

**THE ROLE OF RENEWABLE ENERGY IN  
POVERTY REDUCTION AND  
ENVIRONMENTAL IMPROVEMENT**

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**THE ROLE OF RENEWABLE ENERGY IN  
POVERTY REDUCTION AND  
ENVIRONMENTAL IMPROVEMENT**

by

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## LIST OF ABBREVIATIONS

<i>CO<sub>2</sub></i>	Carbon Dioxide Emission
<i>EKC</i>	Environmental Kuznets Curve
<i>ED</i>	Environmental Degradation
<i>GDP</i>	Gross Domestic Product Per Capita
<i>EDU</i>	Education
<i>RE</i>	Renewable Energy
<i>FDI</i>	Foreign Direct Investment
<i>POV</i>	Poverty
<i>GMM</i>	Generalized Method of Moments
<i>DIF-GMM</i>	First difference GMM
<i>SYS-GMM</i>	System GMM

**PERANAN TENAGA YANG BOLEH DIPERBAHARUI DALAM  
PENGURANGAN KEMISKINAN DAN PENAMBAHBAIKAN ALAM  
SEKITAR**

**ABSTRAK**

Biasanya, kualiti alam sekitar yang baik akan membawa pertumbuhan ekonomi di mana sekurang-kurangnya persekitaran akan membekalkan sumber asli untuk menghasilkan barang dan perkhidmatan. Oleh itu, persekitaran yang baik adalah penting bagi pertumbuhan ekonomi yang mampan. Walau bagaimanapun, bagi kebanyakan negara-negara sedang membangun di dunia, kemiskinan telah menjadi ciri utama di mana orang miskin mengeksploitasi sumber-sumber alam secara berlebihan untuk memenuhi keperluan mereka. Oleh yang demikian, kajian ini menguji kesan kemiskinan ke atas kualiti alam sekitar dengan menggunakan data “panel” daripada 52 negara-negara sedang membangun. Dengan menggunakan kaedah “*Generalized Method of Moments*” (GMM), penemuan kami telah membuktikan bahawa kemiskinan adalah punca utama kemerosotan kualiti alam sekitar di seluruh negara-negara sedang membangun. Sebagai penyelesaian kepada isu ini, kajian ini juga cuba untuk meneliti kesan daripada tenaga boleh diperbaharui untuk mengurangkan kesan buruk kemiskinan ke atas kualiti alam sekitar. Melalui analisis panel, kajian ini dapat membuktikan bahawa tenaga yang boleh diperbaharui cenderung untuk meminimumkan kesan kemiskinan ke atas kualiti alam sekitar. Oleh itu, usaha-usaha untuk mengurangkan pencemaran alam sekitar mestilah cukup komprehensif dan keutamaan dasar alam sekitar perlu, di tempat pertama, menasarkankan pengurangan kemiskinan. Penerimaan dan pengunapakaian tenaga yang boleh diperbaharui serta pelaburan dalam teknologi mesra alam boleh mengurangkan kemusnahan alam sekitar daripada golongan kemiskinan.

# **THE ROLE OF RENEWABLE ENERGY IN POVERTY REDUCTION AND ENVIRONMENTAL IMPROVEMENT**

## **ABSTRACT**

Commonly, a good environmental quality will lead to an economic growth where at the very least environment will supply natural resources to produce goods and services. Therefore, a good environment will be essential for the sustainable economic growth. Nonetheless, for most of developing countries in the world, poverty has been the main feature where poor people may overexploit the environment resources to fulfill their needs. Hence, the present study investigates the effect of poverty on environmental deterioration using panel data of 52 developing countries. Utilizing the Generalized Method of Moments (GMM) estimation technique, our findings establish that poverty is the primary sources of environmental damage across the countries. As part of the potential solution to this issue, this study also attempts to examine the effect of renewable energy in mitigating the adverse effect of poverty on environmental deterioration. Adopting the panel data analysis, the paper discovers evidence that the presence of renewable energy tends to minimize the adverse effect of poverty on environmental degradation. Therefore, the efforts to reduce environmental degradation must be comprehensive enough and the priority of policies on the environment should, in the first place, target poverty reduction. For that reason, adoption and promotion of renewable energy as well as investment in other environmentally friendly technologies can mitigate the extent of destruction that poverty can have on the environment.

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 OVERVIEW**

Environment is recognized as a broad term with a huge interpretation and definitions. Neefjes (2000) employed this term as a “where we live and everything around to a living being particularly the circumstance of life of people in their life conditions”. It consists of a set of natural, social and cultural values which exist in a place at the specific time and influence the life of the human beings. Good environment also has a linkage with economic development where all the economic activities such as processing, manufacturing, and transport are affected by or affect natural environmental resources. It is believed that an environment acts as a “source” to produce goods and services. For instance, natural environment directly provide raw materials and resources such as water, and minerals as inputs for the production of goods and services and contributes indirectly through services by ecosystem with water purification, nutrient cycling and carbon sequestration (Taylor, Haux and Pudney, 2012). Therefore, environment becomes a key factor to underpin and secure economic development and growth in the long-term (Bimonte, 2009).

Likewise, the relationship between economic development and environmental quality has captured much attention among the economists regarding its potential contribution to each other. Commonly, an economic development will lead to a good environmental quality by shifting the economy to less polluting sectors and technologies (Shafik, 1994). Arguably, as posited by Hitam and Borhan (2012), people become more concerned about environmental quality by purchasing less material goods and services. Suppliers also will implement environmentally friendly technologies as income rises. As a result, as income increases the quality of environment and living standard also will move in a positive direction. In a related work, Panayotou (1997), Chimeli and Braden (2005) and Narayan and Narayan (2010) estimated that economic development will lead to utilization of a new and innovative technology which provides a benefit to surrounding environment and improves the sustainability of the global environment. Therefore, it is essential to preserve the surrounding environment for long-term sustainable development and subsequently to preserve people's well-being, current and future generations (Begum, Sohag, Abdullah and Jaafar, 2015).

