013	0.00	0.30	0.06	40%
33	Europe	Latvia	2014	0.00	0.30	0.06	40%
33	Europe	Latvia	2015	0.00	0.30	0.06	40%
33	Europe	Latvia	2016	0.00	0.30	0.06	40%
34	Europe	Lithuania	2007	0.00	0.00	0.10	0%
34	Europe	Lithuania	2008	0.00	0.00	0.10	0%
34	Europe	Lithuania	2009	0.00	0.00	0.12	23%
34	Europe	Lithuania	2010	0.00	0.57	0.12	23%
34	Europe	Lithuania	2011	0.00	0.59	0.12	23%
34	Europe	Lithuania	2012	0.00	0.47	0.13	23%
34	Europe	Lithuania	2013	0.00	0.35	0.13	23%
34	Europe	Lithuania	2014	0.00	0.35	0.13	23%
34	Europe	Lithuania	2015	0.00	0.35	0.13	23%
34	Europe	Lithuania	2016	0.00	0.35	0.13	23%
35	Europe	Luxembourg	2007	0.00	0.41	0.11	0%
35	Europe	Luxembourg	2008	0.00	0.45	0.14	0%
35	Europe	Luxembourg	2009	0.00	0.46	0.14	11%
35	Europe	Luxembourg	2010	0.00	0.48	0.14	11%
35	Europe	Luxembourg	2011	0.00	0.49	0.14	11%
35	Europe	Luxembourg	2012	0.00	0.51	0.13	11%
35	Europe	Luxembourg	2013	0.00	0.52	0.13	11%
35	Europe	Luxembourg	2014	0.00	0.52	0.13	11%
35	Europe	Luxembourg	2015	0.00	0.52	0.13	11%
35	Europe	Luxembourg	2016	0.00	0.52	0.13	11%
36	Europe	Macedonia	2007	0.00	0.53	0.12	0%
36	Europe	Macedonia	2008	0.00	0.55	0.12	0%
36	Europe	Macedonia	2009	0.00	0.56	0.12	0%
36	Europe	Macedonia	2010	0.00	0.58	0.12	0%
36	Europe	Macedonia	2011	0.00	0.60	0.12	0%
36	Europe	Macedonia	2012	0.00	0.61	0.12	0%
36	Europe	Macedonia	2013	0.00	0.63	0.12	0%
36	Europe	Macedonia	2014	0.00	0.63	0.12	0%
36	Europe	Macedonia	2015	0.00	0.63	0.12	0%
36	Europe	Macedonia	2016	0.00	0.63	0.12	0%
38	Europe	Malta	2007	0.00	0.00	0.00	0%
38	Europe	Malta	2008	0.00	0.00	0.00	0%
38	Europe	Malta	2009	0.00	0.00	0.00	10%
38	Europe	Malta	2010	0.00	0.22	0.00	10%
38	Europe	Malta	2011	0.00	0.22	0.00	10%
38	Europe	Malta	2012	0.00	0.22	0.00	10%
38	Europe	Malta	2013	0.00	0.22	0.00	10%
38	Europe	Malta	2014	0.00	0.22	0.00	10%
38	Europe	Malta	2015	0.00	0.22	0.00	10%
38	Europe	Malta	2016	0.00	0.22	0.00	10%
40	Europe	Moldova	2007	0.00	0.00	0.00	0%
40	Europe	Moldova	2008	0.00	0.00	0.00	0%
40	Europe	Moldova	2009	0.00	0.00	0.00	0%
40	Europe	Moldova	2010	0.00	0.00	0.00	0%
40	Europe	Moldova	2011	0.00	0.00	0.00	0%
40	Europe	Moldova	2012	0.00	0.00	0.00	17%
40	Europe	Moldova	2013	0.00	0.00	0.00	17%
40	Europe	Moldova	2014	0.00	0.00	0.00	17%
40	Europe	Moldova	2015	0.00	0.00	0.00	17%
40	Europe	Moldova	2016	0.00	0.00	0.00	17%
42	Europe	Montenegro	2007	0.00	0.00	0.00	33%
42	Europe	Montenegro	2008	0.00	0.00	0.00	33%
42	Europe	Montenegro	2009	0.00	0.00	0.00	33%
42	Europe	Montenegro	2010	0.00	0.00	0.00	33%
42	Europe	Montenegro	2011	0.08	0.21	0.13	33%
42	Europe	Montenegro	2012	0.08	0.21	0.13	33%
42	Europe	Montenegro	2013	0.08	0.21	0.13	33%
42	Europe	Montenegro	2014	0.08	0.21	0.13	33%
42	Europe	Montenegro	2015	0.08	0.21	0.13	33%
42	Europe	Montenegro	2016	0.08	0.21	0.13	33%
43	Europe	Netherlands	2007	0.00	0.45	0.13	0%
43	Europe	Netherlands	2008	0.00	0.54	0.13	0%
43	Europe	Netherlands	2009	0.00	0.64	0.13	14%
43	Europe	Netherlands	2010	0.00	0.58	0.13	14%
43	Europe	Netherlands	2011	0.00	0.52	0.13	14%
43	Europe	Netherlands	2012	0.00	0.47	0.13	14%
43	Europe	Netherlands	2013	0.00	0.41	0.13	14%
43	Europe	Netherlands	2014	0.00	0.41	0.13	14%
43	Europe	Netherlands	2015	0.00	0.41	0.13	14%
43	Europe	Netherlands	2016	0.00	0.41	0.13	14%

Appendix 4 continued..

