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The Determinants
for Enhancing Foreign Direct Investment
on Renewable Energy in Indonesia

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Summary

Energy consumption could be less, but the needs of consuming energy will always exist. Renewable energy is needed to support the supply of energy resources. The enhancement of energy supply is obliged to support the national energy security and resilience. Renewable energy is a potential sector that could be enhanced to support this measure. Inward Foreign Direct Investment (FDI) could contribute as tools to promote technology transfer. Destination countries especially from developing countries that have less experience in renewable energy technologies are looking forward to technology transfer from source countries which mostly come from developed countries. Destination countries, including Indonesia, should take some efforts to attract inward investment. These countries should define their position in renewable energy sector by knowing the characteristics of FDI on Renewable Energy (RE) at the global level and find factors that influence enterprises to locate their business in order to improve their competitiveness on attracting inward FDI on RE. These factors could become guidelines of policies to support improvement on inward FDI on RE and in the end it could also promote improvement on renewable energy sector as well.

Therefore, there are 3 (three) objectives of this research, namely identification of FDI inwards-outwards characteristics on renewable energy at the global level and in Indonesia; to investigate the determinants of inward FDI on renewable energy at the global level; and to propose some measures for Indonesia in order to enhance inward FDI on renewable energy. These research objectives are supported by main research question "what are the factors that influence the competitiveness enhancement to attract FDI on renewable energy in Indonesia?"

Literature review in this research relates to the 4 (four) main concepts, namely the geographical of global corporate networks, competitiveness on globalized economy, Foreign Direct Investment (FDI) on global networks, and renewable energy as alternative source. As conclusion to this literature review, the conceptual framework will be formulated and discussed.

Research design and methods in this research are using descriptive, exploratory, and prescriptive analysis. Descriptive analysis is used to emphasized the characteristics of FDI on RE at global level and in Indonesia. Exploratory analysis uses multiple regression analysis to find the determinants of inward FDI on renewable energy at global level. Prescriptive analysis is applied by providing policies recommendations based on descriptive analysis and multiple regression analysis results.

Based on analysis and findings, this research found that the linkages mainly dispersed in within and among northern hemisphere. Northern part of the world-North America and European countries-are mostly the key players on renewable energy sector. This linkages characteristics happen because the main intention of development of renewable energy is to secure energy supplies within developed countries since they have the largest energy consumption. Expanding their businesses to other countries that have significant potential on renewable energy is their second intention to gain more revenues. Meanwhile based on multiple regression analysis, significant variables that signify as the determinant of location factors of inward FDI are infrastructure, labour market efficiency, market size, energy production, and policy on climate change, and TPES/GDP. Based on this analysis results, countries that have measurement in encouraging inward FDI on RE should have paid more attention to those significant variables. Indonesia is one of the countries that still need inward FDI to their renewable energy sector development. Indonesia could appear as one of the important key players on Asia region if Indonesia can improve those significant variables.

Furthermore, as prescription to enhance inward FDI on RE in Indonesia, Indonesia should provide significant policies regarding those significant variables based on multiple analysis regression result. Indonesia is on the right track since the trends of the significant indicators are increasing. Significant policies have been made regarding those determinants. Only labour market efficiency should be put more into concern among all determinants, since the index of labour market efficiency of Indonesia shows declining. Moreover, despite many policies that have already been made, support by strong commitment of the government, private sector, and society to the implementation of the policy is obviously required.

Keywords

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Foreword

World energy system is now facing energy trilemma, which consist of energy security, energy equity, and environmental sustainability (World Energy Council, 2013). Energy consumption could be less, but the needs of consuming energy will always exist. Renewable energy is needed for supporting the supply of energy resources. The production of energy should be increased to secure energy consumption in the future. Renewable energy is considered as one solution of energy trilemma since this alternative resource meets the three challenges. First, it is more environmentally sustainable rather than fossil fuel since it comes from replenishesable resource. Secondly, it produces significant mass energy of quantity, and lastly the price of energy is mostly affordable and could be combined with local wisdom.

Nowadays, energy sector emerges the participation from private sectors. The private sectors were encouraged by public stakeholders to think seriously about their part in society and rethink over on their operationalization in encountering the changing external environment. Renewable energy urges to meet significant Foreign Direct Investment (FDI) from private sectors. FDI not only promotes long-term economic growth, but also leads the recipient country to adopt policies that are conducive to economic growth, for instance encourages human capital investments or policies that facilitate technology transfer (Liu, 2008).

As developing countries, Indonesia urges to invite investment as important vehicle to technology transfer, contributing to economic growth in larger measure (Borensztein, De Gregorio, et al., 1998). Indonesia has the potential to become key player in renewable energy sectors. In order to increase competitiveness of FDI on Renewable Energy (RE), Indonesia should take important measures based on the determinants of inward FDI on RE. Therefore, this research would like to propose analysis on the determinants of location factors of FDI on renewable energy (RE) in order to enhance inward FDI on RE in Indonesia.

Based on multiple regression analysis, significant variables that signify as the determinant of location factors of inward FDI are infrastructure, labour market efficiency, market size, energy production, and policy on climate change, and TPES/GDP.

Furthermore, regarding the enhancement of inward FDI on RE in Indonesia, Indonesia is on the right track since the trend of the significant indicators are increasing. Significant policies have been made regarding those determinants. Only labour market efficiency should be put more into concern among all determinants, since the index of labour market efficiency of Indonesia showed a decline. Moreover, despite many policies that are already being made, support by strong commitment of the government, private sector, and society to the implementation of the policy is obviously required.

Abbreviations

BP	British Petroleum
CO2	Carbon Dioxide
FDI	Foreign Direct Investment
GCI	Global Competitiveness Index
GDP	Gross Domestic Products
ICT	Information Communication and Technology
IEA	International Energy Agency
MNC	Multinational Company
Mtoe	Million Tonnes of Oil Equivalent
Mwh	Megawatt Hour
OPEC	Organization of the Petroleum Exporting Countries
PV	Photovoltaics
R&D	Research and Development
RD&D	Research Development and Demonstration
RE	Renewable Energy
TPES	Total Primary Energy Supply
UK	United Kingdom
US	United States
USD	United States Dollar
VIF	Variance Inflation Factor
WEC	World Energy Council

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Chapter 1: Introduction

1.1 Background

It begins with the tragedy of the oil shock in 1970's, when the Arab members of OPEC, plus Egypt, Syria, and Tunisia which were incorporated in Organization of Arab Petroleum Exporting Countries declared an oil embargo. People suddenly realized that the world's economy has high dependency on oil resources, especially on fossil fuels. This event affected oil prices at that moment significantly. The oil price had risen dramatically almost four times higher than the regular price. Developed countries, which mostly have the largest oil consumption, began to look for other energy resources alternatives. This situation also coupled with the fact that carbon fossil fuel is non-renewable energy and its supply started to decrease.

Moreover, researches on alternative energy resources were also driven by environmentalists' concern on climate change. They assumed that climate change hazards were caused by the increasing of Green House Gasses (GHG) emission which one of the causes is significantly coming from combustion of carbon fossil fuels.

However, even though fuel dependency could be reduced by certain efforts, it could not be eliminated. People's activity will always be connected with energy consumption. According to the statistical data from BP Energy Outlook2035 (2014), the world energy consumption on 2035 is estimated to grow by 41% between 2012 and 2035 with slower increments and 95% of consumption coming from emerging economies. It also assumed that towards 2035, the world would be leaving the phase of very high energy consumption growth, driven by the industrialization and electrification of non-OECD economies, notably China. World energy consumption based on fuel resource could be seen in **Chart 1**.

Chart 1: World Energy Consumption
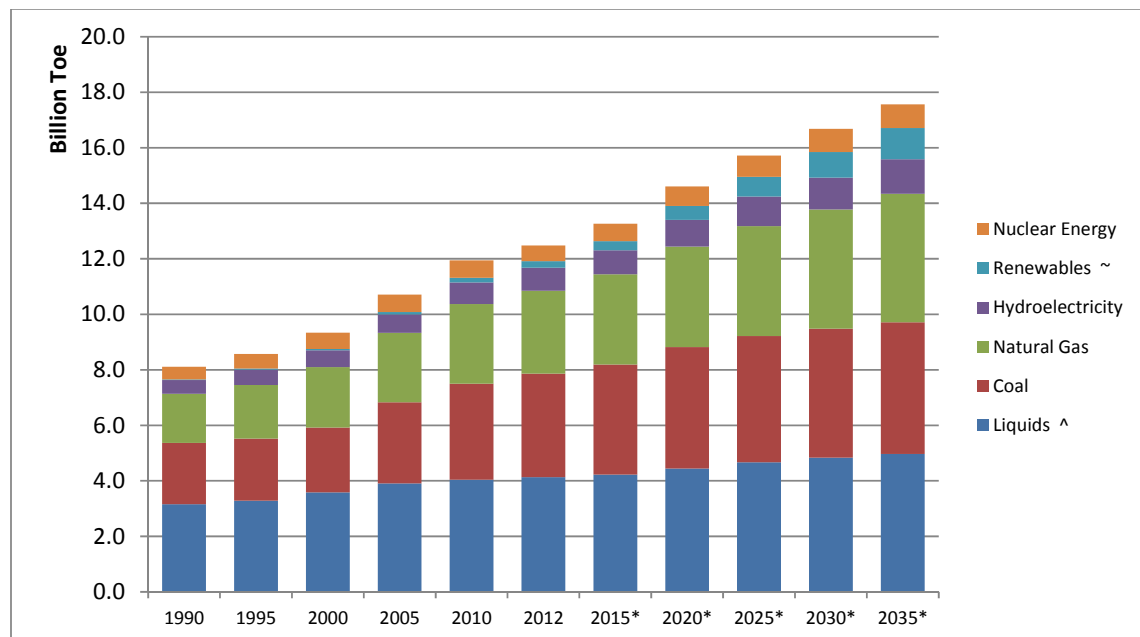
Source: BP Energy Outlook 2035, 2014

*   Estimated
^   Includes oil, biofuels, gas-to-liquids and coal-to-liquids.
~   Includes wind power, solar electricity and other renewables.

Based on **Chart 1**, although the consumption of oil fuels (carbon fossil fuels) has the highest rate among all resources, it turns out that its increment has the slowest growing. The growth of other resources start to substitute oil fuels as new alternatives resources and one of them is renewable energy. According to the BP Energy Outlook 2035 (2014), the consumption of renewable energy will continue growing and replacing the consumption of non-renewable energy like fossil fuel, coal, and natural gas.

Furthermore, the tendency to substitute gradually the role of fossil fuel is also showed on the world energy production trend. As seen on **Chart 2**, world energy production grows from 2012 to 2035 and it is about at 1.5% p.a. The productions starts to expand to all types of energy and is slowly decreasing the dominance of oil fuel. New energy forms play an increasingly significant role. Renewables, shale gas, tight oil, and other new fuel sources in aggregate grow at 6.2% p.a. and contribute 43% of the increment in energy production to 2035.

Chart 2: World Energy Production
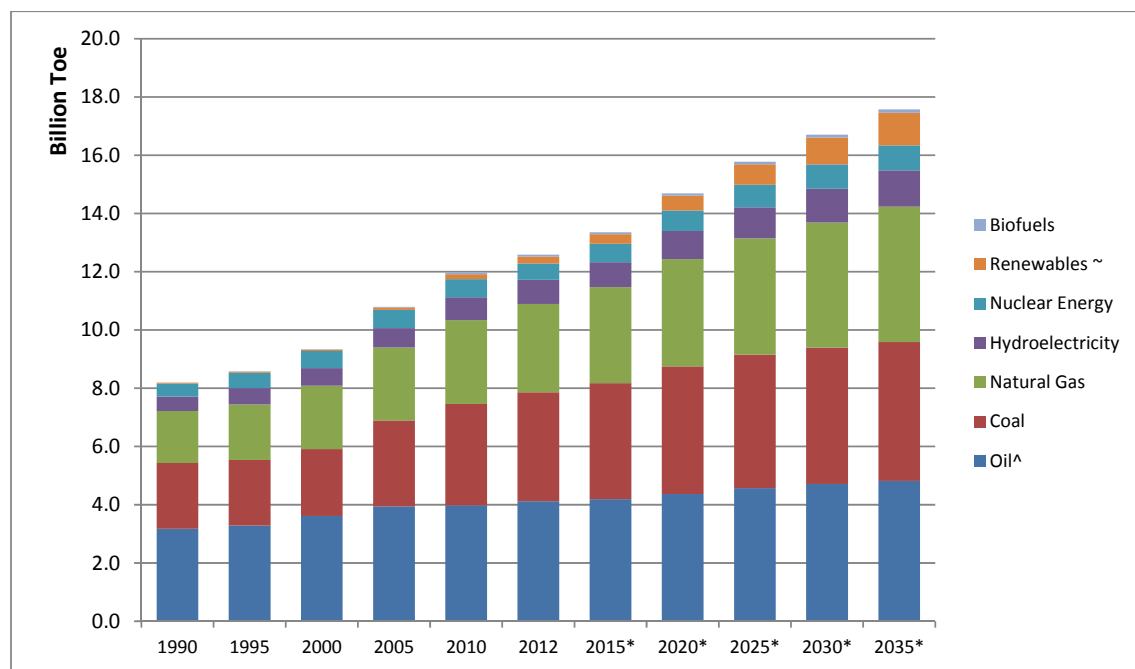
Source: BP Energy Outlook 2035, 2014

*   Estimated
^   Oil Production is measured in billion tonnes; other fuels in billion tonnes of oil equivalent.
~   Includes wind power, solar electricity and other renewables.

As seen on **Chart 1** and **Chart 2**, renewable energy is predicted to be an alternative energy resource and help to reduce fossil-fuel consumption in the future. Comparing to other alternative resources, renewable energy could produce significant energy since it has high productivity, for instance wind power, solar power, hydro power, and biofuel. Renewable energy is also considered to have more environmentally friendly aspects than nuclear energy, like the leaking of Fukushima nuclear power plant in Japan. However, despite all the

advantages, renewable energy in a large scale requires a large area, significant investments, and advanced technology to develop.

Within the global corporate networks era, where modern world economy is formed by an inter-organizational system that connects firms and states together with reduced transportation costs, advanced technologies, increased openness of capital and labour markets, trade liberalization, and institutional harmonization across countries (Wall, Burger, et al., 2011); investments on renewable energy are being established and competition on attracting investment for producing energy is emerging. Although debates of urban and regional competition are still unclear on which territories are competing with each other over which types of investments, they have identified competition and complementariness in urban systems as means to clarify goal-direction orientation and effective strategic planning and policy-making with consideration to competitive advantage and sustainable development strategies (Burger, van der Knaap, et al., 2013).

1.2 Problem Statement

Energy consumption could be reduced, but the needs of consuming energy will always exist. Renewable energy is needed for supporting the supply of energy resources. As seen on **Chart 3** below, the comparison between consumption and production has a small gap. The production of energy should be increased to secure energy consumption in the future. Renewable energy establishment is expected to be able to support energy resilience and mitigation on climate change since it produces significant energy and the resources are replenishable.

Chart 3: Comparison on Energy Consumption and Production
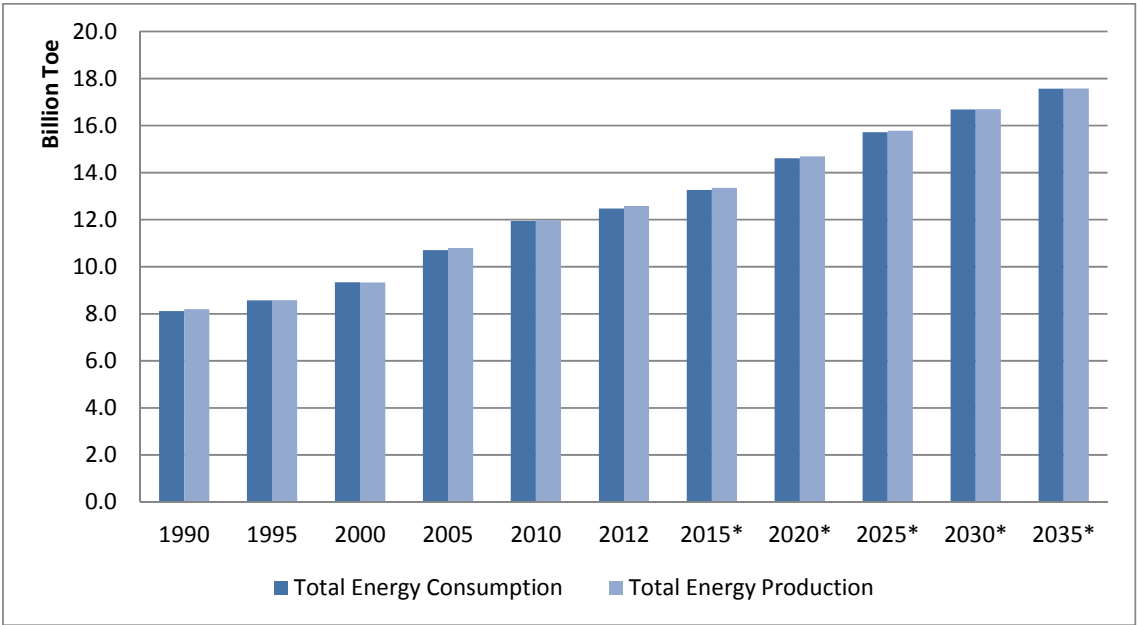
Source: BP Energy Outlook 2035, 2014

* Estimated

According to Indonesia Blueprint of Energy National Development 2006-2025, Indonesia has big export of energy but conversely big import on oil fuels. Consequently, Indonesia becomes oil-fuel net importer and as a result is the rise of oil-fuel price subsidy. To support the security and resilience of the national energy, the enhancement of energy supply is mandatory. Renewable energy is a potential sector that could be enhanced to support this measure.

