

TRANS-ASEAN GAS PIPELINE (TAGP) COOPERATION AND THE PROJECTION OF INDONESIA'S ENERGY SECURITY

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Abstract

Trans-ASEAN Gas Pipeline (TAGP) is a regional cooperation project aims to secure natural gas reserves in ASEAN by building networks of gas pipeline in the region. This research tries to project Indonesia's energy security in the framework of TAGP regional cooperation which has been established since the year of 2002. TAGP cooperation is developed in line with the vision of ASEAN energy policy which strives to suffice regional energy demands by optimizing the production of petroleum and natural gas. This, in turn, will increase industrial and economic growth. The development of TAGP cooperation faces some obstacles. This comes from various aspects, from technical burden, to economical, jurisdictional, political, and environmental aspects. By analyzing these obstacles, this research attempts to project whether TAGP could strengthen Indonesia's energy security in terms of availability, affordability, and efficiency.

Keywords: Energy Security, Trans-ASEAN Gas Pipeline (TAGP), Regional, Indonesia.

1. Introduction: Dilemma of Energy Demand in Southeast Asia

The dynamics of economic growth in Southeast Asia tends to increase if it is reviewed based on each country's income per capita. Some Southeast Asian countries, such as the Philippines and Vietnam are even predicted to experience strong economic growth in the period of 2016 to 2020 due to accelerated foreign investment and increased level of domestic consumption (OECD, 2016, pp. 3-4). The stable economic growth in Southeast Asia is also supported by rapidly growing industrialization and urbanization, as well as increasing number of middle class in urban areas. This growing number of middle-classes does not only impact on the increasing domestic purchasing power, but also generates a very high demand for energy (Roberts & Cull, 2003, p. 16).

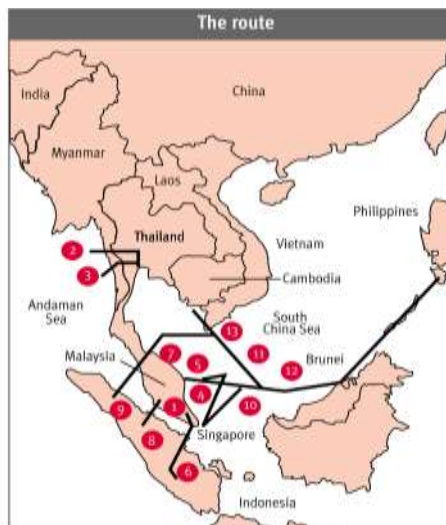
Southeast Asia is a region with abundant energy resources. While the average production of petroleum in Southeast Asia has decreased due to the lack of new oil field sources, natural gas tends to multiply. International Atomic Energy (IAE) projects that from the years 1990 to 2035, total natural gas production in Southeast Asia will continue to increase regardless of the fact that it is also accompanied by the growing demand every year. This becomes a dilemma in many countries when energy production could not meet energy demand. Thus, importing energy sources from other countries remain common and rational for decision makers.

Facing the dilemma on how to manage the increasing demand of energy and to create energy sufficiency in the region, the Association of Southeast Asian Nations (ASEAN) countries reached an agreement to establish regional cooperation framework in the energy sector through Trans-ASEAN Gas Pipeline (TAGP) initiative. TAGP was first announced in 1988 in a meeting of ASEAN Council of Petroleum (ASCOPE) member countries. However, the project started to gain momentum in 1999 when a task force under the ASEAN Council on Petroleum (ASCOPE) was

formed to formulate a TAGP realization strategy. The TAGP draft was formulated in 2000 and signed by all energy ministers of ASEAN member countries in Bali in 2002. In June 2004, the TAGP project was officially implemented. One of the goals of the TAGP project is to realize a regional gas pipelines by 2020 (see Picture 1) (van De Graff & Sovacool, 2014, p. 18).

Picture 1.

ASEAN Gas Pipeline Route 2020



Source: Peter Roberts & Alex Cull. 2003. "Building the Trans-ASEAN Gas Pipeline", *Asia Pacific Review*, 15-20.

