IMPACT OF CONSISTENT GOVERNMENT'S RENEWABLE ENERGY POLICIES ON PRI VATE INVESTMENT TOWARDS RENEWABLE ENERGY

By

HWANG, Geummulgyul

A THESIS

Submitted to

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ABSTRACT

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The study aims to empirically investigate the impact of implementing time-consistent policy on private investment in renewable energy infrastructure in developing countries, while the other independent variables are controlled. Data set of renewable energy PPP project in 16 developing countries between 2005 and 2014 was used in the study while project characteristics, political risk, civil risk and aid were controlled. The study proved that once the renewable energy policy is time-consistent in terms of providing economic incentive to private sector, private investment dramatically increases. The policy recommendation by this study is to establish an umbrella body to resolve asymmetric information problem between government and private sector. This will help private sector more responsive to unexpected policy change. More importantly, policy makers in developing countries should keep in mind value of consistency by making long-term commitment to achieve policy goal. By doing so, policy makers are able to draw relatively accurate blueprint of how government renewable energy policy should be developed.

KEYWORD : Developing countries, Public Private Partnerships, PPP, Renewable energy, Renewable energy policies, Private Investment, Consistency

ACKNOWLEDGEMENTS

Dedicated to my beloved parents

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Ⅰ. Introduction

1.1 Purpose

The purpose of this thesis is to identify how consistency of government's renewable energy policies affects private investment, in particular, in developing countries. By doing so, the research will draw a meaningful policy implication for developing countries to promote private investment which quickly triggers transition from fossil fuel to renewable energy.

1.2 Statement of Problem

Governments in developing countries ("Governments") have realized the important role of private investment in renewable energy ("Private investment") and implemented relevant policies. Indeed, participation of the private sector on the utilization of renewable energy resources is crucial for replacing renewable energy resources with carbon-based fuels (Aslani et al, 2012). Nonetheless, they have neither shown progress in meeting renewable energy targets nor inducing enough private investment which is fundamental to pursue sustainable development instead heavily relying on their deficient public finance or aid from international communities.

From the perspective of investors, the consistency of government policies greatly influences on investors' decision making since policy uncertainty negatively affects the levels of investment (Brunetti and Weder, 1998; Miranda, 2010; Wiser and Pickle, 1997; White et al, 2013). According to Guy Holburn (2010) and White et al (2013), in case of setting up policies encouraging renewable energies, the most determinant to induce private investment is strong credibility based on long-term commitments to investors.

Specifically, this argument holds true for policy incentives such as Feed in Tariff (FiT), tax exemption as renewable energy is not cost-competitive with fossil fuel due to its

high up-front cost. Therefore, policy incentives are essential for investors to recoup their investment towards renewable energy project. Yet, highly fluctuated or segmented government's renewable energy policies in developing countries have failed to create the reliable playing field for private sector, but given the impression that the countries are too risky to invest.

1.3 Importance of the Issue

Rapid and sustainable transition to renewable energy is crucial for developing countries to cope with climate change (REC21, 2015). Indeed, anthropogenic Green House Gas (GHG) emissions, which are the primary cause of climate change, need to be substantially reduced to slow down unprecedented climate change. According to the IPCCC (2014), increase in total annual anthropogenic GHG emissions between 2000 and 2010 was largely attributed to energy with the share of 47%, and increase in the total GHG emission between 1970 and 2010 was due to mainly fossil fuel combustion and industrial processes with the share of 78%. Therefore, it is critical for developing countries, where are relatively vulnerable to climate change (German Watch, 2016), to pursue large-scale change in current energy system by placing more importance on transition to renewable energy.

Furthermore, developing countries are currently troubled with growing energy demand along with industrialization and exploding population. It is expected that such growths will be the key drivers of increasing CO2 emissions from fossil fuel combustion (IPCC, 2014). If integration of high share of renewable energy in generation infrastructure succeeds, developing countries can lay the fundamental ground for combating climate change and even they can expect sustainable economic development.