On other development, there has been a considerable effort made to fully understand the contribution of environment towards poverty. Evidently, United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP) jointly launched the Poverty-Environment Initiative (PEI) (De Coninck, 2009). PEI is a global programme that assists a country to achieve poverty-environment objectives by contributing a reduction in poverty and an inclusive green economy into national and sub-national (De Coninck, 2009). Additionally, PEI provides financial and technical support to the government decision-makers and

stakeholders to improve the living standard and sustainable growth by managing the environment. For illustration, PEI works with government partners in sectors' programmes and budget process in order to raise awareness and strengthen the mainstreaming of a poverty-environment link (De Coninck, 2009).

Correspondingly, Poverty-Environment Partnership (PEP) is one of the programmes to lift up the awareness of environment to Millennium Development Goals (MDGs) which rises up worldwide investment in resources management in order to eliminate poverty and also achieve MDGs. PEP makes an agreement with sustainable development goals in 2015 to reduce poverty, environmental sustainability and climate resilience of the country. It is a joint effort in the field of ending extreme poverty, environmental sustainability and nation and local development agenda (Saith, 2006). Moreover, PEP is more focusing on the green economy especially on ecosystems, natural resources and low carbon economy. This initiative is motivated by the success of inclusive Green Economy Development in which around 650 million people of 1.3 billion women, men, and child in developing countries step out from extreme poverty (less than US\$1.25) in a year between 1990 and 2008 (Hynes and Wang, 2012).

Economists have manifestly proven that the experience of developing economies in the 1980s and 1990s that an economic growth will be the primary mean to lower poverty rate and inequalities (Ravallion, 2001). Economic growth which later on followed by proper redistribution of income and assets will significantly enhances the economic development and the equity (Kakwani and Son, 2008). For instance, in

2009, China's poverty dropped from 84 percent in 1981 to 12 percent and accordingly China has successfully achieved high rates of *GDP* per capita growth and economic development around 100 percent (Samans, Blanke, Corrigan and Drzeniek, 2015). Similarly, the poverty level in Nepal between 1980 and 2014 has decreased as the life of expectancy and year of schooling increased by 20.9 years and 2.6 years respectively. The end result is *GNI* per capita has been also lifted up by 101 percent (Sharma, 2011).

Beyond that, an intrinsic positive relationship has emerged between renewable energy, poverty and economic growth respectively (Boardman, 2010). Particularly, development of renewable energy will diminish the rate dependence on foreign energy sources for import-dependent economies and also minimize the risk of volatile oil and natural gas supplies and price (Apergis, Payne, Menyah and Wolde-Rufael, 2010). Pirlogea and Cicea (2012) argued that increasing share of renewable energy in the energy mix can lead to an increment in the demand for energy in future and also influence the economic development of a country. Therefore, renewable energy is highly correlated to sustainable economic growth across countries (Sadorsky, 2009; Apergis et al., 2010; Bildirici, 2013). Subsequently, renewable energy consumption will enhance the surrounding environment quality by reducing the rate of carbon dioxide emission. Reduction of power consumption and the amount of energy generated from coal will be able to cut down its  $CO_2$  emission such as the case of Germany. In Germany, the level of  $CO_2$  emissions was decreased from eight percent from 2013 to five percent in 2014 due to transition to renewable energy sources and energy efficiencies. The share of renewable energy in Germany increased from twenty- five percent to twenty- eight percent and conversely, energy from fossil

fuels also drop to seven percent (Rueter, 2015). In summary, a number of previous studies proved that the implementation of renewable energy consumption will encourage less carbon emission across the countries (Shafiei and Salim, 2014; Jebli and Youssef, 2015; Al-Mulali and Ozturk, 2016; Bento and Moutinho, 2016).

Nonetheless, renewable energy is not only good for environmental quality. It also may help reducing poverty level around the world. More development in the renewable energy sector may help in poverty reduction, directly by offering job and income for poor people and indirectly by forcing them to less destroying the environment for energy or income. Eventually, reduction in poverty may bring in a better environmental quality (Everett, Ishwaran, Ansaloni and Rubin, 2010). A substantial reduction in poverty level in the large emerging economic sector of renewable energy has also proven good for climate as it will minimize deforestation and reduction of greenhouse emissions (Broadman, 2010). Likewise, the small scale of solar power in Bangladesh and Mongolia has dramatically changed the lives of poor people, lighting up their homes with low cost of solar systems while preserving the environmental quality in those countries. It also generates around 70 thousand jobs through the installation of solar homes system as a part of government's sustainable development strategy in rural Bangladesh (Kyte, 2015). Therefore, renewable energy might play a vital role in the elimination of poverty and well as a tool for easing the environmental degradation in developing economies.



## **1.2 BACKGROUND OF STUDY**

### *1.2.1 Economic Growth and Environmental Degradation*

The correlation between the economic development and environment are always controversial. Economic development defines as a rise in economic activities to produce and consume goods and services over a period of time in order to improve the quality of life. These increments of production and consumption activities will not only lead to the positive impact on social and economic but are also essential to maintain the environmental sustainability (Anderson, 1992; Orubu and Omotor, 2011). As evidenced by Anderson (1992), who compared the World Bank index of environmental sustainability with *GDP* per capita among 117 nations demonstrated that high-income countries uphold the environmental quality better than low-income countries. Thus, it visibly states that environmental quality will improve as income increases.

Table 1.1 illustrates the correlation of income level and  $CO_2$  emission as a proxy for environmental degradation for a number of developed and developing countries. Thus, the simple correlation between income and  $CO_2$  emission in developed and developing countries likely to tell us that as countries experience increasing trend of income, they will have a tendency to suffer less carbon emission and vice versa. An economic development tends to influence the patterns of consumption, efficiency in the production of goods and services and environmental conditions in both developed and developing nations (Orubu and Omotor, 2011). Hence, the increment in the

income per capita has generated a number of socioeconomic benefits, as well as assisted the preservation of environmental quality.