Moreover, as investments come in, it could promote more investments inwards (Li and Liu, 2005). The availability of energy could bring more investments to Indonesia since one of the hindrances of investments in Indonesia is lack of certainty on energy supply for industrial sector in certain areas. Certain steps are being made already in Indonesia in order to secure energy supply. For instance: the establishment of alternative resources on liquid-coal, Liquid Natural Gas (LNG), geothermal power plant, nuclear power plant, biodiesel industry, bio ethanol industry, bio-oil industry, solar power, hydropower, waste power plant, and wave power plant. These efforts require advanced technology and in regards to renewable energy technologies, Indonesia still lacks behind developed countries who become pioneers in establishing renewable energy technologies.

Inward Foreign Direct Investment (FDI) could contribute as tools to promote technology transfer. Destination countries especially from developing countries that have less experience in renewable energy technologies are looking forward to technology transfer from source countries which mostly come from developed countries. Research from Findly (1978) in Liu (2006) indicates that the capital investment from foreign firms have significant role as generalized promoter of technology improvement and give more chances for domestic firms to observe the advanced technology used by foreign-invested firms in order to improve their business.

Destination countries, including Indonesia, should take some efforts to attract inward investment. These countries should define their position in renewable energy sector by knowing the characteristics of FDI on RE at the global level and find factors that influence enterprises locate their business in order to improve their competitiveness on attracting inward FDI on RE. These factors could become guidelines of policies to support improvement on inward FDI on RE and the end it could also promote improvement on renewable energy sector as well.

1.3 Research Objectives

There are 3 (three) objectives of this research:

- Identification of FDI inwards-outwards characteristics on renewable energy at global level and in Indonesia.
- To investigate the determinants of inward FDI on renewable energy at global level
- To propose some measures for Indonesia in order to enhance inward FDI on renewable energy.

1.4 Research Questions

The main question of this research is "what are the factors that influence the competitiveness enhancement to attract FDI on renewable energy in Indonesia?"

Meanwhile, to support the main research question, sub research questions are defined as the following:

- What are the characteristics of FDI inwards-outwards on renewable energy at the global level and in Indonesia?
- What are the determinants of inward FDI on renewable energy that should be improved to increase the likelihood of attracting investment on renewable energy at the global level?
- What policies should be made to enhance competitiveness of FDI on renewable energy in Indonesia?

1.5 Significance of the Study

The research work will have significance in enriching the existing knowledge of Foreign Direct Investment (FDI) and its benefit for economic growth in host countries. Likewise, it will provide a new insight about the performance of FDI on renewable energy by considering certain factors that could influence its development. Particularly, this research will have added benefit to the establishment of renewable energy sectors, especially in Indonesia as the object of the research, and could be taken as an example to other countries that strive to inward FDI on RE. This research could also give illustration on how renewable energy can improve competitiveness.

1.6 Scope and Limitations

The research considers the following scope and limitations:
- The main object of alternative resources in this research will focus on renewable energy since the investment on renewable energy is focused more on the FDI, in order to identify global networks.
- Considering the policy of renewable energy is mainly held in national level, the scope of this research will be on country scale.
- The data of the FDI on renewable energy will consider renewable energy as general, not specifically in each kind of renewable energy.
- Since the data is on country scale, the analysis would not consider specifically to cities.
- The data of Global Competitiveness Index (GCI) that this research uses as independent variables only applied in main pillar, since the sub pillar is giving illogical result in regression analysis.

Chapter 2: Literature Review

2.1 Introduction

In this chapter, theories and concept relate to the 4 (four) main key words: networks, competitiveness, Foreign Direct Investment (FDI), and renewable energy. As conclusion to this literature review, the conceptual framework will be formulated and discussed.

2.2   The Geographical of Global Corporate Networks

Networks on economic geography have created several terminologies on geographical clusters, global cities, international production systems, and globalization (Glückler, 2007). But in a recent critical review, according to Grabher (2006), networks in economic geography have been rather selective, often metaphorical and little formalized. Corporates that generate multilevel network and play as the prime agency of production and reproduction (Taylor, 2004) are allocated across the world wide. However, although the corporate convey of multinational corporations (MNCs) is distinctly global, the geographical extent of their business regularly limited (Wall, Burger, et al., 2011). According to research by Wall, Burger, et al (2011), global corporate networks remains distributed unevenly and the linkages between the richer countries in the northern hemisphere are better connected within the global system rather than the poorer countries in the southern hemisphere.

However, global corporate network is expected to be a tool for knowledge spill over effects. Besides having local knowledge, organizations could also need to build non-local linkages to obtain knowledge from other region (Maskell, Bathelt, et al., 2006). The presence of knowledge investments make knowledge spill overs turn out to be greater and vice versa, with a higher level of knowledge spill overs experience by regions that hold high knowledge investments to contributes significantly to regional knowledge production in interregional spill overs(Maskell, Bathelt, et al., 2004).

Moreover, global corporate networks which are covered by inter-organizational networks are acknowledged to be a crucial element to economic growth and fruitfulness of regions (Huggins and Thompson, 2014). In Huggins and Thompson (2014) it is stated that the presence of established spatially proximate inter-organizational networks are one of the key reasons why regions that have adopted network approach are more successful, more competitive, and grow faster, than those which have not adopted network approach. Huggins and Thompson (2014) also mentioned that it is more valuable to have knowledge flowing from organizations in other regions than focusing in one region. Significant testimony recommends that many organizations do not obtain their knowledge from within regionally proximate areas, especially to organizations with innovation-driven growth where knowledge is primarily sourced internationally (Davenport, 2005).

Furthermore, as stated by Thompson (2014), it is necessary for lower growth regions to establish regional economic development policy to support organizations in enhancing their network capital. Therefore, in order to access beneficial knowledge, such regions should solicit to develop high functioning inter-organizational networks.

2.3 Competitiveness on Globalized Economy

The focus of competitiveness has not just been a macroeconomic phenomenon, but also become key significance at the regional, urban, and local scales (Kitson, Martin, et al., 2004). Competitiveness becomes most important milestone of developed and developing countries since the marketplaces are no longer restricted to particular geographic location (Önsel, Ülengin, et al., 2008). Therefore, analysing a country's competitiveness position becomes necessary for providing better insight to make suitable policies for increasing investment (Önsel, Ülengin, et al., 2008).

Based on Porter's view, competitiveness made locally is humanly built, sector as relevant factor, require variety of actors to co-operate and localised learning environment (Porter, 2003). There are significant relations between factor conditions; firm strategy, structure, and rivalry; institutional support, and demand conditions. Those factors have to be supported by policies made by government and chance from competitiveness appearance in global networks. Porter's view could be described on Porter's Diamond below (Schwab, Porter, et al., 2007).

Figure 1: Determinants of National Competitive Advantage Based on Porter's Diamond

Context for firm strategy and rivalry
- A local context and rules that encourage investment and productivity (e.g. incentives for capital investments, intellectual property protection)
- A context of upon and vigorous local competition, especially among locally based rivals

Factor (input) condition
The efficiency, quality, and specialization of the input available to firm
- Natural resources
- Human resources
- Capital resources
- Physical infrastructure
- Administrative infrastructure (e.g. registration, permits
- Information infrastructure (e.g. economic data, corporate disclosure)
- Scientific and technological infrastructure

Demand conditions
The presence of demanding and sophisticated local customers
- High customer expectations
- Local customer needs that anticipate those elsewhere
- Unusual local demand on specialized segments that can be served nationally and globally

Related and supporting industries
- Access to capable, locally based on suppliers and firms in related fields
- Presence of clusters instead of isolated industries

Source: Porter, 1990 in Porter, 2007

To enhance competiveness in a globalized economy, the definition and explanation of regional competitive advantages need to have concern not only on hard productivity (i.e. skilled labour, supporting and ancillary industries, and knowledge spill-overs) but also consider softer dimensions of the regional or urban socio-economy (Kitson, Martin, et al., 2004). The quality and skills of the labour force (human capital), the extent, depth and orientation of social networks and institutional forms (social/institutional capital), the range and quality of cultural facilities and assets (cultural capital), the presence of an innovative and creative class (knowledge/creative capital), and the scale and quality of public infrastructure (infrastructural capital); have the mutual importance in the form of regional externalities, an efficient productive base to the regional economy (productive capital) (Kitson, Martin, et al., 2004).

Figure 2: Bases of Regional Competitive Advantage
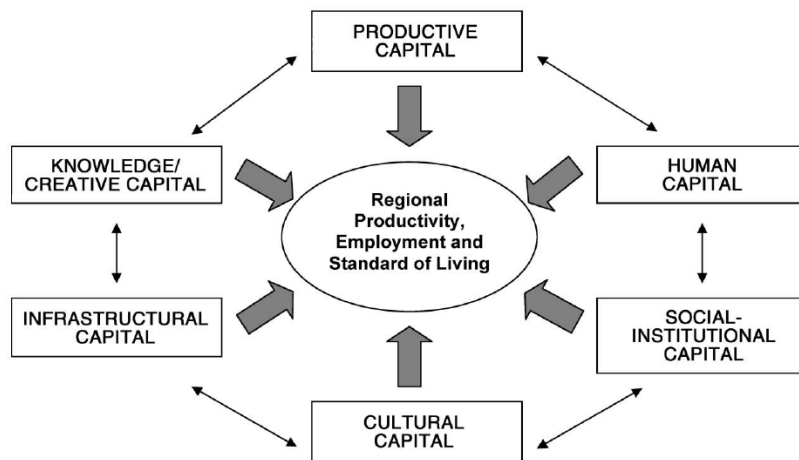
Source: Kitson, 2004

In the development of a nation, the nature of competitive advantage modes moves within several characteristic stages. This stage of development varies by country and has specific development path (Schwab, Porter, et al., 2007).According to Global Competitiveness Report (2013), aligned with renowned economic theory of stages of development, the Global Competitiveness Index which is established in Global Competitiveness Report implies that there are 3 stages of competitiveness experienced by country, first on factor driven stages, secondly on efficiency driven stages, and lastly on innovation driven stages. Each stage has driven components that describe the condition of the stages, called pillars of competitiveness (Schwab, 2013).

In the first stage, the economy development is factor driven and the competitiveness of countries based on their factor endowments, formerly unskilled labour and natural resources. Preserving competitiveness in this stage mainly is drove by well-functioning public and private institutions (pillar 1), a well-developed infrastructure (pillar 2), a stable macroeconomic environment (pillar 3), and a healthy workforce that has received at least a basic education (pillar 4) (Schwab, 2013).

When the countries could maintain their first stage and become more competitive, the development will advance and accompanied by increasing productivity and rising wages. In this step, the countries will transform into the efficiency-driven stage of development (Schwab, 2013). In this stage, development of production becomes more efficient and

product quality will increase since wages have risen and it is hardly to increase prices. Competitiveness is driven by higher education and training (pillar 5), efficient goods markets (pillar 6), efficiency of labour markets (pillar 7), developed financial markets (pillar 8), the ability to absorb the benefits of existing technologies (pillar 9), and a large domestic or foreign market (pillar 10) (Schwab, 2013).

Lastly, when countries move into the innovation-driven stage, higher wages will be sustained and reflected in standard of living with the business ability to compete with new and unique products. Within this stage, competition will domain in producing new and different goods using the most sophisticated business production (pillar 11) processes and by innovating something new (pillar 12) (Schwab, 2013).The Global Competitiveness Report established those stages of development within the driven components in each stages using The GCI with relative weights that are more relevant for an economy given its particular stage of development. These driven components, which are the 12 pillars of competitiveness, are substantial in certain extent for all countries; the relative importance of each one depends on a country's particular stage of development (Schwab, 2013).

2.4   Foreign Direct Investment on Global Networks

No countries could develop themselves by their own efforts. Global network which happens today encourages many of Foreign Direct Investment (FDI) whether it is from Multi-National Corporations (MNCs) or private investor to build network for development. This FDI mostly comes from developed countries that have significant capital of investments. For the home countries, FDI could expand business and market opportunities. They must convince that their investments will bring benefits for their business. Meanwhile, for the host countries, FDI could bring advantages for economic growth (Borensztein, De Gregorio, et al., 1998), become a catalyst for industrial development (Markusen and Venables, 1999), and encourage technology spill-overs (Liu, 2008). Hence, the aim of FDI should be directed to long term benefits as well as the right balance between FDI and domestic investment.

2.4.1   Definition of Foreign Direct Investment

According to OECD, Foreign Direct Investment (FDI) is defined as cross-border investment by a resident entity in one economy with the objective of obtaining a lasting interest in an enterprise resident in another economy. The lasting interest implies the existence of a long-term relationship between the direct investor and the enterprise, and a significant degree of influence by the direct investor on the management of the enterprise. Ownership of at least 10% of the voting power, representing the influence by the investor, is the basic criterion used (Duce, 2003).

Hence, there are two concepts of FDI and two similar measures to describe it (Baldwin and Winters, 2004), perspective of home countries as sources of investment and perspective of host countries as destination of investment. First, FDI seen on home countries perspective is implied as flow linkages across international boundaries which give increase to certain form of international assets to the home countries. This perspective is defined as outward investment linkages which likely, holding value in entities, typically corporations, controlled by a home-country resident or in which a home-country resident holds a certain share of the voting rights (Baldwin and Winters, 2004). Secondly, FDI seen on host countries perspectives, defined as a set of economic activities or operations controlled or partly controlled by firms in some other (home) country and carried out in a host country by firms (Baldwin and Winters, 2004). This perspective is defined as inward direct investments linkages which transfer all liabilities and assets between resident direct investment enterprises and their direct investors. These activities are, for instance, production, employment, sales,

the purchase and use of intermediate goods and fixed capital, and the carrying out of research (Baldwin and Winters, 2004).

2.4.2 The Role of Foreign Direct Investment

Many countries strive to attract Foreign Direct Investment (FDI) since it is believed it could give positive impact for the economic growth. FDI is an important tool for the technology transfer, contributing relatively more growth than domestic investment (Borensztein, De Gregorio, et al., 1998). Borensztein (1998) mentioned that the necessary positive effects on growth of FDI come through higher efficiency rather than simply from higher capital accumulation. Borensztein (1998) also added that FDI contributes to economic growth only when sufficient absorptive capabilities of the advanced technologies are available in the host countries.

Study by Li and Liu (2005), shows that there is a strong complementary connection between FDI and economic growth in both developed and developing countries. Furthermore, FDI not only directly promotes economic growth by itself but also indirectly does so via its interaction terms. There is a strong positive interaction effect of FDI with human capital and a strong negative interaction effect of FDI with the technology gap on economic growth in developing countries. The empirical results from this study give strong support to new FDI and economic growth theories, as they confirm that inward FDI tends to be attracted to any host country with a large market size. In addition, human capital and technology-absorptive ability are very important for inward FDI to positively promote economic growth in developing countries. The policy implications of this study are relatively straightforward. As FDI and economic growth have become increasingly endogenously related, the promotion of human capital, technological capabilities, and economic development will lead to more FDI inwards. This in turn will promote further economic growth and enhance competitiveness (Li and Liu, 2005).

Product competition and factor markets tend to reduce profits of local firms, but linkage effects to supplier industries may reduce input costs and raise profits. In terms of product market competition and linkage effects, FDI has the possibility to act as a catalyst, leading to the local industry development which consequently becomes so strong as to reduce both the relative and absolute position of multinationals in the industry (Markusen and Venables, 1999). Markusen and Venables (1999) suggest that upstream multinational entry is less likely to be complementary with existing local production than is downstream.

Technology transfer is one of long term benefits that FDI could bring to host countries. Even though technology transfer is a costly process-scarce resource must be devoted to learning, the positive rate effect indicates that technology spill-overs enhance domestic firms' future productive capacity (Liu, 2008). An increase in FDI at the four digit industry level lowers the short-term productivity level but raises the long-term rate of productivity growth of domestic firms in the same industry. Spill-overs through backward and forward linkages between industries at the two-digit level have similar effects on the productivity of domestic firms, and backward linkages seem to be statistically the most important channel through which spill-overs occur (Liu, 2008).

2.5 Renewable Energy as Alternative Resource

Regarding to energy security and environmental concern, renewable energy resources are being considered as business not as usual for energy provider since fossil fuels are considered as one of the main contributors to environmental problems and its availability will extinct.

Making transition towards a renewable-intensive energy economy would provide environmental benefits which could not be measured in standard economy account (Johansson and Burnham, 1993). Renewable energy appears to be the one of the most efficient and effective solutions for environmental problems that we face today, which require long-term potential actions for sustainable development. This situation makes renewable energy and sustainable development have strong connections (Dincer, 2000).

2.5.1 The Types of Renewable Energy

Renewable energy is derived from replenishable sources. Most common sources come from wind energy, solar power, hydropower (wave and tidal), geothermal, and biomass energy. **Table 1** below will show scale of technical potential/useful energy output and energy conversion options.

Table 1: Global Renewable Energy Resources

Resource	Scale of technical potential (useful energy output)[a] (TW h/year)	Energy conversion options
Direct solar	12,000 – 40,000	- Photovoltaic (PV) - Solar thermal power generation - Solar water heaters
Wind	20,000 – 40,000 (onshore)	- Large scale power generation - Small scale power generation - Water pumps
Wave	2000 – 4000	- Numerous designs
Tidal	>3500	- Barrage - Tidal stream
Geothermal	4000 – 40,000	- Hot dry rock hydrothermal, geo-pressed, magma (only hydrothermal currently viable)
Biomass	8000 – 25,000	- Combustion, gasification, pyrolysis, digestion, for bio-fuels, heat and electricity

Source: (Gross, Leach, et al., 2003)

[a] These figures are illustrative of the energy that could be usefully extracted using known technologies and allowing for physical constraints. Such figures are inevitably approximate and depend upon assumptions about conversion efficiencies, competing land-use and so on. Figures derived from various primary sources cited in UNDP/WEC (2000) and are based upon conservative estimates of land availability and/or accessibility. Where required, Gross, Leach, et al (2003) have converted data on resource into technical potential—figures for solar based upon PV at 10% conversion efficiency, geothermal for power generation at 20% efficiency and for wave and tidal 20% efficiency. Wind power figure is for large grid connected machines only. Note also that limited data are available on global wave and tidal resources and these figures could be substantial underestimates. Figures will increase as technology improves. However, the resources that are economically viable are much smaller, given the current technologies.

