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December 2019

Online at <https://mpra.ub.uni-muenchen.de/97473/>
MPRA Paper No. 97473, posted 16 Dec 2019 14:17 UTC

Examining risk and return profiles of renewable energy investment in developing countries: The Case of the Philippines

December 9, 2019

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Abstract

This paper examines the risk and return profiles of energy companies with renewable energy (RE) investment in developing countries taking the Philippines as our country case study. First, we analyze the impact of the global RE project specific risk and country risk on RE projects using a simple capital asset pricing model (CAPM) by benchmarking stock returns of these companies to either the global S&P (S&PGCE) index or to the local Philippine Stocks Exchange (PSE) index. Our findings show that on short- and mid- to long term investment interval, a “pure” RE company, the Energy Development Corporation (EDC), is affected by both these risks examined, while those with partial investment in renewables are affected only on the short-term. Next, we calculated these companies’ abnormal returns by using the Jensen’s alpha. Results show that EDC's alpha values are positive on all short- and medium-to-long term investments and on both indices, suggesting that Philippine RE companies are possibly underestimated on both the global RE market and the Philippine stock market. Lastly, we examined the latest Feed-in Tariff (FIT) level by using the beta results of EDC and the FIT structure of solar PV. Results show that the FIT rate generates profit to both the global and local RE companies’ risk and returns from the investors’ perspective, but is higher than the desired FIT rate from the policymakers’ perspective. This paper aids in investment decision-making by showing that differences in investment timeframes and RE shares could impact investment outcomes in developing countries.

Keywords: renewable energy investment, capital asset pricing model (CAPM); developing countries, Philippines

JEL Classifications: G12, G15, Q20

1. Introduction

Global consensus to tackle climate change to its roots is redirecting the countries to re-evaluate their economies to become more sustainable. As of September 2018, there are already 180 countries, comprising the 88.8% of the total GHG emissions, that ratified the Paris Agreement and pledged their own nationally determined contributions (NDCs)(IEA 2015). NDCs reflect a country’s national policy underlying the specific measures and targets the country pursues to reduce the global greenhouse gas (GHG) emissions (UNFCC website, accessed 16 July 2019). In this case, accelerating and scaling up the financing of clean energies will be among the main goals of a climate strategy given that the energy sector produces about 60% of these GHGs and at the same time taking note that total energy consumption is likely to increase by 48% in 2040 from 2012 (EIA 2016).

It therefore no surprise that the last decade has shown an increase in the number of countries that are developing their renewable energy potentials. More than 170 countries now have already set up their renewable energy targets and an estimated 150 countries have created policies that support renewables (KPMG 2016, 3). In terms of investments, developing countries like China, India and Brazil alone will have a 35% share of renewables globally (IRENA 2012, 15). This won’t be surprising given that renewables are not only beneficial for the environmental but as well as a means to increase access to electricity to poor households and to complement the increasing demand for energy to these developing countries’s growing economy (KPMG 2016, 4).

But while developing countries can have a crucial role for the global transition towards clean energy like renewables in these countries are still challenged by the huge capital requirement to build renewables; the higher perceived risks associated with new ‘energy’ technologies; and the ‘unfamiliarity’ in assessing renewable energy projects (IRENA 2012). This is so since renewables remain to be immature and underdeveloped technologies in these countries. For instance, local investors and project developers are having hard time convincing communities even governments of accepting and of building renewable energy facilities into their lands mainly due to political reasons and lack of awareness about renewables (Saculsan & Mori 2018, 281; Marquardt 2017; Meller 2015). This lack of local acceptance could make or break a renewable energy project. Moreover, doing business in developing countries are made more difficult by the already weak infrastructure, the prevalent bureaucratic ‘red tape’ and corruption among others (IRENA 2012, 18). These limitations are drawbacks for renewables to fully maximize its potentiality as a clean energy alternative.

The above scenario reflects the current situation in the Philippines. As one of the fastest growing economies in Asia, the country is in a hurry to fill in its increasing demand for energy, which has pushed the government to approve the construction of new coal-fired power plants in the country, not renewable energies, since this assures a quick and stable energy supply compared (some intermittent) renewables. As a result, the last years have seen a decline of renewables to the energy mix, from 47% in 2000 to 24% in 2016 (DOE website, accessed 19 August 2019; SEPO 2014). Meanwhile, coal now accounts more than 50% share in the energy mix (Remo 2016). This is despite the relative abundance of renewable energy resources in the Philippines compared other countries.

Fuel Type	Potential Capacity, Grid Use (in MW)
Hydropower	10,000
Ocean Energy	170,000
Geothermal	4,000
Wind	76,600
Solar	5 kWh/ m ² /day
Sugar cogen, rice husk, and coconut revenues	500

Table 1. Renewable Energy Potential by Fuel Type. This shows the renewable energy potential of the Philippines as estimated by the Philippines Department of Energy.