Table 1.1: *GDP Per Capita and Environmental Degradation for Selected Countries*

	<b>GDP Per Capita<sup>1</sup></b>		<b>CO<sub>2</sub> Emission<sup>2</sup></b>	
	<b>2010</b>	<b>2013</b>	<b>2010</b>	<b>2013</b>
<b><i>DEVELOPED COUNTRIES</i></b>				
Australia	51845.65	53703.57	16.92	16.35
Canada	47445.76	49229.50	14.49	13.53
Japan	42935.25	44327.94	9.76	9.15
New Zealand	33692.17	35553.03	7.65	7.30
United States	48374.09	49941.49	17.48	16.39
Italy	35851.51	33889.32	6.84	5.72
Germany	41788.04	43554.21	9.28	9.22
Switzerland	74277.12	75228.30	4.99	4.98
Ireland	48541.48	49895.98	8.82	7.60
Norway	87646.27	88394.27	12.29	11.74
<b><i>DEVELOPING COUNTRIES</i></b>				
Costa Rica	8199.43	8833.18	1.67	1.62
Egypt	2668.04	2754.29	2.47	2.43
Jamaica	4902.67	4937.63	2.85	2.70
Kazakhstan	9070.65	10368.67	15.11	15.43
Macedonia	4561.18	4759.23	4.17	4.00
Malaysia	9069.03	10062.91	8.03	7.77
Namibia	5143.13	5608.60	1.31	1.46
Romania	8297.48	8851.96	3.92	3.54
Serbia	5411.88	5670.71	6.30	6.26
Uzbekistan	1377.08	1645.91	3.65	3.41

Note: <sup>1</sup> GDP per capita is measured in constant 2010 US dollar. <sup>2</sup> CO<sub>2</sub> emissions are measured in metric tons per capita.

Sources: World Bank (2016a)

Between 2010 and 2013, it has led to raising the levels *GDP* per capita for almost every developed country and lead to a reduction in environmental damage. Looking specifically at developed countries like Australia, Canada, Japan, New Zealand, United States, Germany, Switzerland, Ireland, Italy and Norway, they are among the most successful in reducing *CO<sub>2</sub>* emission per capita with a score of between 0.08 percent and 16.2 percent relative to high *GDP* growth. Continuing economic growth will boost up the extent of efficiency, transform to more sustainable technologies and

also alleviate environmental destruction of a country (Alam and Kabir, 2013). Evidently, Munasinghe (1999) revealed that increment in *GDP* itself tends to constraint pollution in developed countries by improving the well-being of living standards, health, education and economic opportunities.

In developing countries context, the trend of  $CO_2$  for the year 2010 and 2013 is decreasing for all the developing countries while the *GDP* per capita is rising for Costa Rica, Egypt, Jamaica, Macedonia, Malaysia, Romania, Serbia, and Uzbekistan. The relationship between *GDP* per capita and environmental quality is straightforward because economic development will improve the standard of living and quality of life while it also leads to a good environmental quality. Moreover, the tables suggest that increasing *GDP* per capita for Costa Rica, Macedonia, Malaysia, Serbia, and Uzbekistan are providing better environmental performance where the amounts of carbon emissions are decreasing for the following years. It obviously shows that as people become richer, the consciousness and education related to the friendly environment are also moving upwards.

For instance, Malaysia shows a dramatic increase in *GDP* per capita from *US\$* 9069.03 in 2010 to *US\$* 10062.91 in 2013, while the amount of carbon emissions initially increases but it started to drop in the year 2013 by 0.26 percent. The initial increment of carbon emissions between years 2004 - 2008 is due to the rapid transformation of Malaysia from agricultural based economy to industrialization where the *GDP* per capita and carbon emissions are moving together (Saboori, Sulaiman and Mohd, 2012). As the Malaysian government set a target to reduce

carbon emission around forty percent as well as achieving high-income nation by 2020, a significant concern is given on economic growth and environmental sustainability (Begum et al., 2015). Therefore, the economic growth may lead to efficiency in resources management, technologies which more conducive on environmental protection.

Moreover, Serbia experiences dropping carbon emissions in 2010–2013, while the *GDP* per capita is increasing by 4.78 percent. This is because of the process of rectifying in prices of the energy industry and public utilities in 2005 and it leads to a rational consumption and lower emissions of pollutants by reducing the consumption of electricity and water (International Institute for Sustainable Development and United Nations Environment Programme, 2004). Zarenejad (2012) believed that the economic growth is parallel to the improvement of environmental quality because high economic growth could drive to rise in efficiency, technological change and preference more on conducive of environmental protection and enhancement in environmental quality. Likewise, the same trend goes to Costa Rica, Macedonia, and Uzbekistan where the carbon emissions diminishing as the *GDP* per capita gradually increases between years 2010 - 2013. The growing economic growth will enhance the awareness of good environmental quality, and enlarge the environmental protection investment where it will contribute to the dynamic balance supply and demand of environment. Thus, a sustainable economic development itself must attempt to merge these environmental and economic goals in order to increase the capacity of investment and sustainable development.

### 1.2.2 Poverty

Poverty refers as lack of both income and non-income dimensions which encompassing lack of access basic necessities of income, education, food, health, personal security, and safe water (Forsyth, Leach and Scoones, 1998). The word “poverty” is related to an indicator of the quality of life (Sen, 1981). In developing nations, almost one-quarter of world’s population is living in the circumference of poverty compared to developed (DFID, EC, UNDP, and World Bank, 2002). World Bank (2016a) pointed out that half of the extremely poor are live in Sub-Saharan Africa, who living on less than *US\$1.90* a day in 2013 and acknowledged as most impoverished areas among the regions. This is because the majority of poor are poorly educated and employed in the agricultural sectors. Therefore, the rate of poverty is getting larger in the developing rather than developed economies.

