Research Journal of Applied Sciences, Engineering and Technology 7(17): 3522-3528, 2014
DOI:10.19026/rjaset.7.704
ISSN: 2040-7459; e-ISSN: 2040-7467

Submitted: October 25, 2013 Accepted: November 19, 2013 Published: May 05, 2014

Research Article

A Comparative Study of Liquefied Natural Gas: An Overview

Muhammad Khan Memon, Saleem Qadir Tunio, Khalil Rehman Memon and Arshad Ahmed Lashari
Petroleum Engineering Department, Universiti Technologi PETRONAS, Bandar Seri Iskandar 31750, Tronoh Perak Darul Ridzwan, Malaysia

Abstract: Natural gas is the world's fastest growing fuel and being produced by many countries of the world in the commercial quantities. Increasing natural gas price and new development in the technologies, liquefied natural gas industry is economically attractive in the major gas exporting countries. Liquefied Natural Gas (LNG) is an important energy source and continued to contribute the growth of natural gas industry. The new advance LNG technology is used for natural gas transportation for long distances. LNG can be transported by the large insulated cryogenic tankers at affordable cost. This study presents an overview of LNG liquidation facilities from natural gas as feed gas to LNG storage and transport. The main objective of the study is to highlight the current data for reviewers on LNG world market, mainly on LNG production, supply, demand, price and new development of LNG plants. The technology is growing gradually with increasing number of LNG consuming countries in overall the world. In the near future, LNG price may be affected by the advanced shale gas production in the United States of America and China. Australia becomes the world second largest exporter of LNG market after Qatar. Australia will increase LNG supply by 15 Bcf/day from 2014 and accounting for 25% of world LNG production by 2030. Global LNG production forecast will be reached 540 Bcm by 2020 and LNG trade will be reached 425 Mtpa by 2025. New countries are interested to enter in the LNG world market as importers and exporters.

Keywords: Energy, export, liquefied natural gas, LNG trade, natural gas

INTRODUCTION

LNG fundamentals: The first LNG was imported in limited quantity by Japan in 1960. The LNG technology was developed in Japan after oil shocks of 1970 (Small, 2005). With increasing demand for the clean burning fuel, LNG projects are increasing globally. Nigeria, Norway, Egypt, Trinidad and Qatar imported the LNG from their new plant worldwide. In the year 2000-2010 it was approximately doubled 175 Mtpa. A single train LNG plant may cost 1.5 billion USD and consume 6 to 8% of the inlet gas as fuel. Impurities such as Carbon dioxide (CO_2), Hydrogen Sulfide (H_2S), Water vapor and heavier hydrocarbon compounds in natural gas must be removed. Therefore the natural gas (feed gas) must go through a series of pretreatment steps. This can prevent the damage to liquefaction equipment and meet the specification of customer (Choi, 2010).

LNG processes: When the distance between source and customer is too long (for example 1500 km by sea or 5000 km over land), it is uneconomical to transport the Natural Gas in its original form. Therefore, the Natural Gas (feed gas) is then compressed as Liquefied Natural Gas by injecting at high pressure. Feed gas must be free from condensates, impurities and heavier hydrocarbons. The feed gas is further cooled under refrigeration process at temperature between -159 to -162°C. At this temperature the gas condenses to a liquid state completely. Flashed vapors and boil off gas are recycled within the process (Mokhatab and Economides, 2006). The pressurized LNG is further sub cooled in one or more stages to facilitate storage at slightly above atmospheric pressure. Compared to gaseous state, LNG which is in liquid form only takes up about 1/600 spaces needed by the natural gas (MEO Australia, 2013). LNG is converted to its gaseous state (natural gas) through a re-gasification facility at a receiving terminal where this energy source can be supplied through the pipeline. Figure 1 presents the flow diagram of LNG processes by Barclay and Shukri (2005).