46	Europe	Norway	2007	0.00	0.00	0.00	0%
46	Europe	Norway	2008	0.00	0.00	0.00	0%
46	Europe	Norway	2009	0.00	0.00	0.00	0%
46	Europe	Norway	2010	0.00	0.00	0.00	0%
46	Europe	Norway	2011	0.00	0.00	0.00	68%
46	Europe	Norway	2012	0.00	0.00	0.00	68%
46	Europe	Norway	2013	0.00	0.00	0.00	68%
46	Europe	Norway	2014	0.00	0.00	0.00	68%
46	Europe	Norway	2015	0.00	0.00	0.00	68%
46	Europe	Norway	2016	0.00	0.00	0.00	68%
50	Europe	Poland	2007	0.00	0.00	0.00	15%
50	Europe	Poland	2008	0.00	0.00	0.00	15%
50	Europe	Poland	2009	0.00	0.00	0.00	15%
50	Europe	Poland	2010	0.00	0.00	0.00	15%
50	Europe	Poland	2011	0.00	0.00	0.00	15%
50	Europe	Poland	2012	0.00	0.00	0.00	15%
50	Europe	Poland	2013	0.00	0.00	0.00	15%
50	Europe	Poland	2014	0.00	0.00	0.00	15%
50	Europe	Poland	2015	0.00	0.00	0.00	15%
50	Europe	Poland	2016	0.00	0.00	0.00	15%
51	Europe	Portugal	2007	0.00	0.50	0.11	0%
51	Europe	Portugal	2008	0.00	0.49	0.12	0%
51	Europe	Portugal	2009	0.00	0.30	0.08	31%
51	Europe	Portugal	2010	0.00	0.28	0.09	31%
51	Europe	Portugal	2011	0.00	0.25	0.11	31%
51	Europe	Portugal	2012	0.00	0.23	0.12	31%
51	Europe	Portugal	2013	0.00	0.20	0.13	31%
51	Europe	Portugal	2014	0.00	0.20	0.13	31%
51	Europe	Portugal	2015	0.00	0.20	0.13	31%
51	Europe	Portugal	2016	0.00	0.20	0.13	31%
52	Europe	Romania	2007	0.00	0.00	0.00	0%
52	Europe	Romania	2008	0.00	0.00	0.00	24%
52	Europe	Romania	2009	0.00	0.00	0.00	24%
52	Europe	Romania	2010	0.00	0.00	0.00	24%
52	Europe	Romania	2011	0.00	0.00	0.00	24%
52	Europe	Romania	2012	0.00	0.00	0.00	24%
52	Europe	Romania	2013	0.00	0.00	0.00	24%
52	Europe	Romania	2014	0.00	0.00	0.00	24%
52	Europe	Romania	2015	0.00	0.00	0.00	24%
52	Europe	Romania	2016	0.00	0.00	0.00	24%
54	Europe	Serbia	2007	0.00	0.00	0.00	0%
54	Europe	Serbia	2008	0.00	0.00	0.00	0%
54	Europe	Serbia	2009	0.11	0.32	0.14	0%
54	Europe	Serbia	2010	0.11	0.32	0.14	0%
54	Europe	Serbia	2011	0.11	0.31	0.14	0%
54	Europe	Serbia	2012	0.11	0.31	0.13	0%
54	Europe	Serbia	2013	0.11	0.30	0.13	27%
54	Europe	Serbia	2014	0.11	0.30	0.13	27%
54	Europe	Serbia	2015	0.11	0.30	0.13	27%
54	Europe	Serbia	2016	0.11	0.30	0.13	27%
55	Europe	Slovakia	2007	0.00	0.00	0.00	0%
55	Europe	Slovakia	2008	0.15	0.40	0.11	0%
55	Europe	Slovakia	2009	0.19	0.36	0.11	14%
55	Europe	Slovakia	2010	0.24	0.33	0.12	14%
55	Europe	Slovakia	2011	0.28	0.29	0.12	14%
55	Europe	Slovakia	2012	0.27	0.25	0.12	14%
55	Europe	Slovakia	2013	0.26	0.52	0.13	14%
55	Europe	Slovakia	2014	0.26	0.52	0.13	14%
55	Europe	Slovakia	2015	0.26	0.52	0.13	14%
55	Europe	Slovakia	2016	0.26	0.52	0.13	14%
56	Europe	Slovenia	2007	0.08	0.48	0.09	0%
56	Europe	Slovenia	2008	0.09	0.44	0.10	0%
56	Europe	Slovenia	2009	0.13	0.38	0.13	25%
56	Europe	Slovenia	2010	0.16	0.38	0.13	25%