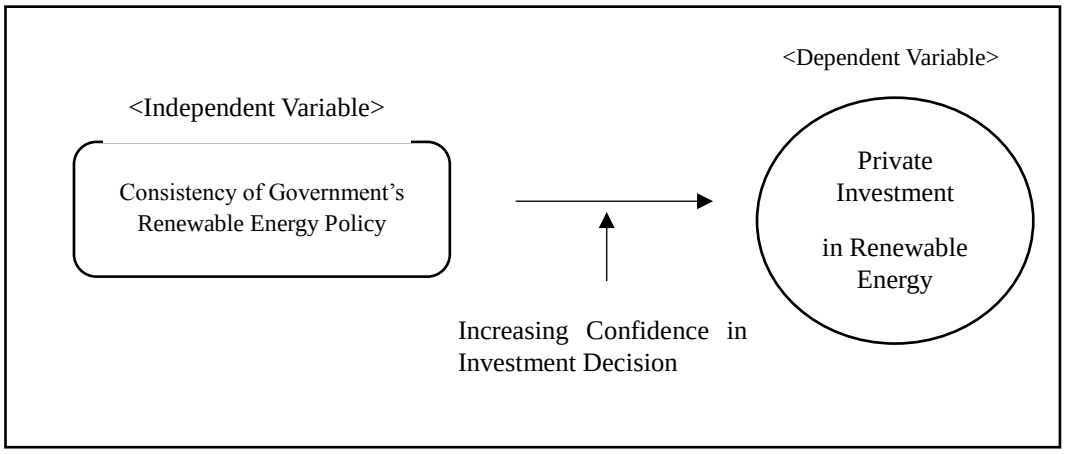
But, given shortage of public finances in developing countries, participation of

private sector is highly necessary to fill the financing gap in renewable energy infrastructure project and it is imperative to offer a clear signal to private sector in that the governments have will to continuously promote renewable energy.

1.4 Hypothesis and Research question

The hypothesis is that consistent government's renewable energy policies over time, in terms of economic incentives, provide a clear market signal to lead private sector to invest in renewable energy infrastructure project. In the study, an independent variable is "consistency of government's renewable energy policy" and it increases confidence in investment decision of the private sector. Therefore, "private investment in renewable energy", which is a dependent variable, will increase as explicitly presented in Figure 1. Assuming that other factors such as financial risk, political risk are constant, the relationship between both variables will be confirmed.

Figure 1. The study's conceptual framework



From this, following research questions will be covered the thesis.

1. Does consistency in government's renewable energy policy have a positive impact on promoting private investment?
2. If so, how consistency of the policy can be ensured?

Ⅱ. Literature Review

Renewable energy is the vanguard to tackle devastating climate change. Since climate change has been mostly attributed to GHG from burning fossil fuel while accounting for more than two thirds of the total emissions (IPCC, 2015; IEA, 2015). In this context, governments have rigorously implemented renewable energy policies, mobilizing more private resources to reduce enormous costs of transition to renewable energy. Meanwhile, the renewable energy policies create incentives to encourage private investments, but uncertainty of the policies does weaken incentives (IEA, 2007; Rolf & Menichetti, 2012). With respect to the effectiveness of these policies, this study aims to identify the impact of implementing time-consistent policy on private investments as to draw meaningful implications for policy makers. Thus, this section will present a summary of the existing literature review concerning two variables in the study, (1) private investment and (2) policy consistency.

2.1 Private Investment

Since the transition from fossil fuel to renewable energy has begun, private investment is thought to be the main driver for the transition to begin in earnest (Aslani et al 2014, Rolf & Menichetti, 2012). Government funding used to be the dominant financial supporting source for renewable energy development, yet private investment has been increasingly started to play larger roles in popularity as an alternative source due to limited public funding resources (Rolf & Menichetti, 2012, Corfee-Morlot et al. 2012; OECD, 2015).

According to the Bloomberg New Energy Finance (2015), the global new investment in clean energy has increased from the year 2004 to 2011 and also rebounded after two years of decline. This upward trend can be attributed to two factors: (1) technology development increases reliability and decreases costs of renewable energy options, leading to attracting

more private investors; (2) new market opportunities were created by renewable energy policies (Rolf & Menichetti, 2012). However, extensive efforts are needed to double the share of renewable energy in the energy mix by 2030 aiming to minimize the mean temperature increase to below 2℃ (IRENA, 2015).