LNG storage and transportation: The capacity of LNG storage is based on the volume of tanker plus four day production. Storage is the expensive item for LNG plant. Majority of LNG tankers having capacity of approximately 140000 m^3 were built during the year 2000-2010. They carry the gas 3.1 Bscf (87 million m^3) or 512000 BOE. Super LNG tankers having capacity of 265000 m^3 were designed for long trade from Qatar to United States of America. In order to meet the

Corresponding Author: Muhammad Khan Memon, Petroleum Engineering Department, Universiti Technologi PETRONAS, Bandar Seri Iskandar 31750, Tronoh Perak Darul Ridzwan, Malaysia

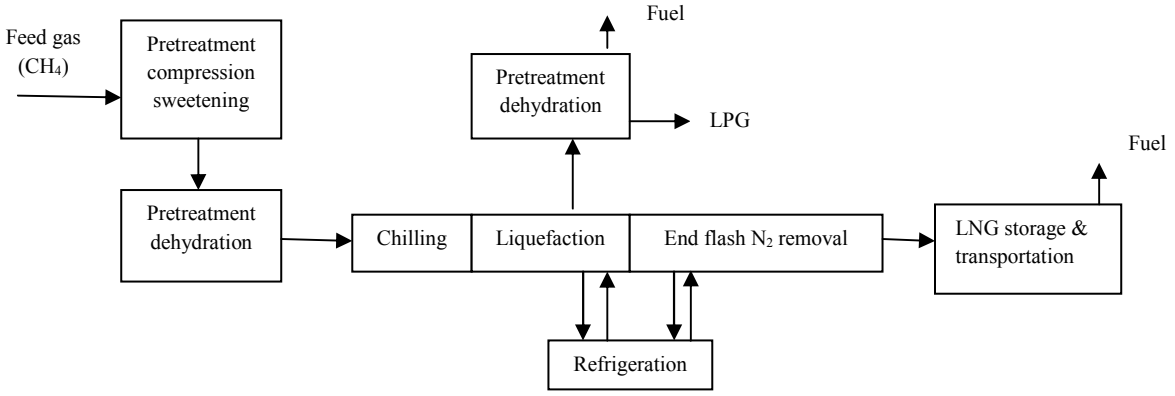

Fig. 1: LNG processes (Barclay and Shukri, 2005)

requirement of tanker load, most of the LNG plants having two or more storage tanks (Choi, 2010). The LNG physical properties allow for its long distance transport from one country to another by ship across ocean to markets and its local distributions. Reducing the LNG transportation costs using cargo ships is an advantage over the construction of long distance pipeline. LNG storage in the tankers is the solution of underground gas storage where geological subsurface conditions are not suitable. LNG storage in the tankers can reduce the cost of gas supply through long distance pipeline (Mokhatab and Economides, 2006).

LITERATURE REVIEW

Worldwide LNG industry: In this study, some countries are selected for comparative study on LNG industry. The main objective of the study is to highlight the current data for reviewers on LNG world market, mainly on LNG production, supply, demand, price and new development of LNG plants.

United States of America (USA): USA exported the LNG and natural gas to the Mexico and other countries of the world. Table 1 presents the LNG and Gas exported by the USA to the countries in 2012. In March 2013, USA exported the LNG to the Mexico (19 Mcf) and Canada (4 Mcf). Also, Natural Gas was supplied through the pipeline to the Mexico (56107 Mcf) and Canada (92889 Mcf) in the same month (US Energy information Administration, 2013).

The first LNG shipment from USA to Asia is expected by the end of 2015, after completing the first four trains of Sabine Pass. USA will export the total LNG capacity of 18 Mtpa by 2018. Sabine Pass USA, LNG with capacity of 26.8 Bcm will be expected to complete in 2015. Freeport (14.5 Bcm) and Lake Charles (20.7 Bcm) will be completed in 2015 (Qatar LNG to Asia, 2012).

Qatar: Qatar is the world's foremost LNG exporter. Nearly 3600 Bcf of LNG was exported to the United Kingdom, Japan, South Korea and India in 2011. In 2012, about 15.7 MT LNG was exported to Japan and 10.8 MT to South Korea. About 63% LNG from Qatar

Table 1: LNG and gas export by USA in 2012 (US Energy Information Administration, 2013)

LNG export (Mcf)		Natural gas export (Mcf)	
Brazil	8154	Canada	970846
India	3004	Mexico	619802
Japan	14379	Total	1590648
Portugal	2618		
Canada	2		
Mexico	153		
Total	28298		

was exported to Asian countries including Japan. On demand side seven importing countries out of 26 (China, Japan, South Korea, India, Taiwan, Spain and United Kingdom) attracted 81% of total LNG (US EIA Qatar, 2013; GIIGNLG, 2012).