The cross-border gas pipeline in the Southeast Asia region was first built connecting Malaysia to Singapore in 1991. Since then, several other gas pipelines were constructed; some were in the status of development and planning. Until 2015, there were 13 bilateral agreements on the construction of gas pipelines which extends along 3,631 kilometers that connects ASEAN member countries. Indonesia has conducted cooperation of gas pipeline with Singapore and Malaysia connecting South Sumatra with Singapore and West Natuna with Singapore and Duyong (ASCOPE, 2017). Cooperation agreements undertaken by ASEAN countries are so far still bilaterally. However, when TAGP is comprehensively connected, it could be a stimulant for the strengthening of ASEAN regional building process through energy cooperation.

Since the TAGP project involves a large scale infrastructure construction, its implementation faces some challenges. The biggest challenges in implementing TAGP projects are (1) conflicting goals and priorities among stakeholders; (2) the difference of objectives on whether the production of natural gas should be prioritized to meet domestic needs or to obtain foreign capital through exports to global markets; (3) different perceptions of energy security between one country and another, or with national and multinational companies.

This research aimed to analyze the challenges of TAGP cooperation, especially for the projection of Indonesia's energy security. This paper identifies five challenges of TAGP cooperation, namely technical, political, economic, jurisdiction, and environmental challenges. In addition, this research also tries to analyze whether bilateral cooperation between Indonesia and other ASEAN countries in the context of TAGP can strengthen Indonesia's energy security in terms of availability, affordability, efficiency, and sustainability.

2. Literature Review

Energy security is a debatable concept because it is often interpreted in national terms. Countries tend to have their respective perceptions according to their interests and expectations of energy needs (Sovacool, 2009, p. 470). Therefore, the concept of energy security becomes ambiguous. Countries can have difference policies to increase and decrease oil and gas production to strengthen their energy security. Benjamin K. Sovacool in the Journal Pacific Affairs outlines four criteria for determining a country's energy security: availability, affordability, energy efficiency, and stewardship.

Table 1.

Four Criterias of Energy Security

Criteria	Values	Explanations
Availability	Self-sufficiency and diversification	Having a variety of energy sources and access to it. By securing sources and access, a state can minimize disruption and reduce dependency with other state or supplier companies.
Affordability	Balanced supply and demand	Can provide energy at an affordable price for consumers with low volatility levels
Efficiency	Innovation and Education	Improve the performance of energy resource technologies and change consumer behavior
Sustainability	Social and environment sustainability	Assurance that government's energy policies are socially acceptable and ensure that non-renewable resources are utilized in accordance with the amount of renewable energy available

Sumber: Benjamin K. Sovacool, 2009. "Reassessing Energy Security and the Trans-ASEAN Natural Gas Pipeline Network in Southeast Asia". *Pacific Affairs*, 82 (3), 471.

The availability aspect relates to the self-sufficiency and diversification of energy resources and services. The availability aspect includes adequate supply guarantees to meet domestic demand and safe distribution. With a sufficient supply of energy resources, a state can reduce its dependency on imported energy sources. Diversification includes three dimensions, namely diversification of energy sources, diversification of energy supplier, and diversification of energy source locations. The aspect of affordability means that consumers can have access to energy sources at stable and affordable prices. Aspect of efficiency refers to the improvement of energy supply performance through technological innovation which is also accompanied by changes in community behavior towards better habits, for example by electricity savings. The last aspect is social and environmental sustainability. This is a guarantee that the government's energy policies are socially acceptable and ensure that non-renewable resources are utilized in accordance with the amount of renewable energy available (Sovacool, 2009, p. 472).

3. Data Analysis: Trans-ASEAN Gas Pipeline Cooperation

In relation to TAGP regional cooperation, a state's commitment to engage in the project is based on its own rationalities and preferences. In general, TAGP is one of regional cooperation frameworks that is considered which can guarantee medium and long-terms energy resilience of a country by opening access of gas pipeline in regional scale. Since the project of TAGP cooperation needs a large-scale of investment, it requires a strong political commitment from ASEAN countries.