Meanwhile, private investors are facing several barriers which turned them reluctant to make investment decisions in renewable energy due to factors such as low profitability, administrative burden, and regulatory risk, risk perception (Chassot et al, 2014; Gatzert & Kosub, 2016; Rodríguez et al, 2015). Similarly, World Bank (2012) also indicates that private investors contend with a combination of barriers like high risk perception, expensive capital or project costs, and distorted price coming from the market of fossil fuels. However, given high sunk costs and the far-reaching policy influence of renewable sector, unstable policies or lack of long-term policies including consistency to support a renewable energy industry and market can be the most significant barrier on investments (Miranda, 2010; Wiser and Pickle, 1997; White et al, 2013; Rodríguez et al, 2015; IRENA, 2016).

2.2 Policy consistency

Scholars have researched the role of policy consistency in various domains. According to the literature review, there is no absolute definition of policy consistency. But the studies covered herein commonly used policy consistency for indicating the long-term commitment of policy support. Kydland and Prescott (1977) and Carlvo(1978) note that time-inconsistent monetary policy under government's discretion fails to achieve optimal policy outcome and leads to loss of social welfare. Helm, D et al (2003) investigated the outcome of time-inconsistent environmental policy leading to discouraging firms from investing. Yang et

al (2008) appraised the effects of government's climate policy uncertainty on private investors' decision-making in the power sector such as coal and gas by using the Real Options Approach (ROA) for analyzing policy effectiveness when revenue streams from investment were uncertain. Through their study, they revealed that investors' risk can be reduced within long-term climate change policy frameworks rather than in the short-term.

At the same context, previous literature on renewable energy also notes the importance of time-consistent policy for promoting renewable energy. The authors generally concur that consistency in policy duration will reduce uncertainty and unpredictability of policy that spur private investments (IEA, 2007; Mallon, 2006; Rolf & Menichetti, 2012; Miranda, 2010). On the other hand, the importance of policy consistency was proved with the case studies of Canada, Norway and U.S.A which revealed that consistent renewable energy policies have contributed to increasing installed renewable capacity by promoting private investments (White et al., 2013, Wüstenhagen & Bilharz, 2006).

The value of policy consistency over time can be ascertained from the theory of bounded rationality (Rolf & Menichetti, 2012). According to Selten, R. (1999), "Boundedly rational decision making necessarily involves non-optimizing procedures." Additionally, he also stated that "boundedly rational decision makers" may rely on "qualitative expectations" connected to alternative decisions rather than "quantitative expectations". This implies that the path dependence may exist when it comes to making a final business decision (Rolf & Menichetti, 2012; North, 1990; Goldstone, 1998). Investor's past experiences may have influenced the risk-return perception of them and will lead them to stick into their past investment patterns (Rolf & Menichetti, 2012). For example, once an investor considers renewable energy as a more profitable or reliable investment option relative to fossil fuel, then it is expected that renewable energy investments will continue unless a greater stimulus

occurs. This implies that consistent policy incentive can increase investor's confidence to invest more in renewable energy.

Despite the importance of stable policy, many developing countries have experienced slow-down of renewable energy expansion due to difficulties in accessing to the financing attributed by policy instability (IRENA, 2016; IEA, 2014). For example, India and Thailand have faced challenges caused by policy uncertainty such as volatile incentive scheme or accelerated depreciation scheme (IEA 2014). These unpredictable changes in incentive scheme within renewable energy policies pose a risk to private sector, which is unable to resolved due to substantial up-front cost of renewable energy.

Moreover, the scholars have failed to clearly capture the effectiveness of time-consistent renewable energy policy on private investment. Rodríguez et al (2015) analyzed the effect of renewable energy policies and private investments spanning for the 2000-2011 time period. This study is robust in the sense of its geographic coverage with 87 countries but it adopted policies per se as an independent variable rather than policy consistency respectively. While they noted that types of policy incentive are critical to increase the likelihood of crowding in private investment, time-consistency of policy incentive is outside of its realm of interest. For example, their study found that price-based instruments such as FiT have been effective to raise private investment in renewable energy project but failed to explain once the FiT was implemented and went through withdrawal or reduction in subsidies, how private investment would change. Their piecemeal approach focusing on whether the particular policy incentives were implemented might oversimplify the effectiveness of renewable energy policy. Furthermore, its worldwide geographic coverage is rather broad context from developing country of interest in the study and it might give skewed policy implication to the developing countries. Therefore, the additional study should be done in the

context of developing countries considering their unique circumstances.