According to the published data in January 2013 by Oil and Gas Journal, Qatar holds 13% of total world gas reserves (890 Tcf). This is the third largest total gas reserves in the world behind Russia and Iran. The major gas reserves are located in the offshore North field. This field is the key to Qatar's natural gas development and production plans (US EIA Qatar, 2013).

Qatar will maintain LNG export for next few years. New exporter competitors such as Australia, North America, Africa and Mediterranean push ahead with new LNG market and they will target Asian customers with new LNG prices (Qatar LNG to Asia, 2012).

Australia: Australia is a leader in CBM-to-LNG development. Estimated gas reserves are 3.8 Tcm including 400 Bcm of Coal Bed Methane (CBM) or Coal Seam Gas (CGS). CBM production is driven mostly by LNG export projects. Australia is the most growing LNG producer in the world. The LNG production will reach 75.8 Bcm/year by 2016. This is the world's second largest LNG exporter after Qatar. Australia will be in the position to export LNG with capacity between 60-100 Mtpa by 2020 (Qatar LNG to Asia, 2012). LNG production capacity from North West shelf Darwin is 19.6 Mtpa (26.7 Bcm). The production capacity of Pluto LNG train is 6.5 Bcm. Gorgon LNG production capacity of 6.8 Bcm will be expected to complete by 2014. Prelude LNG terminal is the world's first floating LNG terminal and will be started with

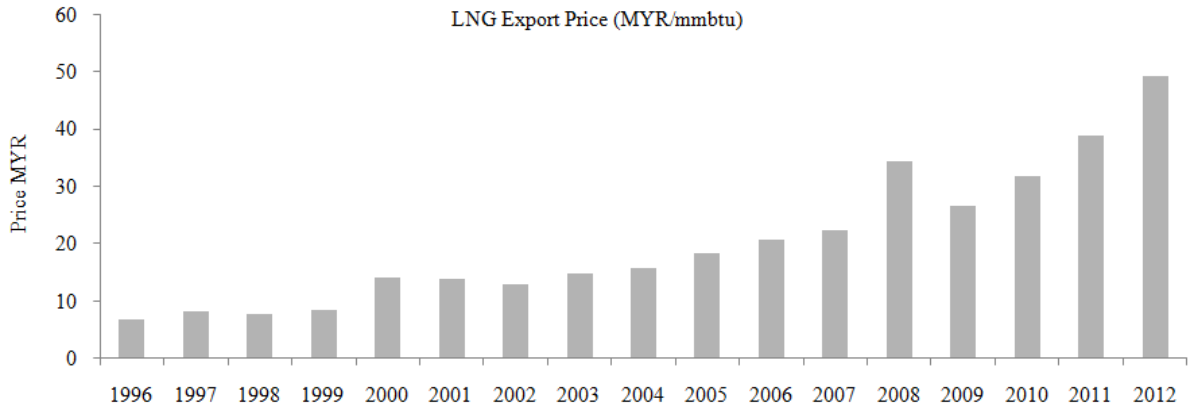

Fig. 2: LNG export price in Malaysia (Kuncinas, 2013; Koh, 2013)

capacity of 4.9 Bcm in 2017. Gladstone LNG project with capacity of 10.6 Bcm will be expected to compete in 2015 (International Energy Agency, 2011).

Russia: Russia is the largest gas supplier through pipeline (The Voice of Russia, 2012). A new LNG plant study was carried out by Japan and Russia. Vladivostok with producing capacity of 6.8 Bcm will be constructed from 2017. Sakhalin 1, 2 (Train II) and 3 with capacities (7.5, 6.5 and 7.5 Bcm, respectively) will be expected to start in 2015. Yamal LNG project with capacity of 20.4 Bcm will be started in 2017. Shtokman LNG project with capacity greater than 10.2 Bcm will be started in 2018 (International Energy Agency, 2011).

