

**YANGON UNIVERSITY OF ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME**

**A STUDY ON CRUDE OIL AND NATURAL GAS SECTOR IN
MYANMAR
(2000-2016)**

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MPA - 25 (17th BATCH)**

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MASTER OF PUBLIC ADMINISTRATION PROGRAMME**

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MYANMAR
(2000-2016)**

A thesis submitted in partial fulfillment of the requirements for the
Master of Public Administration (MPA) Degree

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ABSTRACT

Energy is essential for economic development of a nation. In this sector, crude oil and natural gas can assist to smooth the development of all sectors by creating major revenue stream. In Myanmar, crude oil and natural gas is one of the most valuable and important natural resources and the backbone of the Economy and still plays a vital role for Development. As crude oil and natural gas are parts of energy sector which contributes not only to the fulfillment of domestic consumption but also build the national economy through raising GDP and important role for infrastructure. In this study, the study period covers from 2000 to 2016. This thesis aims to study the production of crude oil and natural gas in Myanmar and to analyze how much portion is used in different sectors. The technical assistance and international cooperation is necessary to enable crude oil and natural gas sector in Myanmar to achieve sustainable energy development. The descriptive method is used in this study and it is found that crude oil and natural gas production rate is slightly decreased from 2011 to 2015. This may be because crude oil and natural gas deposits are depleted over time as they are non-renewable energy resources.

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LIST OF ABBREVIATIONS

AAGR	Average Growth Rate
BBL	Barrels
BCF	Billion Cubic Feet
BOC	Burma Oil Company
CSP	Concentrated Solar Power
DICA	Directorate of Investment and Company Administration
DOE	Department of Energy
EPC	Electric Power Corporation
EPGE	Electricity Power Generation Enterprise
ESB	Electricity Supply Board
FDI	Foreign Direct Investment
FIL	Foreign Investment Law
GDP	Gross Domestic Product
GHP	Geothermal Heat Pump
GTL	Gas to Liquid Technology
HDI	Human Development Index
IEA	International Energy Agency
KM	Kilometers
KTOE	Thousand Tons of Oil Equivalent
KWH	Kilowatt-hours
LNG	Liquefied natural gas
LPG	Liquefied Petroleum Gas
MEPE	Myanmar Electric Power Enterprise
MIC	Myanmar Investment Commission
MMBTU	Million British Thermal Units
MMCFD	Million Cubic Feet per Day
MMSCF	Million Standard Cubic Feet
MOEE	Ministry of Electricity and Energy
MOEP	Ministry of Electrical Power
MOGE	Myanmar Oil and Gas Enterprise
MPE	Myanmar Petroleum Enterprise

MPPE	Myanmar Petroleum Products Enterprise
MT	Metric Ton
MW	Megawatts
NEMC	National Energy Management Committee
OECD	Organization for Economic Cooperation and Development
PSC	Production and Sharing Contract
PTT	Petroleum Authority of Thailand
PV	Photovoltaics
TCF	Trillion Cubic Feet

CHAPTER I

INTRODUCTION

1.1 Rationale for the Study

Since ancient times, the land known today as Myanmar has been famous for its wealth in natural resources of all kinds. Myanmar is a developing country and an important natural gas and petroleum producer in Asia. It is home to one of the world's oldest petroleum industries, with its first crude oil exports dating back to 1853. Today, Myanmar's natural resources include oil and gas, various minerals, precious stones and gems, timber and forest products, etc. Of these, natural gas, rubies, jade, and timber logs are the most valuable and currently provide a substantial proportion of national income.

Due to the population growth and change in the economic system, the demand for energy has increased and to meet the requirement of the country, energy conservation measures and improvement of efficiency of equipment have become essential. The stage of a nation can be dependent on the amount of energy it utilizes. It is very important to achieving economic growth and reducing poverty in developing countries. It is important to recognize the natural gas resource is a part of energy sector which contributes not only to the fulfillment of domestic consumption but also build the national economy through raising GDP and important role for infrastructure development by providing reliable and affordable energy to industries, commerce, and households and it thus instrument in the economic and social development of a nation.

Myanmar's energy sectors of oil and gas are the most productive industry earning and the most foreign exchange from gas export as one of the most fertile and minerals rich countries in Asia. In Myanmar, oil and natural gas sector plays an important role for infrastructure development by providing reliable and affordable energy to industries, commerce, and households and is thus instrument in the economic and social development of a nation. In development of crude oil and natural gas sector can surely contribute to socio economic growth. Therefore, oil and gas field are being implemented whatever possible in the nation to fulfill its energy needs.

Thus, oil and gas is one of the basic needs for development of a country and for promoting living standards. The energy sector of Myanmar has been improved in accordance with the policy initiative to transform the economy into a market-oriented economy, the Ministry of Electricity and Energy has amended and supplemented the existing law, rules, procedures and notifications. Under the market-oriented economy, and to increase oil production, Myanmar has awarded the exploration fields since 1989 for petroleum exploration and production sharing basis in both onshore and offshore areas.

The use of natural gas is dramatically increasing as the science and technology know-how are improving day by day. Nowadays, new ways of using gas were also noted to be increasingly discovered. If the natural gas could be produced and supplied abundantly, it would be better off for both the users and suppliers. As the use of crude oil and natural gas become more and more important in the various industries, the demand for crude oil and natural gas become increasing more and more. Since Myanmar discovered huge natural gas and crude oil which can provide not only for the domestic used but also export to other countries. Myanmar exported its natural gas to Thailand and the income from Natural gas export is increasing gradually year by year compared with other sector of the country's economy. It is further more discussed that the supply of oil and natural gas will be sufficient for the present domestic consumption and export with desirable potential.

1.2 Objective of the Study

The objective of the study is to examine the production of crude oil and natural gas in Myanmar and to analyze how much portion is used in different sectors.

1.3 Methods of Study

The method of the study is descriptive method. This study is based on the available secondary data and information from the Myanmar Oil and Gas Enterprise (MOGE) and other sources from oil and natural gas journals, books, and Internet website and presentation papers.

1.4 Scope and Limitation of the Study

The study is focused on the oil and gas production and consumption of the economy of Myanmar during the period of year 2000-2016 and on the available

resources in Myanmar especially in exploration, production and consumption of crude oil and natural gas.

1.5 Organization of the Study

This study is divided into five chapters. As the introduction part, the rationale, the objective of the study, method of the study, scope and limitation of the study and organization of the study will presents in Chapter 1. Chapter 2 is about literature review on the background of crude oil and natural gas sector. Chapter 3 is about review on energy sector in Myanmar. Chapter 4 is about the production and consumption of crude oil and natural gas in Myanmar. Chapter 5 presents about conclusion and consideration upon findings of the study.

CHAPTER II

LITERATURE REVIEW

2.1 Natural Resources and Sustainable Development

The term of natural resources includes “all resources” that exist in natural state and all systems that are or can be useful to the man in the actual technological, economic and social circumstances (Flavin, 2002). Frequently, into the economic specialty literature and not only the term of “resources” was associated with the one of “reserves” that indicate well defined resources that are known to exist. Nevertheless, the data concerning the reserves are subdue to frequent changes and, supplementary, seem to support a high level of uncertainty. Therefore, the term of reserves is the most frequently mentioned in the connections with the non-renewable reserves (e.g. fossil fuels, iron and non-iron ores, deposits of stones, marble, uranium).

The renewable attribute of the natural resources depends more times of the proper use of some unrestrictive administrative methods, as the case of agricultural lands and proper storage of wastes, because some changes in the system of natural resources can be proven to be irreversible.

The supplementation of stocks of natural resources is generated as a result of discoveries by explorations. From this reason the process of exploration is highly linked with the administration of natural resources. The renewable resources possesses proper rate of increasing or regeneration. Generally, the explorations supply information concerning the reserves of resources. Sometimes these information are precise, with a high level of certainty, but, other times the information can be no more than probable and so subdue to a certain error. Besides, the explorations against the existent stocks are not free but expensive and the information that are supplied must be treated as a, poor input’ in the production process of goods from natural resources. In these conditions, the stocks or reserves indicate that are known to be available in the future while the dynamic of goods and services constitutes an indicator of the current usefulness. It must be underlined the fact that, in the case of in sit utilization,

the distinction is not so clear, because the stock is formed by the itself system of natural resource (e.g. 1000 m²of mature oak forest), while the dynamic of services can consist of the interaction with other natural systems or people (e.g. wild life or usual pleasure or advertising activities).

The terminology concerning the natural resources was defined and accepted clearly in the case of mineral resources and fossil fuels (e.g. coal resources, etc.), because of the initiative taken over by Bureau of Mines – An Geological Survey to standardizing these terms. At the definition of terms there are taken into account two characteristics of resources: 1- the sphere of geological knowledge; 2- the economical probability of regeneration (Flavin, 2002).

In a large number of low or middle income economies, industrial production or exports, and often both, are heavily based towards natural resources. Having a rich natural resource-base has, however, some obvious advantages. If exploits, natural resources provide a country with goods that can be traded and hence guarantee a certain revenue stream from exports. Especially for poor and less developed countries, natural resources hence allow the import of a certain volume of crucial goods, they cannot produce themselves, and therefore- at least in theory- could be used to increase significantly the welfare of the population.

On the negative side, it has been argued that the growth potential of natural resource sectors would be comparatively low. This would result from two features. First, natural resources are limited. Second, it is often claimed that natural resource extraction is a low-tech undertaking, and hence the potential for productivity increases in natural resource sectors is very narrow. The latter is also one of the most common economic explanations of why there might be a resource curse.

Since 1987, the World Commission on Environment and Development (WCED) had sought to address the problem of conflict between environment and development goals. So, WCED formulated a definition of sustainable development. According to this commission, sustainable development means the development which meets the needs of the present without compromising the ability of future generations to meet their own needs.

Regarding to the sustainable development based on utilization of natural resources, there are two principles for sustainability: weak and strong. Weak sustainability approach assumes that natural resources and manufactured capital are fully substitutable so that, say, establishing factories by using revenues from resources

extraction tends to cover resource depletion. In contrast, strong sustainability approach is based on the idea that substitutability between natural resources and manufactured capitals is limited so that specific measures distinct from the ordinary market process are necessary for the conservation of natural resources.

2.2 Energy Resources and Types of Energy Resources

Energy resource types are different from types of energy. **Energy resource types** refer to the origin of the energy source itself, while **types of energy** refer to different types of potential (chemical, electrical, etc.) and kinetic (heat, sound, etc.) energy. Sources of energy can be divided into two main categories: renewable and non-renewable. Renewable simply means that the source can be rejuvenated to provide an almost endless supply of energy. Non-renewable sources are those that are prone to running out.

