

The Implementation of Renewable Energy Programme on Tackling Climate Change through ASEAN Plan of Action for Energy Cooperation (APAEC) 2010-2015

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Keywords: Globalization, Climate Change, APAEC, Renewable Energy Programme.

Abstract: In the globalization era, environmental issues has grew significantly especially regarding the climate change, it can be understood as the change of global temperature and global climate as whole due of human activities which are directly or indirectly contributed to increasing Greenhouse Gas Emission (GGE) such as on energy sector through the release of Carbon Dioxide (CO₂) into the atmosphere due of the increasing supply and demand of non-renewable energy such as coal, oil, fusel fuel burning to fulfill the necessities of industry, transportation, and electricity. Therefore, renewable program which focus on resources such as of hydropower, geothermal, solar, wind are the essentials on tackling climate change which is related with the concept of Green energy that explores the evolution of green energy system for sustainable development, energy security, also focuses on development of new technologies which enable the provision of energy with minimal negative effect on society and the environment. In a view of high threat of climate change and addressing sustainable energy, ASEAN develop renewable energy agenda through the third series of ASEAN Plan Action for Energy Cooperation (APEC) 2010-2015 to enhance a cleaner energy, more efficient and sustainable energy consumption. In order to achieve the development of renewable energy, APAEC has implemented several approaches such as promote technical cooperation to strengthen renewable energy program and sharing information on research and innovation policies regarding renewable energy. Thus, this paper will be focus on how ASEAN implementation of renewable energy agenda in the third series of APAEC through using the concept of green energy, environment security, and energy security to achieve the understanding of renewable energy and climate change which focus on how renewable energy will decrease the impact of climate change.

1 INTRODUCTION

Climate change has been transformed as the global environment threats since the beginning of 21st century. According to United Nations Framework Convention on Climate Change (UNFCCC), climate change defined as the change of climate due to the increasing number of greenhouse gas emission from carbon dioxide, nitrogen dioxide and methane which is directly or indirectly related with the human activities. According to data release by International Renewable Energy Agency (IRENA) in 2012, the largest number of greenhouse gas emission was coming from energy sector with total emission 72%, following with 11% from agriculture sector, 6% of industry, 6% of illegal logging and over land functions, and 3% from waste. The evidence of

climate change are including the rising of sea levels, the global warming, and the changing of precipitation pattern of weather (Adedeji, Reuben and Olatoye 2014, p.1). The increasing of the world temperature was one of the most significant impact of climate change, United Nations Environment Programme (UNEP) estimated the global warming will highly increase in 2100 with the averages 4,0oC or 6,0oC.

Climate change have been impacted all countries in the world, no exception to Southeast Asia countries. Southeast Asia was one of the most vulnerable region impacted on climate change including on the rising of sea levels, extreme weathers and global warming through the increasing of annual temperature. As one of the most vulnerable region impacted on climate change, therefore the issue climate change has been the challenge for Association of Southeast Asia Nations (ASEAN) in many sectors

which are economy, environment, development, energy, agriculture, fisheries, livestock and forestry (Sahraie 2011, p.5). To address the climate change, Southeast Asia through ASEAN in 2003 started to build the commitment to strengthening the cooperation within the region to reduce the risk and further impact of climate change by the establishment of ASEAN Community (AC) based on three pillars which are ASEAN Political Security, ASEAN Economic Community and ASEAN Social-Cultural Community in 2015 (Sahraie 2011, p.6).