56	Europe	Slovenia	2011	0.19	0.38	0.13	25%
56	Europe	Slovenia	2012	0.23	0.39	0.13	25%
56	Europe	Slovenia	2013	0.26	0.39	0.13	25%
56	Europe	Slovenia	2014	0.26	0.39	0.13	25%
56	Europe	Slovenia	2015	0.26	0.39	0.13	25%
56	Europe	Slovenia	2016	0.26	0.39	0.13	25%
59	Europe	Spain	2007	0.10	0.38	0.10	0%
59	Europe	Spain	2008	0.11	0.37	0.12	0%
59	Europe	Spain	2009	0.10	0.44	0.08	20%
59	Europe	Spain	2010	0.10	0.44	0.09	20%
59	Europe	Spain	2011	0.10	0.45	0.11	20%
59	Europe	Spain	2012	0.09	0.40	0.12	20%
59	Europe	Spain	2013	0.09	0.35	0.13	20%
59	Europe	Spain	2014	0.09	0.35	0.13	20%
59	Europe	Spain	2015	0.09	0.35	0.13	20%
59	Europe	Spain	2016	0.09	0.35	0.13	20%
61	Europe	Sweden	2007	0.00	0.00	0.00	49%
61	Europe	Sweden	2008	0.00	0.00	0.00	49%
61	Europe	Sweden	2009	0.00	0.00	0.00	49%
61	Europe	Sweden	2010	0.00	0.00	0.00	49%
61	Europe	Sweden	2011	0.00	0.00	0.00	49%
61	Europe	Sweden	2012	0.00	0.00	0.00	49%
61	Europe	Sweden	2013	0.00	0.00	0.00	49%
61	Europe	Sweden	2014	0.00	0.00	0.00	49%
61	Europe	Sweden	2015	0.00	0.00	0.00	49%
61	Europe	Sweden	2016	0.00	0.00	0.00	49%
62	Europe	Switzerland	2007	0.32	0.09	0.09	0%
62	Europe	Switzerland	2008	0.34	0.88	0.41	0%
62	Europe	Switzerland	2009	0.36	0.68	0.37	0%
62	Europe	Switzerland	2010	0.38	0.48	0.33	0%
62	Europe	Switzerland	2011	0.31	0.48	0.35	0%
62	Europe	Switzerland	2012	0.24	0.47	0.36	0%
62	Europe	Switzerland	2013	0.24	0.36	0.36	0%
62	Europe	Switzerland	2014	0.24	0.36	0.36	0%
62	Europe	Switzerland	2015	0.24	0.36	0.36	0%
62	Europe	Switzerland	2016	0.24	0.36	0.36	0%
66	Europe	Turkey	2007	0.00	0.00	0.07	0%
66	Europe	Turkey	2008	0.00	0.00	0.07	0%
66	Europe	Turkey	2009	0.00	0.00	0.07	0%
66	Europe	Turkey	2010	0.10	0.10	0.07	0%
66	Europe	Turkey	2011	0.10	0.13	0.07	0%
66	Europe	Turkey	2012	0.10	0.12	0.10	0%
66	Europe	Turkey	2013	0.10	0.12	0.10	0%
66	Europe	Turkey	2014	0.10	0.12	0.10	0%
66	Europe	Turkey	2015	0.10	0.12	0.10	0%
66	Europe	Turkey	2016	0.10	0.12	0.10	0%
68	Europe	Ukraine	2007	0.00	0.00	0.00	0%
68	Europe	Ukraine	2008	0.00	0.47	0.11	0%
68	Europe	Ukraine	2009	0.00	0.50	0.11	11%
68	Europe	Ukraine	2010	0.00	0.52	0.11	11%
68	Europe	Ukraine	2011	0.00	0.55	0.10	11%
68	Europe	Ukraine	2012	0.00	0.57	0.10	11%
68	Europe	Ukraine	2013	0.00	0.60	0.10	11%
68	Europe	Ukraine	2014	0.00	0.62	0.10	11%
68	Europe	Ukraine	2015	0.00	0.64	0.10	11%
68	Europe	Ukraine	2016	0.00	0.67	0.10	11%
70	Europe	United Kingdom	2007	0.00	0.00	0.00	15%
70	Europe	United Kingdom	2008	0.00	0.00	0.00	15%
70	Europe	United Kingdom	2009	0.00	0.00	0.00	15%
70	Europe	United Kingdom	2010	0.00	0.45	0.08	15%
70	Europe	United Kingdom	2011	0.00	0.14	0.07	15%
70	Europe	United Kingdom	2012	0.00	0.11	0.07	15%
70	Europe	United Kingdom	2013	0.00	0.08	0.06	15%