2.5.2 The Challenges on Renewable Energy Development

Although Renewable Energy (RE) is being considered as one of the green solutions for energy production, establishing RE also has several challenges. These challenges should be known and anticipated in order to have optimum result of RE development (Gross, Leach, et al., 2003). One of the most important issues for the continued growth of most renewable options is their relative cost. Many technologies are currently more expensive than the least-costly fossil fuel alternative, some markedly so. Costs are intimately bound up with the

development of markets and technical progress—and hence policy (Gross, Leach, et al., 2003).

Chart 4: Comparison of the Cost of the Source of Energy (Cost US cents/KWh)
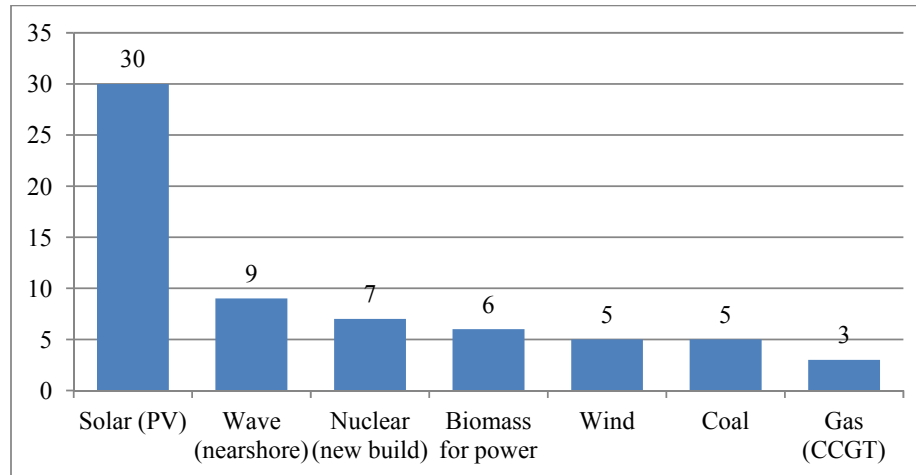
Source: Gross, Leach, et al., 2003

However, despite the large investment for RE, there are three issues of RE regarding sustainability energy systems. There are three energy sustainability dimensions that have to be put in concern for RE development, namely energy security, energy equity, and environmental sustainability, called Energy Trilemma (World Energy Council, 2013).

According to WEC (2013), energy security implies on effectivity of management in primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy providers to meet current and future demand of energy production. The first energy security system was created in response to the Arab oil embargo in 1973 and developed to ensure collaboration of energy policies, ensuring energy supplies distribution, and prevent any disruption of oil supplies from exporters (Yergin, 2006). Yergin (2006) also mentioned that the concept of energy security needs to be enhanced with two critical dimensions, which are the recognition of the globalization of the energy security system and the acknowledgment of the fact that the entire energy supply chain needs to be protected. One of the measures to secure energy supplies is by developing renewable energy and support with sufficient policy on renewable energy (Johansson and Burnham, 1993).

Meanwhile, according to WEC (2013), energy equity means the accessibility and affordability of energy supply across the population. Energy equity emerges since the raising price on energy the global financial crisis. These conditions evoke new challenges of limited access to energy and inequity, especially for the poor (Hall, Hards, et al., 2013).

Lastly, WEC (2013) also acknowledged environmental sustainability as energy efficiency from the achievement of supply and demand-side and the development of energy supply from renewable and other low-carbon sources. Climate change issues regarding environmental sustainability becomes hot topics of energy in this century since the atmosphere's concentration of carbon dioxide (CO_2) has increased by more than 30 percent over the last 250 years, largely due to human activity (Socolow, Hotinski, et al., 2004). Two-thirds of that raise has occurred in the past 50 years. If there was no change, levels of CO_2 emission in the world would be much higher and lead to damaging climate change. This situation should be

supported by policies on climate change mitigation and adaptation leading to a lower rate of CO_2 emissions (Socolow, Hotinski, et al., 2004).

According to Gross (2003), the prime factors hindering RE development worldwide were the lack of governmental policies, competition from fossil fuels (conventional and non-conventional), and lack of public awareness and support. Therefore, based on recommendation from public stakeholders, in 2012, WEC promoted three main recommendations for how policymakers could accelerate the development of sustainable energy systems. Firstly, they need to define a coherent and predictable energy policy. Secondly, implement stable regulatory and legal frameworks to support long-term investments. Lastly, encourage public and private initiatives that enable innovation and foster research, development, and demonstration (RD&D).

2.6   Concluding Remarks on Theory and Concept Related

Renewable energy as alternative sources is believed to be able to decrease the dependency on oil-fuels and secure energy production supplies. To develop and improve the establishment of renewable energy sector require global corporate networks as tool for knowledge spill over effects (Maskell, Bathelt, et al., 2004). Based on the concept of inter-organizational networks, global corporate networks which consist of inter-organizational networks are recognized as crucial element for economic growth and fruitfulness of regions (Huggins and Thompson, 2014), as well as encourage FDI from MNC or private investors to disseminate their business development.

Seeing renewable energy sector as potential sector that will be developed in the future, enterprises that engaged in renewable energy sector surely need to expand their businesses within the location that has benefit for them. The linkages that build from the expansion of business network are not only favourable for the source countries, but also for destination countries especially for economic growth (Borensztein, De Gregorio, et al., 1998), a catalyst for industrial development (Markusen and Venables, 1999), and encourage technology spill-overs (Liu, 2008).

Therefore, countries that intent to improve their renewable energy sector by inviting investment from abroad must have concern about their position in renewable energy networks and their competitiveness advantages. To discover their position in renewable energy networks, they have to recognize the characteristics of FDI on RE that consist of the linkages between source countries and destination countries that build and reinforce linkages of renewable energy development. Meanwhile, to explore competitiveness advantages to increase inward FDI on RE, countries have to understand the determination that affects location factors of RE investments. Based on the theory of competitiveness from Porter, determinants of national competitive advantages consist of factor (input) condition, demand condition, firm strategy and rivalry, and related supporting industries. These determinants could be explored in three components, namely factor driven, efficiency driven, and innovation driven (Schwab, 2013). Each of them has their key sectors described in main pillars of global competitiveness indicator (Schwab, 2013). These main pillars could contribute to measure the determinants of location factors of FDI.

Other important factors that should be put into concern are energy sustainability dimensions which emphasize in energy security, energy equity, and environment sustainability. These dimensions, which are known as energy trilemma (WEC, 2013), could be the components to measure location factors of FDI on RE since the existence of renewable energy should be supported by sustainable energy systems.

2.8   Conceptual Framework

The link and relationship between the theories and concepts about Foreign Direct Investment (FDI) and its characteristics on renewable energy investment, competitiveness advantage based perspectives and sustainable energy investments are formulated to build the conceptual framework of this study as follows:

Figure 3: Conceptual Framework
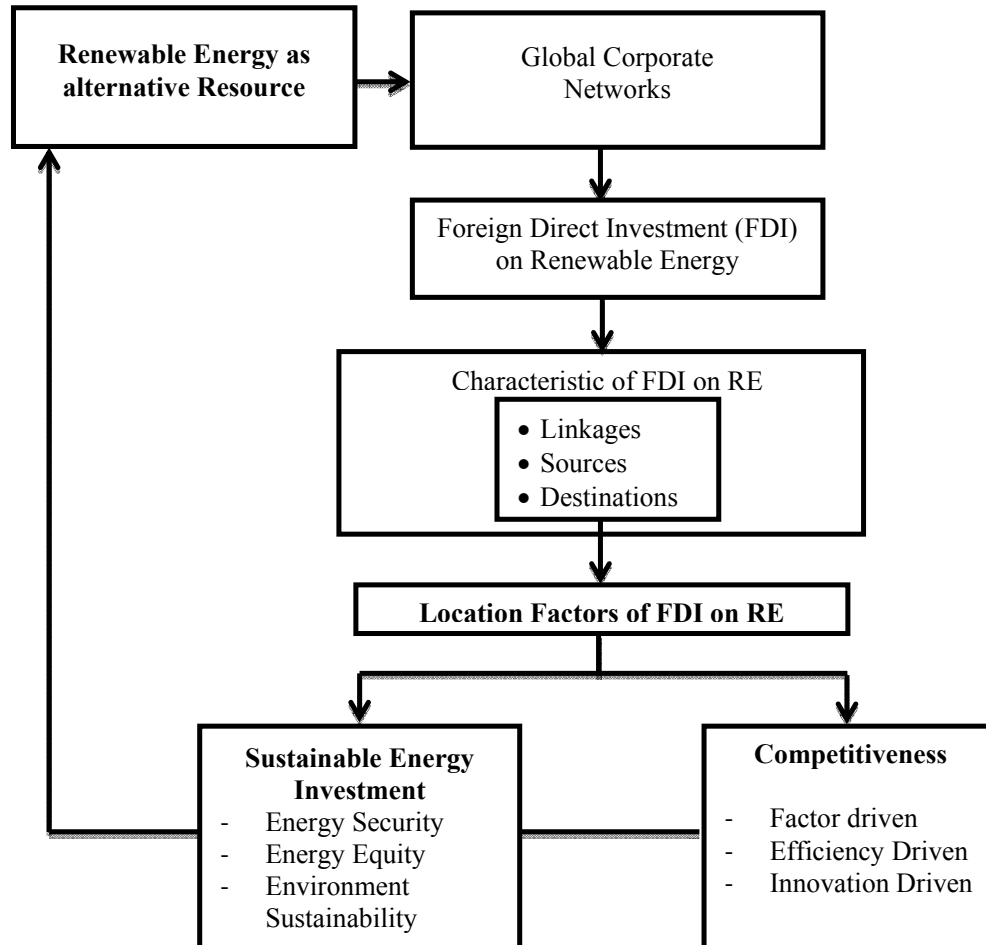
Source: Author, 2014

From **Figure 3** it can be seen the relation of theory and concept that build the research conceptual framework. In order to support renewable energy as alternative resource of energy, global corporate networks encourage enterprises to expand their business by using FDI on RE sector. To understand the global networks of renewable energy sector, comprehension on characteristics of FDI on RE is necessary needed. This characteristic consists of the linkages, source countries, and destination countries. In the linkages of renewable energy sector, it is beneficial to understand the determinants of RE enterprises when they want to expand their business. This could be achieved by exploring the location factors of FDI on RE with the combination factor of competitiveness driven and sustainable energy investment dimensions. In the end, when competitiveness and sustainable energy investment could be achieved, it would make significant influence to the establishment of renewable energy sector.

Chapter 3: Research Design and Methods

3.1 Revised Research Question(s)

To have a better focus on this research, revised research questions is required. The revised main research question for this study is "what are the factors that influence the competitiveness enhancement to attract FDI on renewable energy in Indonesia?"

Meanwhile, to support the main research question, sub research questions are defined as follows:

- What are the characteristics of FDI inwards-outwards on renewable energy at the global level and in Indonesia?
- What are the determinants of inwards FDI on renewable energy that should be improved to increase the likelihood of attracting investment on renewable energy at the global level?
- What policies should be made to enhance competitiveness of FDI on renewable energy in Indonesia?

3.2 Operationalization: Variables, Indicators

Based on literature review, this research indicates 10 main variables in order to answer the research questions. These variables come from concepts of FDI on renewable energy, competitiveness, and sustainability energy investment. To determine these variables, this research will use certain indicators from published index and secondary data.

3.2.1 Explanation of Variables

In this research, dependent variables which is y-variables are derived from inward FDI on RE. This data is taken from Financial Times FDI Market database. This database describes each individual investment with coded of year of investment, source company name, source location with coordinates, destination company name, destination location with coordinates, cluster, industrial sector, industrial activity, investment value, and investment number.

Instead of using the values of investment, the analysis will use number of investments as the y-variables. The investment values are roughly unknown and some of them based on estimation by FDI markets. Using a high degree of estimated data in the analyses would lead to misleading result. Therefore, the solution is by using the number of investments instead of the value of investment as a proxy.

Meanwhile, for the independent variables which are x-variables use several indicators based on theory and concepts on Chapter 2. Definition of x-variables (location factors) for multiple regression analysis could be described as below. X1-X12 variables come from Global Competitiveness Index which identified as 12 pillars of competitiveness in Global Competitiveness Report. Meanwhile, other indicators come from energy indicators that could influence the location factors of FDI on renewable energy.

1. Competitiveness Indicator

X1: Institutions
The institutional environment is defined as the legal and administrative framework within which individuals, firms, and governments interact to generate wealth (Schwab, 2013).

X2: Infrastructure
Infrastructure includes modes of transport (roads, railroads, ports, and air transport), electricity, and telecommunications. Extensive and efficient infrastructure is beneficial factor in determining the location of economic activity and the kinds of activities or sectors that can

develop within a country. Well-developed infrastructure reduces the effect of distance between regions, integrating the national market, and connects it at low cost to markets in other countries and regions (Schwab, 2013).

X3: Macroeconomic environment
Macroeconomic environment could disarray harms the economy, for instance, running fiscal deficits limits the government's future ability to react to business cycles. Firms cannot operate efficiently when inflation rates are out of hand. In addition, the economy cannot grow in a sustainable manner unless the macro environment is stable (Schwab, 2013).

X4: Health and primary education
Health and primary education are the basic needs of which government should provide for the people. With proper basic health and education, workers could adapt to more advanced production processes and techniques (Schwab, 2013).

X5: Higher education and training
Quality higher education and training is crucial for economies that want to move up the value chain beyond simple production processes and products. Workers could perform complex tasks and adapt rapidly to their changing environment and the evolving needs of the production system (Schwab, 2013).

X6: Goods market efficiency
Producing the right mix of products and services given their particular supply-and-demand conditions could be established within countries with efficient goods markets. In driving market efficiency, healthy market competition, both domestic and foreign, are considered as important factors as well as in business productivity, by ensuring that the most efficient firms, producing goods demanded by the market, are those that thrive (Schwab, 2013).

X7: Labour market efficiency
The efficiency and flexibility of the labour market are critical for ensuring that workers are allocated to their most effective use in the economy and provided with incentives to give their best effort in their jobs (Schwab, 2013).

X8: Financial market development
Sophisticated financial markets are required to enhance economies in order to make capital available for private-sector investment from such sources as loans from a sound banking sector, well-regulated securities exchanges, venture capital, and other financial products (Schwab, 2013).

X9: Technological readiness
The technological readiness pillar measures the agility with which an economy adopts existing technologies to enhance the productivity of its industries, with specific emphasis on its capacity to fully leverage information and communication technologies (ICTs) in daily activities and production processes for increased efficiency and enabling innovation for competitiveness (Schwab, 2013).

X10: Market size
Productivity is affected by the size of the market since large markets allow firms to exploit economies of scale (Schwab, 2013).

X11: Business sophistication
Business sophistication concerns two elements that have complex interactions: the quality of a country's overall business networks and the quality of individual firms operations and strategies (Schwab, 2013).

X12: Innovation
This innovation focuses on technological innovation. In long term, technological innovation could enhance standards of living. Breakthrough in technology has been at the basis of many of the productivity gains that our economies have historically experienced (Schwab, 2013).

2. Energy Indicator

X13: policy on renewable energy
Policy on renewable energy relates on policies and measures that countries has taken or planned to encourage the uptake of renewable energy.

X14: energy production (Mtoe)
Energy production is the amount of energy that a country produces in Mtoe.

X15: TPES/population (toe/capita)
TPES/population is TPES per population in capita in the country. According to the International Energy Agency (IEA), TPES is measured as production of fuels added by inputs from other sources and added by imports, then minus exports and minus international marine bunkers, and plus stock changes.

X16: TPES/GDP (toe/thousand 2005 USD)
TPES/GDP is TPES per the amount of GDP in capita in the country.

X17: electricity consumption/population (MWh/capita)
Electricity consumption/population is the total consumption per population in capita in a country.

X18: policy on climate change
Policy on climate change relates on policies and measures that countries have established for climate change mitigation and adaption action.

X19: CO2/population (t CO2/capita)
CO2/population is CO2 emission that is produced per population in capita in a country. CO2 emission is calculated from fuel combustion only. Emissions are calculated using IEA's energy balances and the Revised 1996 IPCC Guidelines.

The relations between research questions, variables, and indicators, with the source of data included, could be seen in table below.