2.3 Expected contributions

Altogether, it is identified through the robust literature review that policy consistency is important to induce private investment while private investment plays crucial role for replacing fossil fuel with renewable energy (IEA, 2007; Mallon, 2006; Rolf & Menichetti, 2012; Miranda, 2010; Rodríguez et al, 2015; White et al., 2013). However, many developing countries have experienced slow-down of renewable energy expansion due to difficulties in accessing to the financing attributed by policy instability. Furthermore, there are only a few studies conducted on topics related to the consistency of government renewable energy policy and its impacts on private investments and if ever, they have failed to capture the clear picture of policy consistency impact on private investments.

Therefore, the study is expected to make significant contributions to knowledge expansion for policy makers in developing countries as follows. First, it adopts the latest data set of the period from 2005 to 2014. Second, it focuses on developing countries so that it gives meaningful policy implications to policy makers in the developing countries. Lastly the study is done by in-depth investigation onto contents of incentives given within policies rather than measuring correlation based on existence of renewable policy or incentives regardless of the policy implementation period.

Ⅲ. Methodology and Data

The study adopted cross-sectional regression with data set of 16 developing countries between 2005 and 2014 to examine the relationship between consistency of renewable energy policy and private investment in renewable energy. Renewable energy referenced here includes solar, wind, geothermal, biomass, hydro power less than 50MW and ocean energy under the IRENA classification of renewable energy. 16 countries are selected based on availability of Public-Private Partnership(PPP) data for renewable energy power plants and existence of fiscal/financial incentives provided by government such as grant, subsides, tax relief and Feed-in-Tariffs. The list of these countries and policies used herein is presented in Appendix 1. To check the hypothesis, the following simple equation is written as:

$$Private_i = \alpha + \gamma CP_i + \beta_1 GC_i + \beta_2 BZ_i + \beta_3 PA_i + \beta_4 VA_i + \beta_5 OA_i + \beta_6 OA_{i+} \varepsilon_i \quad (i=1...N)$$

CP=Consistency of renewable energy policy (1 if policy is time-consistent, 0 if not)

GC=Generation capacity per project;

BZ=Bank-Z score,

PA=Political Stability and Absence of Violence/Terrorism;

VA=Voice and Accountability;

OA=Net Official Development Assistance

Where *Private* is the amount of private investment in renewable energy PPP project *i* as a dependent variable. The amount has been taken from the share of private investment among total project investment in renewable energy PPP projects which have been widely adopted in developing countries due to their weak public finance or banking system. γ is coefficient of interest to measure the impact of consistency of government renewable policy,

holding other variables constant.

The consistency of renewable policy was examined in more detail through historical policy data from IEA/IRENA policy database, complementary government publications and policy research reports. The period of interest was between date of policy enforcement and financial disclosure of private investment and 1 or 0 was given depending on details. If an economic incentive had been consistent over time or increased, it is assumed that the policy was time-consistent and it takes the value 1. If an economic incentive had been reduced or abolished, it is considered that the policy was time-inconsistent, and then it takes the value 0.

The study also uses control variables to ease the omitted variables bias as follows: (1) the generation capacity per project; (2) Bank-Z score; (3) political stability and absence of violence/terrorism; (4) voice and accountability; and (5) net official development assistance. According to Rodriguez et al (2015), besides project characteristics such as generation capacity, credit market imperfection or level of financial development does matter for promoting private investment. In this context, for developing countries whose credit market or banking system has not yet been fully developed, Bank-Z score was used as a proxy for level of stability of country's banking system. The Bank-Z score measured by World Bank is an indicator that captures default probability of national banking system.

It is generally understood that good governance leads to increase in private investment (Emery 2003). It is assumed that poor governance of developing countries substantially hinders investment decision making as it poses great risks for private sector to recoup their investment. Therefore, two representative governance indicators were taken from World Bank to capture political risk and civil risk. As a proxy for political risk, political stability and absence of violence/terrorism was adopted. The indicator states perceived probability of political instability and/or politically-motivated violence, including terrorism.