Given the challenges that could affect renewable energy investments in developing countries like the Philippines it is important in making investment decisions that the risks involved are properly evaluated and likewise compensated for. When undertaking investments, debtors and investors are keen into knowing an asset/project's cost of capital or the asset/project's risk and returns. Knowing the proper cost of capital also gives an effective tool to the policymakers so that they too can structure the incentive rates like the feed-in tariff (FIT) to ensure it bears the right balance between sufficient enough to attract investments but won't be too high to burden taxpayers.

The cost of capital for small and medium-sized renewable energy companies in the Philippines mostly uses a higher percentage of own funding or equity finance given that banks are still unfamiliar with renewable energy projects and are reluctant to lend (Saculsan & Mori, 2018:280-281). With an immature capital market that cannot provide long-term finance and without a 'ready and guaranteed' power market for the output of renewables puts it at a disadvantage compared conventional energies like coal in the Philippines (KPMG 2013). In order to solve these issues, determining the risk and returns of equity finance for renewable energy projects in the Philippines will be the primary focus of this paper.

The paper is organized as follows: Section 2 provides the analytical framework to explain the significance and contribution of this paper to the literature of asset pricing, particularly renewable energy projects, in developing countries. Section 3 describes the data and methodology used for this paper zooming-in the profiles and characteristics of Philippine renewable energy companies. Section 4 presents the regression results and findings. Section 5 looks into the current FIT structure and comparing this with the new FIT structure using the generated betas as benchmarked to either the global renewable S&P GCE or the local PSE index. Section 6 concludes and summarizes the findings of this paper. Lastly, Section 7 discusses the limitations and possible future research regarding this topic.

2. Analytical Framework

In determining the cost of equity, the capital asset pricing model (or CAPM) is the basic and the most widely used finance methodology. CAPM is used for pricing stocks and gauging the extent to which markets are integrated (Treydor, 1961; Sharpe, 1964; Mossin, 1966). Central to CAPM is the calculation of an appropriate beta or systematic risk because this is the kind of risk that cannot be eliminated through diversifying the assets portfolio. This is also the reason why CAPM is also called the single-factor model for asset pricing because it purports that the return to an investment is a linear function of the beta. However, some empirical studies have challenged the validity and efficacy of CAPM given its underlying theoretical assumptions below:

- i) investors are risk averse who are maximizing utility in the same time horizon;
- ii) investors are homogenous that no single investor can affect the price;
- iii) investors can borrow or lend money at the risk-free rate of return;
- iv) assets are marketable and divisible;
- v) there is information symmetry; and
- vi) no tax or transaction costs.

These assumptions beg the question if it can be applicable to the real world more so in developing countries' conditions (Basu D & Chawla D, 2010: 210). May studies have already provided empirical studies showing that CAPM is not suitable and that beta alone is not sufficient to quantify the returns and risk variables of a still immature and volatile market that characterize most developing countries (Kolani & Vikpossi 2014, 18). These studies have also shown that developing countries are vastly different from those of developed markets in terms of risk, return, and liquidity patterns (Kolani & Vikpossi 2014, 18).

A study by Ali et al. (2010), for example, tested the validity of CAPM in in the Dhaka Stock Exchange (DSE), Bangladesh of 160 companies for the period from July 1998 to June 2008. It suggested that the beta cannot be used as the main and only source of risk. This is similar to the findings of Sehgal (1997) and Madhusoodanan

(1997) who founded no positive and significant relationship between risk and returns. When CAPM was tested in Taiwan in 1999 to evaluate eight different industries, Chiang and Doong (1999) see that risk-return relationship varies with the type of industry and that for the most part investors are penalized (not rewarded) for holding risky assets.

For our country reference, the Philippines, its literature are still sparse regarding asset pricing. Among those few like Bautista (2003) who conducted a study about the Philippine stock market concluded that the domestic market is not only sensitive to market volatility but also with the drastic changes in its domestic political and economic conditions. These findings is further validated by Ocampo (2003) who reported that the traditional CAPM approach proved a weak relationship between beta and return in the Philippine equity market by using monthly returns of stocks from 1992 to 2002. So far, CAPM has only been tested in the companies listed in the stocks exchange which are not necessarily renewable energy companies.

In general, Mobarek and Mollah (2005) concluded CAPM is not applicable a tool for the emerging Asian markets. There are many reasons why the model fails in developing countries, but a leading and logical candidate is the lack of market integration to the global market in some developing countries (Harvey 1995). Global market integration happens when a company's stockholders hold globally diversified portfolios (Bodnar et. al, 2003), while its opposite – market segmentation – happens when a country's stockholders investment is confined only to its own country. That is why according to Mishra and O'Brien (2005) the choice between the global and the market indexes makes a substantial difference in CAPM estimates in developing countries. In other words figuring the right cost of capital is also dependent on the choice of market portfolio whether it is a global or a local index.