Table 2: Overview of Research Questions, Variables, and Indicators

Sub Research Question	Main Variable	Indicator	Source
1. Descriptive What are the characteristics of FDI inwards-outwards on renewable energy?	Countries linkages of FDI on Renewable Energy	Based on Intensity of Linkages - High - Medium - Low	FDI Market
	Source Countries	Based on investment number and value - Top 20 source country - Growth of outward investment	
	Destination Countries	Based on investment number and value - Top 20 destination country - Growth of inward investment	

Sub Research Question	Main Variable	Indicator	Source
2. Explanatory What are the determinants of inwards FDI on renewable energy that should be improve to increase the likelihood of attracting investment on renewable energy?	Factor Driven	X1 = Institutions 1. Property rights 2. Intellectual property protection 3. Diversion of public funds 4. Public trust in politicians 5. Irregular payments and bribes 6. Judicial independence 7. Favouritism in decisions of government officials 8. Wastefulness of government spending 9. Burden of government regulation 10. Efficiency of legal framework in settling disputes 11. Efficiency of legal framework in challenging regulations 12. Transparency of government 13. Policymaking performance 14. Business costs of terrorism 15. Business costs of crime and violence 16. Organized crime 17. Reliability of police services 18. Ethical behaviour of firms 19. Strength of auditing and reporting standards 20. Efficacy of corporate boards 21. Protection of minority shareholders' interests 22. Strength of investor protection X2 = Infrastructure 1. Quality of overall infrastructure 2. Quality of roads 3. Quality of railroad infrastructure 4. Quality of port infrastructure 5. Quality of air transport infrastructure 6. Available airline seat kilometres 7. Quality of electricity supply 8. Mobile telephone subscriptions 9. Fixed telephone lines X3 = Macroeconomic environment 1. Government budget balance 2. Gross national saving 3. Inflation 4. Government debt 5. Country credit rating	- Global Competitiveness Index

Sub Research Question	Main Variable	Indicator	Source
		X4 = Health and primary education 1. Business impact of malaria 2. Malaria incidence 3. Business impact of tuberculosis 4. Tuberculosis incidence 5. Business impact of HIV/AIDS 6. HIV prevalence 7. Infant mortality 8. Life expectancy 9. Quality of primary education 10. Primary education enrolment rate	
	- Efficiency Driven	X5 = Higher education and training 1. Secondary education enrolment rate 2. Tertiary education enrolment rate 3. Quality of the educational system 4. Quality of math and science education 5. Quality of management schools 6. Internet access in schools 7. Local availability of specialized research and training services 8. Extent of staff training	
		X6 = Goods market efficiency 1. Intensity of local competition 2. Extent of market dominance 3. Effectiveness of anti-monopoly policy 4. Extent and effect of taxation 5. Total tax rate 6. Number of procedures required to start a business 7. Time required to start a business 8. Agricultural policy costs 9. Prevalence of trade barriers 10. Trade tariffs 11. Prevalence of foreign ownership 12. Business impact of rules on FDI 13. Burden of customs procedures 14. Imports as a percentage of GDP 15. Degree of customer orientation 16. Buyer sophistication	
		X7 = Labour market efficiency 1. Cooperation in labour-employer relations 2. Flexibility of wage determination 3. Hiring and firing practices	

Sub Research Question	Main Variable	Indicator	Source
		4. Redundancy costs, weeks of salary 5. Effect of taxation on incentives to work 6. Pay and productivity 7. Reliance on professional management 8. Country capacity to retain talent 9. Country capacity to attract talent 10. Women in labour force, ratio to men	
		X8 = Financial market development 1. Availability of financial services 2. Affordability of financial services 3. Financing through local equity market 4. Ease of access to loans 5. Venture capital availability 6. Soundness of banks 7. Regulation of securities exchanges 8. Legal rights	
		X9 = Technological readiness 1. Availability of latest technologies 2. Firm-level technology absorption 3. FDI and technology transfer 4. Individuals using Internet 5. Fixed broadband Internet subscriptions 6. International Internet bandwidth 7. Mobile broadband subscriptions	
		X10 = Market size 1. Domestic market size index 2. Foreign market size index 3. GDP (PPP$ billions) 4. Exports as a percentage of GDP	
	- Innovation Driven	X11= Business sophistication 1. Local supplier quantity 2. Local supplier quality 3. State of cluster development 4. Nature of competitive advantage 5. Value chain breadth 6. Control of international distribution	

Sub Research Question	Main Variable	Indicator	Source
		7. Production process sophistication 8. Extent of marketing 9. Willingness to delegate authority	
		X12 = Innovation 1. Capacity for innovation 2. Quality of scientific research institutions 3. Company spending on R&D 4. University-industry collaboration in R&D 5. Government procurement of advanced tech products 6. Availability of scientists and engineers 7. Percentage patents application	
	- Energy Security	X13 = Policy on renewable energy	International Energy Agency
		X14 = Energy production (Mtoe)	
	- Energy Equity	X15 = TPES/population (toe/capita)	
		X16 = TPES/GDP (toe/thousand 2005 USD)	
		X17 = electricity consumption/population (MWh/capita)	
	- Environmental Sustainability	X18 = Policy on climate change	
		X19 = CO_2/population (t CO_2/capita)	
	- Y = number of inward FDI on renewable energy		FDI Market Financial Times
3. Prescriptive What policies should be done to enhance competitiveness of FDI on renewable energy in Indonesia?	X1 to X19 on Indonesia Based on Model 1 Y = FDI on renewable energy	Policies on renewable energy	- Renewable Energy Journals

Source: Author, 2014

3.3 Research Strategy and Methodology

The first part of analysis is using descriptive analysis based on FDI on renewable energy in 110 countries, from year 2003-2012. This data is taken from Financial Times FDI Market database and covers green field data. Green field data identified investments where the prime companies start an entirely new venture in a foreign country by constructing new operational facilities from the ground up level (Wall, R.S. and Burger, M., 2012).

Meanwhile, for the second analysis, the research will conduct multiple regression analysis based on cross section data inward FDI market on renewable energy to identify which location factors are determinants for FDI on renewable energy. FDI market on renewable energy will act as Y variables (dependent variables) and the location factors data set (X variables) comes from Global Competitiveness Index (GCI) and other specific indicator which has relations with renewable energy sectors. For this multiple regression analysis, since the GCI data has period from 2006-2012, in order to perform better analysis, the FDI on renewable energy data will be adjusted with the same period.

This research tries to examine the relationship between two variables, the dependent and independent variables. Based on the data, the statistical measure will be processed and produce information. This research will use country scale model. This model would be formed in descriptive, exploratory, and prescriptive analysis. Since the object study is Indonesia, after the research finds significant variables that influence FDI on Renewable Energy, analysis on this research will focus on how to enhance FDI on renewable energy in Indonesia. For processing of these analyses, this research will use Arc GIS, Microsoft Office Excel, and STATA 10.

Lastly, this research tries to make prescription analysis based on the result of the descriptive and explanatory analysis specifically in Indonesia. The prescription consists of policies recommendations to improve competitiveness advantage in order to attract inward investment on RE in Indonesia.

3.4   Data Collection Methods

Based on the needs of the variables, the research will use the secondary data collection methods. This research purposes is to investigate "what factors influence competitive enhancement on FDI on renewable energy in Indonesia" that build upon pre-existing quantitative data. For the independent variables, the 12 pillars of competitiveness in Global Competitiveness Index (GCI) come from the report by the World Economic Forum; FDI markets data comes from Financial Times: and specific indicators on energy come from published statistic data on International Energy Agency website. Meanwhile, for the dependent variables, Foreign Direct Investment (FDI) on renewable energy comes from Financial Times FDI Market data.

The secondary data collection method is the most suitable method since the research will examine the factors of FDI on renewable energy and the relationship with the performance of countries based on GCI and specific indicator related on energy. This data is already being researched by the institutions mentioned above and this study does not intend to solicit qualitative information. Therefore, collecting data with questionnaires and interviews is not required.

Most of the data are accessed via website of trustful institutions.

1. World Economic Forum
    Website http://www.weforum.org/issues/global-competitiveness
2. International Energy Agency
    Website http://www.iea.org/
3. Renewable Energy Journals (available on Science Direct).

3.5   Validity and Reliability

Since the data comes from different sources, the year ranges of available data are varied. But regarding the validity of this research, all of the data that needs to be processed are secondary data that come from trustful organizations/institutions. Some data are published in their websites and can be accessed freely.

The reliability of published statistics may vary over time. But since the data is taken by using standardized data collection from international organization, this data becomes reliable. The method they are using to collect were published and explained in their websites. The indicators from international organization published-statistics are reliable enough to represent measurements of this study.

3.6   Data Analysis Techniques

The research will be conducted with the modelling research strategy, which involves a set of indicators and its relation with dependent variables. The modelling strategy is the most adequate strategy since the main research question of this research is trying to find factors that influence the competitiveness enhancement of Foreign Direct Investment (FDI) on renewable energy.

Figure 4: Data Analysis Technique
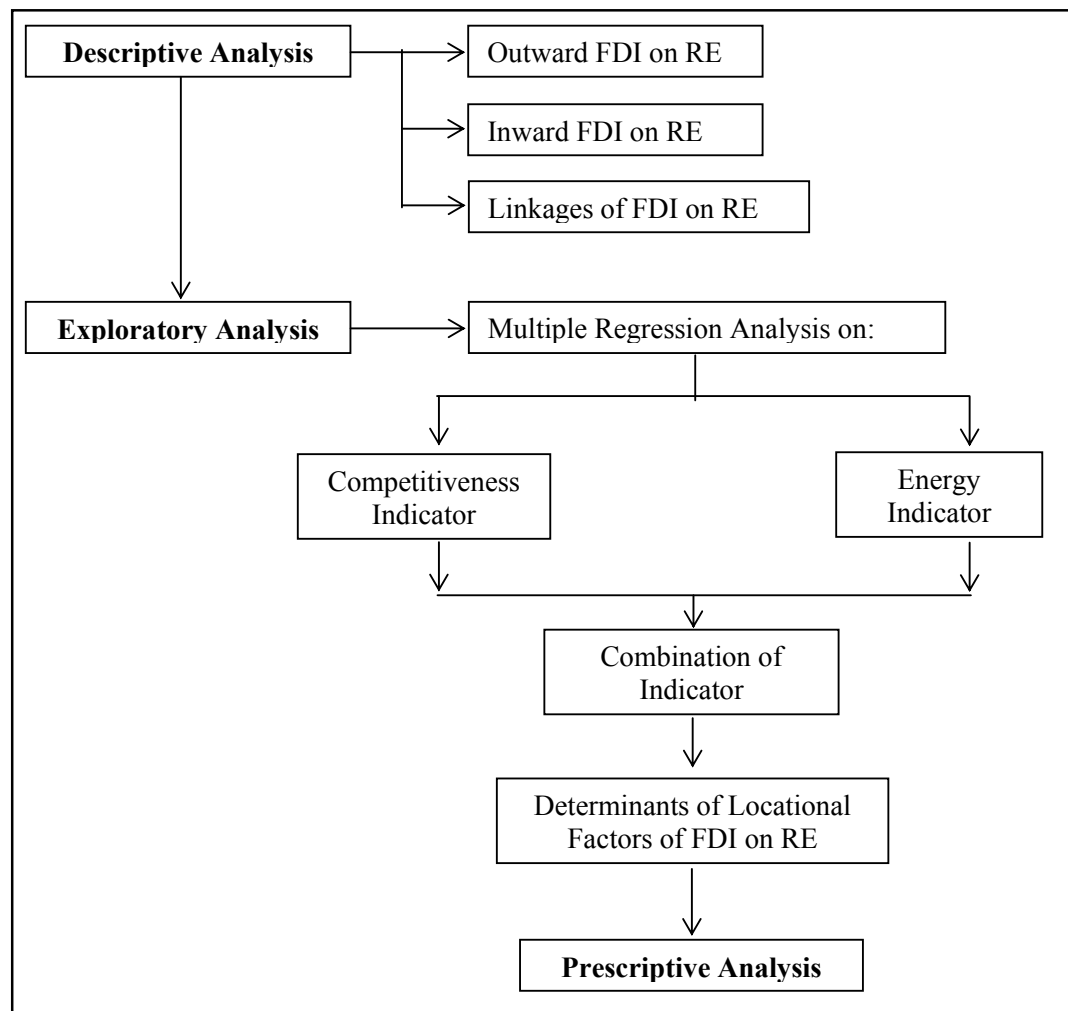
Source: Author, 2014

3.6.1 Descriptive Analysis

Descriptive analysis is applied to understand the characteristics of FDI on Renewable Energy (RE) based on FDI market data year 2003-2012. The description regarding to the growth and distribution of FDI on RE; outward FDI on RE by source region and source country; and inward FDI on RE by destination region and destination country will be analysed with Microsoft Excel. While the linkages of FDI on RE will be using Arc GIS.

Since the objective of study is Indonesia, this descriptive analysis also performs position of Indonesia in FDI on RE, their competitors as destination country in Asia region, identification on types of FDI on RE, and some examples of development on RE in Indonesia.

3.6.2 Explanatory Analysis

Explanatory analysis will use deterministic statistical models, which try to determine the value of the dependent variable from the values of the independent variables and examine their relationship. By using STATA 10, this research will conduct pooled Ordinary Least Square (OLS) regressions. This regression is also considering multicolinearity assumption between variables. Multicolinearity assumption is conducted to find correlation between variables. Sufficient regression should have uncorrelated independent variables. In STATA, this assumption could be detected by seeing correlation between independent variables, or with the variance inflation factor (VIF) values.

Pooled OLS regression considers data set as pooled data. This multiple regression analysis tries to find relation between a set of existing indicators and its relation with dependent variables (FDI on renewable energy). As seen below, the final result of this analysis is an estimating equation that shows the value of dependent variable from known independent variable (Santoso, 2006).

$$y = \beta_0 + \beta_1 x_1 + ... + \beta_k x_k + \varepsilon$$

Where, $x_1, x_2, ..., x_k$ are independent variables from indicators

$\beta_0, \beta_1, ..., \beta_k$ are regression coefficients and ε is a random error

Using STATA 10, the analysis will present several values of statistical terms (Santoso, 2006):

- p> |t| less than 0.1 means that x-variable is significant and could be used to describe y-variables.
- VIF less than 10 means that x-variable is exempt from multicolinearity assumption.
- R^2 is ability of the equation to explain y-variables by using x-variables.

The regression will take FDI on RE as y-variable and indicators as x-variables. Since the main group of indicators consist of 2 groups, this analysis will be conducted on 3 steps; firstly the regression will be conducted on competitiveness factors, secondly regression with energy indicators, and lastly the combination of those 2 main groups indicators.

3.6.3 Prescriptive Analysis

From the statistical conclusions, the trend of FDI on renewable energy will be reflected and factors that influence the competitiveness enhancement of Foreign Direct Investment (FDI) on renewable energy will be discovered.

The last step on this research is prescriptive analysis. By using the result of the descriptive and explanatory analysis, this research tries to make recommendations for policies of FDI on Renewable Energy in Indonesia. This step will also combine reviews from related journals.

Chapter 4: Research Findings

4.1 Analysis and Finding of Research Question 1: What are the Characteristics of FDI Inwards-Outwards on Renewable Energy?

Based on the first research question, this sub chapter explains the characteristics of FDI on renewable energy, which include growth and distribution; outward FDI by source region and country; inward FDI by source region and country; linkages of FDI on RE, and profile of FDI on RE in Indonesia.

4.1.1 Growth and Distribution of FDI on Renewable Energy

Chart 5 shows the trend of FDI on renewable energy between 2003 and 2012 with assumption of exponential growth on renewable energy sector at 19.6 percent. Throughout this period, the number of FDI on renewable energy in worldwide increased in the year 2008. But, unfortunately from 2008 onwards, investments went decrease. The global financial crisis on 2008 somehow gave effect to the growth of FDI years after. During years 2010, several European governments announced incentive cut for solar energy due to acutely economic recession and this is added by event in the late 2011, when the European sovereign debt crisis started to spread out (McCrone, Usher, et al., 2012). There was a dramatical decrease on the supply of debt for renewable energy projects in Europe, as banks had to respond to sharp increases in their cost of funding and upgrading their assessments of the risks involved in lending to borrowers in Italy, Spain, and other affected countries (McCrone, Usher, et al., 2012).

Chart 5: Growth of FDI on Renewable Energy
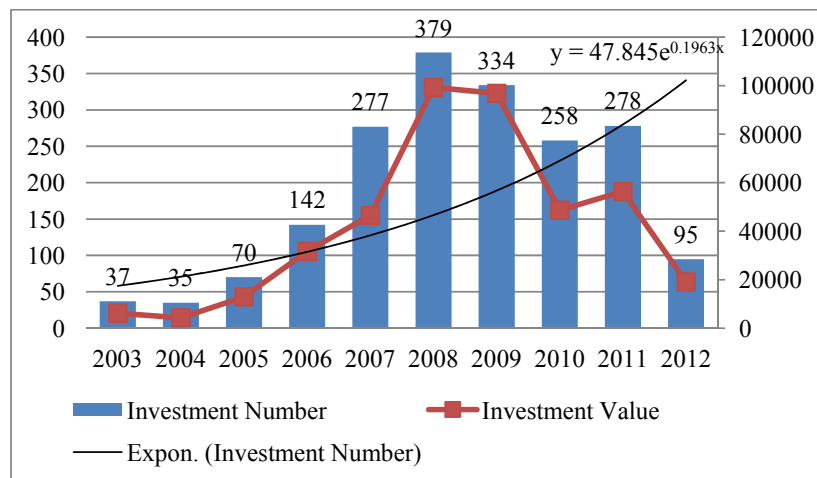
Source: Author, 2014 based on FDI Markets Financial Times, 2013

As seen on **Chart 6** below, the data set of FDI on RE implies 4 clusters of sector in RE, namely energy, environmental technology, ICT and electronics, and retail trade. From these 4 clusters, it can be seen that FDI on RE are mainly engaged in environmental technology. This could happen since mostly every activity related to renewable energy involves environmental technologies sector.

