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## Impact of Macro Economic Factors and Financial Development on Energy Projects - Case in ASEAN Countries

### 1. Introduction

The consumption of RE is the hot issue nowadays due to global warming, and very limited literature has been seen on the nexus among the international trade, real output, financial development, FDI, innovation, and consumption of RE.

Liu et al. (2016) stated that Foreign direct investment (FDI) in advanced renewable energy technology spillover is promising to improve technological capability and promote China's energy industry performance growth. Results demonstrate that FDI renewable energy technology spillover has positive impacts on China's energy industry performance. It can also be found that the technology spillover effects are more obvious in economic and technological developed regions.

Hence, this study is going to test the nexus among international trade, real output, financial development, FDI, and consumption of RE in the ASEAN countries with the help of GMM to fix the issues of heteroscedasticity and

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serial correlation. ASEAN countries made a lot of essential decisions regarding reinforce the international exchanges like plan of structural adjustment and economic liberalization that has been implemented in 1986, the devotion with the “general agreement on tariffs and trade (GATT)” in 1989, the devotion with the “world trade organization (WTO)” in 1994 and ratification regarding the agreement of free trade with European Union (EU) in 1995 (Liu, Zhang, & Bae, 2017).

Table 1 shows there are several investment sources from World Bank, Japan, Korea and Netherlands for renewable energy sector in ASEAN nations. In Malaysia, Indonesia, and Vietnam, there is still need of experts in renewable energy projects. Also these countries need to evaluate the risk of renewable energy investment. Actually, most of ASEAN countries still need a mechanism for higher capital investing in renewable energy projects.

**Table 1. Energy Projects in selected Asian countries**

Country	Net energy imports (% of energy use)	Energy use per capita (MJ/capita)	Electrification rate (% of population)	Energy subsidies as % of GDP
	2014	2014	2017	2017
Northeast Asia				
People’s Republic of China	15%	2237	100%	0.3%
Japan	93%	3429	100%	N/A
Mongolia	-168%	1838	86%	N/A
Korea	81%	5413	100%	N/A
Southeast Asia				
Indonesia	-103%	884	98%	1.7%
Myanmar	-33%	372	70%	N/A
Phillipines	N/A	N/A	93%	N/A
Thailand	42%	1970	100%	0.2%
Vietnam	N/A	N/A	100%	0.1%

Source: www.adb.org

There is still demand for proper policies in South East Asian region to resolve land and environment problems for energy projects.

Hence, the purpose of this study is to emphasize FDI and technological innovation and financial development as among vital factors affect the sustainability of energy in ASEAN countries. It also investigates the role of international trade, financial development, foreign direct investment (FDI) on the consumption of renewable energy (RE) in ASEAN countries of the world.

## 2. Literature Review

First, Abe et al. (2017) mentioned that in the world, as well as in emerging Asia such as ASEAN member States, China and India, the creation of new jobs related to conventional energy sources, such as oil, natural gas and coal, has massively decreased since 2010 while green jobs have gradually increased over the same period, especially in the biomass, solar and wind sectors. Targeted policy interventions would promote and facilitate trade and investment in the renewable energy sector and the deployment of renewable energy and therefore foster job creation. The effectiveness of such policies is sensitive to good public governance, strong trade and investment facilitation and well designed economic incentives. For example, the feed-in-tariff (FIT) scheme has been one of the most widely adopted subsidy-like policies to spur the uptake of indigenous renewable energy for the last two decades, and the relatively recent adoption of the scheme in five out of the 10 ASEAN member States, as well as in China and India, has contributed to the rapid development of solar and wind energy markets

The demand for energy growth is increasing over last thirty years, and government-subsidized the all kind of energy according to the socio-economic development of the ASEAN countries. The most significant energy consumption was observed in the industrial sector that is 36 percent in 2010. While the second-largest energy consumption was observed in the transportation sector that is 31 percent in 2010 (Hussain, Mosa, & Omran, 2017). The hypothesis of EKC supposed that the per capita emissions is the function of the per capita GDP. Therefore, the emissions per capita are increases with the developing countries' GDP that have low income while emissions per capita are decreases with the developed countries' GDP that have high income (Zoundi, 2017). It is comprehensive truth that international trade has significant influence on the pollution of the country that has technology, technique, scale and compositional

effects on the pollution. The technological effects refer to the increase in the technology enhance the production of the country that increases the consumption of energy that also increases the pollution of the country (Wahid, Aziz, & Mustapha, 2013).

Erdiwansyah et al. (2019) provides information on the status of renewable energy as a comprehensive substitute for fossils in Southeast Asian countries, which includes the potential for renewable energy in the region and the capacity of renewable energy currently available. Samuel et al. (2020) revealed that increasing the share of renewable energy by 1% declines greenhouse gas emissions by as much as 35.32% (95% Confidence interval) while a 1% increase in the coupling effect of income level, governance, and renewable energy consumption intensifies climate change by 0.79%. The interactive effects of scale, composition, and technique indicators were found to worsen climate change. The decoupling effect revealed that while foreign direct investment, income level, and governance exacerbate climate change, renewable energy consumption lessens climate change and its impact.