ASEAN Economic Community (AEC) has mentioned the importance to address climate change through the ensuring of sustainability and reduce the use of fossil fuel energy towards the development of renewable energy such as bio-fuels. The AEC also emphasize the need to strengthen the cooperation and the investment on renewable energy development in the region (Sahraie, 2011:p.6). ASEAN Plan of Action for Energy Cooperation (APAEC) 2010-2015 was one of the agenda of AEC to implement the mitigation of climate change through the renewable energy development Programme (ASEAN Center for Energy 2015, p.5). APAEC launched on July 2009 by ASEAN Ministers as the third series of implementation plan of ASEAN Vision 2020 as stated earlier, the establishment of APAEC is to serve as the blueprint for ASEAN cooperation in the field of energy started from 2010-2015 (Suryadi 2014, p.6). Basically, the renewable energy highlighted the reduce of fossil fuel from coal, oil, and natural gas to fulfill the needs of energy to renewable resources including hydropower, biofuels, geothermal, solar, and wind energy which is effective to reduce the greenhouse gas emission as the cause of climate. One of the target of APAEC is to increasing the utilization of renewable energy into 15% from energy total of ASEAN countries.

This paper will highlights the implementation of renewable energy development programme on tackling climate change through the APAEC 2010-2015 as one of the mitigation of ASEAN countries to respond and address climate change. Therefore, the aim of this paper is to increasing the understanding regarding on how ASEAN produce climate change mitigation through the renewable energy development towards APAEC 2010-2015. In general, the explanation on this paper will be divided into several parts, this paper is using of environment security theory and the concept of renewable energy in that will going to be explain in the method section. Then, the explanation of this paper will focus on the issue of climate change including the risk and impact in the context of global and in the region of ASEAN

and will continue to the main focus and mandate and also the purposes of APAEC 2010-2015 as one of the climate change mitigation of ASEAN to address climate change. Next, this paper will explain the core of this paper which is the implementation of renewable energy as the mitigation of climate change of ASEAN to addressing climate change which is focus to describing the strategy to achieve the target 15% of renewable energy by 2015 and the achievement of APAEC 2010-2015 to the development of renewable energy in the region.

2 METHODS

2.1 Environment Security Theory

In this paper, the researcher will use the environment security theory in order to analysis the mitigation of climate change through the renewable energy program during APAEC for period 2010-2015. The study of environment security include a central idea of environmental problem such as climate change, global warming, droughts, and others environment degradation. The starting point of the emergence of environment security was Stockholm Declaration in 1972 that produced the Declaration of Human Environment where the countries in United Nations talked about the environment problems including pollution as well as the global warming (Spiegel 1995, p.404). Therefore, since the Stockholm Declaration, the environment security has emerged as the new security studies in global security in 1970s. Then, Barry Buzan on his book with the title *People, States, and Fear* brought the new concept of security which is non-traditional security at the end of cold war in 1991 that called as "New Patterns of Global Security in the Twenty First Century" (Stonne 2009, P.6). Through his book, Barry Buzan emphasized the new global security threats at the beginning of 21st century from traditional security such as conflict and war towards non-traditional security which is including environment security. Environment security underlined the change of environmental condition will possible as the sources of social conflicts due to the societies face dangers of environment destruction (Swatuk 2004, p.1).

According to Collin in 2007, the environment security was the interpretation of others perspective of security such as on Common Security and Human Security. In the context of common security towards the environment security, Collin argued that the environment issues such as climate change was the common issue due to the impact of climate change

has spread to all of the countries across the world. Then, on the connection between environment security and human security, Collin argued that environment problems was one of the largest threats of human security such as the spread of diseases, droughts, hunger, and many more (Jonsson 2009, p.17-18). Besides that, the environment security theory emphasized and underlined the importance of the institution or international organization such as United Nations as well as regional organization including ASEAN to being the platform to addressing the issue of environment degradation such as climate change by produce the policies or actions. Therefore, the essential meaning of environment security was the mechanism, rules, treatments on the protection of environment from the threats of further impact of environment problems.

Based on the explanation above, environment security has been understood as the theory which emphasize the environment issue as the new perspective of global threats, therefore the existence of the institution or international organization actions to reduce the risk and further impact of environment destruction such as on climate change was the necessity. The implementation of environment security in this paper is to look the respond of ASEAN countries to reduce the risk and impact of climate change as the kind of environment threats especially in the region of Southeast Asia which focused on renewable energy program through the implementation of ASEAN Plan of Action for Energy Cooperation (APAEC) during the period 2010-2015 as one of the key to support the ASEAN Economic Community (AEC) Blueprint 2015.