As a proxy for civil risk, voice and accountability was adopted as it represents the level of guarantee of civil right to participate in governance.

While the previous studies have shown mixed results in respect of aid effectiveness on investment (Boone, 1994), aid flows to the capital market make developing countries differentiated from developed countries as ever. These aid inflows do play a role as a capital supplement for public finance or funding source in the market, thus official development aid was included. ε denotes the omitted variables which possibly affect relationships between the main variables.

To control the technology effect on private investment such as technical maturity of renewable energy technology, the technology dummies were included disregarding some of the between-technology variation. Using an Instrumental Variable (IV) was attempted to resolve the endogeneity problem though by creating IV with lagged dependent variables (t-1), but the attempt was restricted due to limited data. Thus, future research would benefit if it comes with a way of controlling endogeneity problem or balanced data set.

Ⅳ. Data analysis and Discussion

Table 1 shows summary of descriptive statistics for the variables. The table provides the scale of the variables and helps the interpretation of the coefficients estimates. According to the table, amount of private investment and generation capacity per project are highly volatile compared to the other variables.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Amount of private investment	911	94.93025	136.06	0.23	1539
Consistency	911	0.892426	0.310012	0	1
Generation capacity	911	60.66322	195.8902	0.7	4842
Bank-Z score	911	11.65302	5.996038	1.594062	22.6667
Political stability and absence of violence/terrorism	911	31.68897	16.94616	0.4739336	81.42857
Voice and accoutability	911	44.28513	25.83569	4.694836	85.44601
Net official development assistance	911	1.02E+09	1.15E+09	-1.02E+09	4.30E+09

Following table 2 shows that if renewable energy policy is consistent over time until financial disclosure was made, it increases the amount of private investment with various specifications.

Table 2. OLS results on amount of private investment

VARIABLES	Amount of private investment					
	(1)	(2)	(3)	(4)	(5)	(6)
Consistency	42.1213***	41.3654***	49.4818***	51.4400***	30.4278**	27.6832**
	(14.490)	(12.086)	(12.350)	(12.232)	(13.297)	(13.687)
Generation capacity		0.3819***	0.3835***	0.3841***	0.3816***	0.3809***
		(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Bank-Z score			-1.8732***	-1.3787**	0.7347	0.4062
			(0.639)	(0.642)	(0.839)	(0.924)
Political stability and absence of violence/terrorism				0.9875***	0.7623***	0.6549**
				(0.222)	(0.228)	(0.261)
Voice and accoutability					0.7700***	0.7635***
					(0.199)	(0.199)
Net official development assistance						-0.0000
						(0.000)
Constant	57.3401***	34.8502***	49.3370***	10.4945	-22.1894	-8.5504
	(13.688)	(11.473)	(12.447)	(15.100)	(17.201)	(23.538)
Observations	911	911	911	911	911	911
R-squared	0.0092	0.3115	0.3179	0.3325	0.3434	0.3439

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

For example, in regression (6), if renewable energy policy is time-consistent, the amount of private investment is 27.68% higher than the case of time-inconsistent policy, controlling for the other independent variables. The study also finds that although coefficients are smaller than one of consistency, ones of greater generation capacity, strong politic stability and guarantee of civil right are significant and have positive impact on the amount of private investment. However, the result in which stability of national banking system contributes to increase in the amount of private investment is not consistent in case of regression (5), (6) controlling more independent variables and it is not line with the result of Rodrigues et al (2015). Unlike what expected, net official development assistance does not show coefficient at significant level, but rather no influence on the amount of private investment. It is assumed that aid could crowd out private investment in renewable energy infrastructure, but further research should be carefully conducted.

This result shows that policy consistency has positive impacts on private investment become obvious if share of private investment is included in a regression as a dependent variable. As shown in the Table 3, the coefficients are rather smaller than previous regression, but still show significance at 1% level, while the other independent variables shows different patterns. It is interesting that the coefficient of consistency gets larger while the other variables are controlled. This indicates that the efforts to keep the policy consistency might boost the investor’s confidence to participate in a project.