These natural resources are a major source of power for a vast amount of industries – however, there are numerous downsides to non-renewable energy, including their negative environmental impact and the fact they are in limited supply. There are three kinds of non-renewable resources.

2.2.1 Natural Gas

Natural gas gathers below the Earth's crust and, like crude oil, must be drilled for and pumped out. Methane and ethane are the most common types of gasses obtained through this process. These gases are most commonly used in home heating as well as gas ovens, stoves, and grills. Russia, Iran, and Qatar are the countries with the largest recorded natural gas reserves.

Natural gas is the gaseous form of fossil fuels. It is often found near oil deposits in the subsurface. It is lighter than air and composed mainly of methane, which is why it has no smell. Before natural gas can be used, a special additive is mixed in to give it an odor so it can be easily detected. Natural gas is also pumped to the surface, often via the same pump that is used to retrieve oil. Natural gas is mainly used for heating our homes.

2.2.2 Coal

Coal is the last of the major fossil fuels. Created by compressed organic matter, it is solid like rock and is obtained via mining. Out of all countries, China

produces the most coal by far. In fact, it has been the largest producer of coal for the last three decades, producing more than 3 billion tons of coal each year. Coal is most typically used in home heating and the running of power plants.

2.2.3 Crude Oil

Crude oil is a naturally occurring, unrefined petroleum product composed of hydrocarbon deposits and other organic materials. A type of fossil fuel, crude oil can be refined to produce usable products such as gasoline, diesel and various forms of petrochemicals. It is a nonrenewable resource, which means that it can't be replaced naturally at the rate we consume it and is, therefore, a limited resource.

Oil is the liquid fossil fuel and is often referred to as petroleum. Oil is found in the substance between rock layers or within rocks themselves. To retrieve the oil, a well is dug and the oil is pumped up to the surface. Oil is used for everything from heating fuel to making plastic to the gasoline we put in our cars.

2.2.4 Pros and Cons of Non-Renewable Energy Resources

According to the U.S. Energy Information Administration, non-renewable energy sources cannot be replenished in a short period. They include fossil fuels such as oil, natural gas, coal, and uranium used for nuclear energy.

The main advantages of non-renewable energies are that they are abundant and affordable. For example, oil and diesel are still good choices for powering vehicles. Non-renewable energy is cost effective and easier to produce and use. According to National Geographic, there are reservoirs of non-renewable energy sources throughout the world.

Oil and coal are still being drilled and mined. Huge transport networks deliver the fuels from their source to destinations around the world. With a new understanding of the limitations of oil, gas and coal, technology has been developed with an eye to using nonrenewable energy as efficiently as possible. New heating and air conditioning units for homes use far less energy than the old designs of twenty years ago. Cars are now smaller and continue to improve gas mileage to conserve fuel.

On the other side are the disadvantages to non-renewable energy. Burning oil and coal produce greenhouse gases as a byproduct that damages our atmosphere.

Once hotly debated, this is now a known fact. Protecting the environment we live in is a driving force for development of renewable energy sources.

Gasoline prices have been volatile in the past ten years. This is in part due to the huge amount of oil needed to fuel cars in the U.S. However, it's also due to the limited capacity of oil refineries. No new refineries have come online in the past 30 years or so. Environmental agencies, agencies that protect workers and the red tape of strict building codes have increased the cost of building a refinery to the point where cost is prohibitive.

The biggest disadvantage of non-renewable energy is the knowledge that fossil fuels are limited in supply. At some point there will be no more oil to pump from wells and the rich veins of coal will be depleted. For years, it was believed that nuclear energy would replace the use of fossil fuels but the fear of radiation and nuclear meltdowns makes building new nuclear plants unaffordable.

For now the advantage of non-renewable energy is balanced by the disadvantages. The goal for the future is to replace the use of fossil fuels with energy sources that can be renewed naturally. The mining of non-renewable energy and the by-products they leave behind causes damage to the environment. Fracturing rocks can cause mini-earthquakes. The high pressure water and chemicals that are forced underground can also lead to other sources of water. There is little doubt that fossil fuels contribute to global warming.

2.3 The Origin of Oil and Natural Gas

Throughout human history, energy has been a key enabler of living standards. To survive in the agrarian era, people burned wood for warmth and cooking. In addition to use as a building material, wood remained the chief global fuel for centuries. The invention of the first modern steam engine, at the beginning of the 18th century, heralded the transformation from an agrarian to an industrial economy. Steam engines could be powered by either wood or coal, but coal quickly became the preferred fuel and it enabled massive growth in the scale of industrialization.

A half-ton of coal produced four times as much energy as the same amount of wood and was cheaper to produce and, despite its bulk, easier to distribute. Coal-fired steam locomotives dramatically reduced the time and cost of inland transportation, while steamships traversed oceans. Machines powered by coal enabled breakthroughs in productivity while reducing physical toil. With the dawn of the 20th century,

environmental concerns and new technologies led another energy source shift from coal to oil. Interestingly, although women were not yet allowed to vote, ladies' societies in the United States were instrumental in lobbying for laws to improve air quality and reduce the dense smoke caused by burning coal.

All of the oil and gas we use today began as microscopic plants and animals living in the ocean millions of years ago. As these microscopic plants and animals lived, they absorbed energy from the sun, which was stored as carbon molecules in their bodies. When they died, they sank to the bottom of the sea. Over millions of years, layer after layer of sediment and other plants and bacteria were formed. As they became buried ever deeper, heat and pressure began to rise. The amount of pressure and the degree of heat, along with the type of biomass, determined if the material became oil or natural gas. More heat produced lighter oil. Even higher heat or biomass made predominantly of plant material produced natural gas. After oil and natural gas were formed, they tended to migrate through tiny pores in the surrounding rock. Some oil and natural gas migrated all the way to the surface and escaped. Other oil and natural gas deposits migrated until they were caught under impermeable layers of rock or clay where they were trapped. These trapped deposits are where we find oil and natural gas today.

It is very hard to underestimate the significance of oil for the development of human civilization. The oil is used to produce gasoline, jet fuel, synthetic materials, plastic, synthetic oils, asphalt. In order for the oil to be created and later recovered several steps have to happen. (Hyne, 2001) First of all, there should be organic material preserved and buried deep underground before it decays due to oxidation. Second, the organic material should be buried deep enough to be exposed to high temperatures where the transformation into oil can happen. Third, the oil should not get too deep where the temperatures are so high that the oil further decomposes into natural gas and graphite. Forth, there should be a reservoir rock with sufficient amount of pores or cracks that can hold the oil. Fifth, there should be a cap rock on top that prevents the oil from ascending further up and seeping into the ground.

Natural gas is a fossil fuel used as a source of energy for heating, cooking and electricity generation. It is also used as fuel for vehicles and as a chemical feedstock in the manufacture of plastics and other commercially important organic chemicals. Fossil fuel based natural gas is a non-renewable resource.

Natural gas is found in deep underground rock formations or associated with other hydrocarbon reservoirs in coal beds and as methane clathrates. Petroleum is another resource and fossil fuel found in close proximity to and with natural gas. Most natural gas was created over time by two mechanisms: biogenic and thermogenic. Biogenic gas is created by methanogenic organisms in marshes, bogs, landfills, and shallow sediments. Deeper in the earth, at greater temperature and pressure, thermogenic gas is created from buried organic material.

In petroleum production gas is often burnt as flare gas. The World Bank estimates that over 150 cubic kilometers of natural gas are flared or vented annually. Before natural gas can be used as a fuel, most, but not all, must be processed to remove impurities, including water, to meet the specifications of marketable natural gas. The by-products of this processing include: ethane, propane, butanes, pentanes, and higher molecular weight hydrocarbons, hydrogen sulfide (which may be converted into pure sulfur), carbon dioxide, water vapor, and sometimes helium and nitrogen.

Natural gas is often informally referred to simply as “gas”, especially when compared to other energy sources such as oil and coal. However, it is not to be confused with gasoline, especially in North America, where the term gasoline is often shortened in colloquial usage to gas. In the 19th century, natural gas was usually obtained as a by-product of producing oil, since the small, light gas carbon chains came out of solution as the extracted fluids underwent pressure reduction from the reservoir to the surface, similar to uncapping a soft drink bottle where the carbon dioxide effervesces. Unwanted natural gas was a disposal problem in the active oil fields. If there was not a market for natural gas near the wellhead it was prohibitively expensive to pipe to the end.

2.4 Importance of Natural Gas and Oil in Economy Today

Many environmentalists view natural gas as a natural bridge fuel between the dominant fossil fuels of today and the renewable fuels of tomorrow. For a given amount of heat energy, burning natural gas produces about half as much carbon dioxide, the main cause of global warming, as burning coal. Since one of the primary consumption of natural gas is as a source for electrical generation & it is increasingly becoming popular because it burns cleaner than oil and coal and produces less

greenhouse gases. This ability of natural gas raises the possibility that it could emerge as a critical transition fuel that could help to battle global warming.

Due to the decreasing source of Petroleum, the countries in the world today face the financial problems in high rising prices. Developed countries and industrializing developing countries worried about the deficient source of petroleum and high price which would effect to their nations and the World's Economy. The energy data show that the petroleum resources of 1189 billion barrels of Crude Oil could be extended for 30 years only. Thus, the expatriates tried to substitute in the use of other energies in place of petroleum, such as natural gas, coal, nuclear energy, and renewable energy. It is discovered that the Natural Gas is the most suitable energy in place of petroleum.

Natural gas can be easily transported through the pipeline or as liquefied natural gas (LNG). Since, the cost of natural gas is three times cheaper than the petroleum. In the electric power sector, natural gas is an attractive choice for new generating plants because of its relative fuel efficiency and produces less carbon dioxide when it is burned than does either coal or petroleum. The industrial sector, which is the world's largest consumer of natural gas, accounts for 43 percent of projected natural gas use in 2030. Natural gas remains a key energy source for industrial sector uses and electricity generation throughout the projection.

The oil and gas industry has both a direct and indirect impact on the domestic economy, with oil and gas prices directly affecting the health of the economy as a whole. Oil and gas is incredibly important not only to individuals and businesses within the United States, but also to the position of the United States among other countries across the globe. In order to protect the United States economy, the oil and gas industry will need to thrive. (MDG, 2009)

The International Energy Agency (IEA) says that natural gas is viewed "as a good source of electricity supply" for a range of reasons. According to the IEA, natural gas is seen as "lower carbon" relative to other fossil fuels. In addition, it takes around two years to build gas plants, which is seen as being relatively quick, while its share of the global energy mix is increasing at two percent annually until 2020. For its part, the U.S. Department of Energy has described natural gas as playing a "vital role" in the U.S. energy supply. The DOE says that natural gas consumption is set to hit 26.6 trillion cubic feet by 2035, up from 24.3 trillion cubic feet in 2011.