2.2 The Concept of Renewable Energy

To explain the case that is up in this paper, researches using the concept of Renewable Energy. This concept is derivative from green energy concept. From a historical perspective, the 1970s can be considered to be the time of the true formation of the Renewable Energy Sources (RES) concept. The main reason for this was the petrol crisis, which had been gaining force at the time, as a result of a decision, adopted by the Organization of the Petroleum Exporting Countries (OPEC). They imposed restrictions on the production and supply, and established total control over the prices. This shortly became a global energy issue for the petroleum importing countries. Achieving diversification of the energy sources and finding sources that are additional or alternative to petrol, fossil fuels, and, following the series of nuclear accidents, also to nuclear power plants, has

become a task of prime importance. A look at the world's economic history would be enough to prove the great significance of such issues and their possible impact on the national and world economy. Therefore energy safety topics have become a global issue (Yordanov 2014, p. 1-2).

All the country has mentioned this issue as the important issue. So they were concern to protect the environment and natural resources preservation, it is call the Lisbon strategy. For example another similar initiative strategy was launched by European council on March 2010 named "Europe 2020" plan. That was focus on, firstly decreasing the carbon dioxide emissions that produce Greenhouse Gas emission by 20% as compared to the 1990. Secondly, cutting down energy consumption by 20%, achieving a significant increase in energy efficiency as well as a 20% RES share of the total energy consumption (European Commission, Europe 2020). These strategy focus on the most efficiently and reasonably utilize natural resource. The main forms of renewable energy as the RES concept, which are being developed and used worldwide, are the energy from biomass, sunlight, hydro and wind energy as well as ocean/sea wave and tidal energy. Each of these energy sources has its specific characteristics that set the pattern for the methods and locations of their full utilization. Along with the gradual development of production technologies, their constant improvement and position establishment, RES are becoming increasingly reliable and widely used. (Yordanov 2014, p. 2).

The development of Renewable energy concept in the contemporary era, as the key way to reducing the climate change, climate change have linkage of the environmental issues. Fossil fuels energy create environmental problem such as increasing greenhouse gas emission that cause climate change. The depletion of fossil fuels and the environmental hazards posed by the needs of future development are gradually shifting the path of development toward sustainability, better sociability and environmental responsibility which in turn emphasize the need of renewable energy sources (Centre for International Law 2009, p.1).

Regarding explanation above, fit to this paper, renewable energy concept emphasize to use the natural resources energy such wind, solar power, Biomass, Biofuels, Hydropower as replacement Fossil fuels as to reducing the carbon dioxide emission that caused climate change. To respond this issue ASEAN under APAEC 2010-2015 took place the renewable energy program as one of the APAEC agenda to reducing climate change. Recognizing the

limited global reserve of fossil fuels and unstable energy prices, the APAEC emphasizes strategies to further strengthen renewable energy development, such as bio-fuels which is crucial to support and sustain economic and industrial activities, sustainable energy development, through mitigating greenhouse gas emission, strengthen regional cooperation on the development of renewable energy and alternative energy including hydropower and bio-fuels, the ASEAN Energy Ministers to set a collective target for renewable energy in the total energy mix for the next five years, and promote the development of centers of research and development on renewable energy in the region (Centre For International Law, 2009, page 11). Renewable energy program APAEC 20102015 have the program fit to each ASEAN member country policy toward implementation Renewable energy to tackle climate change.