Table 3. OLS results on share of private investment

VARIABLES	Share of private investment					
	(1)	(2)	(3)	(4)	(5)	(6)
Consistency	3.9610***	3.9658***	6.2620***	6.1573***	5.9460***	6.4099***
	(1.501)	(1.501)	(1.503)	(1.502)	(1.646)	(1.694)
Generation capacity		-0.0024	-0.0020	-0.0020	-0.0020	-0.0019
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Bank-Z score			-0.5299***	-0.5564***	-0.5351***	-0.4796***
			(0.078)	(0.079)	(0.104)	(0.114)
Political stability				-0.0528*	-0.0551*	-0.0369
and absence of violence/terrorism				(0.027)	(0.028)	(0.032)
Voice and accoutability					0.0077	0.0088
					(0.025)	(0.025)
Net official development assistance						0.0000
						(0.000)
Constant	92.2347***	92.3777***	96.4761***	98.5535***	98.2248***	95.9196***
	(1.418)	(1.425)	(1.515)	(1.854)	(2.129)	(2.913)
Observations	911	911	911	911	911	911
R-squared	0.0076	0.0087	0.0570	0.0609	0.0610	0.0624

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

For example, generation capacity, political stability and voice and accountability do not show coefficients at significant level, but Bank-Z score shows negative sign on share of private investment at 1% level and it implies that as the national banking system is stable, the share of private investment increases. However, the coefficient is much lower than the one of the policy consistency. However, it is obvious that the results on Bank-Z score and private investment are mixed. So the additional research should be done in the future.

In either case, the central finding is that consistent renewable energy policy over time encourages private investment in terms of absolute value and the share within total project However, it is important to note that the results do not imply that renewable energy policy should not be changed. It should be flexible to changes in environments, but in predictable way. This will be addressed in following discussion section

Ⅴ. Conclusion and Policy Implication

The study aims to empirically investigate the impact of implementing time-consistent policy on private investment in renewable energy infrastructure in developing countries, while the other independent variables are controlled. The study proved that the coefficients of policy consistency are statistically significant and larger than ones of the other independent variables through all the regression models. This result indicates that as the renewable energy policy is time-consistent in terms of providing economic incentive to private sector, private investment increases. Interestingly, the study found that more time-consistent policy is, more private investment occurs in terms of share. It tells that even though the investment amount might be smaller than expected at the first stage of policy implementation, the private will get more confidence on their investment decision according to the policy consistency. Then, it is safely assumed that the absolute investment volume will increase enough to meet the needs towards renewable energy. This can be interpreted as policy makers should stick to current policy measures whereas environments keep changing over time. But, this is not the case. Especially, in case of economic incentive, it should be given flexibly. If a substantial economic incentive is continuously provided even in case of a series of economic shocks, it can be a tremendous burden to the governments of developing countries where have been experienced continuous accumulated budget deficit and have relatively small room to respond to the risks compared to developed countries.

Meanwhile, low level of economic incentives for a long period might impede technology development in renewable energy field. If so, grid-parity, the point at which renewable energy can generate electricity at the same cost of fossil fuel, will never be achieved and it will bolster investment in fossil fuel. Therefore, the renewable energy policy should be flexible, but in ways that private sector can prepare to respond to unexpected

threats and opportunities as well. In many times, governments in developing countries have tried to arbitrarily change their policies without a great deal of understanding on needs of private sector through sufficient consultation. Then, it places private sector in unfavorable position to deal with such unexpected threat. Therefore, resolving asymmetric information between government and private sector is important for shifting towards better preparedness for policy changes. In this context, an umbrella body, which is consisted of members from government and private sector, for protect policy design and implementation from arbitrary changes is needed. The umbrella body would communicate with private sector and monitor changes in internal/external environments so that flexible but predictable changes in policy can be made. More importantly, policy makers in developing countries should keep in mind that they should not disregard the value of consistency, because investors' confidence on government does greatly affect their decision making on investment towards renewables. Long-term commitment toward policy goal should play a fundamental role to lay the ground for promote private investment in renewable energy. By doing so, if private investment is considered as a proxy for the future supply of renewable energy and it is assumed that consistency of policy greatly influences to investors' decision making, governments are able to draw relatively accurate blueprint of how government renewable energy policy should be developed.