Chart 6: Cluster Distribution of FDI on Renewable Energy
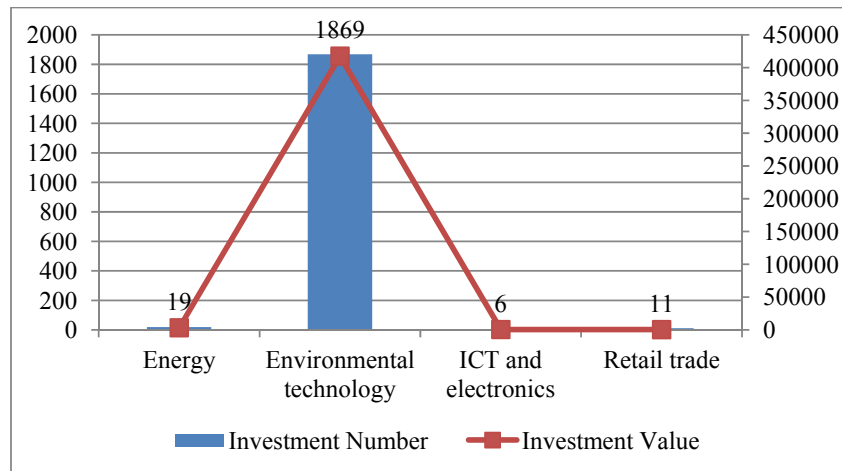
Source: Author, 2014 based on FDI Markets Financial Times, 2013

Chart 7: Activity Distribution of FDI on RE
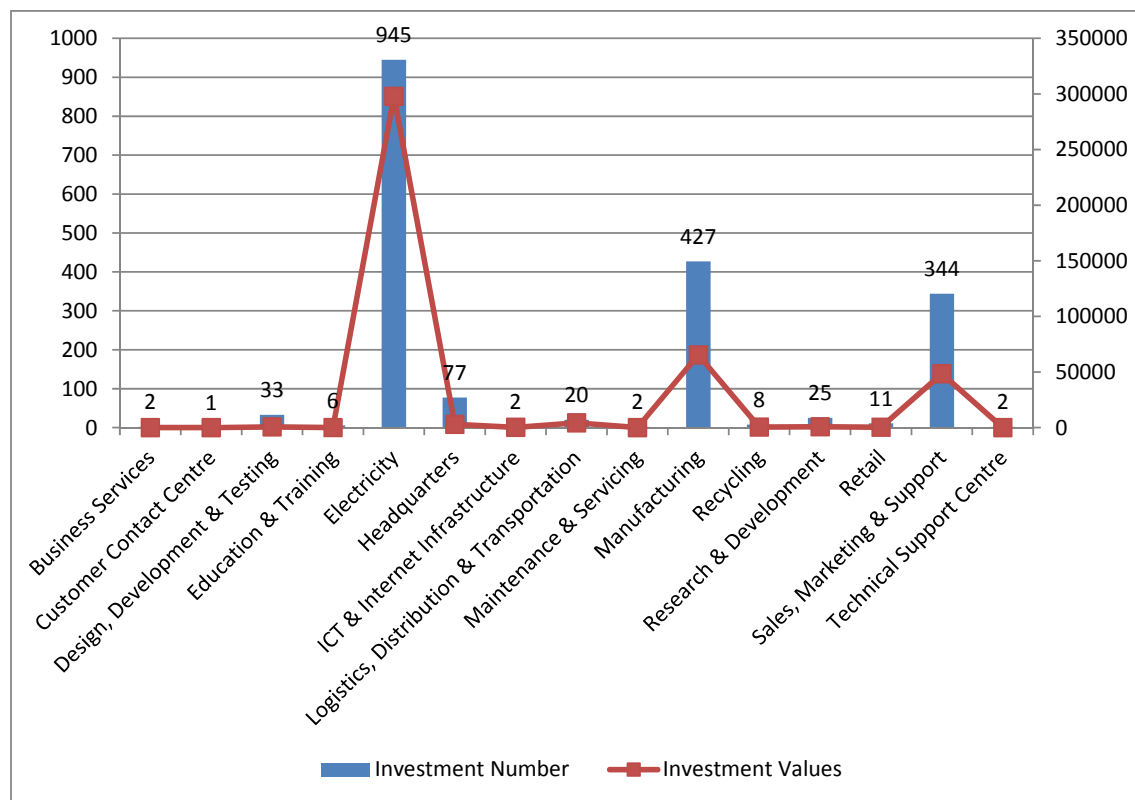
Source: Author, 2014 based on FDI Markets Financial Times, 2013

Meanwhile, for activity on RE, the data set of FDI on RE categorises FDI on RE into 15 activities. **Chart 7** implies that the highest activity of FDI on RE are electricity with 945 investment, which is almost half of total investment on RE, followed by manufacturing and sales, marketing, and support with 427 and 344 investments. These activities reflected that most of renewable energy sector used for the purpose for electricity supplies.

4.1.2 Outward FDI on Renewable Energy by Source Region

Table 3 implies that most of FDI on renewable energy derived from West Europe with 1,067 number of investments, which means more than half of FDI on renewable energy is derived from West Europe. This could happen since countries from West Europe and North America were mainly the pioneers of renewable energy establishment.

Table 3: Outward FDI on Renewable Energy by Source Region

Region	Investment Number	Percentage (%)
West Europe	1,067	56.01
North America	564	29.61
Asian and Pacific	188	9.87
Middle East	33	1.73
Rest of Europe	26	1.36
Latin America	25	1.31
Africa	2	0.10
FDI RE in Total	**1,905**	

Source: Author, 2014 based on FDI Markets Financial Times, 2013

4.1.3 Outward FDI on Renewable Energy by Source Country

Meanwhile, in country level, **Table 4** shows 508 investments come from US, followed by Germany and Spain with 262 and 202 investments. It indicates that more than a quarter of investment is derived from US and dominated by North American and European countries. As explained in previous analysis, North American and European countries like US, Germany, Spain, France, and UK are the first countries to have advanced technology to develop renewable energy in massive scale. Germany has been called the world's first major renewable energy economy according to Renewable Energy World (2009) and has significant renewable energy companies that are based in Germany, like Nordex, Repower, Fuhrländer, and Enercon. Meanwhile, Spain was the first country in Europe that applies the installation of photovoltaic electricity generation in new buildings. Other countries, like US, France, and UK are the place where significant headquarters of companies that are engaged in the energy sector located, for instance: Chevron and Exon Mobil in US, Total in France, Shell and British Petroleum (BP) in UK.

Table 4: Top 10 of Source Country in FDI on Renewable Energy

No.	Country	Investment Number	Investment Value
1	US	508	111,609.66
2	Germany	262	53,003.94
3	Spain	202	53,847.99
4	France	134	27,516.65
5	UK	87	16,449.05
6	Japan	70	12,576.12
7	Italy	65	20,217.29
8	Canada	56	9,356.04
9	Austria	42	7,817.40
10	Sweden	37	7,570.89
	…	…	…
	FDI RE in Total	**1,905**	**421,836.05**

Source: Author, 2014 based on FDI Markets Financial Times, 2013

In **Figure 5**, it clearly described the domination of US and European country as explained previously. Moreover, beside the domination of North America and European countries, Japan and Australia are the countries from Asia Pacific that also have significant role as sources for FDI on RE since these countries provide policies that support the establishment of renewable energy sector.

Figure 5: Source Country of FDI on RE
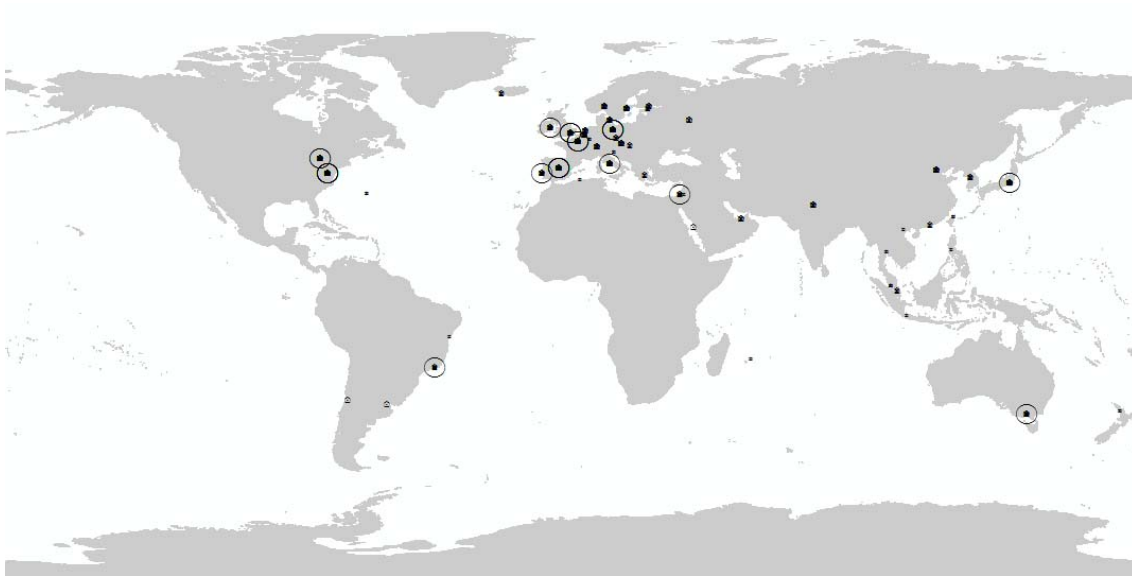
Source: Author, 2014 based on FDI Markets Financial Times, 2013

Table 5 also implies that destination of US investment on renewable energy are mostly within the country itself. Most of the top 5 sources of FDI on renewable energy derived their investment within America and Europe, and some towards China. This could happen since developed countries and China with their significant population numbers have the largest energy consumptions in the world. Therefore, the linkages of renewable energy expanded more on the compliance of domestic needs.

Table 5: Top 5 of Source Country in Outward FDI on Renewable Energy

US		Germany		Spain		France		UK	
Desti nation	Invest ment Number	Desti nation	Invest ment Number	Desti nation	Invest ment Number	Desti nation	Invest ment Number	Desti nation	Invest ment Number
US	258	UK	35	US	24	Spain	14	US	24
Canada	22	France	30	France	20	UK	13	Spain	10
Brazil	18	Spain	26	UK	16	US	13	China	8
China	18	US	22	Italy	13	Canada	9	Canada	6
Spain	17	Italy	20	Poland	13	Brazil	8	Philippines	5

Source: Author, 2014 based on FDI Markets Financial Times, 2013

4.1.4 Inward FDI on Renewable Energy by Destination Region

Regarding to inward FDI on RE, **Table 6** implies that most of the destinations of FDI on renewable energy are toward West Europe with 602 numbers of investments, followed by North America and Rest of Europe, with 482 and 264 investments, which means almost half of investment (45.46%) on renewable energy, develops in Europe. As mention in earlier analysis, since demand on energy mostly comes from developed countries, the linkages of renewable energy seems to expand more on the fulfilment of domestic needs of developed countries. Therefore, the destination is mainly within those regions.

Table 6: Inward FDI on Renewable Energy by Destination Region

Region	Investment Number	Percentage (%)
West Europe	602	31.60
North America	482	25.30
Rest of Europe	264	13.86
Asian and Pacific	237	12.44
Latin America	211	11.08
Africa	83	4.36
Middle East	26	1.36
FDI RE in Total	**1,905**	

Source: Author, 2014 based on FDI Markets Financial Times, 2013

4.1.5 Inward FDI on Renewable Energy by Destination Country

In country level, **Table 7** indicates almost similar results with analysis of top source country. US is implied as the highest destination of investment on renewable energy with 432 investments, followed by UK and Spain, with 135 and 104 investments. The result indicated that most MNCs engaged in renewable energy expand their business to the activity that supports their network within their regions.

Table 7: Top 10 of Destination Country of Inward FDI on Renewable Energy

No.	Country	Investment Number	Investment Value
1	US	432	101986.48
2	UK	135	39295.928
3	Spain	104	10687.94
4	France	87	10161.23
5	Germany	74	19153.3164
6	China	66	14950.63
7	Italy	62	6093.47
8	Brazil	53	20159.55
9	Canada	50	7982.268
10	Bulgaria	49	8908.727577
	…	…	…
	FDI RE in Total	**1,905**	**421,836.05**

Source: Author, 2014 based on FDI Markets Financial Times, 2013

Figure 6: Destination Country of FDI on RE

Source: Author, 2014 based on FDI Markets Financial Times, 2013

Figure 6 also indicates that the destinations on RE are particularly in European and North America since the tendency of securing energy supplies in the domestic markets. Some destinations are expanded in coastal country of Africa, China, India, and Australia. This could imply that enterprises start to expand their businesses to countries that have large market size (big population), like China and India. Meanwhile, as seen on **Table 8**, it indicates that most investments in the top 5 countries destinations are derived from US and European countries. This result almost has similar results as top 5 source countries of investment on renewable energy. Destination of countries revealed that enterprises on RE remain to fulfil domestic needs first and then start to see other potential business in other countries.

Table 8: Top 5 of Destination Country of Inward FDI on Renewable Energy

US		UK		Spain		France		Germany	
Source	Invest ment Number	Source	Invest ment Number	Source	Invest ment Number	Source	Invest ment Number	Source	Invest ment Number
US	258	Germany	35	Germany	26	Germany	30	US	14
Spain	24	US	17	US	17	Spain	20	France	8
UK	24	Spain	16	France	14	US	7	Switzerland	6
Germany	22	France	13	UK	10	Italy	6	China	6
Canada	14	Ireland	10	Italy	8	Canada	5	Iceland	6

Source: Author, 2014 based on FDI Markets Financial Times, 2013

From all the tables above, it can be concluded that northern part of the world-North America and European countries-are mostly the key players on renewable energy sector. This conclusion is also supported by the linkages overview of FDI on renewable energy that will be described in the next sub chapter.

4.1.6 Linkages of FDI on Renewable Energy

Figure 7 shows that the linkages of FDI on RE mostly happen on northern hemisphere. The bold lines come inwards and outwards within North America and Europe. This could be explained by the dominance of developed countries in renewable energy sector that also become location based of big MNC engaged in energy sectors.

Figure 7: Linkages of FDI on RE
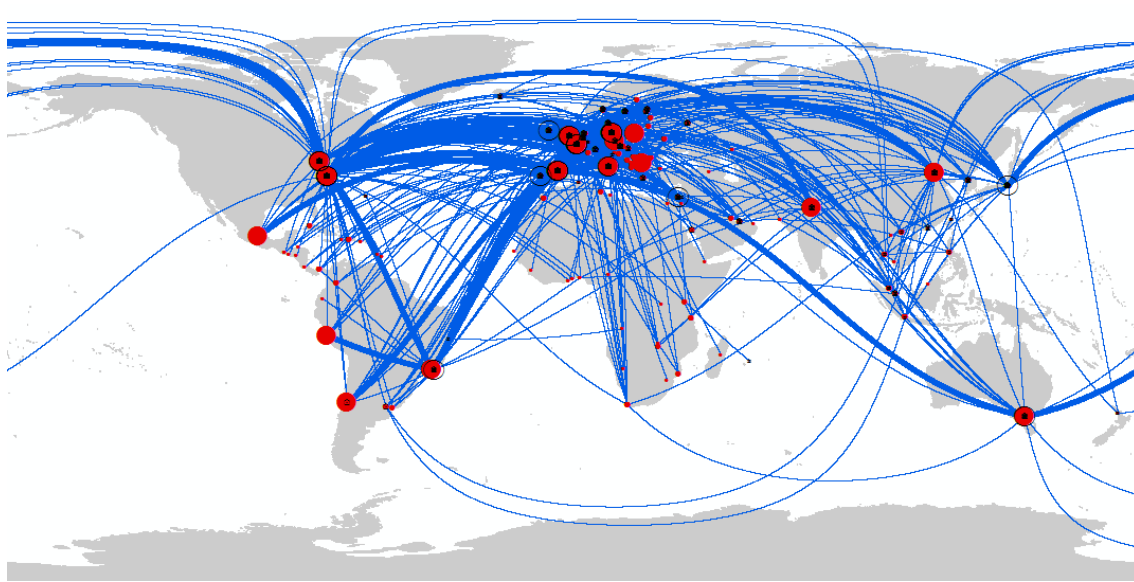
Source: Author, 2014 based on FDI Markets Financial Times, 2013

4.1.7 Profile of Indonesia in FDI on Renewable Energy

The growth of FDI on RE in Indonesia seemed fluctuating from year 2006 until 2012. As seen on **Chart 8**, year 2007-2008 seemed to be the highest number of investment, but in 210, Indonesia reached the highest investment value. Unfortunately by the year 2012, none of investment was derived to Indonesia. This event could be caused by influence from global crisis on 2008 where most of FDIs were also showing decreased.

Chart 8: The Growth of FDI on RE in Indonesia
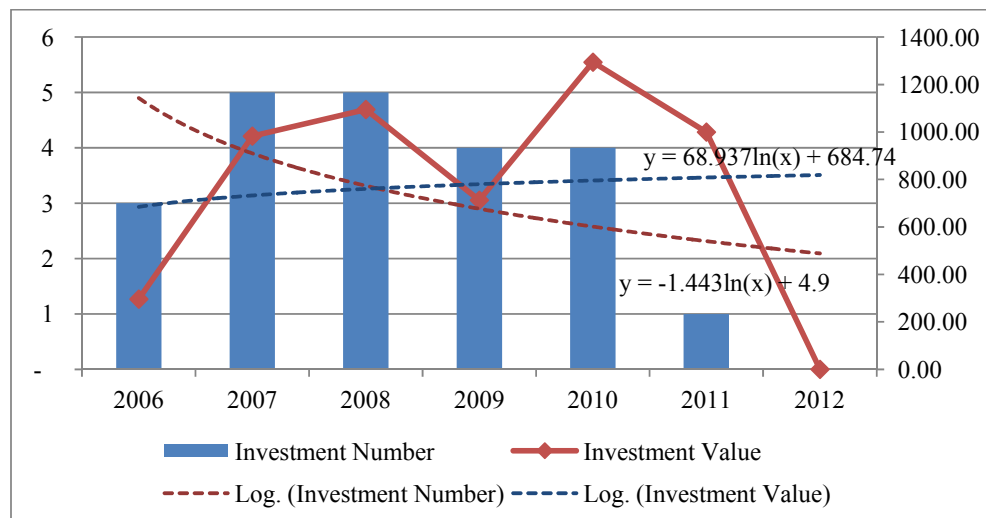
Source: Author, 2014 based on FDI Markets Financial Times, 2013

In accordance with the position of Indonesia in the linkages of FDI on RE, Indonesia played mainly as destination countries. Outward investment from Indonesia was only towards Singapore with one investment. Meanwhile, the inward FDI on RE towards Indonesia were derived from countries like Argentina, Australia, China, Iceland, Japan, Malaysia, Singapore, South Korea, Taiwan, and United States (**Table 9**). The highest number was China with 7 investments, followed by US and Japan with 4 and 3 investments. China and Japan has significant investment in Indonesia since they were the biggest player on RE in Asia (FDI Markets Financial Times, 2013), meanwhile since US was the key players of RE sector at global level, US also gave contribution in renewable energy sector in Indonesia.

Table 9: Inward FDI on RE in Indonesia

No.	Source Countries	Investment Number	Investment Value
1.	Argentina	2	1,000
2.	Australia	1	250
3.	China	7	1,846
4.	Iceland	1	431
5.	Japan	3	999
6.	Malaysia	1	375
7.	Singapore	3	258
8.	South Korea	1	100
9.	Taiwan	1	138
10.	United States	4	524
	Grand Total	**24**	**5921**

Source: Author, 2014 based on FDI Markets Financial Times, 2013

Moreover, Indonesia has good position in world destination of FDI on RE. Indonesia was in 19th position as destination of FDI on RE. Meanwhile, in Asia, Indonesia was in the third place after China and India (**Chart 9**). This can be assumed that China and India are the biggest competitors for persuading inward investment of FDI on RE. China and India has big potential since they have large market demand on energy from their big population (Yergin, 2006) and the significant growth of industries within these countries. Furthermore, other potential competitors are Singapore, UAE, Philippines, Malaysia, South Korea, Vietnam, and Japan. They have developed certain policies regarding the climate change and renewable energy.