According to Moravcsik, specific issues and geopolitical factors also determine the effectiveness of cooperation between countries on a regional scale (Moravcsik, *Liberal Inter-governmentalism and Integration: A Rejoinder*, 1995, p. 26). This is in line with the TAGP cooperation scheme to actualize the Vision of ASEAN 2020. Although TAGP cooperation has not been fully integrated yet, the bilateral initiatives undertaken by ASEAN countries in developing cross border gas pipelines are projected to build more coherent connectivity that can support regional integration processes and strengthen regional energy resilience.

Increased Natural Gas Demand and TAGP Initiatives

Energy efficiency is one of the country's main policies today. The decline in world oil reserves and conflicts in oil-exporting countries encourage importing countries to change their energy security strategy and move on to other energy sources (Yergin, 2009, pp. 772-773; Carlisle, Feezel, et.al., 2017, p. 2). Natural gas is the second alternative energy after petroleum which currently invites the attention of many countries in the world. Natural gas becomes an attractive source of energy because it produces relatively fewer emissions of carbon dioxide (CO₂) than petroleum or coal so it is considered more environmental friendly. In addition, natural gas can be converted into wide variety of products, such as liquid fuels, artificial fertilizers, and hydrogen that can be used as fuel cells. As natural gas produces less CO₂ than coal, it is even widely used as an electric generator (Klare, 2008, pp. 43-44).

Demand for natural gas in the world is predicted to experience an enormous increase. The highest increase in natural gas demand mainly occurred in Europe and Asia. The EU and industrialized countries in Asia, particularly Japan, China, South Korea, and India, began to develop natural gas extraction infrastructure to meet their domestic needs, especially as power generators replacing coal. Based on data released by the US Department of Energy, annual gas consumption in Europe will grow by 43% in the period between 2004-2030, rising from 18.8 to 26.9 trillion cubic feet (tcf). In the same period, annual gas consumption growth in Asia is predicted to increase by 222%, from 8.5 to 27.4 tcf (Klare, 2008, p. 44).

The idea of implementing energy cooperation among ASEAN countries has already been discussed since 1975, while the possibility to establish a linked natural gas network within a region has come to surface since the beginning of 1986. However, the official plan to establish TAGP was only launched in 1998, followed by a feasibility study in 2002 (see Table 2). TAGP not only contributes in enhancing ASEAN-to-ASEAN connectivity, it also plays a role in integrating the natural gas market throughout the Asian continent.

Table 2.
The Chronology of TAGP Formation

Timelines	Location	Explanations
15 October 1973	Jakarta, Indonesia	ASEAN formed the Petroleum Council as a forum to discuss energy issues and collaboration in the region
29-30 September 1980	Bali, Indonesia	ASEAN held the first <i>Economic Ministers of Energy Cooperation</i> (AEMEC) to discuss energy cooperation intra and inter-ASEAN
24 June 1986	Manila, Filipina	ASEAN signed a Petroleum Security Agreement to enhance regional energy cooperation
15-16 November 1990	Manila, Filipina	ASEAN firstly announced the TAGP concept

		in the 9 th AEMEC Meeting
15 December 1995	Bangkok, Thailand	ASEAN signed Agreement on Energy Cooperation to promote "security and sustainability of energy supply through diversification, resource conservation, efficiency, and application of environmentally friendly technologies"
15 December 1997	Kuala Lumpur, Malaysia	ASEAN adopted the ASEAN Vision 2020, which included the provisions of TAGP
7 October 1998	Hanoi, Vietnam	ASEAN initiated a TAGP feasibility study and proposed deliberations in the 6 th ASEAN Summit in 2004
3 July 1999	Bangkok, Thailand	ASEAN established the ASEAN Council on Petroleum (ASCOPE) and formed a TAGP team
5 July 2002	Bali, Indonesia	ASEAN signed a Memorandum of Understanding (MoU) to build TAGP
26 November 2004	Ho Chi Minh, Vietnam	ASEAN called TAGP as a central pillar of energy policy during discussions with China, Japan and South Korea
15 January 2007	Cebu, Filipina	ASEAN initiated the "Cebu Declaration on East Asian Energy Security" which also reaffirmed ASEAN's commitment to TAGP cooperation

Sources: Sumber: Benjamin K. Sovacool. 2009. "Energy Policy and Cooperation in Southeast Asia: The History, Challenges, and Implications of the Trans-ASEAN Gas Pipeline (TAGP) Network. *Energy Policy* 37, *Energy Policy* 37, 2359.