3 RESULT

Global warming over the past 50 years that have released Greenhouse gases emission coming from Carbon Dioxide (CO₂), Nitrogen Dioxide (N₂O), and methane (CH₄) into the atmosphere. The most recent assessment report by the Intergovernmental Panel on Climate Change (IPCC) concludes that the global average surface temperature has increased by about 0.6°C during the 20th century, creates the phenomenon named climate change. Increasing the temperature already showing adverse effects for all the country. (Anand 2013, p.5) ASEAN is particularly vulnerable to the impacts of climate change due to the concentration of people and economic activities in the coastal areas, rich biological diversity, and resource based on economies, and increased vulnerability of the people especially the poor. Due to its geological and geographical factors, the region is also one of the world's vulnerable regions to suffer from a range of climatic and natural hazards such as earthquakes, typhoons, sea level rise, volcanic eruptions, droughts, heat waves and tsunamis which are becoming more frequent and severe. In addition, the geophysical and climatic conditions shared by the region have also led to common and trans-boundary environmental concerns such as air and water pollution, urban environmental degradation and trans-boundary haze pollution. (Raman 2010, p.4). Therefore, the climate change have been impacted many sector of ASEAN including economic, politic, and social (Norwegian Institute of International Affairs 2017, p. 2).

The Asian Development Bank in 2009 reported the three main factors regarding why climate change impacted the region: (1) the growing number of population, (2) long coastlines, (3) high concentration of people and economic activities in coastal areas (Guemide 2017, p.8). Then, The Asian Development Bank in 2009 also reported the change of temperate in Southeast Asia countries. In Indonesia, the high temperature is estimated from 1, 4-1,40oC per century, following by Philippines with the temperature increase of 1,4oC per century, Singapore 0,3oC per decade, Thailand 1,04-1,80oC per century, and Vietnam 1,0oC per century (Guemide 2017, p.10). Another study of Asian Development Bank also have been released the rise of temperature as the implication of global warming have been estimated around 4,8oC in annual temperature and the rising sea level estimated 70 cm by 2100 especially in Indonesia, Philippines, Thailand and Vietnam (Overland 2017, p.2). According to the Global Climate Risk Index, four of the world's ten countries most affected by climate change are located in Southeast Asia: Myanmar, Philippines, Thailand, and Vietnam. Another version regarding the most impacted countries on climate change in ASEAN released in 2016 by the table description below.

Table 1: Ranking Climate Risk of ASEAN Countries (Overland 2017, p.3).

Countries	Index of Climate Change Vulnerability
Myanmar	0.66-1.00
Philippines	0.49-0.56
Vietnam	0.39-0.49
Thailand	0.31-0.39
Cambodia	0.25-0.31
Indonesia	0.20-0.25
Laos	0.15-0.20
Malaysia	0.11-0.15
Brunei Darussalam	0.06-0.11
Singapore	0.00-0.06

As started earlier, the issue of climate change connected with the increasing number of greenhouse gas emission which is one of the source was coming from energy sector. As one of the region with the high mobility of industrialization, the large number of greenhouse gas emission from energy fossil fuel as the major source of energy in ASEAN was one of the

biggest compared to another region. According to data released from World Bank and International Energy Agency in 2011, total greenhouse gas emission in Southeast Asia grew significantly from 1971-2009 from 106 MtCO₂ to 1,022 MtCO₂ which 33% of the greenhouse gas emission each year were coming from fuel-mix related with energy consumption. In 2000, ASEAN contributed to 12% of the world total greenhouse gas emission which remaining 15% was coming from energy sector (Asian Development Bank 2009, p. xxiii). In 2013, around 1,3 Gt of CO₂ emission in ASEAN was coming from energy, and in 2040 the emission of CO₂ from energy sector estimated will increase to almost 2,4 Gt (International Energy Agency 2015, p.35). As an addition, International Energy Agency in 2011 also have been mentioned Indonesia, Malaysia, Philippines and Thailand as the largest contributor of greenhouse gas emission from energy sector among others Southeast

Asia countries. Therefore, renewable energy development was the priority of ASEAN countries to reduce the greenhouse gas emission on tackling the climate change through the implementation of energy mix from non-renewable energy sources including oil, coal, and natural gas and renewable energy sources. ASEAN have been formulated the special body to addressing climate change which is ASEAN Plan of Action for Energy Cooperation (APAEC) 2010-2015 through the development of renewable energy due to the region has been known as the region rich on the potentials on renewable energy sources (Table II) such as on hydropower which estimated around 170 GW in the region (International Energy Agency 2015, p.44) to decrease the dependent on non-renewable energy sources.