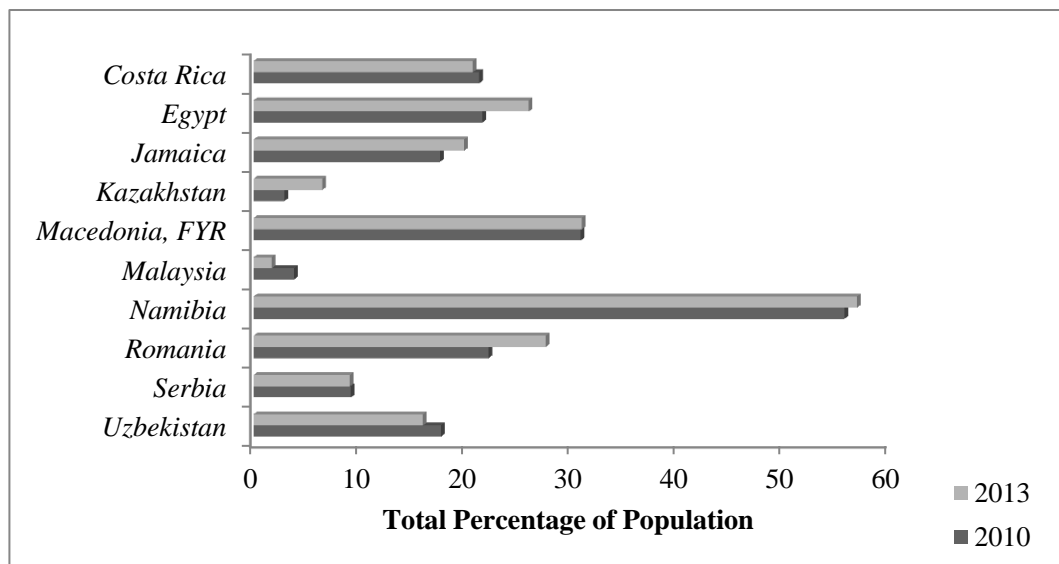


Figure 1.1: The Poverty below Poverty Line  
Sources: World Bank (2016a)

As shown in Figure 1.1, the bars represent 2010 and 2013 total percentage of population below the poverty line as an indicator of the quality of life. The trend of poverty is likely to tell us that countries experience increasing trend of poverty for selected developing nations. For illustration, between 2010 and 2013 Egypt, Jamaica, Kazakhstan, Romania, and Serbia shows that the poverty rate has increased gradually.

Based on this discussion, in Romania, more than one third of the population approximately 2.68 million of peoples is “trapped” in poverty in 2013 compare to those in the year 2006 - 2007 (Tang, 2014). This scenario happening roughly three years due to insufficient of income and even basic necessities for the living (Ilkkaracan, Kim, and Kaya, 2015). Besides that, during the crisis, the percentage of unemployment rate also very high in Romania, increasing from 6.4 percent in 2007 to 7.3 percent in 2013. Accordingly, the stipulation of poverty is being worst or much higher with a high rate of unemployment (Ilkkaracan et al., 2015). Furthermore, as we can see that the poverty rate in Egypt also goes up from 21.6 percent to 25.2 percent between 2010 and 2013, predominant in rural compare to urban areas (Ilkkaracan et al., 2015). As posited by World Bank (2016a), inadequate of education, health, food and largely household size are resulting in extreme poverty and poor living situation. Similarly, Jamaica, Kazakhstan and Serbia increased its poverty line from 17.6, 2.9 and 9.1 percent in 2010 to 19.9, 6.5 and 9.2 percent in 2013, respectively. Therefore, poverty indicator is preferred as the main indicator for measuring the proportion of the population at risk of relative poverty or with severe and material deprivation.

For developing countries as a whole, poverty is set to remain solid but muted. According to World Bank (2016a) , in developing nations, around 1.2 billion or 12 percent of the population live in extreme poverty. It is an unsurprising start to reflect its underlying potential in 2030 by reducing the percentage of people living less than US\$1.25 more than three percent globally. Notably, World Bank advises developing countries to focus on the investment that improves the living standards and creates opportunities for the entire peoples.

### 1.2.3 *Renewable Energy*

Renewable energies have the potential of allowing “win-win” strategies economically, environmentally and socially. These resources can be replenished through natural processes or own reproduction (Everett et al., 2010). For instance, renewable energy sources of solar, hydroelectric, geothermal and wind are able to offer low carbon impact, price stability and indefinite supply of energy. However, the investment of renewable energy is inadequate due to high capital costs, inconsistent supply, and difficulty to generate large quantities as those produced by non-renewable energies (Hidayatullah, Stojcevski, and Kalam, 2011; Giraldo, Mojica-Nava and Quijano, 2014).

Between 2005 and 2015 renewable energy projects has been significantly implemented and supported internationally among developed and developing countries to reduce greenhouse gas emissions by 0.4 *Gt* per year by 2020 (Dogan and

Seker, 2016). These developments are crucial to create enabling renewable sources in many countries in the world, where they can access to a more sustainable form of energy. Statistically, the top five countries which totally installed renewable power in 2014 are China, United States, Brazil, Canada and Germany (Secretariat, 2014).

According to Edenhofer, Pichs-Madruga, Sokona, Seyboth, Kadner, Zwickel, Eickemeier, and Matschoss (2011) and Jager-Waldau, (2007), investment in renewable energy requires long-term capital and becomes a complicated subject to developing countries. This may lead the developing countries to “leapfrog” on developed countries upon the use of sustainable and efficient energy. Therefore, Figure 1.2 and 1.3 exemplify the trend of renewable energy consumption for all developing and developed countries.