As of May 2015, 13 gas pipelines have been constructed with a total distance of approximately 3631 km (See Table 3) and 4 trans-boundary gas pipeline projects under consideration. The gas pipeline built so far is still bilateral because it connects the two countries. It is expected that this

bilateral connection will form a multilateral network that can support regional energy governance as a whole.

Table 3.
Natural Gas Pipeline in Southeast Asia

Natural Gas Pipelines	Distance (km)	Year	Volume (million cubic feet)	Budget (US\$)	Operator
Peninsular Malaysia-Singapore	5	1991	150	1,4 billion	Petronas
Yadana (Myanmar) – Ratchaburi (Thailand)	649	1998	200	1,2 billion	TotalFinalElf, Unocal, PTT (Thailand), MOGE (Myanmar)
Yetagun (Myanmar) – Ratchaburi	340	2000	260	800 million	Premier Oil, Petronas, MOGE, Nippon Oil,

(Thailand)					PTT
Natuna Barat – Singapore	660	2001	325	5,7 billion	SembGas (Singapore), Pertamina
West Natuna – Duyong (Malaysia)	100	2001	250	900 million	Petronas, ConocoPhillips, Pertamina
South Sumatra – Singapore	470	2003	350	832 million	Singapore Power, Pertamina
Grissik-Batam-Singapore	460	2003	150	607 million	PGN (Indonesia)
Duri – Malacca	200	2005	300	320 million	Pertamina, Gulf Indonesia, Talisman (Kanada), Petronas, Santos (Australia), Repsol-YPF (Spanyol)
Malaysia – Thailand (Joint Development Area)	348	2005	1020	2,42 billion	Carigali-Triton (Thailand), PTT, Petronas
Malaysia – Singapore	4	2007	115	4 million	Keppel Corporation, Petronas
Malaysia-Thailand Joint Area	100	2009	-	-	Petronas, PTT
Myanmar-Thailand	250	2010	-	-	MOGE, PTT
Thailand-Malaysia Joint Area	352	2015	-	-	Petronas, PTT

Sources: Benjamin K. Sovacool. 2009. *Energy Policy* 37, 2360; Tilak K. Doshi in Sanchita Basu Das (Ed.). 2013. "ASEAN Energy Integration: Interconnected Power and Gas Pipeline Grids", *Enhancing ASEAN's Connectivity*. Singapore: ISEAS Publishing, 147; ASCOPE, "Trans ASEAN Gas Pipeline Project (TAGP)" in <http://www.ascope.org/Projects/Detail/1060>

4. Challenges of TAGP Implementation

ASEAN countries face some challenges in the implementation of TAGP. First, the development of gas pipeline infrastructure requires huge investment. This is a problem met by most ASEAN countries which are still categorized as developing countries with low per capita income levels. The second obstacle is related to policy synergy. Not all ASEAN countries place energy issues in their policy priorities. Some ASEAN countries are more focused on political and economic policies. Third, if a country focuses on energy policy, then it should also consider the environmental implications of developing energy infrastructure. These three complexities represent a common obstacle for ASEAN in developing regional energy connectivity through the TAGP project. In more detail, the obstacles to TAGP implementation consist of technical barriers, economic constraints, jurisdictional obstacles, political constraints, and environmental barriers (Sovacool, 2009, pp. 2362-2365).

Technical Barriers

Building a gas pipeline infrastructure over hundreds of kilometers requires adequate technical expertise and substantial funds. Not all ASEAN countries have expertise as required. *Pertamina* and *Perusahaan Gas Negara* (PGN), for example, stated that they do not have sufficient experts and technological advantage in developing natural gas pipeline in West Natuna, a location that holds quarter of national natural gas reserves. If natural gas stockpile contains a lot of carbon dioxide gas, then the process of construction and operation becomes more complex. Technical barriers are also linked to differences in standards of operation and maintenance of gas pipelines between connected countries.