Against this backdrop, the authors aim to fill in the gap in existing literatures where not so much are written to analyze the risk and return profiles of renewable energy companies/projects that are located in developing countries taking the Philippines as our country case study. The paper aims to provide empirical analysis on the impact of the global renewable energy project specific risk and country risk on renewable energy projects in the Philippines. CAPM is used to validate whether the beta is more closely aligned to global market index, S&P Global Clean Energy (S&PGCE) index, or to the local market, the Philippine Stocks Exchange (PSE) index. The generated beta is then tested for expected profitability through the Jensen's alpha and is likewise substituted to the current Philippine Feed-in Tariff (FIT) structure of solar PV as a case. Doing so will aid both the renewable energy investors and policymakers in finding the appropriate cost of capital that could attract investments into the sector yet is fair to the consumers who will have to bear the additional cost.

3. Data and Methodology

3.1 Data samples

Th primary data for this paper is derived from the weekly and monthly average stock returns of companies listed in the Philippines Stocks Exchange (PSE) website (Accessed 01 August 2016). The selected companies are all classified under the group '*Electricity, Energy, Power, and Water*'. To be conservative and consistent in our research approach, the authors excluded on the list the companies that are not regularly traded and/or not listed in the above category even if they have or may have renewable energy investment. This is done because of the complexity and difficulty in fleshing out all the companies with renewables in their portfolio from the data at hand. For example, big conglomerates like San Miguel is categorized as a 'Holdings Company' in PSE but is actually the biggest energy company with some renewables in its energy portfolio. There are also renewable energy companies like Vivant that is not regularly traded in PSE. Overall, the authors came up with ten (10) companies that passed these 3 criteria: (i) classified as an energy company in he PSE listing; (ii) have a renewable energy investment; and (iii) are regularly traded.

Among these 10 companies, the Energy Development Corporation (EDC) is particularly taken as a focal company reference given its business scope that is 'purely renewables'. EDC is primarily engaged in the

business of ‘exploring, developing, operating, and utilizing geothermal and other indigenous renewable energy sources for electricity generation’ (EDC 2016). It is worth noting however that EDC is a subsidiary of the Lopez-group First Philippine Holdings (FPH) through its First Gen Group (FGEN) having an effective 50.6 percent economic interest and a 67.1 percent voting interest in EDC.

Company	Code	Brief Description	RE Investment
Energy Development Corporation	EDC	primarily renewables company with almost equal investment shares between PH and other countries	geothermal, wind, solar and hydropower <i>*EDC is part of the First Gen Corporation (“First Gen”) Group</i>
First Gen Corporation	FGEN	natural gas but owns 40% indirect economic interest of EDC	the largest clean and RE IPP in the country; wind, solar, hydropower and geothermal
First Philippine Holdings Corporation	FPH	major investments in power generation, real estate development, manufacturing, and construction and other services.	about 1,459.6 MW of wind, solar, and hydropower, with shares on EDC and FGEN <i>*mostly just partnerships or indirectly through its subsidiaries</i>
Aboitiz Power Corporation	AP	power distribution and generation	geothermal, large hydro and run-of-river hydro
Alsons Consolidated Resources, Inc.	ACR	investment holding company, and oil and coal exploration	Hydropower <i>*mostly in Mindanao</i>
PetroEnergy Resources Corporation	PERC	oil exploration and development and mining activities	solar and wind
Phinma Energy Corporation	PHEN	oil, gas	wind and geothermal
Basic Energy Corporation	BSC	primary an investment holding company; oil and gas exploration; eco farms	geothermal and biofuels
Petron Corporation	PCOR	refining of crude oil and the marketing and distribution of refined petroleum products including gasoline, LPG, diesel, jet fuel, kerosene, asphalts and petrochemicals.	Hydropower <i>*mostly engaged in refinery investments abroad</i>
Manila Electric Company	MER	Coal	hydroelectric through a joint venture <i>*mostly, if not all are coal</i>

Table 2 Profile of Listed Energy Companies with Renewables in their Energy Portfolio. This is a brief profile of each of the selected companies in the Philippines highlighting renewables in their investment portfolio. The information is taken from these companies’ financial reports and their respective company websites. Renewable energy companies under study as listed and classified under the “Electricity, Energy, Power, and Water” category in the Philippine Stocks Exchange (PSE) website. Additional information about the company were gathered from company reports.

The monthly average data, which we pertain as the mid- to long-term investment interval, is from 01 August 2016 to 31 July 2017. The weekly average data or the short-term investment interval, on the other hand, is from 01 August 2016 to 11 August 2017. The difference in timeframe is due to the availability of S&P GCE data on renewable energy returns globally. Also, renewable energy (except large geothermal) is relatively at the early stage of development in the Philippines. The renewable energy law was only passed in 2008 while incentives to promote renewables like FIT was only accomplished 4 years after in 2012.

3.2 Methodology

The averages of the stock returns of these companies are benchmarked using either of these two index: (i) the S&P Global Clean Energy index (here referred to as S&P GCE) or the (ii) the local Philippine Stocks Exchange (here referred to as PSE) index.