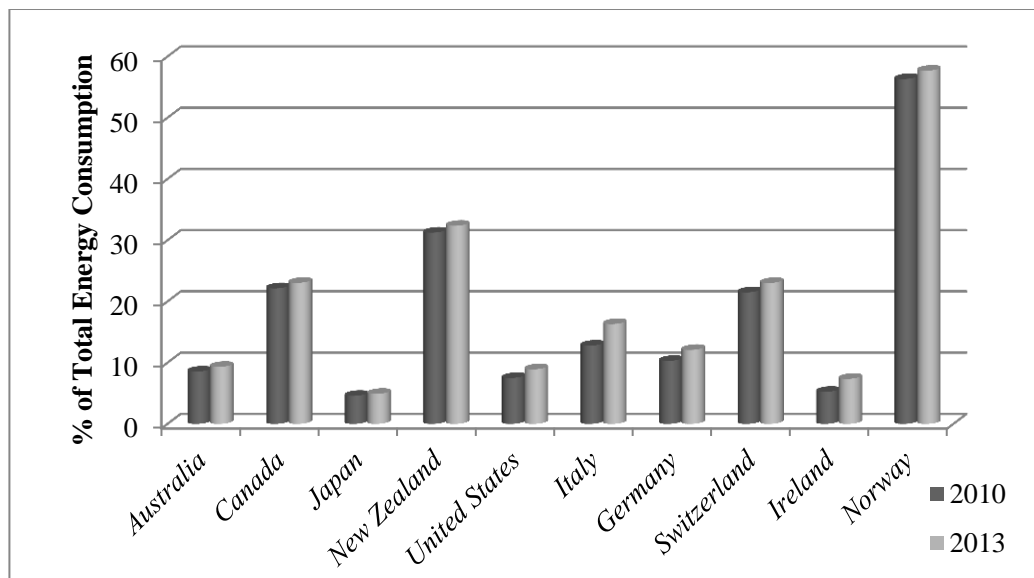


Figure 1.2: The Renewable Energy for Developed Countries  
Sources: World Bank (2016a)



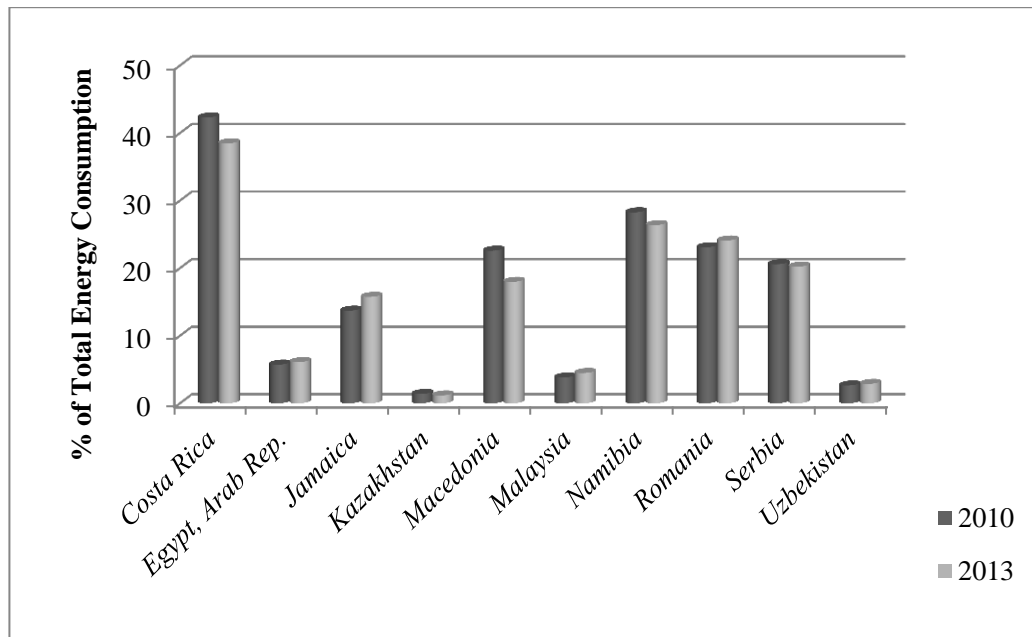


Figure 1.3: The Renewable Energy for Developing Countries  
Sources: World Bank (2016a)

Although the correlation between developed and developing countries probably tell us that both countries use or promote renewable energy, but developed economies jumped ahead of developing countries. Consumption of renewable energy increased almost fivefold (from 0.8 percent to 40.13 percent) for developed countries, while for developing countries the growth is just over 7.15 percent only. Between 2010 and 2013, all developing countries recorded low usage of renewable energy and struggled to support for the effective transfer of advanced energy technologies or sustainable energy systems (Steiner, Figueres and Steffens, 2016).

Surprisingly, the amount of investment in developing economics out-weighted developed nations in terms of total new renewable energy investment in 2015. Based on this dispute, Steiner, Figueres, and Steffens (2016, p. 20) recorded that “share of global investment accounted by developing countries rose from forty-nine percent in 2014 to fifty-five percent in 2015, while developed economies invested 141.6 billion

in 2015 from 130.1 billion 2014". Steiner et al. (2016) confirmed this institution that among the developing countries, the "big three" of China, India and Brazil continued to dominate global renewable energy investment in 2015. These "big three" of China, India and Brazil raise their new investment in renewable energy around sixteen percent or approximately \$120.2 billion in 2015, whereas the same investment in other developing country goes up by \$36.1 billion (Steiner et al., 2016).

Although the adoption of renewable energy consumption is growing in the entire of the world, the adoption is constraint by various factors such as poor regulation and financial support. Particularly, the circumstances of developing countries are even worst or complicated than developed countries. Therefore, it will be necessary for these countries to utilize more renewable-energy-based sources and decrease the shares of non-renewable sources such as fossil fuel, coal and natural gas (Al-mulali and Ozturk, 2016). In this way, the developing countries can continue to benefit by stimulating economies, reinforcing energy security and consistently promoting clean environment by promoting the development of renewable energy sector.