Chart 9: Position of Indonesia as Destination of FDI on RE in Asia Region
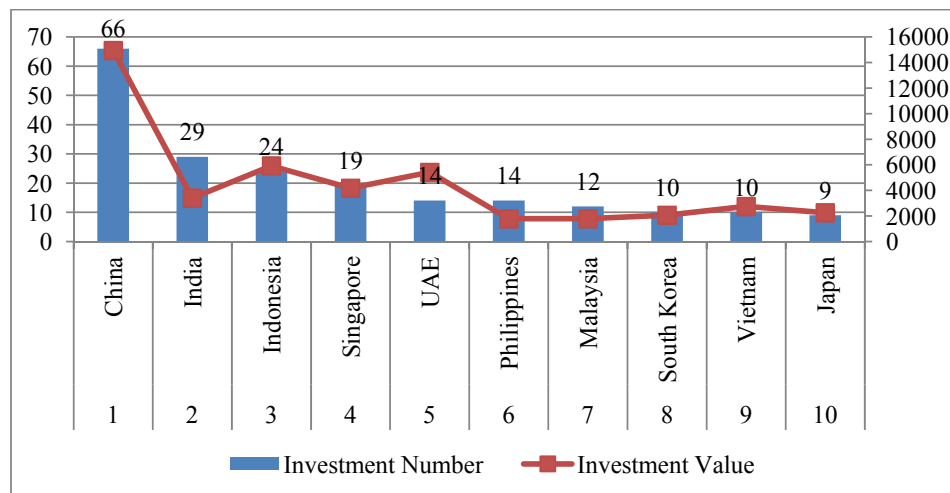
Source: Author, 2014 based on FDI Markets Financial Times, 2013

According to FDI Markets data, inward investments that have emerged in Indonesia are basically engaged in environmental technology cluster with 3 main activities, namely electricity; manufacturing; and sales marketing and support (**Chart 10**). Based on the data, most investments have activities in electricity, but manufacturing activities have the biggest investment value in Indonesia. This activities show that most of renewable energy sector is derived to fulfil electricity supplies.

Chart 10: Activity Distribution of FDI on Renewable Energy
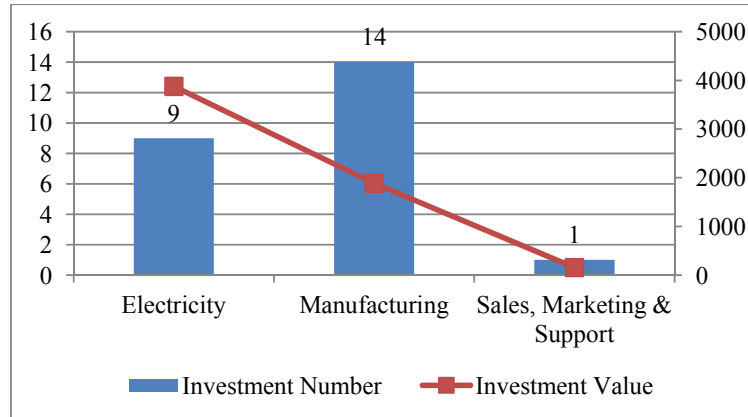
Source: Author, 2014 based on FDI Markets Financial Times, 2013

Since this research implies relation between FDI on RE with competitiveness factors and energy indicator, it is necessary to acknowledge position of Indonesia on those factors. **Chart 11** shows the growth of GCI of Indonesia from 2006 until 2012.

Chart 11: Global Competitiveness Index of Indonesia (2006-2012)
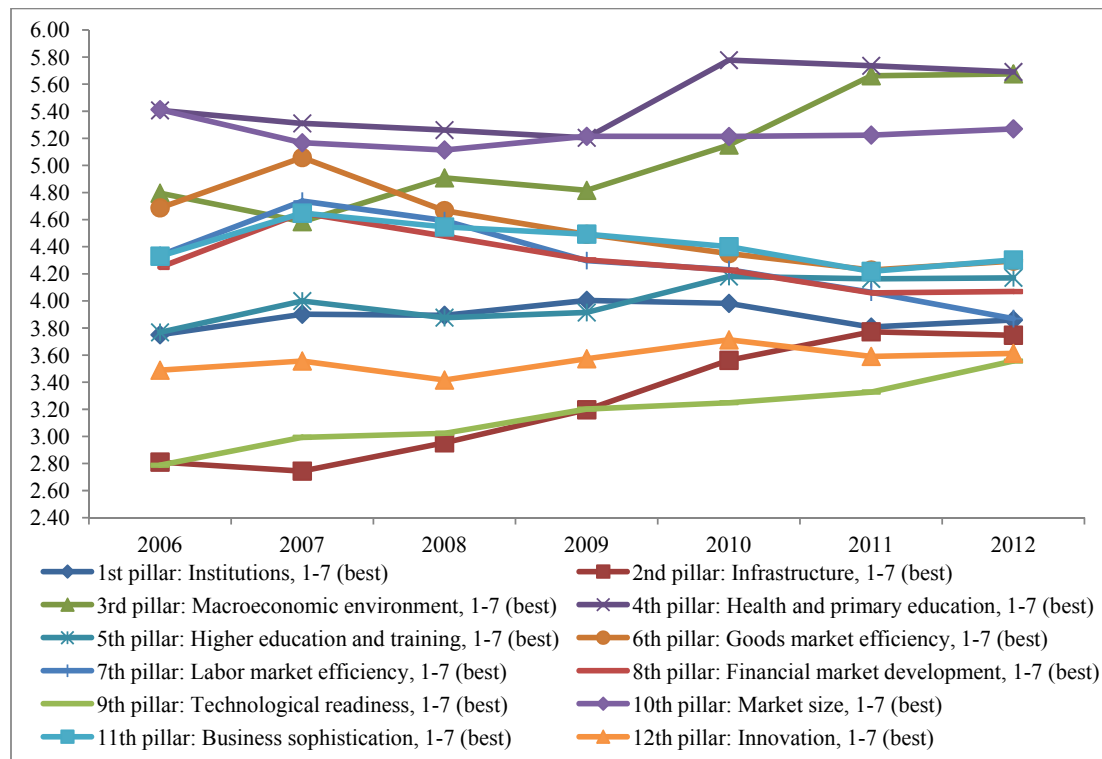
Source: Author, 2014 based on Global Competitiveness Index Report, 2013

As seen on **Chart 11** above, Indonesia has significant increment in pillar of infrastructure; macroeconomic environment; health and primary education; higher education and training; technological readiness, and innovation. It means that Indonesian government has significant regulation and policies that made those sectors have good increase. Meanwhile, other pillars like institution and market size remain stagnant. Even though government already made significant regulations but level of trust still remains low since corruption revealed mostly in government sector, therefore the institution remains stagnant. Meanwhile, even though Indonesian people's purchasing power is still at a good level, but for the scale of the country Indonesian people's purchasing power is the lowest purchasing power compared to other Asian countries that is why Indonesia's market size remains stagnant.

However, pillars of goods market efficiency; labour market efficiency; financial market development has decreased in the progress. This could happen since these sectors often have problems that mainly occur, for instance: dependency on imported raw materials, many demonstrations from labour demanding wage increase, and foreign exchange rates that are very volatile to the countries condition. This should be put in concern with beneficial policies.

Meanwhile, as seen on **Chart 12**, according to International Energy Agency, energy indicator for Indonesia has shown increment in energy production. This could happen since Indonesia has significant policies that affected to the value of energy production. But unfortunately the increase of energy production coupled with the increase of TPES/population, CO_2 emission/population, and electricity consumption/population. This means that Indonesian people are applying less power-efficient lifestyle. Only TPES/GDP has showed decrease progress. This could happen since the divisor of this indicator is GDP, where Indonesian GDP was rising significantly within those years.

Chart 12: Energy Indicator of Indonesia (2003-2011)
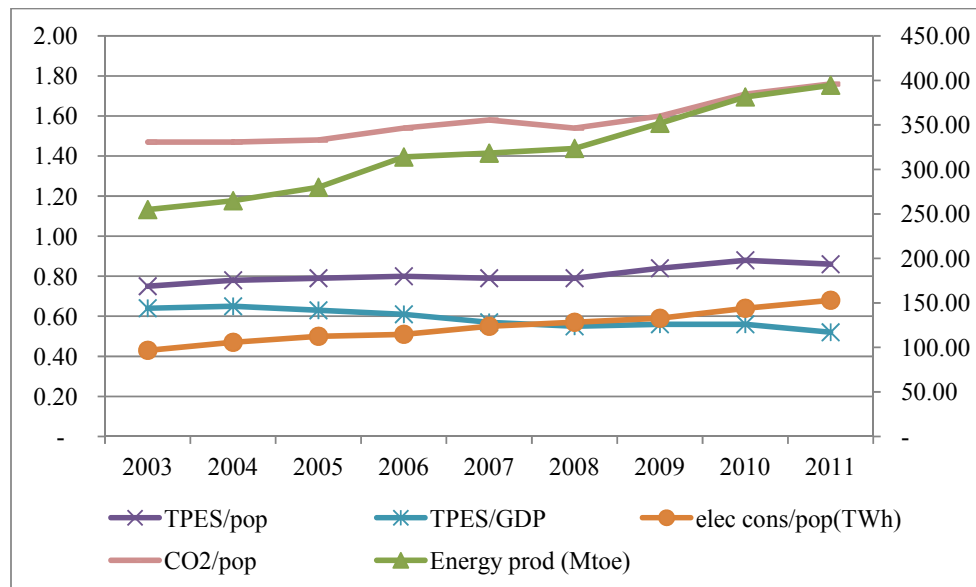
Source: Author, 2014 Based on International Energy Agency (IEA), 2013

Moreover, based on IEA, since 2006 until 2011, Indonesia already established 3 policies regarding mitigation and adaptation on climate change and 5 policies regarding renewable energy. Natural disasters which often occurs like tsunami, floods, and forest fires with vulnerable geographical to natural disaster that affected from climate change, made Indonesia has more attention regarding energy systems and renewable energy sector.

4.1.8 Findings

In accordance with the descriptive analysis, this research found that the growth of FDI on RE was influenced by global crisis in 2008 where incentives were cut and supply debt for renewable energy were decreasing in Europe. As the key player of renewable energy sector, these events significantly affected the establishment of renewable energy. Furthermore, FDI on RE were mainly engaged in environmental technology cluster and electricity as the main activities. This verifies that renewable energy sector more focused on environmental measure to provide electricity supply. Meanwhile, the investments on RE were derived mostly from West Europe and North America region and towards their regions. Countries like US, Germany, France, UK, and Spain were the first countries that have advance technology to develop renewable energy in massive scale and yet still active to promote renewable energy development. Moreover, since the demand on energy were mostly comes from developed countries, the linkages of renewable energy seems expanded more on the fulfilment of domestic needs of developed countries. Therefore, the linkages of FDI on RE were distributed unevenly within those regions since the linkages occurs rapidly within northern hemisphere where developed countries are located. Secure energy supplies within developed countries were their main purposes in developing renewable energy sector since they have the largest energy consumption. Expanding their business to other countries that has significant potential on renewable energy was their second intention to gain more revenues.

Regarding to FDI on RE in Indonesia, the growth of inward FDI were also particularly similar with the growth of FDI on RE at global level, it is affected by the global crisis in 2008. In FDI on RE, Indonesia was play more as destination countries, with the global key players on RE like China, Japan, and US as its source countries. As destination country, Indonesia has China and India as its main competitor since China and India have large market size of energy consumption from their big population.

Moreover, competitiveness in Indonesia based on GCI showed that Indonesia has made improvement in infrastructure; macroeconomic environment; health and primary education; higher education and training; technological readiness, and innovation since Indonesian government has significant regulation and policies to support those sectors, for instance additional budget for infrastructure (Indonesia Ministry of Finance, 2013), price controlling to keep inflation rate (Indonesia Statistic Agency, 2013), additional budget for health facility for the poor (Indonesia Ministry of Health, 2013), increment on school enrolment (Indonesia Statistic Agency, 2013), and others measures.

4.2   Analysis and Findings of Research Question 2: What are the Determinants of Inwards FDI on Renewable Energy that should be Improve to Increase the Likelihood of Attracting Investment on Renewable Energy?

Regarding the second research questions, this research applies pooled OLS regression analysis to find significant variables that have relation with FDI on renewable energy. Since most of the data set in year 2003-2005 comes to result with non available data and this will affect the distribution of data, the data set for the regression analysis is applied to the data set from year 2006-2012 and not from year 2003-2012.

In this sub chapter, the regression analysisis elaborated in 3 regressions, namely regression on main pillar of GCI, regression on energy indicator, and regression of the combination of those 2 groups of indicators. This analysis is applied with 150 countries as object of analysis and 909 inward investments.

4.2.1 Regression on Competitiveness Indicators

By using Stata 10, **Table 10** shows significant independent variables from competitiveness indicator using pooled OLS regression.

Table 10: Determinants by Main Pillar of GCI for FDI on Renewable Energy

No.	Significant X-variables	OLS Regression
1.	X_1=1st pillar: Institutions	-1.32**
		(0.61)
2.	X_2=2nd pillar: Infrastructure	0.98**
		(0.39)
3.	X_3=3rd pillar: Macroeconomic environment	-1.00***
		(0.27)
4.	X_4=4th pillar: Health and primary education	-0.78**
		(0.32)
5.	X_6=6th pillar: Goods market efficiency	-2.30**
		(0.93)
6.	X_7=7th pillar: Labour market efficiency	2.81***
		(0.54)
7.	X_8=8th pillar: Financial market development	0.93*
		(0.49)
8.	X_{10}=10th pillar: Market size	2.16***
		(0.25)
9.	X_{12}=12th pillar: Innovation	1.11**
		(0.54)
	Constant	**-5.77****
		(2.37)
	Observations	**909**
	R^2	**0.23**
	Adjusted R^2	**0.22**

Standard errors in parentheses
* $p< 0.1$, ** $p< 0.05$, *** $p< 0.01$
Source: Author, 2014 Based on STATA

The equation model for the dependency of inward FDI on RE with competitiveness factor is:

$$\hat{Y} = -5.77-1.32X_1+0.98X_2-1.00X_3-0.78X_4-2.30X_6 + 2.81X_7 + 0.93X_8 + 2.16X_{10} + 1.11X_{12}$$

In the equation, the value of R square is 0.23, which means 23% from FDI on RE variation could be explained by significant pillars. The rest (100%-23% = 77%) could be explained by other causes. Meanwhile Constanta value by (-5.77) indicates that if there was no strive on those significant pillars, inward FDI on RE would be diminished by 5.77 number of investments. Variables of infrastructure, labour market efficiency, financial market development, market size, and innovation are giving positive effects with expected positive sign on coefficient. Meanwhile, variables of institutions, macroeconomic environment, health and primary education, goods market efficiency are showing negative effects with expected positive sign on coefficient. This result acknowledged that countries with more competence on those sector will attract FDI on RE towards their countries.

4.2.2 Regression on Energy Indicator

In order to explore the relation with energy indicator, by using STATA 10, **Table 11** below shows the significant variables from energy indicator using pooled OLS regression.

Table 11: Determinants by Energy Indicators for FDI on Renewable Energy

No.	Significant X-variables	Y-variable = Number of FDI on RE
1.	X_{18} = Energy production (Mtoe)	0.01***
		(0.00)
2.	X_{20} = TPES/GDP (Mtoe/capita)	-2.93**
		(1.36)
3.	X_{22} = Policy on Climate Change	0.77***
		(0.07)
	Constant	**0.64***
		(0.61)
	Observations	**485**
	R^2	**0.44**
	Adjusted R^2	**0.43**

Standard errors in parentheses
*$p< 0.1$, **$p< 0.05$, ***$p< 0.01$
Source: Author, 2014 Based on STATA

The equation model for the dependency of inward FDI on RE with energy indicators is:

$$\hat{Y} = 0.64+ 0.01X_{18} - 2.93X_{20}+ 0.77X_{22}$$

In the equation, the value of R square is 0.44, which means 44% from FDI on RE variation could be explained by energy indicators, namely energy production, TPES/GDP, and policy on climate change. The rest (100%-44% = 56%) could be explained by other causes. Meanwhile, Constanta value by 0.64 indicates that if there was no strive on those significant pillars, inward FDI on RE would be added by 0.64 number of investments. Variables of energy production and policy on climate change are giving positive effects on FDI on RE with expected positive sign on coefficients. The growth of energy production and policy on climate change indicates increase in demand and pleasant condition to held business in the sector energy, therefore inward FDI interested to enter the energy business in the country. Moreover, variable of TPES/GDP is giving negative effects with expected negative sign on coefficient. Since TPES is measured as net total of primary energy in a country and most of countries have their energy mostly from oil-fuel, it means that the proportion of dependency on oil-fuel decreased and replaced with other resources, including renewable energy.

4.2.3 Regression on all Indicators (Competitiveness and Energy Indicators)

This regression is applied to observe whether the combination of main pillar on GCI and specific indicator could influence inward FDI on renewable energy. **Table 12** implied the significant variables from overall indicator using pooled regression analysis.