Singapore: Singapore has no domestic gas production. Natural gas was imported from Malaysia through pipeline since 1992. In 2010 the gas consumption was 8.7 Bcm. Singapore LNG Corporation (SLNG) built and operated its own LNG terminal with storage capacity of 4.1 Bcm. In the year 2010, the Singapore Energy Market Authority has announced the third storage tank with capacity of 4.1 Bcm at the SLNG terminal. The storage capacity of this terminal will be doubled (8.2 Bcm) in 2014 (OECD/IEA, 2013).

Malaysia: LNG in Bintulu was the first major gas project in Malaysia started in 1983. This was the first world scale LNG project. The project was a joint venture between PETRONAS, Shell Gas BV and Mitsubishi Corporation of Japan (Abdullah, 1998). Major importers of Malaysia's LNG are Japan, Korea and Taiwan. In 2009, Malaysia was the world's second largest exporter of LNG. However, declining the gas recovery from existing fields and rising demand from country's power plant, industries, positioned Malaysia one step back in the world. Malaysia exported over (1 Tcf) of LNG in 2010 (10% of the world LNG export). In 2010 Malaysia was the third largest LNG export country in the world (OECD/IEA, 2013). Malaysia's overall LNG production capacity stands at 25.7 Mtpa. Malaysia aims to be Asia's leading hub in LNG production and business. Figure 2 presents the Malaysia's LNG export price. The LNG price was increased from 1996 to 2008. The price was shown decline in 2009, due to the infrastructure development and re-gasification projects initiated by the PETRONAS (Kuncinas, 2013; Koh, 2013). Malaysia is on one step closer to become the world's largest LNG producer.

The largest LNG complex in the world was facilitated at Bintulu Sarawak Malaysia. Total liquefaction capacity of this LNG complex was 1.7 Tcf/year from eight production trains. The ninth LNG train will be added to Bintulu Sarawak Complex on Borneo, announced by PETRONAS in February 2012 (OECD/IEA, 2013). The capacity of ninth train will be 3.6 million tones/year and bring the total capacity at the site to 27.6 million tones/year. The plant will start at the end of 2015. The feed gas for the new train will be produced by offshore fields of Sarawak (Oil and Gas Journal, 2013).

The first LNG re-gasification terminal to receive and store LNG with two floating storage units (Tenaga Empat and Tenaga Satu) is located at sungai udang port in Melaka Malaysia. The terminal linked with Jetty re-gasification unit and will start this year. The maximum capacity of this terminal is 3.8 mmtpa. For import and re-gasification of LNG a new LNG terminal project by PETRONAS is under construction at Pengerang, Johor. The terminal capacity is 3.8 mmtpa. This terminal will be expected to complete in 2016 (The Edge Malaysia, 2013; Petronas Malaysia MLNG, 2013; GIIGNLG, 2012).

A new Asia's largest LNG trading hub will be established with US$1.3 billion at Pengerang Integrated Petroleum Complex in Malaysia. This terminal will allow multiple LNG users to store and trade the product and will be the first independent LNG terminal in the Asia by 2020 (PETRONAS Malaysia MLNG, 2013).

PETRONAS Malaysia signed some of the LNG import agreements to meet the increasing domestic gas market demand. First agreement was signed in May 2011 with France's GDF Suez for 2.5 MT of LNG over the period of 3.6 years. The second agreement was signed with Qatar Gas for the LNG supply 1.5 mmtpa

for over 20 years, started from 2013. Third agreement was signed with Australia for LNG supply 3.5 mmtpa (Malaysian Insiders, 2013; Kuncinas, 2013).

Other countries: Japanese companies planned to build new LNG project at the southern coast of Alaska with LNG producing capacity of 20 mtpa. Japan will implement this LNG project by 2018 (The Voice of Russia, 2012).