70	Europe	United Kingdom	2014	0.00	0.08	0.06	15%
70	Europe	United Kingdom	2015	0.00	0.07	0.06	15%
70	Europe	United Kingdom	2016	0.00	0.07	0.06	15%

Appedix 5. Summary of FiT rates and RPS quotas in South American countries

Counry Code	Region	Country	Year	FiT (Geothermal)	FiT (Solar)	FiT (Wind)	RPS
3	South America	Argentina	2007	0.04	0.00	0.03	0%
3	South America	Argentina	2008	0.06	0.00	0.05	0%
3	South America	Argentina	2009	0.09	0.30	0.07	0%
3	South America	Argentina	2010	0.11	0.28	0.13	0%
3	South America	Argentina	2011	0.11	0.26	0.13	0%
3	South America	Argentina	2012	0.11	0.23	0.13	0%
3	South America	Argentina	2013	0.11	0.21	0.13	0%
3	South America	Argentina	2014	0.11	0.21	0.13	0%
3	South America	Argentina	2015	0.11	0.21	0.13	0%
3	South America	Argentina	2016	0.11	0.21	0.13	0%
8	South America	Brazil	2007	0.00	0.00	0.07	0%
8	South America	Brazil	2008	0.00	0.00	0.07	0%
8	South America	Brazil	2009	0.00	0.00	0.06	0%
8	South America	Brazil	2010	0.00	0.00	0.06	0%
8	South America	Brazil	2011	0.00	0.00	0.06	0%
8	South America	Brazil	2012	0.00	0.00	0.06	0%
8	South America	Brazil	2013	0.00	0.00	0.06	0%
8	South America	Brazil	2014	0.00	0.00	0.06	0%
8	South America	Brazil	2015	0.00	0.00	0.06	0%
8	South America	Brazil	2016	0.00	0.00	0.06	0%
10	South America	Chile	2007	0.00	0.00	0.00	10%
10	South America	Chile	2008	0.00	0.00	0.00	10%
10	South America	Chile	2009	0.00	0.00	0.00	10%
10	South America	Chile	2010	0.00	0.00	0.00	10%
10	South America	Chile	2011	0.00	0.00	0.00	10%
10	South America	Chile	2012	0.00	0.00	0.00	10%
10	South America	Chile	2013	0.00	0.00	0.00	10%
10	South America	Chile	2014	0.00	0.00	0.00	10%
10	South America	Chile	2015	0.00	0.00	0.00	10%
10	South America	Chile	2016	0.00	0.00	0.00	10%
17	South America	Ecuador	2007	0.00	0.00	0.00	0%
17	South America	Ecuador	2008	0.00	0.00	0.00	0%
17	South America	Ecuador	2009	0.00	0.00	0.00	0%
17	South America	Ecuador	2010	0.00	0.00	0.00	0%
17	South America	Ecuador	2011	0.13	0.40	0.10	0%
17	South America	Ecuador	2012	0.12	0.35	0.10	0%
17	South America	Ecuador	2013	0.10	0.30	0.09	0%
17	South America	Ecuador	2014	0.10	0.30	0.09	0%
17	South America	Ecuador	2015	0.10	0.30	0.09	0%
17	South America	Ecuador	2016	0.10	0.30	0.09	0%
48	South America	Peru	2007	0.00	0.00	0.00	0%
48	South America	Peru	2008	0.00	0.00	0.00	0%
48	South America	Peru	2009	0.00	0.00	0.00	0%
48	South America	Peru	2010	0.00	0.12	0.07	0%
48	South America	Peru	2011	0.00	0.12	0.07	0%
48	South America	Peru	2012	0.00	0.12	0.07	0%
48	South America	Peru	2013	0.00	0.12	0.07	0%
48	South America	Peru	2014	0.00	0.12	0.07	0%
48	South America	Peru	2015	0.00	0.12	0.07	0%
48	South America	Peru	2016	0.00	0.12	0.07	0%

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