Economic Constraints

The development of a natural gas pipeline infrastructure requires enormous investment, averaging billions of US\$. In addition to infrastructure development, the funds are also allocated for drilling and compression equipment. Most ASEAN countries do not have the ability to fund transboundary gas pipeline development projects independently. In addition to applying bilateral investment patterns, ASEAN countries involve major countries and multinationals, such as Total, Conoco Phillip, Repsol-YPF, Talisman, Nippon Oil, and Santos. The involvement of these multinational corporations on the one hand poses an economic risk because they can benefit more from the investment. Even though ASEAN countries are able to invest independently in natural gas pipeline infrastructure development projects, returning profits cannot be ascertained. Many experts say that natural gas pipeline construction projects are not a profitable investment when compared to investments in other energy sectors, such as petroleum, biofuels, and hydroelectric.

Jurisdictional Obstacles

Jurisdictional obstacles related to the synergy of regulatory frameworks and the harmonization of national laws. In fact, the regulations governing the distribution and transmission process between one country and other ASEAN countries are still different. This uniform regulation requires a strong commitment from each ASEAN member country. Meanwhile, the process of law enforcement in the domestic sphere has not been optimal. This condition becomes constraining factors for investors to invest their capital in infrastructure development projects. Investors need legal protection of their property guaranteed by the state. Political instability due to regime change or violation of contract and rule of law can lead to friction in bilateral relations and create distrust among investors. This will certainly hinder the development of infrastructure. In addition, there is reluctance from foreign investors if the destination country does not privatize thoroughly. As can be seen in Table 3, the development of natural gas pipelines in the ASEAN region is still dominated by state-owned enterprises. This indicates that the liberalization process in energy trade in the ASEAN region has not been comprehensive because of the relatively dominant role of the state.

Political Constraints

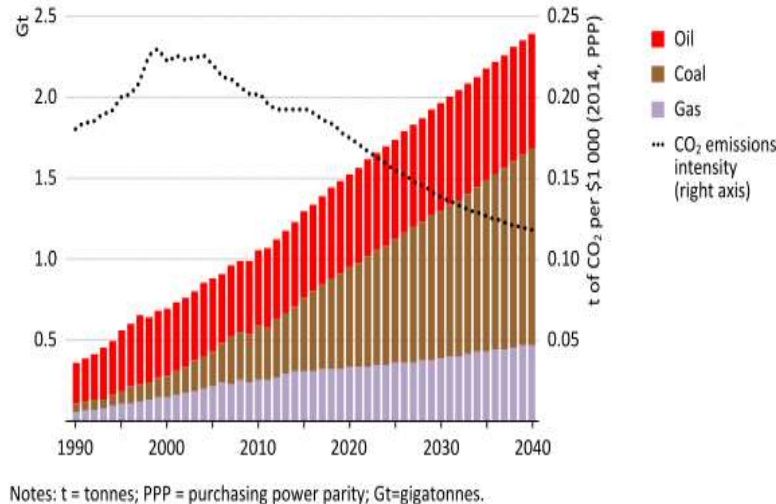
Many factors occur behind the emergence of political obstacles in the implementation of the TAGP project. Diplomatic relations between ASEAN member states are often colored by sovereign tensions. Factors of cultural differences, racial sentiments, and nationalism are some elements that contribute to create tensions between ASEAN member countries. Cases of wood theft, fish theft, smoke smog pollution, smuggling, territorial disputes are unresolved issues and arouse suspicion between one country to another. In relation to energy, political contestation that could hamper TAGP cooperation is the claim of several ASEAN countries to the East Natuna and Spratley Islands in the South China Sea (Sovacool, 2009, p. 2363; Cossa and Khanna, 1997). The claims are based on the abundant natural gas reserves in the South China Sea region. Another political obstacle is the lack of support and political commitment from ASEAN leaders against TAGP.