Due to increase in domestic demand, Indonesia is reducing LNG export from traditional LNG Trains. Masela LNG Train 1 and 2 with their storage capacity of (3.4 and 2.7 Bcm) will be started in 2018 (International Energy Agency, 2011). United Kingdom import LNG 10.5 MT in 2012. It has four import terminals with total capacity of 38mtpa (Spomer, 2013). To become LNG exporter Israel need more time. An estimated gas reserves from Tamar and Leviathan field offshore Israel's coast will lead to develop their own LNG project. Estimated gas reserves from both fields are 240 and 450 Bcm (International Energy Agency, 2011).

LNG trade worldwide: Before 1990, the total trade of LNG was 53 MT. Only eight importers and eight exporters countries were in the LNG market with 70 LNG vessels in operation. Today the LNG trade scenario is changed and it is increased five times of total supply of 1990. The technology improved with new shipboards, terminals, re-gasification, floating production, large capacity cargo in the new LNG markets worldwide. 25-26 importers and 18 exporting countries were delivered about 240 million tonnes of LNG worldwide in the year 2011-2012 through 365 ships. Number of countries is increasing in the LNG market globally (Walker, 2013; Hill, 2013).

The world largest LNG producing region is the Asia-Pacific. It includes the LNG export/import along the Pacific Rim (including Alaska) and in South Asia (including India). Atlantic Basin includes LNG export/import in Africa, Europe and the Western Hemisphere (Small, 2005). Asia consuming more gas and demand is increasing continuously. According to the published report, LNG imports to Asia in May 2011 were 20.4% more as compared to May 2010. Asia will require 100 million tonnes of LNG by 2020 (LNG World News, 2013). China and Japan are main customers of LNG. Both countries import natural gas from other countries (Tran *et al*., 2012). New Gulf Coast terminals are expected for more than 70% of United States of America terminal by 2025 (Harrison *et al*., 2006). Table 2 presents the LNG export and import business by different countries of the world in 2011.

The LNG traditional market all over the world is increasing continuously. The LNG global supply ratio

Table 2: LNG export and import in 2011 (IGU, 2011)

Countries	LNG export (MT)	Countries	LNG import (MT)
Qatar	75.5	Japan	78.8
Malaysia	25	Korea	35.8
Indonesia	21.4	UK	18.6
Australia	19.2	Spain	17.6
Nigeria	18.7	China	12.8
Trinidad	13.9	India	12.7
Algeria	12.6	Taiwan	12.2
Russia	10.5	France	10.7
Oman	7.9	Italy	6.4
Brunei	6.8	USA	5.9
Yemen	6.7	Turkey	4.6
Egypt	6.4	Belgium	4.5
UAE	5.9	Argentina	3.2
Guinea	4.0	Mexico	2.9
Peru	3.8	Chile	2.8
Norway	2.9	Canada	2.4
USA	0.3	Kuwait	2.4
Libya	0.1	Portugal	2.2
Total	241.6	UAE	1.2
		Greece	1.0
		Dom. Rep	0.7
		Thailand	0.7
		Brazil	0.6
		Netherlands	0.6
		Pureto Rico	0.5
		Total	241.8

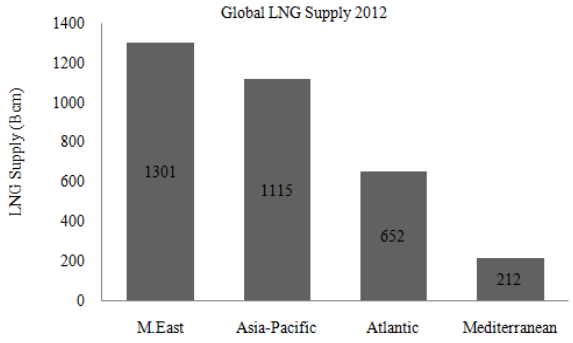

Fig. 3: Global LNG supply 2012 (Stream LNG, 2012)

was estimated as 4.5%/year up to 2030. LNG will contribute 25% of global supply in the period of 2010-2030. Australia will increase LNG supply by 15 Bcf/day from 2014 and accounting for 25% of global LNG production by 2030. Proved gas reserves were estimated about 6609 Tcf in 2010. Shale gas and CBM will account for 63% of North American production by 2030. Growth of shale gas rises the prospect of LNG exports from North America by 2030 (BP Statistical Review, 2012; BP Energy Outlook, 2013). Figure 3 and 4 presents the world LNG supply and demand in 2012.