The S&P GCE is chosen to represent the renewable energy project specific risk because this index is one of the most popular clean energy index use globally that tracks the performance of companies that invest in clean

energy specifically in renewable energy projects¹. Aside from this, the S&P GCE index was also chosen because of the ease of access and availability of data online. These renewable project specific risks (eg. grid risk, technological risks, policy risks, credit risk) are specifically identified to be the risks commonly faced by investors when investing in renewable energy projects worldwide (Lee 2014). On the other hand, the PSE is chosen to represent the country risk vis-à-vis Philippine local conditions because this is the national and the only stock exchange in the Philippines with about 261 listed companies as of September 2014 (pse.com.ph website, accessed 31 July 2017). These country risks (e.g. political risk, economic risk) refers to the risks associated when investing in a particular country, in this case, the Philippines (Investopedia. *country risk*, 5 August 2019).

For the calculation of beta, the authors made use of a simple linear regression in Excel, which indicates the relative risk of a renewable energy company versus a benchmark market (ie., global S&P GCE or local PSE index) over a period as shown in the formula:

$$\text{Regress } r_i \text{ on } r_m \tag{1}$$

β = the slope of the regression estimate

r_i = one of the companies' average weekly or monthly stock prices

r_m = market portfolio index (eg., S&P GCE or PSE index) average weekly or monthly stock returns

Furthermore, the companies' Jensen's Alpha (or simply 'α') is included to measure the average return of a portfolio or investment above or below the predicted returns under the CAPM methodology (Investopedia. *Jensen's Measure*, accessed 05 August 2019). Simply put, this is the excess market returns of an investment. The value of the alpha is shown as the intercept of the regression estimate of the CAPM. It can also be computed manually using the equation below:

$$\alpha = r_s - [r_f + \beta (r_b - r_f)] \tag{2}$$

α = Jensen's alpha

r_s = the average sum total of a company's average weekly or monthly stock prices

r_f = risk free rate

β = the computed beta based on either of the two indices mentioned;

r_b = the average sum total (either S&P GCE or PSE index) average weekly or monthly returns

We also looked into the t-stat value and standard error to check for the statistical significance of the results. In this case, a greater than absolute value of 2 means the computed value is statistically significant.

Secondary and extensive literature review are also done to complement the primary data when analyzing and making the comparisons. Publicly available data on FIT regulations, for example, as issued by the Philippine Department of Energy (DOE) and Energy Regulatory Commission (ERC) are used.

At last take note that although many scholars have proposed alternative methodologies to fill in this weakness of CAPM to account for the risks that is not captured by the beta of the CAPM (eg., Arbitrage Pricing Theory (APT) of Ross (1976); the Multi-Factor Model of Fama and French (1996); the Downside or D-CAPM of Estrada (2002), and the Global CAPM of Damodaran (1999), among others, this paper does not intend to propose any alternatives to CAPM because of data limitation of the country reference study, the Philippines.

1 According to the global renewables S&P GCE website (Accessed 22 August 2019), the index "provides liquid and tradable exposure to 30 companies from around the world that are involved in clean energy related businesses. The index comprises a diversified mix of clean energy production and clean energy equipment & technology companies".

4. Empirical Study Results and Discussions

4.1 Examining the beta (risk) in terms of the global renewable S&P GCE and the local PSE over the short-term and mid-to-long term investment intervals

First, we analyzed the regression results of generated betas from the weekly average stock returns, which represent the short-term investment interval, given in Table 3. The results have adjusted R-square higher than 90% for all companies except AP and MER in cases when these companies are benchmarked to either the global S&PGCE index or the local PSE index. The adjusted R-square indicates the percentage by which the dependent variable (i.e., company's stock returns) can be predicted or explained by the independent variable (i.e., index's stock returns). In this case, 90% of the movement in the stock returns are predicted or explained by the movement in the benchmark index used.

In terms of beta results, whether benchmarked to the global renewables S&PGCE or the local PSE, all companies generated positive and statistically significant betas close to 1. This entail that all companies stock prices and thereby their risks can be predicted by the movement in both the global renewables market and the Philippine local market.

Now zooming in the regression results of our proxy to a 'pure' renewable energy company, EDC, as shown in Tables 4 & 5, EDC's beta results are almost similar when benchmarked to both indices although a bit closer to 1 when data is benchmarked to the global renewables S&PGCE index. These beta results as well as the models itself are both statistically significant with less than 5% error of beta. Also, the two models' adjusted R-square is around 98% indicating that the stock returns for short-term investment could be predicted by the movement in both of the two index used.

Thus, looking at a short-term investment interval, we see that energy companies with renewable energy investment are strongly affected by both global renewable energy project specific risk (represented by the S&P GCE index) and the country risk (represented by the PSE index).