### **1.3 PROBLEM STATEMENT**

The twenty-first century has been marked by continued major environmental damage around the world. For instance, as observed by He, Lu, Mol, and Beckers (2012), the deterioration of the environment in China has been taking place dramatically. The

main system of seven rivers in China is polluted and has caused major health consequences among the societies. It is also affecting the supply of drinking water in that country (Saboori and Sulaiman, 2013). Although each corner of the planet is unique, the depletion of environmental elements in specific areas has been creating a global ripples effect and eventually resulted in a global issue.

Woodward (2009) and Pao and Tsai (2011) revealed that the most important environmental problem of our age is global warming and developing countries are the most vulnerable to climate change. The increase in fossil fuel burning and quantities of greenhouse gases into the atmosphere has led to the greenhouse effect and resulting in climate change. Climate change will raise global temperatures, change rainfall patterns and resulted in severe floods and droughts. The OECD environmental outlook for 2030 suggests that currents trends in the global emission of greenhouse gases are projected to grow around 37 percent and 52 percent to 2050 (Woodward, 2009). Subsequently, the projected global temperatures are expected to increase over pre-industrial levels in the range of 1.7° - 2.4° Celsius by 2050, leading to increases in heat waves, droughts, and floods, as well as resulting in severe damage to infrastructure and crops. Hence, without decisive action, emission of carbon dioxide will be more than double by 2050 and the consequences of climate change will be severe. All in all, environmental depletion has gain greatest recognition as a fundamental challenge to the whole economic growth process, especially in developing nations (Omer, 2008).

What are the factors that are responsible for the degradation of the environment? Many studies had proven the negative effects of economic output (Hamilton and Turton, 2002; Finco, 2009; and Sharma, 2011) and foreign direct investment (FDI, Cole and Elliott, 2005; Acharyya, 2009; Jalil and Feridun, 2011) on environmental deterioration. FDI also can represent urbanization and industrialization. Urbanization and industrialization are the two interrelated processes that are assumed to be invariably linked up with modernization (Huntington, 1971). In order to achieve a sustainable economic growth, it may degrade the environment as the consumption of natural resources continues at an increasing pace (Lau, Choong, and Eng, 2014). The process of economic development along with lack of trade, investment barriers, accessible 'clean' technologies, and capital circulation has induced a proportion of the pollution and waste emission in developing countries (Ahmed, 2014). Likewise, it is well known that urbanization increases pollution as the levels of industrialization is high in urban areas. In urban areas, the consumption levels of natural resources are higher, which can occur through the industrial processes in producing commodities and the corresponding domestic articulated consumer markets. Also, urbanization provides more jobs, creates social changes, and encourages a higher modernization process. The accumulation of these effects will raise pollution (Al-Mulali and Ozturk, 2016). As a result, developed nations have not only received a few benefits of the reduction in the cost of production due to the lack of environmental control but they have also become the cause for environmental degradation in the developing countries. Therefore, these statements suggest that economic development and urbanization have a high responsiveness on the destruction though it induces economic growth (Dinda, 2004).

Whilst admitting that the issues of the FDI-environment or education-environment are yet to be fully resolved, efforts, suggestions, and standard of compliances, particularly on the FDI-environment, are on the way as suggested by several studies (see Cameron and Abouchar, 1991; Rondinelli and Vastag, 1996; McAfee, 1999; Epstein and Roy, 1998; Rondinelli and Berry, 2000; Newell, 2001; Sethi, 2002; Shinsato, 2005; and Aragón-Correa and Rubio-López, 2007 amongst others). Specifically, Aragón-Correa and Rubio-López (2007) offered a good summary of the framework that can help corporate bodies to deal with the natural environment that allows for profitability and sustainability to be preserved. Prior to that, Cameron and Abouchar (1991) highlighted the precautionary principles that may guide decision-makers to consider the likely destructive effects of their activities on the quality of the environment before pursuing any activities. Epstein and Roy (1998), McAfee (1999), Newell (2001), and Sethi (2002), in a similar spirit, provided some key elements in an environmental strategy to tackle several strategic issues surrounding environmental management by multinational corporations. Rondinelli and Vastag (1996) and Rondinelli and Berry (2000), on the other hand, focused on corporate social responsibility as the main agenda needed behind multinational corporations' activities so that there will be more environmental friendly. Finally, Shinsato (2005) asked for more accountability from corporations dealing with potentially environmentally harmful activities. In short, the role of education and FDI on the environment has been receiving huge attention and good outcomes are expected in the long run.

Yet, solving environmental issue can be like ‘killing two birds with one stone’ by the less researched topic on the poverty-environment nexus. Environmental degradation problems might also be hidden behind the situation of poverty and should not be overlooked, especially in low- and/or medium-income countries as highlighted by Kuznet curve. In reality, the well-being of poor people is inextricably linked to the environment in terms of their livelihoods, health and vulnerability (Bryceson, 2002). Natural environments are deemed as public goods have common accessibility and do not have any property rights (Aggrey, Wambugu, Karugia and Wanga, 2010; Nwagbara, Abia, Uyang, and Ejeje, 2012; Hassan, Zaman, and Gul, 2015). As a result, those are poor may tend to overuse the resources unsustainably and it can trigger destruction to the environment (Finco, 2009). Brundtland (1987) viewed poverty and environmental problems in a broader perspective and expected that poverty as the major cause of environmental degradation in developing nations. Hence, the actual affiliation between poverty and degradation is still uncertain. Figures 1.4 and 1.5 show the link between number of population below poverty line as a proxy of poverty and carbon dioxide emissions (metric tons per capita) as an indicator environmental degradation in ten countries which are chosen based on regional and income groups, namely East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa and Sub-Saharan Africa countries and also lower middle and upper middle income countries (World Bank, 2015).