2.5 Oil and Gas Sector in Economic Development

It is widely acknowledged that energy and development are closely related to each other. But especially in rural areas, the provision of energy services remains a challenge. In order to understand the importance of energy in the development process, there are strong relationships between energy and development.

In all levels from the household to the national level, the correlation between energy and economic development has been proved, indicating a close, and positive relationship for developing countries. Further empirical evidence confirms positive impacts of energy on the Human Development Index (HDI) and a great number of studies points to the importance of modern energy services in order to meet the MDGs. (Goldemberg, 2004)

The sustainable access to affordable energy is essential for the functioning of modern economies. However, the distribution of energy supplies among countries is uneven, prompting increased competition over different energy sources. Fossil fuels account for approximately 83 per cent of global energy consumption; however, in the future, their contribution to the global energy mix will depend on policies designed to mitigate climate change, enhance energy security and address energy poverty. Natural gas is one of the most widely utilized fossil fuels because of its environmental characteristics: (a) low carbon dioxide emission (half as much carbon dioxide emitted in natural gas than in coal when burned); (b) efficiency in power production; (c) growing demand from the industrial sector; and (c) a wide geographical distribution of reserves across regions. As such, natural gas is widely considered as the fuel of choice both from an environmental and economic point of view.

For many developing countries, natural gas also offers opportunities for industrial development which could launch their economies on a sustained growth path of rising income and poverty reduction. Ensuring sustainable and reliable supply of gas to many developing countries remains a major constraint. The Special Unit on Commodities special event on Natural Gas as an Engine of Growth represents a timely contribution to the global initiative Sustainable Energy for All. Increasing demand for fossil fuels – such as coal, crude oil and its derivatives for industry, transportation and households, among others – has raised concerns about rising carbon dioxide emissions and climate change effects. As these concerns continue to grow, several measures – including emissions capping, carbon taxation, and cleaner sources of commercial energy – have been introduced to reduce negative

environmental impacts. In this context, natural gas has gained attraction as a fuel of choice due to its relatively low greenhouse emissions, efficiency and versatility, abundant reserves and good geographical distribution. However, in the long term, stringent emissions measures could limit the pre-eminence of natural gas if new carbon capture and storage technologies are not developed to enhance competitiveness with renewable energy sources.

Many developing countries have untapped gas reserves in large and small volumes and some still flare gas associated with crude oil production resulting in adverse environmental effects. Monetizing these resources has become an important and fast growing market for the following reasons: (a) there is a surge in demand for fuels emitting lower greenhouse gases for example in power generation and buildings; (b) value added products such as Liquefied Petroleum Gas (LPG) generated from gas processing, or liquid fuels manufactured using Gas to Liquids technology (GTL) respond to the growing needs for energy security; (c) improvements in the transport of Liquefied Natural Gas (LNG) have created export opportunities for developing countries where natural gas is found but is underdeveloped or is being flared; and (d) policies to reduce global greenhouse gas emissions are hastening the substitution of inefficient and polluting energy sources with environmentally superior fuels. (American Petroleum Institute, 2013)

2.6 The Opportunities and Challenges of Oil and Natural Gas Exporting Countries

The oil and gas exporting countries can be faced with opportunities for turning oil and natural gas resources into economic wealth to alleviate poverty. At the regional level, the energy demand-supply balance situation is positive. Given the regional's total energy resource endowment, substantially higher oil and gas consumption can adequately be met with regional supplies- with sample surplus still maintained for export. Addressing the issue of volatile and high oil prices calls for a holistic approach; both the short and long-term dimensions of the likely economic and social impacts must be addressed. The short-term consideration include how to manage the immediate impact of higher oil prices. This has been the preoccupation of several net oil-importing countries in the region. However, exploring the short-term issues without adequate consideration of medium and long-term issues puts these countries at risk of being perpetually trapped in a low-level energy and low-growth

equilibrium. The other considerations are medium to long-term in nature and concern economic, institutional, and organizational considerations required to pursue the important goal of achieving expanded access to oil, gas and other energy forms in oil and natural gas exporting countries.

Making rational choices about oil and natural gas resources is central to making natural wealth work for the poor and to maximizing the contribution that the resources endowment can make to social and economic development. Three key elements are (1) environment and nature (oil and gas resources); (2) wealth; and (3) the enabling environment (governance, institutions, and power structure).

At the governance level, the main challenges include weak legal and fiscal regimes, corruption, social and political conflicts, inappropriate revenue distribution mechanisms, lack of human capital, weak institutional capacity, and lack of resources to improve governance. The challenges related to the wealth include inability to attract investment into the oil and gas sector, deficiencies in promoting economies of scale, limited cost effective technical solutions, lack of equitable distribution of wealth, macroeconomic distortions, dependence on a few commodities, poverty volatility, limited intra-regional trade and cooperation, and so on.

The increasing competition for oil and gas exporting countries due to rising international trade, the environmental advantages of gas over oil, and production declines in the largest gas markets in OECD countries, represents an opportunity for these countries. Furthermore, the continuous democratization of the continent is a key opportunity for the sustainable management of oil and gas resources.

Oil and gas resources can be a source of growth and development if efficiently exploited and managed. To promote broad based development and socioeconomic equity, governments must ensure that all citizens have equitable opportunities to assets and use natural resources. Governments can promote pro-poor economic growth by helping to create new opportunities that boast the assents of rural communities, especially those engaged directly or indirectly in oil and gas exploration. Institutional and governance failure are the root causes of much underdevelopment and environmental degradation.

Oil and gas exploitation have caused major economic, social, political, and environmental problem in some oil and gas exporting countries. Oil and gas wealth has not supported sustained economic growth and development in most countries. The major challenge is to translate oil wealth into sustained economic growth and

development. Particular challenges faced by oil and gas rich countries include weak governance, low accountability, low capacity for proper budgeting and accounting, and lack of transparency in the oil and gas industry. (ADB, 2009)

2.7 Reviews on Previous Studies

Hnin Ei Kyaw, 2008 from MPA also conducted on her paper “A Study on Energy Resources Management of Oil and Natural Gas Sector in Myanmar” in which, Myanmar is moving towards a market oriented economic system and energy demand is sure to increase sustainably once the transformation gains momentum. Natural gas has emerged as the most preferred fuel due to its inherent environment greater efficiency and cost effectiveness.

According to Mya Htwe Yee, 2010 from EMPA, she suggested on her paper “Analysis on production of Crude Oil in Myanmar” in which, after promulgation of Foreign Investment Law in 1998, the Ministry of Oil and Gas Enterprise entered into Crude Oil Exploration and Production Contracts with multinational companies has been signed. At present, MOGE has been operating with foreign companies in 13 onshore blocks and 28 offshore blocks. Efforts are being made to sign more contracts in onshore and offshore areas in the near future. The demand for crude oil is being increased in Myanmar and it is planned to meet the increasing demand by importing crude oil or by offering private entrepreneurs the opportunities to share the surplus capacity at the refinery. Moreover, MOGE invite the other investors to fulfill investment and technology for finding new oil field and current crude oil production sustainability.

As Soe Hlaing Maung, 2011 from MPA, he suggested on his paper “A study on Oil and Natural Gas Production in Myanmar” in which, the production of crude oil is not being sufficient for domestic consumption from all oil fields in Myanmar consequently, oil was imported from other countries. It was found that the production of natural gas is being surplus for domestic consumption so it is exported to Thailand. As gas exports causes natural resources depletion and on the other hand, it should also reduce the poverty alleviation in the country. To enhance the use of natural gas export revenue for disinflation, it pointed out the strict controls on foreign exchange that aggravate the limited usage of revenue from natural gas exports.

CHAPTER III

REVIEW ON ENERGY SECTOR IN MYANMAR

3.1 Background of Crude Oil and Natural Gas

Myanmar has experienced oil exploration since the first hand-dug wells were drilled on the Central Burma Basin around 900 BC. In 1755, when Myanmar was part of the British colonial empire of India early British soldier diplomats visited some of the hand-dug wells in the Central Burma Basin, located in the vicinity of Yenangyaung. In 1886 the British colonial Rangoon Oil Company, registered in Scotland, was organized, which later became the foundation of the storied Burma Oil Company. Burma drilled the first cable tool wells in 1889 in Yenangyaung, which resulted in the “discovery” of Yenangyaung Oil Field. From 1886-1901, Burma Oil Company held a colonial monopoly in the country, until the Standard Oil gained the first lease in 1901. As the Japanese were invading, seeking a source of oil, British troops destroyed all producing wells.

After the end of WWII Burma Oil Company enjoyed an exclusive monopoly on exploration until the Union Oil Company and General Exploration Company combine obtained a huge lease for most of the Central Burma Basin outside of Burma’s producing fields in 1961 and began field work to assess how to proceed with their exploration efforts. With the nationalization of the oil industry in 1963, Burma Oil and Union Oil lost their leases, and the newly formed state oil company, later called the Myanmar Oil and Gas Enterprise (MOGE) assumed all operations. MOGE successfully delineated the older fields and found smaller fields from their own exploration.

In 1988, the government opened oil and gas exploration to foreign oil companies, and Unocal again acquired a huge block in the same location. Many other companies explored the country during this first foreign involvement, but only Shell tested any significant petroleum. In 1992, TOTAL acquired a previously-discovered 3DA gas field in offshore Burma in the Irrawaddy Delta, later called Yadana Gas Field. Total was joined by Unocal Corporation as a partner. This gas field continues to

produce today, with well over 5 TCF of recoverable reserves. Texaco, Premier Oil and Nippon Oil discovered the Yetagun Gas Field in 1992, and it began production in 2000.

In 2000 Daewoo International acquired exploration acreage in Western Myanmar offshore, where they discovered nearly 5 TCF of gas in the Shwe Project. Other exploration efforts, both onshore and offshore, have not yielded economic success to date, but the long saga of oil and gas exploration in Myanmar continues. There are many legends regarding the origin and discovery of oil in Yenangyaung, but they may however be grouped into three principal versions.

3.2 Energy Resources in Myanmar

Since ancient times, the land known today as Myanmar has been famous for its wealth in natural resources of all kinds. Today, Myanmar's natural resources include oil and gas, various minerals, precious stones and gems, timber and forest products, hydropower potentials, etc. Of these, natural gas, rubies, jade and timber logs are the most valuable and currently provide a substantial proportion of national income.

Myanmar has abundant energy resources, particularly hydropower and natural gas. In 2013, Myanmar exported 8561 ktoe of natural gas and 144 ktoe of crude oil. (IEA, 2015) The country is one of the five major energy exporters in the region and is the second biggest exporter of natural gas in the Asia Pacific region after Indonesia (World Energy Council, 2015).