<i>Company</i>	β -S&P	<i>Standard Error of Beta</i>	<i>Adj. R²</i>	<i>Standard Error of the Model</i>
EDC	1.002	0.015	0.989	0.032
FGEN	0.992	0.016	0.986	0.035
FPH	1.000	0.028	0.961	0.060
AP	0.776	0.088	0.599	0.188
ACR	0.993	0.036	0.938	0.076
PHEN	0.993	0.011	0.993	0.024
PERC	1.013	0.029	0.960	0.062
BSC	0.999	0.032	0.952	0.067
MER	1.010	0.104	0.647	0.221
PCOR	0.995	0.016	0.986	0.035

<i>Company</i>	β -PSE	<i>Standard Error of Beta</i>	<i>Adj. R²</i>	<i>Standard Error of the Model</i>
EDC	1.003	0.015	0.989	0.032
FGEN	0.994	0.016	0.987	0.033
FPH	0.999	0.029	0.958	0.062
AP	0.774	0.089	0.595	0.189
ACR	0.993	0.036	0.937	0.077
PHEN	0.994	0.011	0.994	0.023
PERC	1.012	0.030	0.957	0.064
BSC	1.000	0.032	0.951	0.067
MER	1.015	0.103	0.651	0.220
PCOR	0.996	0.015	0.988	0.032

Table 3 Beta Results using Weekly Average Stock Returns. The results show that adjusted R-squares are higher than 90% for all companies except AP and MER in both cases where these companies are benchmarked to the global S&PGCE and the local PSE indices. This suggests 90% of the movement stock returns for short-term investment is predicted or explained by the movement in the benchmark index used. In terms of beta results, whether benchmarked to the global S&PGCE or the local PSE, all companies generated positive and statistically significant betas close to 1.

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.994
R Square	0.989
Adjusted R Square	0.989
Standard Error	0.032
Observations	52

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.003	0.005	0.612	0.543
β	1.002	0.015	66.630	0.000

Table 4. Proxy Renewable Energy Company Regression Results (Global S&P-Weekly). When data is benchmarked to the global S&PGCE index on short-term investment interval, EDC’s beta results show a positive and statistically significant beta closest to 1. Also, the adjusted R-square is pegged at 99% indicating that EDC’s weekly stock returns are aligned and predicted by the market movement of renewables worldwide.

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.995
R Square	0.989
Adjusted R Square	0.989
Standard Error	0.032
Observations	52

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.004	0.005	0.778	0.440
β	1.003	0.015	67.417	0.000

Table 5. Proxy Renewable Energy Company Regression Results (Local PSE-Weekly). Identical with the previous result, EDC’s beta results show a positive and statistically significant beta also close to 1 when stock returns on a short-term duration are benchmarked to the local PSE. Also, the adjusted R-square is pegged at 99% indicating that EDC’s weekly stock returns are aligned and predicted by the movement within the local Philippine market.

Next in Table 6, we analyzed each company’s monthly average stock returns to represent the mid- to long-term investment interval. When benchmarked to the global renewables S&P GCE index, beta results are more variable and have larger gaps from one company to another. Among these companies, only EDC and ACR have betas close to 1 although EDC alone is statistically significant. These results are also similar even when the stock returns were benchmarked to the local PSE index, only this time EDC and PERC have betas close to 1 and EDC alone is statistically significant.

In both market index, EDC is the only company that have positive and statistically significant beta. However, EDC’s adjusted R-squares are 55% and 35% when benchmarked to the global renewables S&P GCE and local

PSE respectively, as shown in Tables 7 and 8. This suggest that the variability in the stock returns could only be ‘partially’ explained by the movement in these benchmark markets on a mid- to long- term investment interval.

Overall, the results imply that on both short and mid- to long-term investment intervals, EDC is the only renewable energy company that is affected by both the global renewable energy project specific risk and country risk. Meanwhile, energy companies with partial investment in renewables tend to work as defensive assets to market portfolio, which are affected by these two risks for the short-term investment interval only but not for the mid- to long-term investment interval. This implies that when investing in the renewable energy projects in developing countries, it is important to examine in advance how much the renewable energy projects’ share in the prospect companies from the viewpoint of renewable energy project specific risk and country risk.

Company	β -S&P	Standard Error of Beta	Adj. R^2	Standard Error of the Model
EDC	0.946	0.256	0.558	0.033
FGEN	0.277	0.196	0.091	0.025
FPH	0.301	0.248	0.045	0.032
AP	0.314	0.131	0.322	0.017
ACR	1.0396	0.633	0.145	0.082
PHEN	0.529	0.344	0.121	0.045
PERC	0.669	0.845	-0.039	0.120
BSC	1.324	0.764	0.167	0.099
MER	-0.939	1.073	-0.024	0.139
PCOR	0.208	0.532	-0.093	0.069

Company	β -PSE	Standard Error of Beta	Adj. R^2	Standard Error of the Model
EDC	0.853	0.337	0.352	0.040
FGEN	0.069	0.234	-0.101	0.028
FPH	0.126	0.287	-0.088	0.034
AP	0.188	0.171	0.021	0.020
ACR	1.918	0.450	0.632	0.054
PHEN	0.470	0.388	0.044	0.047
PERC	0.847	0.905	-0.013	0.108
BSC	0.542	0.939	-0.071	0.112
MER	-0.415	1.203	-0.097	0.144
PCOR	0.711	0.531	0.073	0.064

Table 6. Beta Result using Monthly Average Stock Returns. Data on monthly average or the mid- to long-term investment interval only has 11 observations covering one-year period from August 2016 to August 2017. The authors wish to expand the data timeframe in the future researches when data becomes available. When each company’s monthly average stock returns are benchmarked to the global S&PGCE index, beta results are shown to be more variable and have larger gaps from one company to another. Among these companies, only EDC and ACR have betas close to 1 although EDC alone is statistically significant. These results are also similar even when the stock returns were benchmarked to the local PSE index. This time EDC and PERC have betas close to 1 although EDC alone is statistically significant.