Table 2: Energy Resources Overview in ASEAN Countries.

ASEAN Country	Overview of Renewable Energy Sources
Brunei Darussalam	Solar Energy
Cambodia	Hydropower, Biomass, and Biofuel
Indonesia	Highest Potential on Geothermal
Lao PDR	Small Hydropower
Malaysia	Hydropower, Solar, and Biofuels
Myanmar	Biofuels and Biomass
Philippines	Geothermal and Hydropower
Singapore	Solar Energy

Thailand	Solar, Bioenergy and Hydropower
Vietnam	Biomass and Biofuels

(Rahmadi, Hanifah & Kuntjara 2017, p.3)

Basically, APAEC 2010-2015 was the energy component on the implementation of ASEAN Economic Community (AEC) Blueprint 2015 which is focus to ensuring the secure and reliable energy supply in the region through the implementation of collaborative partnership on ASEAN power Grid (APG), Trans-ASEAN Gas Pipeline (TAGP) by the promotion of the cleaner coal use, energy efficiency and conservation, and the implementation of renewable energy development programme which is more specific focus on the development of bio-fuels and hydropower. The formulation and establishment of APEC 2010-2015 was supported by ASEAN Center for Energy (ACE), ASEAN Secretariat, Renewable Energy Support Programme for ASEAN (ASEAN-RESP), by ASEAN Renewable Energy Sub-Sector (RE-SSN) and others energy bodies in the regional and international which consist of 26 strategies and 91 actions. Besides that, APAEC 2010-2015 is also a product of deliberation by the APAEC Drafting Committee chaired by the Thailand in Singapore on 15 November 2007 as the third series of implementation plan of ASEAN Energy cooperation, as a continuation of the two previous energy plans which are APAEC 2004- 2009 completed on June 30, 2009 that have been installed the renewable energy was around 37,100 MW and APAEC 1999-2004 completed on June 30, 2004.

The APAEC during the period 2010-2015 have been recognized the regional and global challenges on energy and the environment issue including climate change which impacted on the energy development, health, safety, and environment circumstances in the region, as stated earlier. Therefore, the main focus of APAEC 2010-2015 through the development of renewable energy and others program was on initiatives to support the development of energy in the region through the development of energy infrastructure and enhance energy security by the integration of energy development energy policies to achieve the sustainable development on the protection of environment. (ASEAN Research Institute 2017, p.2). As the third energy outlook in ASEAN, APAEC 2010-2015 have emphasized the fourth strategic goals of renewable energy in the region which are; (1) to achieve a collective target of 15% renewable energy installed capacity in the region by 2015, (2) strengthen the regional cooperation to support the development of renewable energy such as

on biofuels and hydropower which is crucial to achieve the sustainable economic development and industrialization activities, (3) the promotion of renewable energy centers and research institutions in the region, (4) promote the liberalization of trade, facilitation and others kind of cooperation to support the installation and the development of renewable energy in ASEAN countries.

4 DISCUSSION

ASEAN body have been expressed their concern and commitment for ASEAN to play a proactive role to addressing climate change through the establishment of The ASEAN Plan of Action for Energy Cooperation (APAEC) 2010-2015 to produce the cleaner and green energy sources. The importance of renewable energy development in the region was to transform ASEAN into stable, secure, prosperous, rules-based, competitive, resilient, and integrated towards ASEAN Economic Community (AEC) Blueprint 2015. During the period 2010-2015 of APAEC, the core renewable energy development is needed to increase the diversity of energy in the region and reduce the risk climate change as the cause of greenhouse gas emission from fossil fuel energy, although the number of energy from nonrenewable energy resources is still widely installed in Southeast Asia (Center for International Law 2009, p.25). The renewable energy target on APAEC for 2010-2015 is 15% in the total power installed capacity in 2015, as what this paper been mentioned earlier on the result section. Basically, there are several strategies on APAEC 2010-2015 to achieve the target of 15% renewable energy in the region of ASEAN that have been formulated to support the program of renewable energy.