Myanmar is basically an agricultural country but recent development trends are to have a balance between emphasis on agriculture and industry. The change of economic system to market oriented, created many economic activities leading to increasing demand for energy.

Myanmar is richly endowed with both renewable and nonrenewable types of energy sources. The need for increased production of commercial energy (such as Crude Oil, Natural Gas, Hydropower and Coal) is emphasized to meet the requirement of industrial development program.

The most important of natural resources is natural gas, which is estimated to account for 40% of export of Myanmar. It is the 39th biggest producer of natural gas currently and exported around \$6 billion of petroleum in 2016. (Thomas, 2019)

3.3 Government Reform and Policy Formulated on Oil and Natural Gas

The policy on foreign investment is an important component of the overall economic restriction and policy of the country. With regard to Foreign Direct Investment (FDI), the Union of Myanmar Foreign Investment Law (FIL) was formulated in November 1988 and its procedures were prescribed in December 1988. After promulgation of foreign investment law in 1988, the Ministry of Energy entered into petroleum exploration and production contracts with multinational oil companies up to now 43 contracts had been signed. Intention of foreign investment law is enhanced technical knowhow and investments in all sectors are expected reserve for the state. Increasing the petroleum reserves and to boost the existing production level, Myanmar Oil and Gas Enterprise (MOGE) under the Ministry of Electricity and Energy invited multinational oil companies and worked in joint venture on a production sharing basis in both onshore and offshore areas.

In accordance with the Market-Oriented policy of the government, the Ministry of Electricity and Energy has amended and supplemented the existing law, rules, procedures and notifications. Under the market oriented economy, and to increase oil production, Myanmar has awarded the exploration licenses to multinational oil companies since October 1989 for petroleum exploration and production both onshore and offshore areas. Since discoveries of oil and gas on land, Myanmar Government had built new refineries, fertilizer methanol, LPG plants and gas turbine power stations. Myanmar could even export crude oil petrochemical products.

There are many departments and Agencies under various Ministries, which share responsibilities on various responsibilities on various aspects of energy sector's operations and management. Ministry of Electricity and Energy has the main responsibility to carry out Exploration and Production of Crude oil and Natural Gas, Refining, Manufacturing of Petrochemicals and Transportation, Distribution of Petroleum Products. MOGE is responsible for Exploration, Production and Transportation of Crude Oil and Natural Gas in both onshore and offshore areas and Transport Crude Oil to Refineries and Natural Gas to Power Stations, Fertilizer Plants, Methanol Plant, LPG Plant, Cement Factories, Paper Mills and other industries.

MPE is responsible for Refining and Processing of Crude Oil and Natural Gas to produce Petroleum Products and Petrochemicals Products such as Urea Fertilizer,

Methanol, Liquefied Petroleum Gas, Bitumen, Carbon Dioxide in Liquid and gaseous forms and Transportation of Petroleum Products and Petrochemicals Products.

The Ministry of Electricity and Energy in the Union of Myanmar has been meticulously pursuing the following energy policy, in order to increase the energy production level:

- To maintain the status of energy independence,
- To save non-renewable energy for future energy sufficiency of the nation,
- To promote efficient utilization of energy and impress on energy conservation,
- To prevent deforestation caused by excessive use of fuel wood and charcoal.

The Ministry of Electricity and Energy is promoting energy conservation and awareness of the state implemented projects has also organized teams to oversee the efficient and effective use of fuel in various development projects implemented by the government. Structure facilities required for processing of crude oil transportation and storage facilities and effective distribution is also an important issue and need to be addressed. The main component of the policy is

- a. Adoption of market oriented system for the allocation of resources
- b. Encouragement of private investment
- c. Opening of the economy for foreign trade and investment

The economic policy of Myanmar has now opened up opportunities in the energy development programmed and with the introduction of market policy, the external cooperation is allowed in energy sector. The responsibility of the Ministry of Electricity and Energy as a whole is to carry out the exploration and production of oil and gas, refining, distribution and transportation of products and manufacturing petrochemicals.

3.4 Prospects in Myanmar's Oil and Gas Blocks

Among the 14 onshore basins of Myanmar, the main oil production areas are Chindwin basin, Central Myanmar basin, Pyay basin and Delta basin. While it is known that the Rakhine coast is resource-rich, and that more attempts will also be made to produce oil from the sedimentary basins, exploration activities cannot be carried out due to difficulties such as transport.

As such, oil companies that are financially and technically strong must be allowed to invest and explore in these areas to encourage discoveries of new oil fields.

As exploration techniques have improved since then, it is expected that more onshore oil and gas fields will be uncovered using 3D seismic information. According to the study on Myanmar's offshore sector, thick sediment can be found, north and east of the coast of Rakhine. At the near-shore shallow water blocks, deposits where oil and gas may be hidden are seen and the evidence of this is strong. Oil and gas are being explored for at the Miocene and Pliocene formations.

According to the geographical situation, the seabed more than 30 miles from the Rakhine coast has obviously changed. The slopes have become steeper and are occurring in deep-water. This situation occurred as the two continents of earth crashed into each other about 45 million years ago. The lower part of ocean floor is about 3000 meters deep. Sediment is densely settled at on the subsea bed, becoming reservoirs where gas is trapped, especially in the sedimentary rocks on the steep slopes. Some examples include the Shwe Gas reservoir and Shwe Yee Htun Gas reservoir in blocks AD-7 and AD1.

Potential oil and gas prospects are found in other blocks too. However, this needs to be confirmed by drilling. It can be said that the Rakhine Offshore Region is a virgin area with a huge potential for resources discovery. Deposits from Ayeyarwaddy, Sittaung and Thanlwin rivers have accumulated into thick deposits in the Mottama and Tanintharyi Offshore Depression. The deepest parts of the sea floor can range from 2,500 m to 3,000 m and the thickness of the deposits is up to 2,000 m. In that deposit, Miocene and Pliocene-age sediments where natural and oil deposits lay are found.

Oil and natural gas deposits in Yadana, Yetagun, Zawtika and Aungsinkha have already been discovered. These are in shallow waters and no one has discovered anything about the potential in the deep water offshore area. As there are more deposits in deeper water, it is safe to expect that there would be oil and natural gas deposits in these sandstone reservoirs. Investors are only hindered by the huge costs of exploring and extracting in offshore areas.

The existence of Source Rock, Reservoir Rock, Cap Rock and Migration in the large offshore sedimentary basins of Myanmar indicates a perfect condition to form the oil and gas deposits for commercial extraction. More than 20 exploratory wells were drilled in offshore Rakhine. Measurements and results of these exploratory wells can reduce risks for exploration activities.

There are many potential resources in offshore blocks and it is reported that proven gas reserves of about 8 trillion cubic feet remain. If A-6, AD-7 and M-3 start producing, the gas reserves may be increased more. A solution that would benefit both sides needs to be sought in order to fulfill the country's energy demand. Therefore, the cooperation of oil companies in discovering existence of commercially viable oil in Rakhine offshore and Mottama offshore can produce better results and if existing platforms and pipelines are connected, production can start in a short time.

So, negotiations should be conducive to attracting oil companies which want to conduct deep-water operations in Myanmar. Oil companies with genuine interest in the business should be welcomed. For this reason, the prospect of the blocks must be presented to attract companies with the help of MOGE. Whatever it is, as natural gas exploration work involves considerable uncertainties, further investigations and exploration drilling will need to be carried out and inevitably involve some risks. (Dobermann, 2016)

3.5 Opportunities for Foreign Investors in Oil and Natural Gas Sector

There are plenty of investment opportunities for foreign investors both in the upstream and downstream sectors of the oil and gas industry. The downstream sector is relatively under-developed compared to the upstream sector; however, until recently, not every downstream business has been open to foreign investors. While the law only permits local players to engage in retail business, foreign players can enter into joint ventures with government agencies to take part in downstream activities, such as fuel storage and distribution. In recent years, several privatizations have taken place in the downstream sector. The following major privatizations have happened in the oil & gas sector recently.

- Myanmar Petrochemical Enterprise (MPE), part of the Ministry, invited both local and foreign companies to tender for a joint venture project to operate and rehabilitate Thanlyin Refinery. Parami Energy Services Company was given the green light to run the project at a rent of Ks6.4 billion per year;
- MPE, part of the Ministry, invited foreign investors to look at a joint venture to upgrade the ageing Nyaung Don Liquefied Petroleum Gas (LPG) plant;
- Myanmar Petroleum Products Enterprise (MPPE) invited foreign investors to express their interest to enter a joint venture with MPPE for the importation,

storage, distribution and sale of petroleum products, except LPG and liquefied natural gas (LNG);

- Puma Energy was awarded a contract for the import and distribution of jet fuel in a joint venture agreement with MPPE of the Ministry of Electricity and Energy.

Many of the major opportunities in the downstream and upstream sectors have already been exploited by first movers. Many of the onshore and offshore blocks have already been contracted, and in 2015, the Ministry announced that no new offshore bidding rounds would be launched until 2016. At the time of writing, the Ministry has not yet given any updates regarding the potential for a new bidding round in 2017.

3.6 Government Sector Strategy, Policy, and Plans

3.6.1 Development Plan and Reform Program

The government has prepared a set of reform programs aiming to transform the country to a modern, democratic, and developed nation by 2030. The framework for these reforms was laid down in the 2011–2031 “National Comprehensive Development Plan.” The 2012 “Framework for Economic and Social Reforms” aimed to achieve poverty alleviation, improved infrastructure, and capacity building through many plans, such as

- (i) rural development and poverty alleviation;
- (ii) human resources development, investment, and trade sector development;
- (iii) industrial development;
- (iv) finance sector development; and
- (v) regional and sector-wise development.

3.6.2 National Energy Policy

To ensure development of the energy and electricity sectors, the NEMC prepared the National Energy Policy paper which was approved by the President in January 2014. The paper summarized the national energy sector policies as follows:

- (i) To implement short-term and long-term comprehensive energy development plans based on systematically investigated data on the potential energy resources that are feasible and can be practically exploited, considering minimum impact on natural environment and social environment.

- (ii) To institute laws and rules and regulations to promote private sector participation and privatize state energy organizations in line with State Economic Reform Policy.
- (iii) To compile systematic statistics on domestic demand and supply of various different kinds of energy resources of Myanmar.
- (iv) To implement programs through which local population could proportionally enjoy the benefit of energy reserve discovered in the areas.
- (v) To implement programs on a wider scale, utilizing renewable energy resources such as wind, solar, hydropower, geothermal, and bioenergy for the sustainable energy development in Myanmar.
- (vi) To promote energy efficiency and energy conservation.
- (vii) To establish a research, development, design, and dissemination institution to keep abreast with international practices in energy resources exploration and development works, and to produce international quality products and conduct energy resources exploration works in accordance with international standards.
- (viii) To promote international collaboration in energy matters.
- (ix) To formulate appropriate policy for energy product pricing, meeting economic security of energy producers and energy consumers.