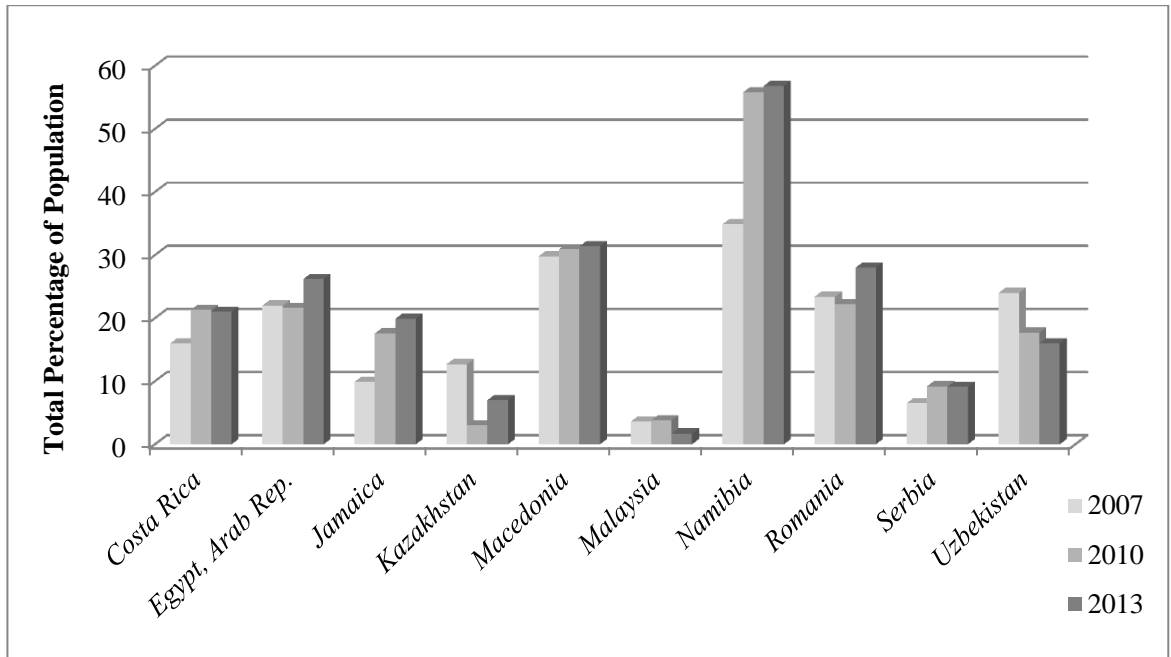


Figure 1.4: Population below Poverty Line.  
Sources: UNCTAD (2016) & World Bank (2016a).

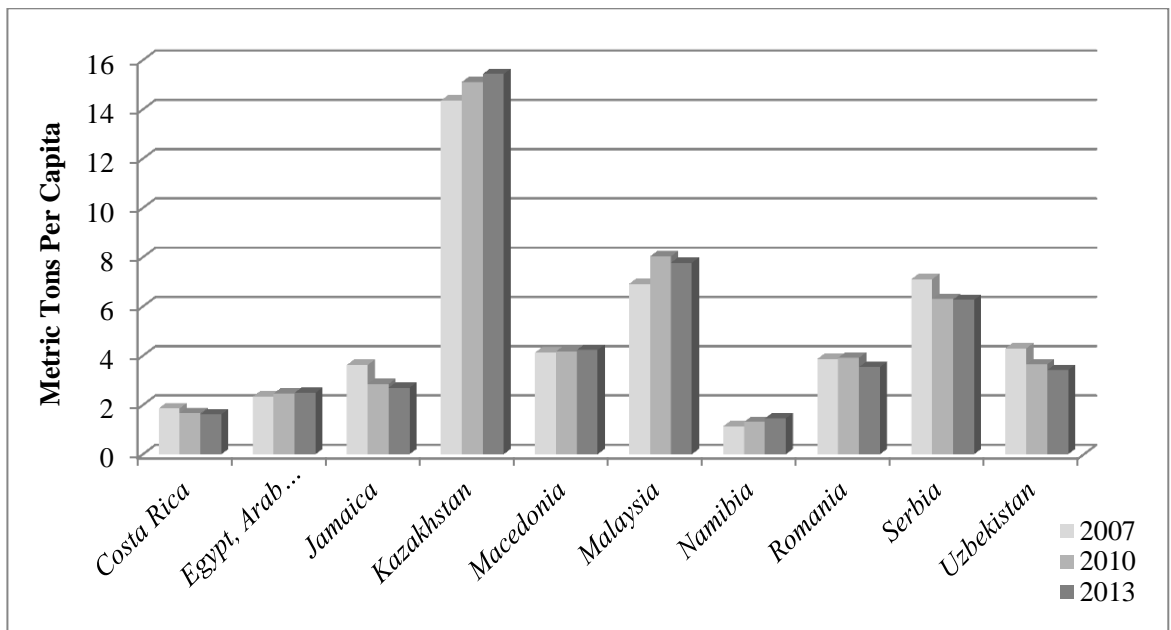


Figure 1.5: The  $CO_2$  Emissions Per Capita.  
Sources: World Bank (2016a).

Thus, the relationship between poverty and  $CO_2$  emission or the proxy of environmental degradation likely to tell us that as countries experience increasing trend of poverty, they will have a tendency to suffer more carbon emission simultaneously. For illustration Egypt, Kazakhstan, Macedonia, and Namibia have

high poverty rate and at the same time degradation of environment is relatively more serious.. As suggested by Grossman and Krueger (1995) and Banister (1998), impoverished countries may force their people to use greater amounts of resources to assist their basic necessities and to accumulate economic benefit. As a result, it may generate a negative impact on the environment by offering various destructions on it. Besides that, Figure 1.4 and Figure 1.5 above also tell us that as the number of population below poverty line is dropping, the rates of carbon dioxide emission level are also decreasing for Malaysia and Uzbekistan. Dropping poverty rate indicated that there is economic growth where a group of social and physical experts conjectured that higher level of economic growth will contribute to the adoption of environmental awareness and shift the economy towards less polluting sectors (Kaufmann, Davidsdottir, Garnham and Pauly, 1998). People become more concerned on environmental quality by purchasing less material goods and services and suppliers also will implement environmental friendly technology as income rise (Grossman and Krueger, 1995; Banister 1998; Chu and Yu, 2002). Positive economic development progress will contribute some reparation in the natural environment of developing countries.