Table 12: Determinants by All Indicators

No.	Significant X-variables	Y-variable = Number of FDI on RE
1.	X_2 = 2nd pillar: Infrastructure, 1-7 (best)	0.96
		(0.52)
2.	X_3 = 3rd pillar: Macroeconomic environment, 1-7 (best)	-1.93[***]
		(0.46)
3.	X_4 = 4th pillar: Health and primary education, 1-7 (best)	-1.73[***]
		(0.61)
4.	X_6 = 6th pillar: Goods market efficiency, 1-7 (best)	-4.54[***]
		(1.11)
5.	X_7 = 7th pillar: Labor market efficiency, 1-7 (best)	3.72[***]
		(0.82)
6.	X_{10} = 10th pillar: Market size, 1-7 (best)	1.41[***]
		(0.39)
7.	X_{14} = Energy prod (Mtoe)	0.01[***]
		(0.00)
8.	X_{16} = TPES/GDP	-6.75[***]
		(1.64)
9.	X_{18} = Policy on Climate Change	0.80[***]
		(0.08)
	Constant	**15.08[***]**
		(4.71)
	Observations	**462**
	R^2	**0.50**
	Adjusted R^2	**0.49**

Standard errors in parentheses
[*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$
Source: Author, 2014 Based on STATA

The equation model for the dependency of inward FDI on RE with all indicators is:

$$\hat{Y} = 15.08 + 0.96X_2 - 1.93X_3 - 1.73X_4 - 4.54X_6 + 3.72X_7 + 1.41X_{10} + 0.01X_{14} - 6.75X_{16} + 0.80X_{18}$$

In the equation, the value of R square is 0.50, which means 50% from FDI on RE variation could be explained by those significant variables. The rest (100%-50% = 50%) could be explained by other causes. Meanwhile, the Constanta value by 15.08 indicates that if there was no strive on those significant pillars, inward FDI on RE would be added by 15.08 number of investments. Variables of infrastructure, labour market efficiency, market size, energy production, and policy on climate change represent positive effects to inward FDI on RE with expected positive sign on coefficient. Other variable, TPES/GDP signifies negative effects to inward FDI on RE with expected negative sign on coefficient. Moreover, other variables like macroeconomic environment, health and primary education, goods market efficiency are showing negative effects with expected positive sign on coefficient.

4.2.4 Findings

Based on competitiveness indicators, multiple regression analysis found that variables of infrastructure (2nd pillar of GCI), goods market efficiency (6th pillar of GCI), labour market efficiency (7th pillar of GCI), financial market development (8th pillar of GCI), market size (10th pillar of GCI), and innovation (12th pillar of GCI) have significant influence to inward FDI on RE. These indicators have positive effects to inward FDI on RE, which means every additional effort on these pillars would give increment to inward FDI on RE in a country.

Meanwhile, the regression analysis based on energy indicators gave result that variables of energy production (Mtoe), policy on climate change, and TPES/GDP (Mtoe) have significant relation with inward FDI on RE. Energy production (Mtoe) and policy on climate change give positive effects, which means every added value to these indicator will increase inward FDI on RE. While variable of TPES/GDP is giving negative effects, which means every added value of TPES/GDP will give negative effects to inward FDI on RE.

Furthermore, by overall, the combination of competitiveness and energy indicator, gives variables of infrastructure (2nd pillar of GCI); labour market efficiency(7th pillar of GCI); market size(10th pillar of GCI); energy production; policy on climate change; and TPES/GDP as significant variables to inward FDI on RE. Most of them give positive effects on inward FDI on RE, only TPES/GDP that gives negative effects.

Based on the analysis results, countries that have measures in encouraging inward FDI on RE should have paid more attention to those significant variables. Indonesia is one of the countries that still need inward FDI to their renewable energy sector development. Indonesia could appear as one of important key players on Asia region if Indonesia could improve those significant variables. The explanation of each variable will be clarified in Chapter 5.

Chapter 5: Conclusions

5.1   Introduction

As World Energy council says, "This is a time of unprecedented uncertainty for the energy sector. Energy demand will continue to increase. The pressure and challenge to develop and transform the energy system is immense" (World Energy Council, 2013).This challenge is summed up with the three core elements of energy systems called energy trilemma of achieving environmental sustainability, energy security, and energy equity.

Renewable energy is considered as one of the solutions to energy trilemma since this alternative resource meets the 3 challenges, it is more environmental sustainable rather than fossil fuel since it comes from replenishable resource, it produces significant mass energy of quantity, and the price of energy is mostly affordable and could be combined with local wisdom.

Nowadays, energy sector emerges the participation from private sectors. Earlier times, especially when the United Nations Millennium Development Goals were approved in 2000, there was no direct request for business to play an active role in the achievement of set targets. But after twenty years later, according to the development agenda of UN after 2015, cash strapped governmental institutions acknowledged that the private sector has a role to play in energy systems(World Energy Council, 2013). The private sectors are encouraged by public stakeholders to think seriously about their part in society and rethink over on their operationalization in encountering a changing external environment.

Therefore, for the reasons mentioned above, renewable energy urges to meet significant FDI from private sectors. FDI not only promotes long-term economic growth, but also leads the recipient country to adopt policies that are conducive to economic growth, for instance encourages human capital investments or policies that facilitate technology transfer (Liu, 2008).

This research tries to explain the conclusions based on analysis findings. These findings are closely related with research objectives and research questions that this research would like to achieve.

5.2   Retrospect: Research Objective

Reviewing the research objective of this study, three research objectives in this study that want to be achieved are the identification of FDI inwards-outwards characteristics on renewable energy at global level and in Indonesia, investigation to the determinants of inward FDI on renewable energy at global level, and suggestion for Indonesia to enhance inward FDI on renewable energy. Those three research objectives have met the goals based on analysis that has been done in Chapter 4 of this research.

5.3   Conclusions and Discussions

According to the research objectives and research questions that this research would like to accomplished, the conclusions are developed in three sub chapters, namely the characteristics of FDI inwards-outwards on renewable energy, the determinants of inwards FDI on renewable energy, and lastly, the kind of policies in order to enhance competitiveness of FDI on renewable energy in Indonesia.

5.3.1 The Characteristic of FDI Inwards-Outwards on Renewable Energy

The characteristics of FDI on renewable energy seem to bestill following FDI linkages patterns in general, the linkages mainly dispersed in within and among northern hemisphere. As Wall (2011) acknowledged, that in this globally integrated organization of economic activity modern world, the dense of economic agglomerations are within and among North America, Europe, and Pacific Asia.

This evidence is also supported by survey of the energy sustainability index in 2013. The results of the top performing countries in the 2013 energy sustainability index represent that most of West Europe countries that have higher shares of energy coming from low-or zero-carbon energy sources and supported by well-established energy efficiency programmes outperform, meet across all three dimensions of the energy trilemma which become the requirement in the assessment of sustainability index (World Energy Council, 2013). Meanwhile, occurrence of US as the leading country in source and destination countries of FDI on renewable energy seems reasonable since this country has major MNCs concerned on energy sector and their energy consumption is the second highest after China with 1,784.77 Mtoe in 2011 (International Energy Agency, 2013).

Moreover, viewed from the historical development of renewable energy, a rapid research and development on renewable energy was first developed in European countries and North America. Therefore, it is logical that this sector has European countries and North America as key players. The dominancy of developed countries and linkages that build mostly within North America and European country verify that these key players established renewable energy sector in line with the concern of energy system on trilemma especially to secure their domestic supplies of energy as well as promote climate change actions to reduce dependency on fossil fuels.

The dominancy of North America and European countries does not intend to rule out the possibility for other countries outside those regions to be able to develop renewable energy sector. Countries in Asia Pacific, like Japan, China, India, and Indonesia are potential countries in the development of renewable energy sector since the linkages start to lead to these countries. This network has to be developed and maintained to ensure the development of renewable energy.

Regarding to FDI on RE in Indonesia, the growth of inward FDI were also influence by the growth of FDI on RE at global level. Indonesia was play more as destination countries, with the global key players on RE like China, Japan, and US as its source countries. Indonesia has China and India as its main competitor as destination country, since China and India have large market size of energy consumption from their big population. However, the linkages of FDI on RE in Indonesia were among top 20 of destination countries, it signify that Indonesia could have chance to have a role in renewable energy sector.

5.3.2 The Determinants of Inwards FDI on Renewable Energy

Regarding to the second research question, based on overall indicators, which are the combination of competitiveness and energy indicator, the multiple regression analysis indicate that at the global level, variables of infrastructure; labour market efficiency; market size; energy production; policy on climate change; and TPES/GDP are significant as determinants of inward FDI on RE. Most of them give positive effects on inward FDI on RE, only TPES/GDP that gives negative effects.

1. Infrastructure

Infrastructure, the second pillar of competitiveness based on Global Competitiveness Index Report (2013), is the factor driven that has important influence on FDI on RE. This determinant is consistent with the concept by Munnell and Cook (1990). Countries that have invested more in infrastructure tend to have greater output, more private investment, and more employment growth (Munnell and Cook, 1990). With effective modes of transport, like good quality airports, ports, roads, railroads, and transportation systems, could ensure investor to get their goods and services to the market right on time and facilitate workers to their place to work (Schwab, Porter, et al., 2007).

For renewable energy sector, the renewable energy itself plays important role as infrastructure on energy. The existence of power plant from renewable energy could ensure production process free from disruption and shortages of electricity. Certainly, good quality and advance power plant from renewable energy development needs support from other adequate infrastructure, for instance availability of roads to the site, good connections with other network system, etc.

2. Labour market efficiency

Labour market efficiency in a country could be achieved when workers ensure to be employed to their most effective use in the economy and serve incentives to pursue maximum productivity(Schwab, Porter, et al., 2007). With the efficiency in labour market, it could give positive influence on productivity and labour performance to attract more investment.

3. Market size

Large market size in a country appeals for investor as their target of marketing of the products. Especially for renewable energy sector, since the final result is energy-product with limited mobility, the market should be available largely in the country. Therefore, the inward investment would be interested to expand their business towards country with large market size.

4. Energy production

FDI on renewable energy and energy production are closely related each other. This could possibly happen because the increment of energy production indicates the presence of increasing demand and tendency that energy sector in the country is held properly, therefore inward FDI interested to enter the energy business in the country.

5. Policy on climate change

Establishing policy regarding climate change could signify the world that the country has a great concern on the development of renewable energy in order to support completion of environmental problems regarding climate change. Moreover, participation of a country in international events especially on environmental action could make better network with other countries. Renewable energy sector has become great issues to substitute fossil-fuels and decrease the dependency on fossil fuels; therefore there will be key players of renewable energy sector that are involved in such events. The networks with the key players will intertwine and intensify technology assistance from developed countries on the development of renewable energy, thus indirectly bring investment into the country.

6. Total Primary Energy Supply/Gross Domestic Product (TPES/GDP)

Different from other factors, TPES/GDP as the determinants has opposite effects to inward FDI on RE, if TPES/GDP decreased it will increase inward FDI on RE. This could happen since TPES is measured as net total of primary energy in a country and most of countries

have their energy mostly from oil-fuel. Therefore, if TPES diminished, especially on fossil fuel supply, it implies that the proportion of dependency on oil-fuel decreased and replaced with other resources, including renewable energy. The inward investment on RE would see the declining as opportunity to invest more on renewable energy.

5.3.3 The Policies to Enhance Competitiveness of FDI on Renewable Energy in Indonesia

As developing countries, Indonesia urges to invite investment as important vehicle to technology transfer, contributing to economic growth in larger measure than domestic investment (Borensztein, De Gregorio, et al., 1998).Indonesia has the potential to become key player in renewable energy sectors. In order to increase competitiveness of FDI on RE, Indonesia should take important measures based on the determinants of inward FDI on RE that build upon the analysis results, which are infrastructure, labour market efficiency, market size, energy production, and policy on climate change.

Based on GCI from 2006 until 2012, trend of infrastructure in Indonesia was well improved. It means that Indonesia is on the right track on imposing infrastructure to attract investment. Infrastructure developments become the main priorities of national government of Indonesia for strengthening the national connectivity. As the results, the nominal value of investment has increased for almost eight fold in eight years (from 2015 to 2013). The reformation on infrastructure development in marketing, regulation, permit license, and on building stage has been important measurement in enhancing the development of infrastructure. Infrastructure project, like electricity, ports, railways, roads, toll roads and bridges, and airports start to establish in increasing stage with significant additional budget in Indonesian National Budget.

Meanwhile in labour market efficiency factors, according to GCI from 2006 until 2012, Indonesia experienced decline in progress. It signifies that labour market efficiency should have the government serious attention using significant policies to improve their competitiveness. Policies that should be done are adjusting types of education and training with jobs requirements. Another strive is to reform labour laws which not only protect the rights of workers but also secure company authorization as their employer. Furthermore, market size is also substantial factor that should be placed into concern. In renewable energy sector, market size is related with diversion from fossil fuels to renewable energy. As policies to be less dependent established, it will increase market size of renewable energy.

Moreover, improvement of energy production in Indonesia could also attract inward FDI on RE. This condition should be supported with effective policies regarding climate change and participation in energy world events. One of the policies that have been established in Indonesia is Presidential Regulation Number 5 concerning National Energy Policies. This policy becomes the basis for renewable energy development in Indonesia. The policy consists of 4 main policies. First, supply of energy through availability guarantee of domestic energy supply, optimization on domestic production, and implementation of energy conservation. Second, energy utilization through energy efficieny and diversification. Third, energy pricing policy towards the economical price, taking into account the ability of small businesses and help the less fortunate people. And the last, environment protection by applying the principles of sustainable development. This main policy is sustained by supporting policies, like development of infrastructure; encouragement of partnerships between government and the business community; community empowerment; and the development of R&D and training (Blue Print of Energy Policies in Indonesia, 2007). Other important measure is commitment made by the President of Indonesia during G-20 forum in Pittsburgh on 2006. He stated target

for 26 percent reduction relative to business-as-usual at 2020 undertaken by Indonesia unilaterally, and up to 41 percent with international assistance (Indonesia National Energy Planning, 2006). This statement surely opened the world eyes of strong commitment made by Indonesia for climate change action. Those two policies mentioned above are actually already significant for increasing FDI on RE. However, the strive on policy on climate change has to be implemented and transformed into specific policies, for example development of focused learning systems by initiating learning process through the value chain from initial equipment producers to the end users so it could increase the domestic added value and support long-term competitiveness of RE sector, and encouragement of new types of players, and flexible financing mechanisms of RE sector (Tsoutsos and Stamboulis, 2005). National government also has to encourage cities to have their own climate change programs and expand network with other cities with the participation of citizen and private sectors. Moreover, to support policies to enhance inward investment on RE, support by strong commitment to the implementation of the policy is obviously required.

5.4   Interpretation of the Main Research Question

Based on analysis results, the factors that influence the competitiveness enhancement to attract FDI on renewable energy in Indonesia are policies enhancement on infrastructure, labour market efficiency, market size, energy production, and climate change action. Those determinants are also significant to other countries that would like to invite investment on RE. Moreover, according to study by Tsoutsos and Stamboulis (2005), innovation is one of important thing for renewable energy development. But apparently, based on this research, infrastructure, labour market efficiency, market size, energy production, and climate change action are more significant than innovation. It implies that for destination countries, those significant determinants should be preferred to be developed first rather than innovation.

Determinants like infrastructure, labour market efficiency, and market size are also apply not only for determinants of inward investment on RE, but also as determinants on general inward investment and other sectors. This also acknowledge that in order to attract inward investment on RE, those determinants-which includes in factor driven and efficiency driven stages of development based on Porter's theory of competitiveness-, needs to be prioritized first rather than factor in innovation driven stages of development.

Indonesia has been on the right track to most of the significant determinant factors, which are infrastructure, labour market efficiency, market size, energy production, and climate change action. Many policies has been done regarding to the improvement of those factors as mention in the previous sub chapter. More policies should be established regarding to the labour market efficiency since Indonesia still has substantial problems regarding labour systems.

5.5   An Addition to the Existing Body of Knowledge

FDI on RE is not only beneficial to the economic growth of a country (Li and Liu, 2005). It also could bring more advantage to enlarge the network of renewable energy sector and transfer knowledge in order to support energy sustainability. The value-chain of renewable energy sector to the end-user can meet the challenge of the energy trilemma.

The empirical literature on determinants of FDI on RE is still general enough that most hypotheses are still argued and can be enhanced. Study by Chakrabarti (2001) acknowledged that most determinants of cross-country FDI are fairly fragile statistically. However, as this research tries to explore the issues that are complicated enough that broad general hypotheses such as infrastructure increment encourages FDI simply should not be expected once one

takes a closer look. The more insightful on this research is how to propose ways to increase those determinants that influence inward FDI on RE.

Although study by Tsoutsos and Stamboulis verified that innovation is one of the important things to renewable energy development, this research complement that improvement on infrastructure, labour market efficiency, market size, energy production, and climate change action are also important. These determinants should be given priority over innovation measurements.

5.6   Recommendations

To complement this research, recommended further study could be implied on priority of policies on RE that should be established regarding FDI on RE and specific policies on RE. The availability micro-level data and direct observation in object of study should also help in the future to clear some of the broad general hypotheses. Again, the better papers in the literature have been cognizant of how data issues affect interpretation of their results, and this will be a key issue as the literature moves forward.