Government plans as set out in the National Energy Policy paper include sector restructuring, investment planning, pricing and fuel subsidy review, renewable energy and energy efficiency development, promotion of private sector, increased international trade, and a national electrification program to achieve 100% electrification by 2030. These plans are at various stages of development and implementation with

- (i) a new electricity law approved in 2014 allowing for corporatization, private sector participation, and establishment of an independent electricity regulatory commission;
- (ii) energy sector and power subsector plans to be completed identifying required investments; and
- (iii) commencement of a national electrification program.

CHAPTER IV

THE PRODUCTION AND CONSUMPTION OF OIL AND GAS IN MYANMAR

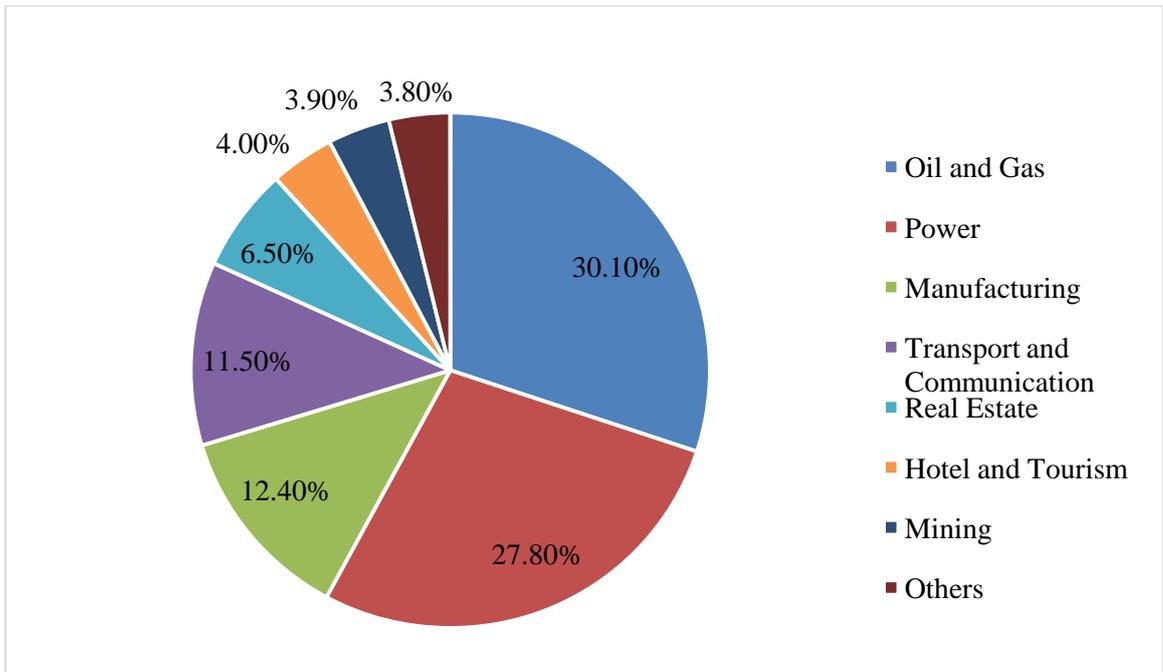
4.1 Foreign Investment in Myanmar's Energy Sector

Myanmar's Foreign Investment Law was enacted in 1988 soon after the adoption of a market-oriented economic system to boost the flow of FDI into the country. Foreign investors positively responded to these measures in the early years and FDI inflow into Myanmar gradually increased during the period from 1989 to 1996. However, after 1997, FDI inflow was dramatically reduced and markedly declined until 2004. In 2005, FDI inflow increased at an unprecedented rate and reached the highest level in the country's history. ASEAN is a major investor in Myanmar, which investment is significantly exceeds the combined investment of other regions of the world. Among top ten countries, Thailand's investment alone is significantly more than combined total investments of the other nine countries. Next to Thailand in terms of investments in Myanmar are Singapore and Malaysia among ASEAN, at second and third places, respectively. The combined total FDI inflows into the power and oil and gas sector represent about 65 percent of the total investment.

4.1.1 Foreign Direct Investment into Myanmar, 1998-2017

According to Myanmar's Directorate of Investment and Company Administration (DICA), in terms of FDI by sector, the oil and gas sector has received 30.1% of all USD 74.5 billion of FDI between 1998-2017. To date, there have been 154 oil and gas investments, totaling USD 22.4 billion. The power sector accounted for 27.8% of FDI, or USD 20.1 billion across 14 investments, most of which were large hydropower projects as shown in Figure 4.1.

Figure (4.1) Foreign Direct Investment into Myanmar 1998–2017



Source: DICA Data & Statistics

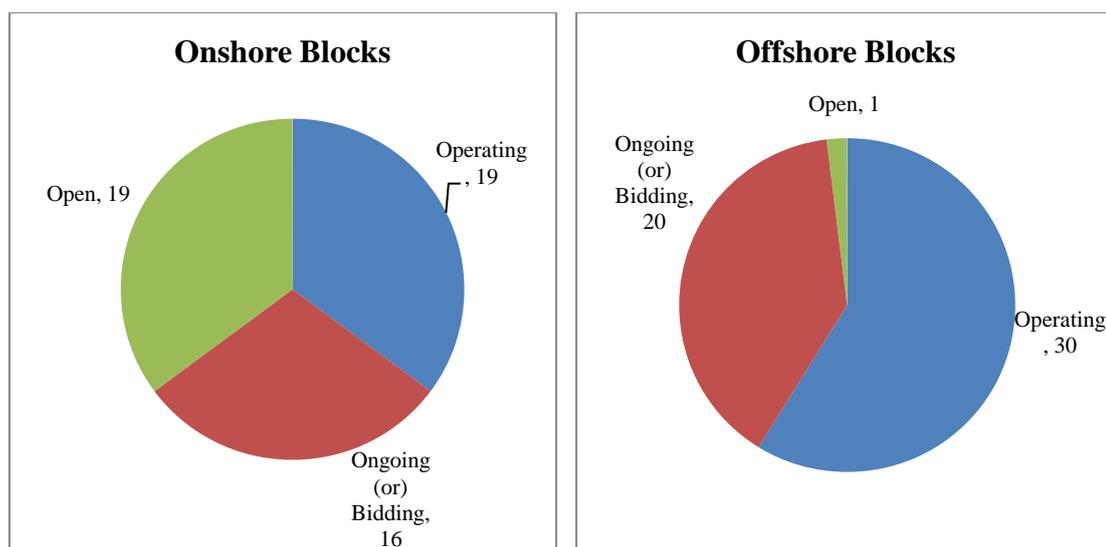
4.1.2 Oil & Gas

From 1994 to 2017, Myanmar has produced on average around 6 million barrels of crude oil per year. As of February 2017, daily production is 15,000 barrels per day, against a 2006 high of 23,000 barrels.

In terms of natural gas, Myanmar exported 81% of production in 2015. Natural gas exports accounted for 40% of the country's income with some USD 170 million each month and a total of 1.6 billion cubic feet of natural gas exported to Thailand and China every day. As an integral export commodity, the country is vulnerable to falling natural gas prices, which caused a significant drop in export revenue between 2016–2017.

The following charts detail the 105-listed oil and gas blocks. There are 54 onshore and 51 offshore, of which 24 are classified as deep sea.

Figure (4.2) Status of Oil and Gas Blocks



Source: Open Development Myanmar, 2017

4.2 Current Production of Natural Gas Fields in Myanmar

The following shows the offshore gas projects that bring in the most income to Myanmar in exports.

Table (4.1) Offshore Gas Projects

NO	PROJECTS	ESTABLISHED	OPERATORS	DAILY PRODUCTION RATE
1	Yadana	Discovered in 1992. Production began in 1998.	Total SA	910 million cubic feet (711 mmcf exported to Thailand daily and 119 mmcf for local consumption)
2	Zawtika	Discovered in 1997. Production began in 2014.	PTTEP	350–360 million cubic feet (100 mmcf for local consumption, 250 mmcf for daily export to Thailand)
3	Yetagon	Discovered in 1992. Production began in 2000.	Petronas	Over 250 million cubic feet
4	Shwe	Discovered in 2005. Production began in 2014.	Daewoo	500 million cubic feet

Source: MOGE, 2018

Gas fields are predominant in Myanmar's offshore region, from an exploration point of view, that there is a higher likelihood for gas to be discovered as opposed to oil. There are currently four producing offshore fields in the country consisting of the Yadana, Yetagun, Shwe, and Zawtika fields. Most of the productions from these fields are exported to either Thailand and China with a portion or allocated for domestic consumption.

4.3 Oil and Natural Gas Offshore Fields in Myanmar

Myanmar is an important producer of oil and natural gas in Asia. Today, Myanmar is still one of the major natural gas producer in the Asian continent. The following projects are exploration of natural gas offshore projects.

a. Yadana Gas Field

The Yadana gas field is located in the Andaman Sea. It is located about 60 kilometers (37 miles) offshore to the nearest landfall in Myanmar. That field was developed under a conventional Production Sharing Contract (PSC) agreement by four investors, Total Myanmar Exploration and Production, Unocal (United States), PTTEP International Limited (Thailand) and MOGE. That project began in July 1988 and the gas sales agreement signed between Total and the Government will run for 30 years. (Yadana Project, 2007-12-18)

Table (4.2) Production and Consumption of Yadana Gas Field (MMSCF)

Year	Production (MMSCF)	Export (MMSCF)	Domestic (MMSCF)
1998-99	3,636.63	954.15	0.00
1999-00	7645.55	6,527.11	0.00
2000-01	107,372.40	106,336.70	0.00
2001-02	200,796.24	197,113.42	2,566.33
2002-03	225,916.43	213,657.26	11,176.83
2003-04	221,395.07	207,759.73	12,585.43
2004-05	249,248.70	233,796.86	14,304.82
2005-06	234,829.63	217,859.18	15,836.30
2006-07	259,458.48	236,550.13	21,740.79
2007-08	281,244.67	241,732.24	38,321.38
2008-09	233,659.03	197,636.09	34,588.76
2009-10	250,102.26	223,291.25	25,551.04
2010-11	271,408.63	215,192.18	53,997.83
2011-12	287,385.15	218,336.05	66,460.21
2012-13	288,455.83	217,332.70	67,727.69
2013-14	270,578.93	197,826.07	69,410.52
2014-15	293,306.74	225,237.97	64,743.14
2015-16	273,696.61	213,718.20	56,686.58
Total	3,960,136.97	3,370,857.30	555,697.66

Source: MOGE, 2018

Table (4.2) clearly indicates that total production of natural gas produced by Yadana Gas Field from 2006 to 2016 is about 3.9 million cubic feet is produced and among them, 3.3 million cubic feet is exported. About 85% of the gas was exported from 1989 to 2016 and only 14% of the gas is for domestic use.