Environmental Challenges

In each step of infrastructure development, from exploration, drilling, processing and distribution, there are consequences of environmental degradation such as land degradation, destruction of animal and plant habitat, not mention the CO₂ emissions generated from natural gas combustion. Although the amount of CO₂ emissions generated from natural gas combustion is relatively less than emissions from petroleum and coal combustion (see Picture 2), natural gas is still classified as fossil energy that cannot be categorized as environmental friendly. Moreover, because natural gas also produces emissions of methane gas which has a greenhouse effect 25 times of CO₂ emissions with the same number of periods of 100 years (Hanle, 2016).

Picture 2.

Projection of CO₂ Emission from Fossil Fuel in Southeast Asia (1990-2040)



Hanle, Lisa. 2016. "Methane Emissions from the Oil and Gas Industry: Is the World Getting It Right?" dalam <https://ghginstitute.org/2016/07/18/methane-emissions-from-the-oil-and-gas-industry-is-the-world-getting-it-right/>, diakses 17 Desember 2017.

Natural gas pipeline projects also contain risk of leaks that have a fatal impact on the environment and health. Leakage may occur due to a tight or cracked pipe connection, a non-functioning valve, operator negligence, or corrosion. In the period between 1997-2007, the level of accidents caused by disruption of natural gas pipeline infrastructure in the world reached 33% (Sovacool, 2008, p. 1802).

5. Conclusion: Indonesia and TAGP Cooperation: A Projection of Energy Security

Indonesia has the largest natural gas reserves in Southeast Asia and the third in the Asia Pacific region, reaching about 3 trillion cubic meters (Southeast Asia Energy Outlook Special Report, 2015, 61). This amount accounts for 1.5% of the world's natural gas reserves. Indonesia's natural gas reserves are mostly located in Sumatra, Natuna waters, Mahakam Blocks in East Kalimantan, and Papua. In many cases, the development of new sources of reserves in Indonesia encountered many obstacles because of their location in offshore or remoted border areas which is far away from industrial centers. Therefore, although Indonesia is still listed as a country with the largest natural gas reserves in Southeast Asia, but the level of production tends to decline.

The development of natural gas pipeline infrastructure requires substantial investment so that the Indonesian government needs to involve foreign investors. However, to attract foreign investment is not an easy matter as investors need legal guarantees and certainty of profit sharing, while 25% of total production should be allocated to domestic needs (Southeast Asia Energy Outlook Special Report 2015, p. 62).

The decline in production rates and natural gas supply resulted in two power plants in Indonesia being shut down or operating partially. In 2007, Perusahaan Gas Negara (PGN) had to negotiate with China, Qatar and Iran to cover supply at higher prices (Sovacool, 2009, p. 2364). This condition does not meet the aspect of availability and affordability of energy security.

In post-economic crisis, more efforts have been made to deregulate markets, especially in the energy sector. In 2001, there was a change in government regulations regarding oil and gas. Based on the new regulations, government intervention (through state-owned company, Pertamina) in the management of natural gas transmission is limited. This opens opportunities for private and multinational companies to invest by forming new subsidiaries.

To see whether TAGP can strengthen Indonesia's energy security, this study uses four energy security indicators consisting of availability, affordability, efficiency, and environmental management.

Availability Aspect

The TAGP project on one hand can secure regional energy in terms of supply, but on the other hand, it can also increase dependency on natural gas suppliers. Although Indonesia is still classified as a supplier country in South East Asia, the availability of natural gas through gas pipelines can be threatened by excessive cost of infrastructure development and maintenance. The gas pipeline is also a vital investment for the economy. Therefore, its existence becomes strategic and can be utilized by a group of parties to take advantage. For example, suppliers and distributors can increase the rental rates for service users so that the selling price becomes high.

In addition, with the gas pipeline infrastructure network, natural gas demand will increase but not necessarily accompanied by adequate inventory. Since 2004, Southeast Asia and Asia Pacific have started to reduce the supply of natural gas to the world by 8.33% to meet domestic needs. Indonesia itself is currently listed as one of the countries of energy importers.