In addition, international trade refers to the exchange of products and services among different nations of the world that enhance the GDP of the country and also play a vital role in the economic development of the country. It increases the trade among the countries in terms of import and export which produce the foreign sources of the income for the country (Barbier, Barbier, Bishop, & Aylward, 2019). Thus, international trade is necessary for economic growth of the country because it increases the production level of the country and this paper used it as predictor in the study.

The development of the country in respect of the finance through increasing their level of productivity and economic activities is known as financial development in the country (Beck, Demirgüç-Kunt, & Levine, 2010).

In Viet Nam, ADB's private sector operations financed the country's first large-scale installation of floating solar photovoltaic panels and the largest in Southeast Asia. The plant pairs hydro and solar technology as it is located on the reservoir of an existing hydropower plant. (source: [www.adb.org](http://www.adb.org), date access: 18/11/2020). In 2019, active private sector projects supported by ADB, including renewable energy projects, helped reduce greenhouse gas emissions by a combined 18.3 million metric tons of carbon dioxide equivalent. New technologies can make clean energy more viable and affordable. ADB supported Lomligor Company Limited to develop a 10-megawatt (MW) wind power plant in southern Thailand. Its advanced battery energy storage system—a first in Thailand—allows energy to be

stored when wind turbines generate more power than the grid can absorb. Moreover, FDI means the investment of individuals and firms of other countries to the home country. This type of investment can take place when the individual or firms of other countries are interested in establishing their business in our home countries to generate revenue from our economy (Tang & Tan, 2015). Thus, FDI is necessary for economic growth of the country because it increases the production level of the country and this paper used it as predictor in the study.

FDI in SouthEast Asia 2015-16 (m USD) as follows (table 2).

**Table 2. For the year 2015 to 2016 FDI by sector**

Sector	2015	2016
Financial and insurance	36364	33941
Wholesale and retail trade	7569	18428
Manufacturing	29148	8013
Real estate	8463	7776
Transportation and storage	3645	4796
Mining and quarrying	7867	3885
Electricity, gas, steam	1959	3080
Agriculture, forestry, fishing	5389	1797
Total	121621	96723

Source: irena.org

### 3. Research Methods

The foremost purpose of the paper is to investigate the role of international trade, real output, financial development, FDI, and innovation on the consumption of RE in ASEAN countries. Data were gathered from the World Bank for the year 1991 to 2015 to explain the nexus among the predictors and main constructs of the study. "Generalized Methods Movement (GMM)" has been used to test the hypotheses of the study after checking the assumptions of the regression and develops the following equation:

$$REC_{2it} = \alpha_0 + \beta_1 IT_{it} + \beta_2 RO_{it} + \beta_3 FD_{it} + \beta_4 FDI_{it} + \beta_4 IN_{it} e_{it} \quad (1)$$

Where:

$i$  = Country

$t$  = time period

REC = Renewable Energy Consumption

RO = Real Output

FD = Financial Development

FDI = Foreign Direct Investment

IN = Innovation

IT = International Trade

#### 4. Findings

The outcomes of the study deal with assumptions of the regressions and the GMM estimator to test the hypotheses. The first assumption deals with the multicollinearity that is verified through VIF and found no high correlation between the variables because VIF is less than 0.05 and tolerance is less than 5. Table 3 shows the VIF given below.

**Table 3. Variance Inflation Factor (VIF)**

	VIF	1/VIF
FD	3.44	.291
FDI	2.935	.341
RO	2.022	.494
IN	1.623	.616
IT	1.082	.924
Mean VIF	2.221	.

Source: own study

The path analysis shows that the significant positive nexus among the international trade, real output, financial development, FDI, innovation, and consumption of RE because p values are less than 0.05, and t values are higher than 1.96. Table 4 shows the path analysis is given below.

**Table 4. Path Analysis (GMM Estimator)**

CO <sub>2</sub>	Coef.	Std.Err.	t	p	L.L	U.L
IT	0.017	0.002	7.530	0.000	0.012	0.022
FDI	1.035	0.019	55.340	0.000	0.994	1.076
RO	1.013	0.007	151.200	0.000	1.028	0.998
IN	0.023	0.004	5.810	0.000	0.014	0.031
FD	0.001	0.001	2.700	0.021	0.000	0.003
_cons	-0.077	0.020	-3.760	0.003	-0.122	-0.032