According to the problem above, one possible way to minimize the adverse effect of poverty on environmental degradation is to increase the share of renewable energy in consumption. The increased renewable energy may offer significantly “win-win” opportunities to cushion the negative effect of poverty on environmental degradation and more importantly, may solve the problem of both simultaneously. More development in the renewable energy sector may help in poverty reduction,



indirectly by offering job and income for poor people and forcing them to less destroying the environment for energy or income (Dogan and Seker, 2016).

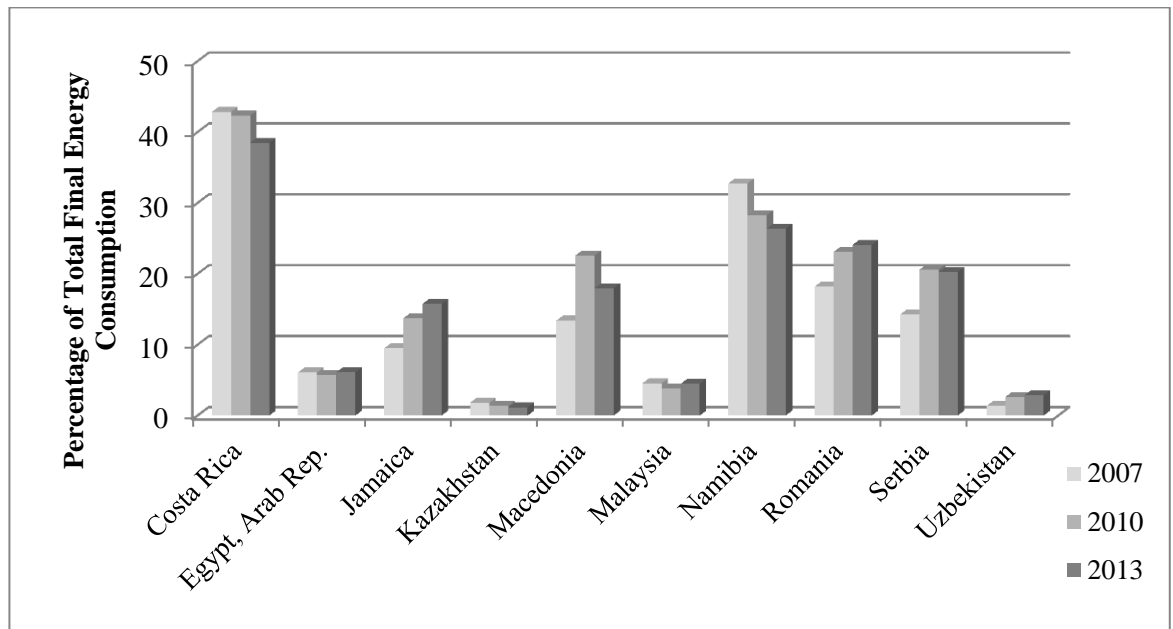


Figure 1.6: The Renewable Energy Consumption.  
Sources: World Bank (2016a).

Figure 1.6 shows the consumption of renewable energy in each country and its potential link to the Figure 1.5 to imply that increases in the share of renewable energy will mitigate the carbon emissions of respective countries. Nonetheless, the reality is far beyond or against our expectations. As shown in Figure 1.6, the trend of renewable energy consumption is generally decreasing for selected developing countries. In contrast and most probably the results of less development in the renewable energy sector, Figure 1.5 demonstrates that carbon emissions per capita have been increasing for some countries under considerations. Thus, the relationship between renewable energy and carbon emission likely tell us that as countries use or promote less renewable energy, they will have a tendency to suffer more of carbon emissions. For instance, Kazakhstan, Macedonia, and Namibia have low usages of

renewable energy and at the same time the amounts of emissions released to the environment are also increasing dramatically. On the other hand, Jamaica, Malaysia, Romania and Uzbekistan show a significant drop in  $CO_2$  between years 2007-2013, as there are increments in consumption of renewable energy. Therefore, renewable energy may play a vital role in promoting economic growth, elimination of poverty and well as a tool for easing the environmental degradation in developing countries.

#### **1.4 RESEARCH QUESTIONS**

In general, the main research question that this study wants to address is “what is the effect of poverty on environmental degradation”. Specifically, this study has the following sub-questions:

- I. Does poverty cause environmental degradation in developing countries?
  
- II. Can renewable energy mitigate the adverse effect of poverty on environmental deterioration in developing countries?

#### **1.5 OBJECTIVES OF STUDY**

The purpose of this study is to examine the effect of poverty on environmental degradation in developing countries.

Based on general objective, the study intends to describe the specific objectives are as follows:

- I. To investigate the effect of poverty on environmental degradation in developing countries.
  
- II. To examine the effect of renewable energy in mitigating the adverse effect of poverty on environmental deterioration in developing countries.

## **1.6 SCOPE OF STUDY**

This study focuses on the effect of poverty on environmental degradation among fifty- two developing countries. The developing countries are chosen based on the regions known as East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East t& North Africa, South Asia and Sub-Saharan Africa and income groups such as upper middle income, lower middle income and low-income countries. The list of developing countries is taken from World Bank (2015) and shown in Table 1.2. The selection of those countries is based on two considerations. Firstly, most of the previous studies are studied based on single country and developed country and lack of research on a group of developing countries. Secondly, there is limited availability of data that restrict the initial intention to have all developing countries in the list.