On another note, one limitation of this study relates to the over simplistic views on investment decision making process. In particular, this study covers only the risk aspect, which remains as one of the numerous considerations for investment decisions and therefore policy consistency impacts may be overestimated. Finally, future studies need to take a holistic approach by including as much considerations such as improving methodologies to control endogeneity bias and tracing changes in private investment per project.

Appendix

Appendix 1. List of developing countries and renewable energy policies covered

No	Country	Renewable energy policies	Enforcement year
1	Argentina	1. Renewable Energy Generation Program (GENREN)	2010
		2. Promotion of Renewable Sources of Energy for Electricity Production (26.190)	2007
2	Brazil	1. Brazil Renewable Energy Auctions	2007
		2. Programme of Incentives for Alternative Electricity Sources	2002
3	Bulgaria	1. Feed-in tariffs (FITs) for electricity from renewable sources	2011
		2. Renewable and Alternative energy sources and Biofuels Act	2007
4	Chile	1. Invest Chile Project	2005
5	China	1. Feed-in tariff support for solar PV	2013
		2. Adjustment of surcharge of renewable electricity generation	2013
		3. Notice on promotion of PV industry by exert the price leverage effect	2013
		4. Notice on feed-in tariff for co-firing generators burning coal and household waste	2012
		5. The Renewable Energy Tariff Surcharge Grant Funds Management Approach	2012
		6. Solar PV feed-in tariff	2011
		7. 2010 Biomass electricity Feed-in tariff	2010
		8. Import duty removal on wind and hydro technological equipments	2010
		9. Onshore wind feed-in Tariff	2009

No	Country	Renewable energy policies	Enforcement year
5	China	10.Renewable Electricity Surcharge	2006
6	India	1. National Solar Mission (Phase I and II)	2010
		2. Generation based incentives for wind power	2008
		3. Solar Power Generation Based Incentive	2008
7	Pakistan	1. Alternative and Renewable Energy Policy, 2011 (Medium term policy)	2011
		2. Alternative and Renewable Energy Policy, 2006 (Short term policy)	2006
8	Peru	1. Accelerated depreciation benefits	2008
		2. Legislative decree 1002 on investment promotion for generation of electricity using renewable energy	2008
9	Philippines	1. Feed-In Tariff for Electricity Generated from Biomass, Ocean, Run-of-River Hydropower, Solar and Wind Energy Resources	2012
		2. Renewable Energy Act	2008
10	South Africa	1. Renewable Energy Independent Power Producer Programme (REIPPP)	2011
		2. Renewable Energy Feed-in Tariff (REFIT)	2009
11	Thailand	1. Feed-in premium for renewable power	2007
12	Turkey	1. Renewable Energy Law 2010	2011
		2. Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy - No. 5346	2005
13	Uganda	1. Renewable Energy feed-in tariff	2011
		2. Tax Incentives for renewable energy	2005
14	Ukraine	1. Corporate income tax exemptions in Ukraine available for renewable energy sector	2011

No	Country	Renewable energy policies	Enforcement year
14	Ukraine	2. Green Tariff (Feed-in Tariff)	2009
		3. VAT and Customs Duties Exemptions	2008
15	Uruguay	1. Private generation of photovoltaic energy (Auctions and Feed-in Tariffs)	2013
		2. Auctions of up to 150 MW of wind energy (159-2011)	2011
		3. Wind auction (424-2011)	2011
		4. Wind power auctions (403-2009)	2009
		5. Auctioning decree (77-2006)	2006
16	Vietnam	1. Accelerated depreciation tas relief for renewable energy projects	2013
		2. National Power Development Plan 2011-2030 (RES targets and wind feed-in tariff)	2011

Appendix 2. Consistency of renewable energy policy in 16 developing countries

(1 if economic incentive is time-consistent, if not 0)