The strategies of APAEC 2010-2015 are include: (1) increasing the development of renewable energy sources in order to achieve the target 15% of renewable energy through the promotion of technical cooperation to complement efforts on renewable energy targets of the ASEAN member, funding institutions, project developers and the promotion of renewable energy program (2) enhancing the awareness and information sharing by strengthening the networks in the level of regional and international through innovation policies, market based on energy policies, organize media campaigns, conferences, seminar, workshops and the competition on renewable energy, (3) promoting intra- ASEAN cooperation through the regional market studies on renewable energy, propose the standards for

renewable energy products, strengthen local manufacturing capabilities for renewable energy, increasing the number of investment, encourage the establishment of ASEAN renewable energy association forum, (4) promotion of renewable energy financing scheme by strengthening the collaboration with ASEAN dialogue partners and international agencies and encourage the involvement of banking sector and financial to support renewable energy project in the region, (5) promotion of the commercial development and utilization of biofuels as the source of renewable energy through the development of "ASEAN Renewable Energy Policy Paper" on long term sustainability of biofuels and enhance the commercialization of biofuels in the region, (6) Develop ASEAN as the region of renewable energy that include the strategy to create renewable energy roadmap and stockpile of renewable energy in the region (Center for International Law 2009, p.27).

To support the implementation of renewable energy target of 15% by 2015 in the region, ASEAN through APAEC 2010-2015 and also collaborated with ASEAN Center for Energy (ACE) under Renewable Energy Support Programme for ASEAN (ASEAN-RESP) have been cooperated with agency which originally located in Germany named as the *Gesellschaft Fur Internationale Zusammenarbeit* (GIZ) known as a development agency. The cooperation with GIZ consist on several agenda, which are: (1) the adoption of regional guidelines on renewable energy by ASEAN specialize energy bodies, (2) the development and the promotion of renewable energy through the formulation of policies to establish access to renewable energy sources, (3) formulation of the group which is focus to works on the implementation and the development of renewable energy in ASEAN by ASEAN Renewable Energy Sub-Sector (RE-SSN) to support the target of APAEC during the period of 2010-2015 (ASEAN Research Institute 2017, p.8). One of the implementation of the cooperation with GIZ were conducted of the workshop focused on "Innovative Rural Electrification Approaches in ASEAN" in order to encourage the development of renewable energy for electricity in the region (Shi & Malik 2013, p.35).

Besides that, APAEC along with RE-SSN also cooperated with HAPUA WG 4 (renewable energy and environment) to working on the assessment of the capacity of ASEAN to achieve the target of 15% renewable energy installed by 2015. To support the financing system during the APAEC 2010-2015, RE-SSN have been prepared the concept of paper on the framework to promoting innovative financing system

through the involvement of banking sectors and financial institutions in renewable energy projects which also supported by ASEAN-RESP (Shi & Malik 2013, p.35). In order to prepare the paper on the standardization of renewable energy in the region, APAEC 2010-2015, ASEAN-RESP and ASEAN RE-SSN was conducting the regional stakeholder workshop, and in order to enhancing the sharing information and strength the network in the region, RE SSN have been actively to conduct ASEAN Energy Awards on renewable energy project (Shi & Malik 2013, p.36). Then, ASEAN Hydropower Competence Sector (HYCOM) was also active to support the implementation of renewable energy through APAEC 2010-2015 by promoting the services on renewable energy project in regional and international networks (Shi & Malik 2013, p.36). Another international cooperation that focused on the financing assistance during the implementation of renewable energy through APAEC, ASEAN have been cooperated with ASEAN Dialogue Partners which including European Union, Japan, Australia, China, South Korea, and India, and another countries such as Switzerland and United States. Then, ASEAN also cooperated with United Nations and others agencies such as Institute of Energy Economics Japan (IEEJ), International Energy Agency (IAE), New energy and Industrial technology development