Natural Gas production not only generates energy and financial resources, it also creates jobs and spurs social progress for local communities. Some 2,500 people were employed during the construction of the gas facilities and today the project provides employment for more than 1,000 people, including over 300 direct employees. More than 85% of these jobs are filled by Myanmar nationals.

b. Yetagun Gas Field

Yetagun Natural Gas Project is located in Taninthayi offshore blocks M-12, M-13 and M-14. The field was developed under a conventional PSC agreement by four investors: Petronas (40.9%), PTT Exploration & Production (19.3%), MOGE (20.5%) and Nippon Oil (19.3%).

Table (4.3) Production and Consumption of Yetagun Gas Field (MMSCF)

Year	Production (mmscf)	Export (mmscf)	Domestic (mmscf)
2006-07	160,251.27	153,277.33	6,973.94
2007-08	165,203.74	157,793.58	7,410.16
2008-09	136,722.38	130,166.67	6,555.71
2009-10	157,491.03	150,581.88	6,909.15
2010-11	157,848.71	150,516.60	7,332.11
2011-12	153,602.45	146,649.45	6,953
2012-13	155,439.04	144,823.23	10,615.81
2013-14	146,814.46	137,823.23	8,991.23
2014-15	136,746.40	127,846.15	8,900.25
2015-16	102,669.33	95,664.15	7,005.18
Total	1,472,788.81	1,395,142.24	77646.54

Source: MOGE, 2018

Table (4.3) clearly indicates total production of natural gas produced by Yetagun Gas Field from 2006 to 2016 is about 1.5 million standard cubic feet (mmscf) and among them, 1.39 million standard cubic feet is exported.

c. Shwe Gas Field

The Shwe gas field is a natural gas field in Andaman Sea. It was discovered in 2004 and developed by Daewoo. It began production in 2013.

Table (4.4) Production and Consumption of Shwe Gas Field (MMSCF)

Year	Production	Exports	Domestic
2013-14	42,078.91	37,040.59	530.51
2014-15	137,428.71	127,963.03	6,795.33
2015-16	185,059.06	163,806.52	18,149.83
Total	364,566.67	328,810.13	25,475.66

Source: MOGE, 2018

Table (4.4) indicates that total production of natural gas produced by Shwe Gas Field from 2013 to 2016 is about 364 million cubic feet. 328 million cubic feet is about exported and 25 billion cubic feet is for domestic use. About 88% of gas is exported in 2013-14 fiscal year and also 88% of gas is exported in 2015-16 year.

d. Zawtika Gas Field

Zawtika natural gas project is located in Mottama offshore blocks M-9 which is operated by PTTEP. First gas is exported in July- December 2013. Agreement between MOGE and PTTEP International Limited and PTT Public Company Limited has been signed in June 2008.

Table (4.5) Production and Consumption of Zawtika Gas Field

Year	Production (MMSCF)	Export (MMSCF)	Domestic (MMSCF)
2013-14	985.66	0.00	618.17
2014-15	84,101.65	57,624.98	23,260.84
2015-16	115,529.31	84,030.90	27,762.79
Total	200,616.62	141,655.88	51,641.81

Source: MOGE, 2018

According to Table (4.5), total production of natural gas from Zawtika Gas Project from 2012 to 2016 is about 200 million cubic feet. Among this, 141 million cubic feet is exported and 51 billion cubic feet is for domestic use.

With regard to Table (4.2), (4.3), (4.4) and (4.5), the production rate from offshore gas projects is increased during these years, it is due to the technical improvement or workers' performance improve.

4.4 Oil and Gas Subsector

(a) Oil production

Myanmar was one of the earlier countries to have a national oil and gas industry in the Southeast Asia region. No new oil reservoirs were discovered in the last 20 years, and the production caliber per well is limited because of the natural depletion of reservoirs. The monthly oil production fell from about 1 million barrels in 1984 to about 0.2 million barrels in 2014. Furthermore, improvements from petroleum recovery contracts in some producing fields are not significant, resulting in a decrease in crude oil supply for the domestic market.

(b) Gas production

The discovery of large offshore gas deposits in the early 1990s led the government to export the gas partly due to low domestic usage at the time. Myanmar's production of offshore gas started in 1998 from the Yadana gas field, followed by the Yetagun gas field in 2000, the Shwe gas field in 2013, and the Zawtika field in mid-2014. The gas fields are explored and developed by private operators as shown in Table (4.6), and depending on the arrangement with operators, the allocation for domestic supply has been determined.

Table (4.6) Status of Key Operating Offshore Gas Fields in Myanmar

Phase	Gas Field	2P Reserves (TCF)	Block	Main Developer	Export	Domestic Supply (%)
Existing	Yadana	6.9	M-5, M-6	Total	Thailand	20
	Yetagun	4.2	M-12, M-13, M-14	Petronas	Thailand	0
Ongoing	Shwe	5.4	A-1, A-3	Daewoo	PRC	20
	Zawtika	1.8	M-9	PTTEPI	Thailand	20

Source: Myanmar Oil and Gas Enterprise, 2018

There are two gas export markets: the PRC and Thailand. The export to the PRC is from the Shwe gas field, which started in 2013 for 4.5 trillion cubic feet of gas over 30 years via an 870-kilometer (km) 40-inch gas pipeline financed and operated by the PRC. Export to Thailand started from the Yadana field in 1998. The total volume of gas export to the PRC and Thailand was 1,300 million cubic feet per day (MMCFD) in 2013.

(c) Gas price

The gas prices of Yadana are \$7/million British thermal units (MMBtu) (wellhead) and \$12–\$13/MMBtu (borderline). The gas prices of Shwe are \$7.73/MMBtu (wellhead) and \$15–\$16/MMBtu (borderline). In 2013, the export price to Thailand was \$10.30/MMBtu on average. Gas for power generation charged to Electricity Power Generation Enterprise (EPGE) increased from \$5/ MMBtu to \$7.50/MMBtu in 2013. Nevertheless, power sector users avail of subsidized gas prices while nonpower sector users pay \$11.20/MMBtu.

(d) Domestic gas supply

Myanmar Oil and Gas Enterprise (MOGE) supplies 250–300 MMCFD of natural gas to domestic consumers. Of this, about 60 MMCFD is from MOGE's onshore production. The remaining amount is from the Yadana gas field, operated by Total E&P; the Shwe gas field, by Daewoo International; and the Zawtika gas field, by PTT International. Yadana gas is priced at the same level as the export price to Thailand; Shwe and Zawtika gas is priced at the level set for the domestic market obligation. The domestic market obligation price is at a 10% discount of the contract price to foreign buyers. Consumers include EPGE for its power plants (run by both independent power producers [IPPs] and EPGE), other government industries, private industries, and compressed natural gas vehicles.

4.5 Energy Sector's Share on GDP

As natural gas and crude oil export become one of the major export commodities, energy sector's share of Myanmar's gross domestic product (GDP) is

also critical to study. Table (4.7) and (4.8) shows that the gross domestic product (GDP) at current and constant prices by Energy Sector.

Table (4.7) Share of Energy Sector in GDP (at Current Prices)

Year	Gross Domestic Product (Million Kyats)	Energy Sector Contribution on GDP (Million Kyats)	Energy Sector Contribution on GDP (in percentage)
2000-01	2,552,732.3	4,838.5	0.19
2001-02	3,548,472.2	5,389.7	0.15
2002-03	5,625,254.7	7,539.5	0.13
2003-04	7,716,616.2	8,607.6	0.11
2004-05	9,078,928.5	10,852.3	0.12
2005-06	12,286,765.4	20,075.7	0.16
2006-07	16,852,757.8	29,719.2	0.18
2007-08	23,336,112.7	48,159.0	0.21
2008-09	29,233,288.0	62,436.8	0.21
2009-10	33,894,039.1	72,445.9	0.21
2010-11	39,776,764.9	66,994.9	0.17
2011-12	46,307,887.7	2,241,424.3	4.84
2012-13	51,259,260.0	2,745,827.8	5.35
2013-14	58,011,626.0	2,919,975.0	5.03
2014-15	65,262,092.5	4,011,384.2	6.14
2015-16	72,780,464.5	3,687,504.4	5.07

Source: CSO, 2018

According to Table (4.7), the share of energy sector on GDP was significantly increased during 2010-2015 but slightly decreased in 2015-2016 year. Increase in GDP means that it takes an increase in demand by energy sector to grow the economy, and an increase in demand means an increase in income by energy sector. GDP decreases in 2015-2016 fiscal year due to recession within in country or energy resources depletion or technical error.

Table (4.8) Share of Energy Sector in GDP (at 2000 - 01 Year Constant Prices)

Year	Gross Domestic Product (Million Kyats)	Energy Sector Contribution on GDP (Million Kyats)	Energy Sector Contribution on GDP (in percentage)
2000-01	100,274.8	511.2	0.51
2001-02	2,842,314.4	5171.4	0.18
2002-03	3,184,117.3	6465.9	0.21
2003-04	3624926.4	7132.5	0.19
2004-05	4116635.4	7723.2	0.19
2005-06	4675219.6	9221.0	0.20
2006-07	13893395.3	22248.2	0.16
2007-08	15559412.8	23083.3	0.15
2008-09	17155078.1	24860.6	0.14
2009-10	18964940.4	24636.6	0.13
2010-11	39,776,764.9	66,994.9	0.17
2011-12	42000875.7	64234.6	0.15
2012-13	45080661.5	63390.1	0.14
2013-14	48879158.5	65283	0.13
2014-15	52785050.8	88821	0.17
2015-16	56476225.1	88366.9	0.17

Source: CSO, 2018

As consequences of the new gas fields of Shwe Project and Zawtika Project starting their production and exporting in 2010-11 fiscal year and the gas export value are significantly increased since 2010, the contribution of Energy Sector to GDP is significantly increased since 2010. The share of energy sector on GDP was 4,011.431 million kyats which was the highest with 6.14% of total GDP in the fiscal year 2013-14. Since the new offshore blocks are awarded in 2013, the development of oil and gas production, export and contribution to GDP has high potential to be increased when these new offshore blocs discover more natural gas and reach to production stage in next ten years.