Source: own study

## 5. Discussions

First we see the SWOT analysis of Renewable energy projects in ASEAN nations

### Opportunities

- Output Products. Vietnam's energy demand is always in shortage and must be imported from abroad. This ensures that the output of Renewable energy projects is always in demand and consumed completely. Vietnam and Suth East Asian countries always imports energy from overseas with large import volume, so energy outputs with guaranteed quality and competitive price are always consumed by the market. In the near future, R>E project outputs such as oil... will replace imported FO oil, in order to reduce partially the burden of trade deficit for ASEAN as well as to lower production cost to increase competitive capability for customers' products.
- Input material. Waste tires in ASEAN nations and the world are constantly increasing as an abundant source of materials for R.E companies. The development of waste treatment into renewable energy and beneficial products for society, reducing the amount of waste to the environment to protect the environment is a global trend of the era which creates the development of R.E firms. This is an industry that is being researched and developed by the world and a special sector receiving incentives of the government of ASEAN nations.

### Threats

- Input prices are not stable when buying input materials in the country.
- The selling price of products (energy output, oil...) depends on the market price in the world.

### **Strengths**

- Human Resource - Engineers: a lot of experience, capability, creativity. Experienced engineers in petrochemical industry, mechanical design, gas pipeline. These engineers have been involved in large projects in the chemical and petroleum groups in Asean nations and abroad.
- A team of skilled, young, enthusiastic workers, who are willing to learn and trained to participate in production operations.
- Specialists: have in-depth knowledge in the field, passionate in researching new ideas in order to optimize efficiency, increase value, as well as passion in researching technology and solutions to increase efficiency and pyrolysis yield, minimize wastes and their negative impact on the environment.

### **Weaknesses**

- In some Asean countries, the field of waste treatment into renewable energy is a new industry, so it is necessary to have more improvements and intensive research in order to have higher value added products on the market. Energy companies requires more intensive and long-term research to improve the technology and product quality.
- Marketing activity has not been much, so some customers are not aware of energy output products.

In addition to, The findings show that the significant positive nexus among international trade, real output, financial development, FDI, innovation, and consumption of RE. The smooth economic condition has been seen in the ASEAN countries due to which the international trade is at the peak, real output is increased, high financial development in the countries, FDI is also at peak level and high innovation in the country that enhance the use of RE in the country. These findings provide the guideline to regulators that they must form the regulation to encourage the consumption of RE in the presence of international trade, real output, financial development, foreign direct investment (FDI), and innovation.

## **6. Conclusion**

FDI and technological innovation and financial development are among vital factors affect the sustainability of energy in ASEAN countries. Sustainable energy needs go together with environment protection to create values for society of nations in the region. Each country needs to have their own policies , but together, ASEAN nations need to coordinate well to have good cooperation in this field.

Thus, the present study concluded that the import and export of the ASEAN countries are at the peak, high financial development and innovation have been seen in the countries, and FDI and real output are also at high level that needs to use of RE to produce the goods for the fulfillment of the requirement. This study has some suggestions for upcoming researchers and also the limitations of the study. The present study takes only ASEAN countries under examinations, and future studies can include other countries under investigation. The prospective studies may also include the other predictors to predict the consumption of RE.

Last but not least, this paper suggests macro polices for ASEAN countries. For instance, government of these nations need to support R.E firms:

1. Incentives:

Land tax: land allocated, low land rent.

Import tax for expanded investment project: Free import tax for imported goods to create fixed assets, materials, supplies for the execution of investment project.

CIT: exemption, or reduction (50%) of corporate income tax rate for the whole life of the project.

2. Price: if world oil price or energy price going down too much, government need to support price gap for R.E firms.

This paper emphasizes positive nexus among the international trade, real output, financial development, foreign direct investment and consumption of RE.

In addition, R.E firms are also seeking and advising the government and authorities on the planned disposal of waste tires or plastic wastes from automotive repairers, the organized storage, as well as pressing, packaging and transporting waste tires to waste treatment zone in a reasonable, scientific way. This will contribute to reducing the impact of wastes to the environment, minimizing the area of wastes and quickly transforming wastes into renewable energy, which increases value added for ASEAN nations and addressing environmental pollution for the society.

## Summary

### **Impact of Macro Economic Factors and Financial Development on Energy Projects - Case in ASEAN Countries**

ASEAN (The Association of SouthEast Asian Nations) demand on energy is depending on economic growth of each country, resources, and political and regulations of each country. This study aims to investigate the role of international trade, financial

development, foreign direct investment (FDI) on the consumption of renewable energy (RE) in ASEAN countries of the world. The findings explore that positive nexus among the international trade, real output, financial development, foreign direct investment and consumption of RE. Last but not least, this paper will propose several recommendations and policy suggestion for ASEAN countries to manage and encourage better renewable energy projects in the region. One of its original value is that, in the globalization and integration era, environment pollution will affect all ASEAN countries and in the region, so these nations need to link together to implement renewable projects for environment protection and for further generation.

**Keywords:** *Commerce, Financial Development, Energy projects, macro policies.*

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**Classification:** E44, E60

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