Country	Renewables	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Argentina	Biomass	0	0	1	1	1	1	1	1	1	1
	Solar, PV	0	0	1	1	1	1	1	1	1	1
	Wind	0	0	1	1	1	1	1	1	1	1
Brazil	Bioenergy	1	1	1	1	1	1	1	1	1	1
	Hydro, Small (<50MW)	1	1	1	1	1	1	1	1	1	1
	Solar, PV	0	0	0	0	0	0	0	0	0	0
	Wind	1	1	1	1	1	1	1	1	1	1
Bulgaria	Hydro, Small (<50MW)	0	0	0	0	0	0	1	1	0	0
	Solar	0	0	1	1	1	1	1	1	0	0
	Wind	0	0	0	0	0	0	1	1	0	0
Chile	Bioenergy	1	1	1	1	1	1	1	1	1	1
	Hydro, Small (<50MW)	1	1	1	1	1	1	1	1	1	1
	Solar	1	1	1	1	1	1	1	1	1	1
	Wind	1	1	1	1	1	1	1	1	1	1
China	Bioenergy	0	0	0	0	0	1	1	1	1	1
	Hydro, Small (<50MW)	0	1	1	1	1	1	0	1	1	1
	Solar	0	1	1	1	1	1	1	1	1	1
	Wind	0	1	1	1	1	1	1	1	1	1
India	Bioenergy	0	0	0	0	0	0	0	0	0	0
	Hydro, Small (<50MW)	0	0	0	0	0	0	0	0	0	0
	Solar	0	0	0	1	1	1	1	1	1	1
	Wind	0	0	0	1	1	1	1	1	1	1
Pakistan	Bioenergy	0	0	0	0	0	0	0	0	0	0
	Hydro, Small (<50MW)	0	1	1	1	1	1	1	1	1	1
	Wind	0	1	1	1	1	1	1	1	1	1
Peru	Bioenergy	0	0	0	1	1	1	1	1	1	1
	Hydro, Small (<50MW)	0	0	0	1	1	1	1	1	1	1
	Solar	0	0	0	1	1	1	1	1	1	1
	Wind	0	0	0	1	1	1	1	1	1	1
Philippines	Bioenergy	0	0	0	1	1	1	1	1	1	1
	Geothermal	0	0	0	0	0	0	0	0	0	0
	Hydro, Small (<50MW)	0	0	0	1	1	1	1	1	1	1
	Wind	0	0	0	1	1	1	1	1	1	1
South Africa	Hydro, Small (<50MW)	0	0	0	0	1	1	1	1	1	1
	Solar	0	0	0	0	1	1	1	1	1	1
	Wind	0	0	0	0	1	1	1	1	1	1
Thailand	Bioenergy	0	0	1	1	1	1	1	1	1	1
	Solar	0	0	1	1	1	1	1	1	1	1
	Wind	0	0	1	1	1	1	1	1	1	1
Turkey	Geothermal	1	1	1	1	1	1	1	1	1	1
	Hydro, Small (<50MW)	1	1	1	1	1	1	1	1	1	1
	Wind	1	1	1	1	1	1	1	1	1	1
Uganda	Bioenergy	0	0	0	0	0	0	1	1	1	1
	Hydro, Small (<50MW)	1	1	1	1	1	1	1	1	1	1
Ukraine	Solar	0	0	0	1	1	1	1	1	1	1
	Wind	0	0	0	1	1	1	1	1	1	1
Uruguay	Solar, PV	0	0	0	0	0	0	1	1	1	1
	Wind	0	1	1	0	1	1	1	1	1	1
Vietnam	Hydro, Small (<50MW)	0	0	0	0	0	0	0	0	1	1
	Wind	0	0	0	0	0	0	1	1	1	1

Appendix 3. List of variables used

Type of variable	Variable	Source	URL
Dependent variable	Private finance towards renewable energy infrastructure	World Bank	http://ppi.worldbank.org/
Independent variable	Consistency of government's renewable energy policy	IEA	https://www.iea.org/policiesandmeasures/renewableenergy/
Control variable	Generation capacity	World Bank	http://ppi.worldbank.org/
	Bank Z-score		http://databank.worldbank.org/data/reports.aspx?source=global-financial-development
	Political Stability and Absence of Violence/Terrorism		http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators

	Voice and Accountability		http://data.worldbank.org/data-catalog/global-financial-development http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators
	Net official development assistance and official aid received		

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