SUMMARY OUTPUT

<i>Regression Statistics</i>				
Multiple R		0.776		
R Square		0.603		
Adjusted R Square		0.558		
Standard Error		0.033		
Observations		11		

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.004	0.010	0.444	0.668
β	0.946	0.256	3.693	0.005

Table 7. Proxy Renewable Energy Company Regression Results (Global S&P-Monthly). EDC’s adjusted R-squares is at 55% when benchmarked to the global S&PGCE, suggesting that on a mid- to long-term investment interval the variability in the stock returns could only be *partially* explained by the movement of renewable energy market worldwide. Beta result, on the other, is positive and statistically significant.

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.645
R Square	0.416
Adjusted R Square	0.352
Standard Error	0.040
Observations	11

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.001	0.012	0.091	0.929
β	0.853	0.336	2.534	0.032

Table 8. Proxy Renewable Energy Company Regression Results (Local PSE-Monthly). EDC’s adjusted R-squares is at 35% when benchmarked to the local PSE, suggesting a weak correlation between the stock movement of EDC with the local Philippine market on a mid- to long-term investment interval. Beta result, however, remains positive and statistically significant.

4.2 Examining renewable companies’ profitability thru the Jensen’s alpha

We then computed for the Jensen’s alpha based on the CAPM regression estimate (see Table 9). Jensen’s alpha (α) is a measure of profitability, or the average return of a portfolio or investment above or below the predicted returns under the CAPM methodology (Investopedia website on *Jensen's Measure*. Accessed 5 August 2019). Put simply, this is the investment’s excess returns relative the returns predicted by CAPM. When comparing, we determine the ‘profitable’ companies based on which has (greater) positive or (lesser) negative alpha values.

<i>Company Name</i>	<i>Mid- to Long-Term</i>		<i>Short-Term</i>	
	<i>S&PGCE</i>	<i>PSE</i>	<i>S&PGCE</i>	<i>PSE</i>
EDC	0.004*	0.001	0.003	0.004*
FGEN	-0.026	-0.027	-0.005	-0.005
FPH	-0.003	-0.004	0.001	0.002*
AP	-0.012**	-0.014**	-0.025	-0.025
ACR	-0.016	-0.02	-0.005	-0.004
PERC	0.064	0.061	0.014	0.015*
PHEN	-0.013	-0.015	-0.005	-0.004
BSC	0.027*	0.022	0.001*	0.001*
PCOR	-0.009	-0.01	-0.003	-0.003
MER	-0.008	-0.005	0.014	0.015*

Table 9. Jensen’s Alpha Results. Jensen’s Alpha (or simply “ α ”) is computed to measure the average return of a portfolio or investment above or below the predicted returns under the CAPM methodology. Take note that the those with * are companies with positive and greater alpha value compared opposite investment interval, while the company, which is in this case is AP with ** is the only company that has statistically significant alpha value.

On a short-term investment interval, more companies are likely to be more profitable when their beta is benchmarked to the local PSE index. These include companies such as EDC, FPH, ACR, PERC, PHEN, BCS, and MER. Among these companies only EDC, FPH, PERC, BSC, and MER have positive alpha values although none of which are statistically significant. The result is opposite on a mid- to long- term investment where all of these companies with the exception of only MER are likely to be more profitable if their beta is benchmarked to the global S&PGCE than otherwise. Two companies, EDC and BSC, have positive alpha values although both not statistically significant. On the other hand, AP has negative alpha value but is statistically significant.

The results show that on a short-term investment interval, renewable energy companies are more profitable to the national market portfolio than to the global renewable energy market portfolio. While on a mid- to long-term investment interval, Philippine renewable energy companies are more profitable to the global renewable market portfolio than the national stock market portfolio. Taking into account this information can help investors make their investment strategies such that different time intervals could provide profitable returns to renewable investments. More importantly, EDC's alpha value is positive for both short- and medium-to-long term investments and both S&PGCE and PSE indices. It shows that Philippine renewable energy companies are possibly underestimated in both the global renewable energy market and the Philippine stock market.

5. Evaluating the Incentive for Renewable Energy Investment through FIT

In the Philippines, the cost of equity is one of the basis in providing the incentives for renewable energy investment. For most countries including the Philippines this incentive is usually in the form of a Feed-in Tariff (FIT). FIT refers to a long-term guaranteed payment, typically with rate higher than the conventional energy, calculated per Kwh of energy produced from renewables. It is considered the most popular renewable energy incentive around the world with 75 countries and 29 states or provinces implementing this as means to promote and attract the investment to renewable energy technologies (REN 21 2017). Knowing the appropriate FIT rate from the calculated beta through CAPM could help policymakers decide the FIT rate at the level that is sufficient to boost investments in the sector while ensuring fairness to the taxpayers who will have to shoulder the cost.