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Appendix

Pooled OLS Multiple Regression Analysis Using STATA 10

```
. reg  Fdi_RE_number A_1stpillarInstitutions17best A_2ndpillarInfrastructure17best A_3rdpillarMacroeconomicenvironm A_4thpillarHealtha
> ndprimaryeduca A_5thpillarHighereducationandtra A_6thpillarGoodsmarketefficiency A_7thpillarLabormarketefficiency A_8thpillarFinanci
> almarketdevelo A_9thpillarTechnologicalreadines A_10thpillarMarketsize17best A_11thpillarBusinesssophisticati A_12thpillarInnovation
> 17best
```

Source	SS	df	MS
Model	9420.08967	12	785.007472
Residual	32158.7222	896	35.891431
Total	41578.8119	908	45.791643

Number of obs = 909
F(12, 896) = 21.87
Prob > F = 0.0000
R-squared = 0.2266
Adj R-squared = 0.2162
Root MSE = 5.9909

Fdi_RE_number	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
A_1stpillarInstitutions17best	-1.300168	.6140388	-2.12	0.035	-2.50529	-.0950466
A_2ndpillarInfrastructure17best	.9260053	.4633813	2.00	0.046	.0165662	1.835444
A_3rdpillarMacroeconomicenvironm	-.9924772	.2760366	-3.60	0.000	-1.534231	-.4507236
A_4thpillarHealthandprimaryeduca	-.8804708	.4442201	-1.98	0.048	-1.752304	-.0086377
A_5thpillarHighereducationandtra	.2299936	.7060384	0.33	0.745	-1.155688	1.615675
A_6thpillarGoodsmarketefficiency	-2.436428	1.041178	-2.34	0.019	-4.47986	-.3929953
A_7thpillarLabormarketefficiency	2.842139	.5603816	5.07	0.000	1.742325	3.941952
A_8thpillarFinancialmarketdevelo	.877725	.5072323	1.73	0.084	-.1177767	1.873227
A_9thpillarTechnologicalreadines	-.0579263	.5849937	-0.10	0.921	-1.206044	1.090191
A_10thpillarMarketsize17best	2.133814	.2669118	7.99	0.000	1.609969	2.657659
A_11thpillarBusinesssophisticati	.3362785	.9952602	0.34	0.736	-1.617034	2.289591
A_12thpillarInnovation17best	.9184985	.7185405	1.28	0.201	-.49172	2.328717
_cons	-5.799345	2.486617	-2.33	0.020	-10.67962	-.919073

```
. vif
```

Variable	VIF	1/VIF
A_11thpill~i	14.60	0.068513
A_5thpilla~a	11.91	0.083997
A_9thpilla~s	10.30	0.097132
A_6thpilla~y	9.97	0.100266
A_12thpill~t	9.78	0.102235
A_2ndpilla~t	8.61	0.116171
A_1stpilla~t	7.72	0.129467
A_4thpilla~a	4.20	0.237836
A_8thpilla~o	3.93	0.254437
A_10thpill~t	2.59	0.386222
A_7thpilla~y	2.30	0.434590
A_3rdpilla~m	1.41	0.711344
Mean VIF	7.28	

```
. reg  Fdi_RE_number A_1stpillarInstitutions17best A_2ndpillarInfrastructure17best A_3rdpillarMacroeconomicenvironm A_4thpillarHealtha
> ndprimaryeduca A_5thpillarHighereducationandtra A_6thpillarGoodsmarketefficiency A_7thpillarLabormarketefficiency A_8thpillarFinanci
> almarketdevelo A_9thpillarTechnologicalreadines A_10thpillarMarketsize17best A_12thpillarInnovation17best
```

Source	SS	df	MS
Model	9415.9922	11	855.999291
Residual	32162.8197	897	35.8559863
Total	41578.8119	908	45.791643

Number of obs = 909
F(11, 897) = 23.87
Prob > F = 0.0000
R-squared = 0.2265
Adj R-squared = 0.2170
Root MSE = 5.988

Fdi_RE_number	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
A_1stpillarInstitutions17best	-1.313484	.6124701	-2.14	0.032	-2.515526	-.1114431
A_2ndpillarInfrastructure17best	.9476171	.4587188	2.07	0.039	.0473301	1.847904
A_3rdpillarMacroeconomicenvironm	-1.003178	.2740783	-3.66	0.000	-1.541087	-.4652686
A_4thpillarHealthandprimaryeduca	-.87853	.4439636	-1.98	0.048	-1.749858	-.0072017
A_5thpillarHighereducationandtra	.2432303	.7046025	0.35	0.730	-1.139631	1.626092
A_6thpillarGoodsmarketefficiency	-2.283152	.9366937	-2.44	0.015	-4.121518	-.4447853
A_7thpillarLabormarketefficiency	2.797565	.5443634	5.14	0.000	1.729191	3.86594
A_8thpillarFinancialmarketdevelo	.9167374	.493672	1.86	0.064	-.0521493	1.885624
A_9thpillarTechnologicalreadines	-.0575706	.5847038	-0.10	0.922	-1.205117	1.089976
A_10thpillarMarketsize17best	2.157527	.2573925	8.38	0.000	1.652366	2.662689
A_12thpillarInnovation17best	1.052035	.59979	1.75	0.080	-.1251207	2.22919
_cons	-5.636884	2.438482	-2.31	0.021	-10.42268	-.85109

```
. vif

    Variable |      VIF      1/VIF
-------------+----------------------
 A_5thpilla~a |    11.87    0.084257
 A_9thpilla~s |    10.30    0.097132
 A_2ndpilla~t |     8.44    0.118428
 A_6thpilla~y |     8.08    0.123760
 A_1stpilla~t |     7.69    0.130002
 A_12thpill~t |     6.82    0.146580
 A_4thpilla~a |     4.20    0.237876
 A_8thpilla~o |     3.73    0.268341
 A_10thpill~t |     2.41    0.414908
 A_7thpilla~y |     2.17    0.460087
 A_3rdpilla~m |     1.39    0.720833
-------------+----------------------
    Mean VIF |     6.10
```

```
. reg  Fdi_RE_number A_1stpillarInstitutions17best A_2ndpillarInfrastructure17best A_3rdpillarMacroeconomicenvironm A_4thpillarHealtha
> ndprimaryeduca A_6thpillarGoodsmarketefficiency A_7thpillarLabormarketefficiency A_8thpillarFinancialmarketdevelo A_9thpillarTechnol
> ogicalreadines A_10thpillarMarketsize17best A_12thpillarInnovation17best

      Source |       SS       df       MS              Number of obs =     909
-------------+------------------------------           F( 10,   898) =   26.27
       Model |  9411.71944    10  941.171944           Prob > F      =  0.0000
    Residual |  32167.0924   898  35.8208156           R-squared     =  0.2264
-------------+------------------------------           Adj R-squared =  0.2177
       Total |  41578.8119   908  45.791643            Root MSE      =   5.985

-------------------------------------+----------------------------------------------------------------
                       Fdi_RE_number |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------------------------+----------------------------------------------------------------
        A_1stpillarInstitutions17best | -1.319408   .6119293    -2.16   0.031    -2.520386   -.1184294
      A_2ndpillarInfrastructure17best |   .9641584   .4559854     2.11   0.035     .0692373    1.85908
      A_3rdpillarMacroeconomicenvironm | -1.002882   .2739425    -3.66   0.000    -1.540524   -.4652402
      A_4thpillarHealthandprimaryeduca | -.7804279   .3409209    -2.29   0.022    -1.449522   -.1113334
      A_6thpillarGoodsmarketefficiency | -2.304592   .9341736    -2.47   0.014     -4.13801   -.4711746
      A_7thpillarLabormarketefficiency |  2.807707   .5433034     5.17   0.000     1.741415    3.873999
      A_8thpillarFinancialmarketdevelo |   .9339664   .4909017     1.90   0.057    -.0294818    1.897415
      A_9thpillarTechnologicalreadines |   .0253751   .5327895     0.05   0.962    -1.020282    1.071033
            A_10thpillarMarketsize17best |  2.164356   .2565054     8.44   0.000     1.660936    2.667776
            A_12thpillarInnovation17best |   1.10319   .5809098     1.90   0.058    -.0369087    2.243289
                                 _cons | -5.752864    2.41404    -2.38   0.017    -10.49068   -1.015046
-------------------------------------+----------------------------------------------------------------
```

```
. vif

    Variable |      VIF      1/VIF
-------------+----------------------
 A_9thpilla~s |     8.56    0.116868
 A_2ndpilla~t |     8.35    0.119734
 A_6thpilla~y |     8.04    0.124306
 A_1stpilla~t |     7.69    0.130104
 A_12thpill~t |     6.41    0.156110
 A_8thpilla~o |     3.69    0.271112
 A_4thpilla~a |     2.48    0.403006
 A_10thpill~t |     2.40    0.417373
 A_7thpilla~y |     2.17    0.461431
 A_3rdpilla~m |     1.39    0.720840
-------------+----------------------
    Mean VIF |     5.12
```

```
. reg Fdi_RE_number A_1stpillarInstitutions17best A_2ndpillarInfrastructure17best A_3rdpillarMacroeconomicenvironm A_4thpillarHealtha
> ndprimaryeduca A_6thpillarGoodsmarketefficiency A_7thpillarLabormarketefficiency A_8thpillarFinancialmarketdevelo A_10thpillarMarket
> size17best A_12thpillarInnovation17best
```

Source	SS	df	MS
Model	9411.63819	9	1045.73758
Residual	32167.1737	899	35.7810608
Total	41578.8119	908	45.791643

Number of obs = 909
F(9, 899) = 29.23
Prob > F = 0.0000
R-squared = 0.2264
Adj R-squared = 0.2186
Root MSE = 5.9817

Fdi_RE_number	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
A_1stpillarInstitutions17best	-1.321964	.609232	-2.17	0.030	-2.517647	-.1262815
A_2ndpillarInfrastructure17best	.9755903	.3874809	2.52	0.012	.2151179	1.736063
A_3rdpillarMacroeconomicenvironm	-1.002863	.2737901	-3.66	0.000	-1.540206	-.4655212
A_4thpillarHealthandprimaryeduca	-.7750933	.3218165	-2.41	0.016	-1.406692	-.1434941
A_6thpillarGoodsmarketefficiency	-2.299536	.927606	-2.48	0.013	-4.120061	-.4790107
A_7thpillarLabormarketefficiency	2.808508	.5427417	5.17	0.000	1.74332	3.873696
A_8thpillarFinancialmarketdevelo	.9347047	.4903845	1.91	0.057	-.027727	1.897136
A_10thpillarMarketsize17best	2.16175	.2504653	8.63	0.000	1.670186	2.653315
A_12thpillarInnovation17best	1.11377	.5364637	2.08	0.038	.0609028	2.166637
_cons	-5.774598	2.369201	-2.44	0.015	-10.42441	-1.12479

```
. reg Fdi_RE_number EnergyprodMtoe TPESpop TPESGDP elecconspopTWh CO2pop Pol_CC Pol_RE
```

Source	SS	df	MS
Model	17055.714	7	2436.53057
Residual	21561.8294	476	45.2979609
Total	38617.5434	483	79.953506

Number of obs = 484
F(7, 476) = 53.79
Prob > F = 0.0000
R-squared = 0.4417
Adj R-squared = 0.4334
Root MSE = 6.7304

Fdi_RE_number	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
EnergyprodMtoe	.0122828	.0010245	11.99	0.000	.0102697	.0142958
TPESpop	.8248196	.5736547	1.44	0.151	-.302389	1.952028
TPESGDP	-4.038528	1.469134	-2.75	0.006	-6.925317	-1.151738
elecconspopTWh	-.248746	.1715106	-1.45	0.148	-.5857576	.0882656
CO2pop	-.2623461	.1416481	-1.85	0.065	-.5406789	.0159867
Pol_CC	.7987682	.085023	9.39	0.000	.6317014	.9658351
Pol_RE	.0347604	.3803898	0.09	0.927	-.7126905	.7822113
_cons	1.442102	.7772797	1.86	0.064	-.0852214	2.969426

```
. vif
```

Variable	VIF	1/VIF
TPESpop	23.85	0.041933
elecconspo~h	13.42	0.074520
CO2pop	5.80	0.172445
Pol_CC	1.62	0.617822
TPESGDP	1.47	0.679664
Pol_RE	1.35	0.741390
Energyprod~e	1.21	0.824883
Mean VIF	6.96	

```
. reg Fdi_RE_number EnergyprodMtoe TPESGDP elecconspopTWh CO2pop Pol_CC Pol_RE
```

Source	SS	df	MS
Model	16962.0666	6	2827.0111
Residual	21655.4768	477	45.3993223
Total	38617.5434	483	79.953506

Number of obs = 484
F(6, 477) = 62.27
Prob > F = 0.0000
R-squared = 0.4392
Adj R-squared = 0.4322
Root MSE = 6.7379

Fdi_RE_number	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
EnergyprodMtoe	.0122059	.0010242	11.92	0.000	.0101934	.0142185
TPESGDP	-3.48173	1.418763	-2.45	0.014	-6.269527	-.6939324
elecconspopTWh	-.0163965	.0575299	-0.29	0.776	-.1294309	.0966469
CO2pop	-.0903251	.0759179	-1.19	0.235	-.2395	.0588498
Pol_CC	.8010934	.0851027	9.41	0.000	.6338709	.968316
Pol_RE	.0087933	.3803857	0.02	0.982	-.7386456	.7562321
_cons	1.336419	.7746618	1.73	0.085	-.1857527	2.85859

```
. vif

    Variable |      VIF      1/VIF
-------------+----------------------
      CO2pop |     1.66    0.601663
      Pol_CC |     1.62    0.618046
 elecconspo~h |    1.51    0.663802
     TPESGDP |     1.37    0.730412
      Pol_RE |     1.35    0.743065
 Energyprod~e |    1.21    0.827132
-------------+----------------------
    Mean VIF |     1.45

. reg  Fdi_RE_number EnergyprodMtoe TPESGDP Pol_CC

      Source |       SS       df       MS              Number of obs =     485
-------------+------------------------------           F(  3,    481) =  124.12
       Model |  16850.5132      3  5616.83774           Prob > F      =  0.0000
    Residual |  21767.6229    481  45.2549332           R-squared     =  0.4363
-------------+------------------------------           Adj R-squared =  0.4328
       Total |  38618.1361    484  79.7895374           Root MSE      =  6.7272

--------------+----------------------------------------------------------------
Fdi_RE_number |     Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+----------------------------------------------------------------
EnergyprodMtoe |  .0119048   .0010009    11.89   0.000     .0099382    .0138714
      TPESGDP | -2.932976   1.35573     -2.16   0.031    -5.596861   -.2690913
       Pol_CC |  .7728707   .0747735    10.34   0.000     .6259476    .9197937
        _cons |   .63588    .6095562     1.04   0.297    -.5618419    1.833602
--------------+----------------------------------------------------------------

. reg  Fdi_RE_number A_1stpillarInstitutions17best A_2ndpillarInfrastructure17best A_3rdpillarMacroeconomicenvironm A_4thpillarHealtha
> ndprimaryeduca A_6thpillarGoodsmarketefficiency A_7thpillarLabormarketefficiency A_8thpillarFinancialmarketdevelo A_10thpillarMarket
> size17best A_12thpillarInnovation17best  EnergyprodMtoe TPESGDP Pol_CC

      Source |       SS       df       MS              Number of obs =     462
-------------+------------------------------           F( 12,    449) =   38.27
       Model |  19408.7204     12  1617.39337           Prob > F      =  0.0000
    Residual |  18974.4679    449  42.2593939           R-squared     =  0.5057
-------------+------------------------------           Adj R-squared =  0.4924
       Total |  38383.1883    461  83.2607122           Root MSE      =  6.5007

---------------------------------+----------------------------------------------------------------
                   Fdi_RE_number |     Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------------------------+----------------------------------------------------------------
   A_1stpillarInstitutions17best | -1.379731   .974548     -1.42   0.158    -3.294972    .5355111
 A_2ndpillarInfrastructure17best |  1.122367   .6322299     1.78   0.077    -.1201299    2.364864
A_3rdpillarMacroeconomicenvironm | -1.785698    .46906     -3.81   0.000    -2.707523   -.8638724
A_4thpillarHealthandprimaryeduca | -1.740371   .6249067    -2.79   0.006    -2.968476   -.5122661
  A_6thpillarGoodsmarketefficiency | -4.251854  1.621487    -2.62   0.009      -7.4385   -1.065208
  A_7thpillarLabormarketefficiency |  3.244895   .8889095     3.65   0.000     1.497955    4.991834
   A_8thpillarFinancialmarketdevelo |  .4556133   .8395593     0.54   0.588    -1.19434    2.105567
       A_10thpillarMarketsize17best |  .9772244   .4735805     2.06   0.040     .0465148    1.907934
       A_12thpillarInnovation17best |   1.04321   .8757713     1.19   0.234    -.6779097    2.76433
                     EnergyprodMtoe |  .0098949   .0012264     8.07   0.000     .0074828     .012305
                            TPESGDP | -6.883062   1.647083    -4.18   0.000    -10.12001   -3.646114
                             Pol_CC |  .7798293   .0817096     9.54   0.000     .6192486     .94041
                              _cons |  16.54148   5.043157     3.28   0.001     6.630353     26.4526
---------------------------------+----------------------------------------------------------------

. vif

    Variable |      VIF      1/VIF
-------------+----------------------
 A_6thpilla~y |    8.56    0.116883
 A_1stpilla~t |    8.02    0.124617
 A_12thpill~t |    6.36    0.157128
 A_2ndpilla~t |    5.81    0.172224
 A_8thpilla~o |    3.91    0.255747
 A_10thpill~t |    2.75    0.363507
 A_7thpilla~y |    2.55    0.391643
 A_4thpilla~a |    2.19    0.456950
      TPESGDP |    1.86    0.538670
 Energyprod~e |    1.85    0.541222
       Pol_CC |    1.58    0.633699
 A_3rdpilla~m |    1.28    0.778707
-------------+----------------------
    Mean VIF |     3.89
```

```
. reg  Fdi_RE_number A_2ndpillarInfrastructure17best A_3rdpillarMacroeconomicenvironm A_4thpillarHealthandprimaryeduca A_6thpillarGood
> smarketefficiency A_7thpillarLabormarketefficiency A_10thpillarMarketsize17best EnergyprodMtoe TPESGDP Pol_CC

      Source |       SS       df       MS              Number of obs =     462
-------------+------------------------------           F(  9,   452) =   50.75
       Model | 19291.7213      9  2143.52459           Prob > F      =  0.0000
    Residual | 19091.467     452  42.2377589           R-squared     =  0.5026
-------------+------------------------------           Adj R-squared =  0.4927
       Total | 38383.1883    461  83.2607122           Root MSE      =  6.4991

-----------------------------------------------------------------------------------------
            Fdi_RE_number |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------------+---------------------------------------------------------------
 A_2ndpillarInfrastructure17best |  .9630956   .5194282    1.85   0.064    -.0576984    1.983889
A_3rdpillarMacroeconomicenvironm | -1.92645    .4595465   -4.19   0.000    -2.829562   -1.023337
A_4thpillarHealthandprimaryeduca | -1.734671   .6148397   -2.82   0.005    -2.94297    -.5263715
A_6thpillarGoodsmarketefficiency | -4.537432   1.1115     -4.08   0.000    -6.72178    -2.353084
A_7thpillarLabormarketefficiency |  3.715503   .8188877    4.54   0.000     2.106204    5.324803
    A_10thpillarMarketsize17best |  1.41082    .3883314    3.63   0.000     .6476614    2.173979
                    EnergyprodMtoe |  .009605    .0012071    7.96   0.000     .0072328    .0119773
                          TPESGDP | -6.75168    1.6409     -4.11   0.000    -9.97642    -3.52694
                           Pol_CC |  .7975408   .0798359    9.99   0.000     .6406453    .9544363
                            _cons | 15.07915    4.705662    3.20   0.001     5.831458    24.32684
-----------------------------------------------------------------------------------------
```

Source: Author, 2014 Based on STATA