Organization (NEDO), Japan Coal Energy Center (JCOAL), Energy Charter Secretariat, Asia Development Bank (ADB), Asian Institute of Technology (AIT), and Japan Oil, Gas, Metals National Cooperation (JOGMEC). The key achievements of APAEC during the period 2010-2015 on the implementation of renewable energy program in the region was include: (1) in 2013, total powered installed capacity on energy from fossil fuel and renewable energy sources estimated 184, 156 MW which 45,673 MW or around 25% was coming from renewable energy sources on hydropower, biomass, biogas, geothermal, solar and wind energy, (2) in 2013, total electricity generation in the region was about 821 TWh and 169 TWh or around 21% was coming from renewable energy sources that had surprised and beyond the target of 15% renewable energy on APAEC 2010-2015 (ASEAN Center for Energy 2015, p.18). Another achievements of APAEC 2010-2015 to increasing the capacity of ASEAN on the installed renewable energy had more than double compared from 2006 to 2014 with total capacity 197, 581 MW with the contribution 26,1% was coming from renewable energy which overall accounts around 28,000 MW renewable energy have been produced and built with annual rate 10,25% during 2006-2014 (ASEAN Research Institute 2017, p.3).



Figure 1: Renewable Energy Development of ASEAN in 2013.

Another data have been mentioned the high number of the installed renewable energy capacity in the region which increased by 42% from 2010-2013. Among the renewable energy sources, hydropower (of all sizes and types) had the highest contribution, with about 37.2 GW in installed capacity in 2013. Indonesia through HYCOM in Bandung in 2011 develop and transfer best practices in small-scale hydro power to achieve APAEC 2010-2015 program (Zamora 2016 p. 32). Another Renewable resources

program is Geothermal energy will be further developed in the Philippines and Indonesia which will result to 3.9 percent annual growth rate in the primary energy supply (Centre For International Law, 2006 Page 8). In the study case of biofuel, the ASEAN member states which are Indonesia, Malaysia, the Philippines, Thailand, and Vietnam have incorporated their renewable energy target into their national energy mix into the APAEC 2010 often use this alternative fuel as a substitute for fossil fuel.

(Rahmadi, Hanifah and Kuntjara 2017, p.3). As an addition, according to ASEAN Research Institute in 2017 on the cooperation of energy in ASEAN have been released the data regarding the performance of ASEAN member states during the implementation of renewable energy program through APAEC 2010-2015. Lao PDR and Vietnam have been performed well during the APAEC 2010-2015 on the exploration and the development of renewable energy sources, Lao PDR relied on hydropower and Vietnam have increased the capacity to 12 GW between 2006 until 2014 which is the highest compared to another ASEAN countries with the average 1,76 GW.

5 CONCLUSIONS

Based on the explanation above, this paper has been explained regarding on how ASEAN address climate change through renewable energy program to reduce the greenhouse gas emission and to prevent the larger impact of climate change from energy sector. But, there are several important points that should be underlined on this paper, (1) climate change have been impacted all countries in the world, no exception for Southeast Asia countries as one of the most vulnerable region which impacted on the climate change in term of the increasing of the temperature, rising sea levels, extreme weathers that has been the challenges of economic, social and political development in the region, (2) renewable energy program development was one of the mitigation in order to addressing and decreasing the larger impact of climate change of ASEAN countries that formulated through the ASEAN Plan of Action for Energy Cooperation (APAEC) 2010-2015, (3) APAEC 2010-2015 focused to increasing the renewable energy capacity in the region and have the target of 15% renewable energy by 2015 to support the implementation of ASEAN Economic Community (AEC) Blueprint 2015 on reducing the use of fossil fuels such as oil, natural gas, and coal to fulfill energy needs in the region, (4) APAEC have cooperated with United Nations and others countries including Germany, United States, Switzerland, European Union, Japan, Australia and others competence agencies to support the implementation of renewable energy program in the region, (5) Through the strength international and regional cooperation, APAEC have been successful to increasing the capacity of renewable energy in Southeast Asia such as in 2013, total electricity generation in the region was about 821 TWh and 169 TWh or around 21% was coming from renewable energy sources that had

surpassed and beyond the target of 15% renewable energy on APAEC 2010-2015.

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