Table (4.9) Annual Growth Rates of Energy Sector

Year	Annual Growth Rate in Percentage
2000-01	30.1
2001-02	6.9
2002-03	25.0
2003-04	10.3
2004-05	8.3
2005-06	19.4
2006-07	10.8
2007-08	3.8
2008-09	7.7
2009-10	-0.9
2010-11	-6.0
2011-12	-4.1
2012-13	-1.3
2013-14	3.0
2014-15	36.1
2015-16	-0.5

Source: CSO, 2018

According to Table (4.9), the annual growth rate of GDP from 2000 to 2009 is positive value, it means that the economy has grown during these years. But in 2009-2010 to 2012-2013 fiscal years, GDP falls from one year to the next year, and then growth is negative. Meanwhile, weak growth signals that the economy in energy sector is doing poorly. This often brings with it falling incomes from energy sector or lower consumption or production by energy sector. In 2013-2014 and 2014-2015 fiscal years, GDP turns positive, it means that economy in energy sector has grown. But in 2015-2016 fiscal year, GDP turns negative value, it possibly dues to the energy resources depletion, or technical assistance or revenues from energy sector is less than the previous year.

4.6 Natural Gas Consumption Sectors in Myanmar

The following table shows the detailed gas consumption sectors in Myanmar for the year 2015-2016. The finding in that main gas consumption is power sector and it is 64.5% and the second gas consumption is industrial sector, 19.5%. gas utilization for raw, transportation and cooking and others are 5.00%, 3.50 % and 7.50% respectively.

Table (4.10) Gas Consumption Pattern in Myanmar

No	Particular	Percentage (%)
1	Power	64.5
2	Industry	19.5
3	Raw	5.0
4	Transportation	3.5
5	Cooking and others	7.5

Source: MOGE, 2018

Nowadays, current production of natural gas is about 100% and among these, 65% is exported to Thailand, 23% is exported to China and the remaining 12% is consumed for local market.

Table (4.11) Natural Gas Exports and Local Market

Natural Gas Blocks	Production Rate (mmcf/d)	Exported to Thailand (mmcf/d)	Exported to China (mmcf/d)	Local Market (mmcf/d)
onshore	53.9088	-	-	53.9088 (100%)
Yadana	543	500 (92%)	-	43 (8%)
Yetagun	262	262 (100%)	-	-
Shwe	448	-	348 (78%)	100 (22%)
Zawtika	230	230 (100%)	-	-
Total	1536.9088	992 (65%)	-	196.9088 (35%)

Source: Oil and Gas Planning Department, 2018

Table (4.11) indicates that natural gas export market is greater than local market. It possibly means that the production of natural gas is being sufficient for domestic consumption, therefore it can be exported to other foreign countries and then

can get revenues form export market. The MOEE collects data on natural gas production by onshore and offshore gas field. The data collected includes the amount of production, export, sale, own use, flaring and venting, and loss in gas fields. Gas sales amount by clients has also been collected since 2012.

4.6.1 Indigenous Gas Production

Most of Myanmar gas is non-associated gas, whose production started in 2012. The stock data is available only after 2014, and venting and flaring data is available after 2011.

Table (4.12) Gas Production

Year	Indigenous Production		Exports	Opening Stock	Closing Stock	Gas Vented/ Gas Flared
	Of which Associated Gas	Of which Non-associated Gas				
2000	-	5,190.83	3,637.39	-	-	-
2001	-	8,268.52	6,870.87	-	-	-
2002	-	10,081.82	8,365.42	-	-	-
2003	-	10,522.26	8,620.17	-	-	-
2004	-	12,060.63	10,001.44	-	-	-
2005	-	12,387.74	10,440.24	-	-	-
2006	-	13,030.51	11,032.10	-	-	-
2007	-	13,494.26	11,307.60	-	-	-
2008	-	11,476.24	9,276.80	-	-	-
2009	-	12,441.10	10,580.61	-	-	-
2010	-	12,575.10	10,349.56	-	-	-
2011	-	13,157.77	10,329.08	-	-	17.55
2012	27.75	13,188.48	10,249.01	-	-	69.09
2013	13.65	13,635.77	10,547.13	-	-	112.27
2014	13.46	18,985.32	15,244.42	39.52	47.15	33.95
2015	19.94	19,683.40	15,790.16	47.15	42.72	27.81
2016	19.24	18,941.99	14,778.53	39.52	44.15	93.95

Unit million cubic meters

Source: MOEE, 2018

Table (4.12) states that associated gas produced starting from 2012 when non-associated gas produced since 2000. Both of these gases exported, and also available at opening and closing stock, gas vented and gas flared. The data slightly decreased from 2015 to 2016, it is possible that natural gas depleted therefore, production rate also decreased.

4.6.2 Natural Gas Consumption in Transformation and Energy Sector

Natural gas is used to generate electricity and produce LPG in Myanmar. It is also used in gas fields and refineries. However, data on the natural gas input in LPG plants and consumption in refinery is available only after 2012. The gas fields' own use and loss data can be traced back to 2011.

Table (4.13) Gas Consumption in Transformation and Energy Sector

Year	Transformation Sector		Energy Sector		
	Main Activity Producer- Electricity Plants	Gas to Liquid	Oil and Gas Extraction	Oil Refineries	Distribution Losses
2011	1,477.15	-	216.38	-	10.42
2012	1,622.52	24.37	217.51	56.03	0.82
2013	1,713.94	13.64	255.40	53.22	0.24
2014	2,437.08	15.06	408.67	37.16	-
2015	2,746.06	19.94	438.80	22.86	79.93
2016	3,144.26	19.24	470.96	25.42	0.49

Unit: million cubic meters

Source: MOEE, 2018

Table (4.13) shows that gas in electricity plant is consumed mostly. It also used in transforming gas to liquid. It can be used itself to extract oil and gas extraction, and oil refineries. But, there can be losses during natural gas distribution. Distribution losses decreases during these years, it is due to the technology improvement and more attempt is made to decrease distribution loss coming years.

4.6.3 Indigenous Natural Gas Consumption by sector

Natural gas is used in the industry, transport, and other sectors. Sector consumption data can be disaggregated after 2012. Moreover, the natural gas consumption of the construction industry is found to be by the cement and the brick production industries, it needs to be reclassified.

Table (4.14) Indigenous Natural Gas Consumption by Sector

Year	Indigenous Production					
	Iron and steel	Chemical and Petrochemical	Non-ferrous Metals	Non-metallic Minerals	Transport Equipment	Machinery
2012	17.06	226.92	1.77	8.14	2.03	5.12
2013	10.32	176.68	1.81	13.43	1.70	5.23
2014	11.18	161.68	2.17	7.95	1.28	5.28
2015	6.14	184.11	2.04	7.25	0.02	5.99
2016	7.49	134.57	1.98	6.45	0.07	5.88

Unit: million cubic meters

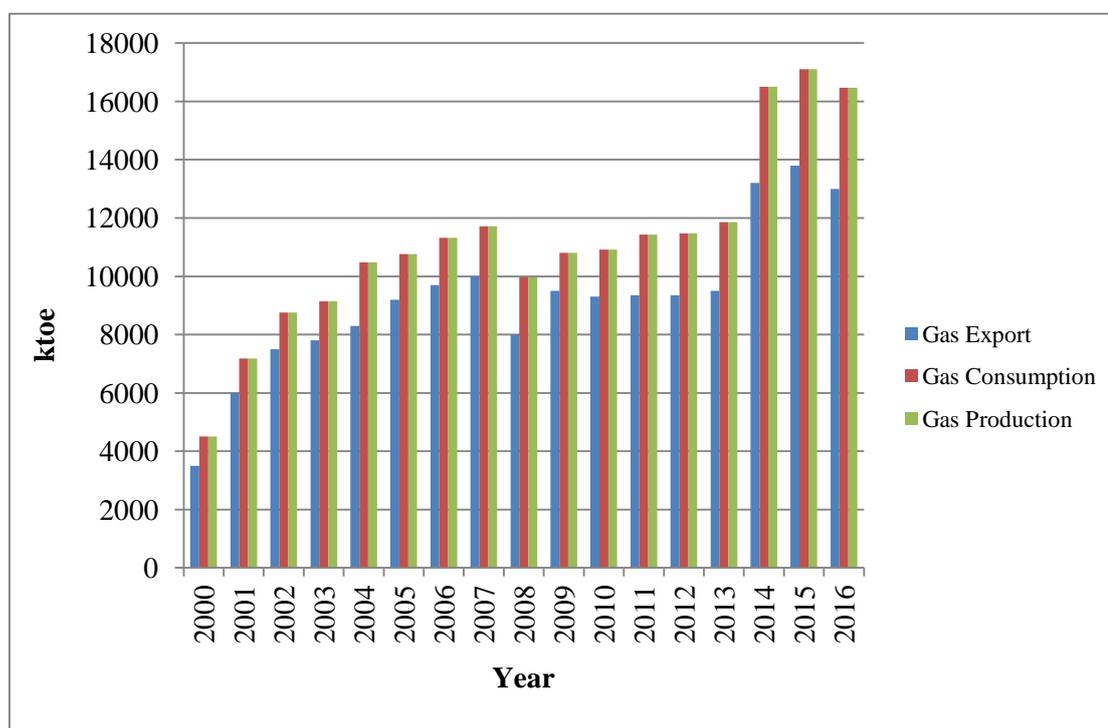
Source: MOEE, 2018

Table (4.14) indicates that indigenous natural gas production is consumed by iron and steel, chemical and petrochemical, non-ferrous metals, non-metallic minerals and machinery. Of these, chemical and petrochemical is most consumed.

4.7 Gas Supply and Consumption in Different Sectors

Figure (4.3) indicates Myanmar's gas export, production and consumption from 2000 to 2016.

Figure (4.3) Myanmar Gas Production and Use



Source: MOEE, 2018

Myanmar's gas production is mainly export to Thailand, which was almost 3,160 ktoe in 2000, about 70% of total gas production. Gas export increased around fourfold by 2016, reaching 12,834 ktoe. This exported gas is 78% of the total production of 2016.

Domestic gas consumption also significantly increased in 2000-2016, but more slowly than export. For gas export, the AAGR was 9.2% while for domestic gas consumption the rate was 6.6%. Domestic gas consumption increased from 1,300 ktoe in 2000 to 3,600 ktoe in 2016. Figure shows the country's gas production and its use domestically and for export.

Gas is consumed domestically in the transformation and the final sectors. Gas is used in the transformation sector for power generation, gas processing plants, and own use. In the final sector, gas is consumed by industries, vehicles, and commercial buildings.