International Energy Agency (IEA) (2011) estimated that, unconventional gas (production of shale gas) will increase about 25% of the world's gas supply by 2035 (Ernst and Young global energy LNG, 2013). Anadarko Petroleum and Eni agreed for cooperative development program of adjoining offshore areas of Mozambique in December 2012. Good source of gas in

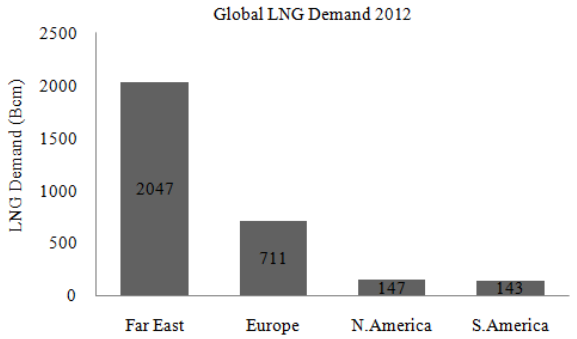

Fig. 4: Global LNG demand 2012 (Stream LNG, 2012)

place (more than 110 Tcf) has been estimated in the offshore Mozambique. Both companies will plan and construct a general onshore LNG liquefaction/export facility (IHS Global Insights, 2012).

LNG trade should be facilitated in those countries having limited source of natural gas. It is therefore suggested to make the better policies for the customer countries for long time period. In this case the LNG price will be stable for long time.

FUTURE WORLD LNG PROJECTS

Some of the world LNG projects are highlighted in this study. Few of these projects are increasing their current LNG capacity. The first CBM-TO-LNG project by Australia will start the production with capacity 11.6 Bcm in 2014. In Russia, Gazprom planning new LNG project with increasing capacity from 29 Bcm by 2020 to 60 Bcm by 2030. Another project Yamal Peninsula Russia contains 11.7 Tcm of gas reserves the gas production will be expected 185-220 Bcm by 2030. Prelude LNG project Australia with capacity of 4.9 Bcm will complete in 2017. The project is operated by shell. Queensland Curtis LNG Australia led by BG, CNOOC, Tokyo gas with capacity of 11.6 Bcm will start in 2014. Gladstone LNG Australia led by Santos Australia with capacity of 10.6 Bcm will complete in 2015. Gorgon LNG project in Australia led by Chevron, Shell, Exxon Mobil with capacity of 20.4 Bcm will be completed in 2014. Papua New Guinea LNG project with capacity of 9.0 Bcm will be completed in 2014 (International Energy Agency, 2011). The project is operated by Exxon Mobil and Oil search. Donggi Senoro LNG Indonesia led by Mitsubishi, Pertamina KOGAS will start production in 2014. Angola will start LNG production with capacity of 5.2 Mtpa and adding 3.4 million tonnes LNG supply during this year. New import LNG terminals are going to start in Malaysia (LNG re-gasification terminals in Melaka, Pengerang and Tawau), Singapore and Israel (BG Group, 2013; Finance Malaysia Blogspot, 2013; MGA, 2013). Delta Caribe Oriental 1, 2 and 3 LNG project Venezuela with total capacity of 18.2 Bcm will be started in 2015. Kitimat LNG project Canada with capacity of 7.2 Bcm will start in 2015 (International Energy Agency, 2011).

The suggested LNG export projects of North America and East Africa are well conditioned against the LNG projects of Greenfield Australia. This was reported by the analysts at Credit Suisse. They analyzed the price with unit costs averaging less than US$ 2000 per tonne as opposed to Australian average of more than US$ 3000 per tonne (Credit Suisse, 2012). If spot prices remain under the long term agreement therefore, America LNG price will be attractive. Analyst has been assumed that, American spot gas price will be about 5 to 6 US$ per million BTU (DB Research, 2012). For future America based cargos, few of the buyers from the Asia have begun to sign contracts already on the basis of Hennery hub linked prices. Spot prices increase buyer's choices. Flexibility increase in LNG contracts, re-exporting of cargos and other flexibilities to the buyers by the America LNG will contribute to greater linkages between markets and region. This will provide some convergence of regional prices for Asia customers (Macquarie Research, 2012).