Affordability Aspect

Natural gas infrastructure is a capital-intensive project. For global scale exploration and production of natural gas, it proximately requires an investment of approximately US \$ 260 billion annually. The construction of gas pipelines in Southeast Asia requires much larger funds because of the distance between one region to another, the uncertainty of investment and funding, and the unpredictable demand for natural gas. The construction of a gas pipeline infrastructure connecting Southeast Natuna to Singapore 640 km requires approximately US \$ 5.7 billion, exceeding US \$ 1.1 billion of the estimated amount (Sovacool 2009, p. 477). In addition, natural

gas prices are also strongly influenced by socio-political conditions in a country. Natural gas prices can soar and then drop dramatically in a time due to political instability, for example, or natural disasters. For developing countries in Southeast Asia, such as Indonesia, Cambodia, Laos and Vietnam, the speculative nature of the price of natural gas can have a serious impact, especially in the distribution to low income communities.

The high selling price of natural gas in the domestic market reduces the competitiveness of local companies using natural gas as raw materials. The cause of the high prices of the local gas market is due to inadequate infrastructure and long supply chains, as some of the natural gas resources are far from the industrial centers of Java. One of the government's strategies in dealing with these obstacles is to determine 7 local companies that can buy natural gas at a lower price through Presidential Regulation No.40 / 2016. Local companies that are government priorities are: petrochemical companies, fertilizers, rubber gloves, steel, glass, ceramics, and oleochemicals

Energy Efficiency Aspect

Energy efficiency is a key to ensure the availability of safe, quality, affordable, and sustainable energy for the future. It refers to the most abundant energy sources in a country and can be produced quickly and inexpensively in order to maintain security, environmental and economic challenges. Related to this, the TAGP project does not actually fulfill the energy efficiency element. The main objective of building a gas pipeline infrastructure is to anticipate an increasing consumer need. TAGP investments require substantial funds and in the process have not yet fulfilled the aspect of sustainable energy.

The efficiency of inter-country gas pipelines can be measured from two major perspectives, namely economic efficiency and transport efficiency. Economic efficiency compares transportation costs with the price of natural gas itself. Transport efficiency calculates the fuel or electrical energy used for the natural gas distribution process. This measurement also includes the efficiency of the entire system design, how the system is run, and the efficiency of the compressor unit (INGAA, 2010, p. 2).

References

- i. ASCOPE, "Trans-ASEAN Gas Pipeline Project (TAGP)", [Online] Available at: <http://www.ascope.org/Projects/Detail/1060>.[Accessed 10 February 2017].
- ii. Doshi, Tilak K. dalam Sanchita Basu Das, 2013. *Enhancing ASEAN's Connectivity*. Singapore: ISEAS Publishing.
- iii. Graaf, Thijs Van de & Benjamin K. S., 2014. "Thinking Big: Politics, Progress, and Security in the Management of Asian and European Energy Megaprojects". *Energy Policy* No. 74.
- iv. Klare, M., 2008. *Rising Powers, Shrinking Planet: How Scarce Energy is Creating A New World Order*. Oxford: One world Publications.
- v. Moravcsik, A, 1995. Liberal Intergovernmentalism and Integration: A Rejoinder". *Journal of Common Market Studies* vol. 33, no. 4.
- vi. Roberts, P. & Alex C, 2003. "Building the Trans-ASEAN Gas Pipeline". *Asia Pacific Review*.
- vii. Sovacool, Benjamin K. 2008. "The Costs of Failure: A Preliminary Assessment of Major Energy Accidents, 1907-2007". *Energy Policy* vol. 36, no.5.
- viii. TAGP, 2009. "Energy Policy and Cooperation in Southeast Asia: The History, Challenges, and Implications of the trans-ASEAN Gas Pipeline (TAGP) Network. *Energy Policy* No. 37.
- ix. TAGP, 2009. "Reassessing Energy Security and the Trans-ASEAN Natural Gas Pipeline Network in Southeast Asia". *Pacific Affairs*, vol. 82, no.3.
- x. Yergin, D., 2009. *The Prize: The Epic Quest for Oil, Money & Power*. New York: Free Press.