Most of the gas used domestically is for power generation. Power generation share in total consumption was 62% in 2000 and increased to 76% in 2016. The industry sector was the second major use of the gas domestically. Its consumption, however, decreased from around 400 ktoe in 2000 to 265 ktoe in 2016. In contrast, gas use in the road transport sector increased, especially in Yangon. The services/commercial sector has started to use gas since 2012. Table (4.15) shows Myanmar's gas supply and consumption.

Table (4.15) Gas Supply and Consumption in Different Sector

Year	Estimated Gas Supply	Gas Consumption	Electricity Plant	Gas Processing	Own Use	Industry	Transport	Services
2000	1,349.01	1,297.18	806.72	0.00	92.65	395.99	1.82	0.00
2001	1,213.72	1,112.08	714.31	0.00	147.58	248.39	1.80	0.00
2002	1,490.53	1,360.53	827.94	0.00	179.94	350.97	1.69	0.00
2003	1,651.78	1,451.51	950.90	0.00	160.78	338.00	1.83	0.00
2004	1,788.21	1,653.39	1,080.29	0.00	182.53	386.88	3.68	0.00
2005	1,691.21	1,484.72	1,000.63	0.00	185.89	262.81	35.39	0.00
2006	1,735.42	1,687.05	909.52	0.00	232.57	462.46	82.50	0.00
2007	1,898.90	1,892.16	1,014.51	0.00	240.84	518.52	118.28	0.00
2008	1,910.00	1,932.56	976.81	0.00	204.83	603.32	147.60	0.00
2009	1,615.65	1,409.27	566.40	0.00	222.02	457.08	163.77	0.00
2010	1,932.66	1,912.24	1,013.16	0.00	224.44	501.63	173.01	0.00
2011	2,456.43	2,316.12	1,282.75	0.00	196.95	660.33	176.09	0.00
2012	2,576.73	2,240.98	1,409.00	21.16	238.26	392.80	165.28	14.48
2013	2,694.03	2,422.61	1,488.39	11.85	268.21	475.23	178.28	0.65
2014	3,253.66	3,089.90	2,116.36	13.08	387.15	391.40	181.24	0.67
2015	3,402.05	3,370.49	2,384.68	17.31	470.32	330.33	167.33	0.52
2016	3,631.01	3,608.40	2,730.47	16.71	431.38	264.90	164.40	0.44
AAGR	6.38	6.60	7.92	-5.74	10.09	-2.48	32.51	-5.74

AAGR= average growth rate, ktoe= kilo ton of equivalent

Source: MOEE, 2018

According to Table (4.15), about 96.2% of gas is consumed by different sectors. Of these portions, 62% is for electricity plant, 30.5% is for industry sector and only 0.14% is for transportation sector. In 2016, gas consumption is about 99% by different sectors and among these portions, 75.67% is used in electricity plant, 0.5% for gas processing, 12% is for own uses, 12% is for industry sector, 4.5% for transportation sector and 0.01% is for services. Therefore, more gas is consumed during these years and electricity plant uses more gas than other sectors. This is because in order to increase livelihood of the citizens, electricity sector should be improved year by year, so more gas need to be used in this sector.

4.8 Crude Oil Supply and Consumption

Crude oil production consists of oil from the oil wells owned by MOGE and some small wells. Lack of detailed data on the transformation of input to output in small wells assumes that small well oil production is equal to direct use. In addition to oil production, the imports, exports, stock and refinery intake are also reported by MOGE. However, stock data is not always consistent and needs to be adjusted.

Table (4.16) Crude Oil Supply and Consumption

Year	Indigenous Production	Imports	Exports	Direct Use	Stock at Opening	Stock at Closing	Refinery Intake
2000	415.96	647.11	-	-	-	-	1057.18
2001	591.03	538.22	167.24	-	75.68	41.23	986.26
2002	820.06	470.27	167.81	-	41.23	59.95	1,056.14
2003	931.26	-	-	-	59.95	44.63	965.36
2004	994.24	-	57.47	35.18	44.63	57.05	909.14
2005	1,061.47	-	163.27	8.99	57.05	52.47	866.99
2006	996.80	-	111.48	13.40	52.47	91.81	852.14
2007	1,012.75	-	141.74	18.33	91.81	85.27	857.31
2008	906.83	-	-	28.37	85.27	100.18	825.07
2009	870.26	-	94.03	23.34	100.18	62.83	797.71
2010	927.93	-	-	21.53	62.83	56.00	882.46
2011	840.39	-	-	41.26	62.94	87.97	827.04
2012	821.08	-	139.52	25.22	54.23	26.63	689.58
2013	837.73	-	235.64	36.97	26.99	23.58	551.79
2014	801.46	-	240.59	80.30	39.52	53.89	555.46
2015	652.77	-	148.58	75.66	50.44	82.24	427.83
2016	600.89	-	144.06	76.67	83.94	82.56	414.16

Unit: MT (metric ton)

Source: MOEE, 2018

Myanmar's production of crude oil (including natural gas liquid) was 420 ktoe in 2000 and reached 607 ktoe in 2016, increasing at an average growth of 2.3% per year. The crude produced was exported and consumed domestically in refineries. Myanmar also imported crude to its refineries to meet the petroleum product requirement off the country. Although crude oil production increased in 2000-2016, the total crude oil supply decreased from 1,068 ktoe in 2000 to 461 ktoe in 2016 at an average rate of -5.1% per year.

4.9 Expected and Actual Production in Crude Oil and Natural Gas

The production of crude oil and natural gas from underground reservoirs involves chemical and mechanical processes that affect the wellbore. Many of these processes can eventually cause a problem with the well, resulting either in a decrease in production or in failure of equipment installed down hole or at the surface. Table (4.17) and (4.18) show the expected and actual production rate of crude oil and natural gas.

Table (4.17) Crude Oil Sector (ktoe)

Year	Expected Production (ktoe)	Actual Production (ktoe)	Percentage (%)
2011-12	6,619	6,623	100.06
2012-13	6,563	6,197	94.42
2013-14	6,327	6,118	96.70
2014-15	6,128	5,851	95.48

Source: MOGE, 2018

Table (4.17) clearly states that, in 2011-12 fiscal year, 6,619 ktoe is expected to produce while in reality, 6,623 ktoe can be produced, about 100.06%. In 2014-15 fiscal year, 6,128 ktoe is expected but 5,581 ktoe can be produced, about 95.48%. production rate is slightly decreased during these years.

Table (4.18) Natural Gas Sector (ktoe)

Year	Expected Production (ktoe)	Actual Production (ktoe)	Percentage (%)
2011-12	454,616	455,393	100.17
2012-13	454,392	452,538	99.59
2013-14	569,859	465,120	81.62
2014-15	714,109	653,157	91.46

Source: MOGE, 2018

Table (4.18) clearly states that, in 2011-12 fiscal year, 456 ktoe is expected to produce while in reality, 455 ktoe can be produced, about 100.17%. In 2014-15 fiscal year, 714 ktoe is expected but 653 ktoe can be produced, about 91.46%. production rate is slightly decreased during these years.

According to Table (4.17) and (4.18), crude oil and natural gas production rate is slightly decreased from 2011 to 2015. This may be because crude oil and natural gas deposits are depleted over time as they are non-renewable energy resources.

CHAPTER V

CONCLUSION

5.1 Findings

As Myanmar is the developing country for economic and social progress inevitable involves the basic problem of the most rational use of limited resources such as labor, managerial and administrative talent, capital foreign investment and natural resources, to yield the best economic result. Myanmar has large quantity of natural resources. It was one of the world's oldest producers and the first Myanmar Crude Oil was exported in 1854. Myanmar oil industry was developed during the region of King Mindon. After the whole Myanmar was annexed by the British in 1886, Burma Oil Company (BOC) was established and started to control Myanmar Oil Industry. Later, Rangoon Oil Company (ROC) the first foreign Company was established and carried out the refining and marketing.

Natural Gas is the most reliable energy industrial sector in the world. In view of increase in population and economic development in the country, the demand for future energy problem and environmental affairs, the use of Natural Gas will be increased in the future.

Myanmar Oil and Gas Enterprise have entered into PSC contracts with multinational companies for natural gas exploration and production in both onshore and offshore areas. The government has formulated and implemented energy policies which were seek to sustain the momentum in energy exploration and development.

Natural gas from Myanmar offshore especially deep and shallow offshore projects are in apposition to sell to the neighbor countries gained export earning as well as the domestic use at home country. A statement of the Ministry of National Planning and Economic Development issued that the export of natural gas in the financial year 2007-08 has increased up to 25% and that is the 40% of the total export of the country.

Regarding the contribution of energy sector to GDP, the ratio of net value of output from energy sector to total GDP is small. However, as studying from the data,

the contributions of energy sector to GDP have been increasing year by year. Therefore, to achieve all round economic development, the roles of energy sector have been increasingly important.

With the opening of the markets, the demand for crude oil is being increased in Myanmar and it is planned to meet the increasing demand by importing crude oil. Moreover, MOGE invite the other investors to fulfill investment and technology for finding new oil fields and current crude oil production sustainability which is the aim for not to decline the crude oil production.

Although Myanmar is rich in oil and gas, and these resources have been exporting over a decade, how revenue from the sales of gas resources are spent is not known. It is also important to ensure transparency and sound management of the country's largest source of foreign's income-revenues from the export of oil and gas.

5.2 Suggestions

In Myanmar, technical assistance and international corporation is necessary to enable Myanmar to achieve sustainable energy development while meeting its international obligations. In particular, effort should be made to promote cooperation with international organization for assistance and support in policy analysis and capacity building capabilities for regional energy, environment and sustainable development programmes.

Myanmar has abundant energy resources and measure is yet to be taken to utilize systematically in order to have a sustainable development. In order to meet the challenges of the energy growth in the future, oil and gas sector should be laid and pursued. New policy guidelines should be: to invite foreign investment more and should review investment laws and regulations to facilitate smoothly; to generate and substitute other energy resources to fulfill crude oil shortage; and to promote efficient utilization of energy and impress on energy conservation.

The government has formulated and implemented energy policies which were to sustain the momentum in energy exploration and development. Policies should also promote private sector participation at the same time. Foreign companies can assist in providing much needed investment and technological improvements for exploration and production of crude oil and natural gas. It can also promote the exploration and development by crude oil and gas for energy sector.

The increase in production of oil and gas, promoting the foreign investment more in line with investment laws and enhancing efficiency utilization of energy and carrying out the future plan regarding energy extraction will support the future economic development of Myanmar. But developing energy sector of the country, it is believed that the country will get a large role in the region in supplying the energy to neighbouring countries. On the other hand, the local energy requirements to the development of the country will be covered from these present and upcoming projects. It is suggested to meet the future energy demand that need develop all round sectors achievements in Myanmar.

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