According to the Douglas-Westwood, the capital expenditure of new LNG market is expected to grow $169 billion between 2012 and 2016. For the development of LNG import terminal, Asia will be the main investor during 2012-2016. Asia will invest about $31 billion on new LNG import terminals (Dormer, 2012). New discoveries make LNG export projects possible in the new regions of the world.

CONCLUSION

Due to decrease of global oil reserves and high oil prices, the strongest LNG demand will be increased globally. The world energy source LNG play an important role in the power generation due to its flexible prices. The technology is growing gradually with increasing number of LNG consuming countries all over the world. LNG is the only source of energy that can transport and provide in the cheap price from long distance to fulfill the demand by the countries of the world.

In the near future the most rapidly growing LNG producer in the world is Australia. After Qatar, the world second largest LNG exporter will be the Australia. Australia will increase LNG supply by 15 Bcf/day from 2014 and accounting for 25% of world LNG production by 2030.

Global LNG production forecast will be reached 540 Bcm by 2020 and LNG trade will be reached 425 Mtpa by 2025.

United States of America and China will minimize their LNG demand in the near future due to their domestic production of shale gas.

NOMENCLATURE

BOE = Billion of Oil Equivalent
Bscf = Billion Standard Cubic Feet

Bcf = Billion Cubic Feet
Bcm = Billion Cubic Meter
CBM = Coal Bed Methane
IEA = International Energy Agency
Mtpa = Million Tonnes per Annum
mmtpa = Million Metric Tonnes per Annum
MT = Million Tonnes
Tcf = Trillion Cubic feet
Tcm = Trillion Cubic Meter

ACKNOWLEDGMENT

We would like to acknowledge the Universiti Teknologi PETRONAS for supporting this research study.

REFERENCES

Abdullah, M., 1998. Trends for future gas supply planning for gas utilization projects in Malaysia. Proceedings of the SPE Asia Pacific Oil and Gas Conference and Exhibition. Perth, Australia.

Barclay, M. and T. Shukri, 2005. Enhanced Single Mixed Refrigerant Process for Stranded Gas Liquefaction. Retrieved from: http://www.fosterwheelerag.ch/publications/tech_papers/.

BG Group, 2013. Global LNG Market 2012-2013. Retrieved from: http://www.bg-group.com. (Accessed on: May 9, 2013).

BP Energy Outlook, 2013. BP Energy Outlook 2030. pp: 1-86. Retrieved from: www.bp.com/en/global/...bp/...energy-2013/energy-outlook-2030.html.

BP Statistical Review, 2012. BP Statistical Review of World Energy June 2012. pp: 1-48. Retrieved from: www.bp.com/.../bp.../statistical_energy_review.../statistical_review_of_worl.

Choi, M.S., 2010. LNG for petroleum engineers. SPE Proj. Fac. Const., 6(4): 255-263.

Credit Suisse, 2012. Credit Suisse Global Equity Research Global LNG Sector. Retrieved from: https://www.credit-suisse.com. (Accessed on: June 7, 2012).

DB Research, 2012. Deutsche Bank Markets Research, Global LNG. Google Search. Retrieved from: http://www. dbresearch.com/. (Accessed on: September 17, 2012).

Dormer, M., 2012. LNG Import and Export Growth to be Driven by Activity in the Pacific Basin. Douglas, Westwood, pp: 2016-2018. Retrieved from: www.douglas-westwood.com.

Ernst and Young Global Energy LNG, 2013. Will New Demand and New Supply Mean New Pricing? Retrieved from: www.ey.com/oilandgas. (Accessed on: April 6, 2013).

Finance Malaysia BlogSpot, 2013. IPO: Gas Malaysia. Retrieved from: http://financemalaysia.blogspot.com/2012/06/ipo-gas-malaysia.html. (Accessed on: June 3, 2013).