FIT calculation in the Philippines basically follows the renewable energy technology market-based Weighted Cost of Capital (WACC) to determine return on invested capital, given in the following equation (Philippine Department of Energy):

$$WACC = [r_i \times E] + [r_d \times D / V] \quad (3)$$

where,

r_i = cost of equity

r_d = cost of debt

E = the amount of equity funding equivalent

D = the amount of debt funding equivalent

V = E + D

<i>Particulars</i>	<i>Values</i>
Market Risk Premium (MRP) ($r_m - r_f$)	8.60%
Beta (β)	1.0
Risk Free Rate (r_f)	5.27%
<i>Cost of Equity</i>	<i>13.87%</i>

Table 10. Breakdown of Solar PV Equity Rate. To evaluate the FIT incentive, we are taking the FIT incentive structure for solar PV as a case

Since debt is pretty much guaranteed and thus less risky, it is not so much as tricky as the determination of the cost of equity where more risks are involved. The complexities of these risks and assigning each the appropriate values are matters altogether that gives the evaluators the headaches. Also, from the perspectives of investors and project developers who are after profits and even the government who is trying to strike the balance between luring investments into the renewable energy sector yet would not compromise the public's coffer, knowing the appropriate cost of equity could help create a strategy that is beneficial for each if not for everyone, thus, we are focusing here on the evaluation of the cost of equity (IRR) in the calculation of FIT. As mentioned previously, the CAPM evaluates the cost of equity through the following equation:

$$r_i = r_f + \beta (r_m - r_f) \quad (4)$$

where,

r_i = cost of equity

r_f = risk-free rate

β = beta or the systematic risk-free

r_m = expected market returns

$r_m - r_f$ = market premiums

The MRP follows the Total Risk Premium (TRP) and is set at 8.60%. The TRP equals the estimated Default Spread of 190 basis points plus the historical risk premium for a mature equity market (estimated from historical US data). Because most of the renewable energy companies in the Philippines are still not listed in the Philippine stocks exchange market, MRP estimate of renewable energy investment relies on a sophisticated capital market of a developed country such as the U.S. The 5.27% risk-free rate (r_f), on the other hand, was benchmarked on the daily average of Philippine Dealing System Treasury Fixing (PDST -F) rates for the CY 2014 as published by Philippine Dealing and Exchange Corporation (PDEX) in its official website (Accessed 19 August 2019). Lastly, the beta of 1.0 is estimated from the levered and re-levered betas of listed comparable companies from Bloomberg database.

The authors recalculated the cost of equity as derived from the FIT structure for solar PV using the beta results from EDC, as proxy for all renewable energy companies/projects (see results in Table 11, 2nd and 3rd columns). For purposes of comparison, two analyses were done. In the analysis, all figures were retained except for the beta. In the second analysis, the MRP was set to 8.40% to reflect the latest computed Philippine market risk premium, as published by Damodaran (2017).

<i>Particulars</i>	<i>Cost of Equity (viz. FIT)</i>	<i>Cost of Equity- EDC- S&P</i>	<i>Cost of Equity- EDC- PSE</i>
Market Risk Premium (MRP)($r_m - r_f$)	8.60%	8.60% 8.40%**	8.60% 8.40%**
Beta (β)	1.00	0.9462 (monthly) 1.0017 (weekly)	0.8527 (monthly) 1.0028 (weekly)
Risk Free Rate (r_f)	5.27% 1.32% (weekly)	5.27% 1.32% (weekly)	5.27% 1.32% (weekly)
<i>Cost of Equity/FIT</i>	13.87%(monthly) 9.92%(weekly)	13.41% (monthly) 9.93% (weekly)	12.60% (monthly) 9.94%(weekly)
<i>Cost of Equity/FIT**</i>	N/A	13.22% (monthly) 9.73% (weekly)	12.43%(monthly) 9.74%(weekly)

Table 11. Cost of Equity/FIT Structure from Generated Betas. Result of recalculated cost of equity as derived from the FIT structure for solar PV using the beta results from EDC as proxy for all renewable energy companies/projects in the Philippines. Note that the current *Cost of Equity/FIT level* is greater than the computed Cost of Equity/FIT with ** from the new generated betas.

In the first analysis, the cost of equity computed from the generated betas on the mid- to long-term investment duration is lower than current FIT rate. The lowest FIT rate generated is at 12.60% when beta is benchmarked to the local PSE index. However, using generated betas on short-term investment interval resulted to a slightly higher cost of equity at 9.93% (S&PGCE) and 9.94% (PSE) respectively compared with only 9.92% when beta was 1 at current FIT rate.

In the second analysis, the market premium was set at 8.40%. Similar to previous results were found. The equity cost of equity is lower on both cases: when beta was benchmarked to the global renewable S&PGCE on mid- to long-term investment interval, and when beta was benchmarked to the local PSE on short-term investment interval.

In general, the current cost of equity/FIT rate is shown to be greater than the computed rates when benchmarked to either S&PGCE or PSE. This implies that the latest FIT level generates profit for both the perspectives of the Philippine renewable energy companies' risk and returns and the global renewable energy companies' risk and returns. This is particularly highlighted more in a mid- to long-term perspective for Philippine companies' risk and returns. Although these results sound good for the investors who are after profits, this signals that policymakers may have to adjust the current FIT rate to reflect the lower cost of equity that is necessary to attract investments in the renewables sector. FIT are basically funded from taxpayers who are now burdened to pay more for the development of renewables in the Philippines.

6. Summary and Conclusions

Although clean energy projects are growing globally with bright prospect, investment in renewable energy remains to be a challenge for developing countries. As a developing country with huge potentials for renewables but is struggling to attract investments in the sector because of the difficulty to access finance, administrative hurdles, local opposition to build renewable facility, uncertainty with FIT approval, among others, we take the Philippines as a country case study to analyze the risk and return profiles of energy companies with renewable energy investments. By doing so the authors aim that the findings of this paper can help investors and policymakers alike in their investment decision-making and in setting appropriate incentive schemes that will promote renewables in the country.

First, the authors examine the impact of the global project specific risk and country risk to the Philippine energy companies/projects through the simple Capital Asset Pricing Model (or CAPM). Of the 10 companies under study, a 'pure' renewable energy company, Energy Development Corporation (EDC), is taken as a focus of analysis. We specifically explored the calculation of the beta (β) through CAPM by employing a simple linear regression in Excel of each company's stock returns benchmarked to a market index, which is either the global renewables S&P Global Clean Energy (S&PGCE) or the local Philippine Stocks Exchange (PSE). The S&PGCE market index represents the project specific risks in investing to renewables worldwide while the PSE market index represent the risks confined only to local conditions. Weekly and monthly average returns data from August 2016 to August 2017 were used to represent short and mid- to long-term investment intervals, respectively. Beta results shows that on a short-term investment interval, all energy companies with renewable energy investment are strongly affected by both the global renewable energy project specific risk and country risk. However, for a mid- to long-term investment interval, EDC is the only renewable energy company that is affected by these two risks as this it is the only company that has statistically significant close to 1 beta results. Meanwhile, energy companies with partial investment in renewables tend to work as defensive assets to market portfolio, which are not affected by both risks. It implies that to invest in renewable energy projects in emerging economies, it is important to examine in advance how much is the renewable energy project's share in the prospect company from the viewpoint of renewable energy project specific risk and country risk.

Next, EDC's abnormal returns, as derived from Jensen's alpha calculation, is shown positive for both short- and medium-to-long term investments whether benchmarked to S&PGCE index or PSE index. This shows that Philippine renewable energy companies' expected returns are possibly underestimated in both the global renewable energy market and the Philippine stock market.

Lastly, we use the beta results of EDC as proxy to determine the incentive for investing in renewables in the form of the Feed-in Tariff (FIT), using the rate structure of solar PV as a case study. The result shows that the latest FIT rate is greater than the FIT rate computed from the generated betas. This implies that the latest FIT level generates profit for both the perspectives of the global renewable energy market and the Philippine companies' risk and returns. This gap is highlighted more in a mid- to long-term perspective for Philippine companies' risk and returns. Although this may sound good for the investors who are after profits, this signals that policymakers may have to adjust the current FIT rate to reflect the lower cost of equity so as not to burden the taxpayers who have to pay more for the development of renewables in the country.

7. Limitations and possible future study

While, overall, the paper provided a rich analysis of the use of CAPM in evaluating the renewable energy investment and incentive of a developing country like the Philippines, the authors recognize that the study was limited in scope. Due to data availability, we are only able to include 10 companies with only 1 company that is truly a 'pure' renewable energy company while the remaining others have only partial if not very little investments to renewables. Also, due to the relative early development of renewables in the Philippines, the timeframe is only limited to 1 year. In which case the small samples and short observation period may lead to some measurement errors.

In terms of market portfolio use as a benchmark, the S&P Global Clean Energy index that is used to represent the project specific risk to renewables is a market portfolio not only confined to renewable energy investments worldwide. Because it is impossible to gather and combine all renewable energy assets into one global market portfolio we opt to use S&P GCE as our proxy. Also, the PSE index is not as sophisticated and developed compared that of course of developed markets, say, the US. As of the present there are only about 261 companies listed in the Philippine stocks exchange. In one study, Krištofik (2010, 5) pointed that using the stock price index as the market portfolio in developing countries like the Philippines is 'rarely a good proxy' as it doesn't truly reflect the real local business environment of these countries. It is so because local businesses are subject to

strong foreign impacts in much greater measure than their counterparts in developed countries and that most of the companies listed in the stocks are controlled by a monopoly of family groups or few shareholders.

Despite its weakness, the analysis presented in this paper add to the still few literatures on asset valuation of renewables in developing countries. At the same time the paper raises many issues and questions we can explore and further elaborate like, perhaps, expanding the CAPM to tailor fit the conditions of a developing country. As the first study in the Philippines that has, so far, utilize the tools of CAPM to analyze its renewable energy investment, the authors hope that there will be succeeding future studies of the same topic.

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