GIIGNLG, 2012. International Group of Liquefied Natural Gas Importers. Net Global LNG Trade Slides in 2012. Retrieved from: www.ogj.com. (Accessed on: June 10, 2013).

Harrison, M.C., P. Campbell, F.M. Coelho, C. Grecco, C. Ikeocha, X.T. Wang, M.J. Economides *et al*., 2006. Natural gas: Overcoming limitations toward energy supremacy. Proceeding of the SPE Annual Technical Conference and Exhibition. San Antonio, Texas, pp: 1-8.

Hill, S., 2013. LNG-Are The Dynamics Changing? BG Group. Retrieved from: files.the-group.net/library/bggroup/files/doc_392.pdf.

IGU (International Gas Union), 2011. Waterborne LNG Reports, US DOE, PFC Energy. World LNG Report 2011, Retrieved from: www.igu.org/gas-knowhow/.../igu.../LNG%20Report%202011.pdf.

IHS Global Insights, 2012. Anadarkes and Eni Sign Gas Deal With Mozambique Government Awards FEEO Contracts. (Accessed on: December 21, 2012).

International Energy Agency (IEA), 2011. Medium-term Oil and Gas Markets 2011. Retrieved from: http://www.iea.org. (Accessed on: May 5, 2013).

Koh, Q., 2013. Malaysia Aims to Become LNG Trading Hub Through New $1.3B Terminal. Retrieved from: http://www.rigzone.com. (Accessed on: March 15, 2013).

Kuncinas, P., 2013. Malaysia: Push for Liquefied Natural Gas. Borneo Post Online. Retrieved from: http://www.the borneopost.com. (Accessed on: March 14, 2013).

LNG World News, 2013. The Industry's LNG News Terminal. Retrieved from: http://www.lngworldnews.com. (Accessed on: May 5, 2013).

Macquarie Research, 2012. Macquarie Equity Research. Global LNG Outlook, (Accessed on: September 10, 2012).

Malaysian Insiders, 2013. Malaysia Imports LNG in Struggle to Eliminate Subsidies. Retrieved from: http://www.themalaysianinsider.com. (Accessed on: February 23, 2013).

MEO Australia, 2013. Liquified Natural Gas. Retrieved from: http://www.meoaustralia.com. (Accessed on: Feburary 15, 2013).

MGA (Malaysian Gas Association), 2013. The Gas Industry in Malaysia. Retrieved from: http://www.malaysiangas.com. (Accessed on: June 3, 2013).

Mokhatab, S. and M.J. Economides, 2006. Onshore LNG production process selection. Proceeding of the SPE Annual Technical Conference and Exhibition. San Antonio, Texas, pp: 1-11.

OECD/IEA (International Energy Agency), 2013. Developing a Natural Gas Trading Hub in Asia: Obstacles and Opportunities. Retrieved from: http://www.iea.org. (Accessed on: May 5, 2013).

Oil and Gas Journal (OGJ), 2013. International Group of LNG Importers. The LNG Industry in 2012. Retrieved from: http://www.ogj.com. (Accessed on: May 7, 2013).

Petronas Malaysia MLNG, 2013. Retrieved from: http://www.mlng.com.my. (Accessed on: March 1, 2013).

Qatar LNG to Asia, 2012. Qatar Looking to Export US Shale Based LNG to Asia. Retrieved from: http://www.theaustralian.com.au/business/ mining-energy/. (Accessed on: June 10, 2013).

Small, D., 2005. The Global LNG Industry-Changed Market Dynamics. Proceeding of the 18th World Petroleum Congress. Johannesburg, South Africa, Sept. 25-29, pp: 1-11.

Spomer, B., 2013. Natural Gas Challenges and Drivers for the Future. BG Group. Retrieved from: http://www.bg- group.com/ InvestorRelations/ Presentations/ Documents/ BG Group-IP-week_BetsySpomer-Feb-2013.pdf.

Stream LNG, 2012. LNG Trade and the Impact of Technology. Retrieved from: http://www. streamlng.com. (Accessed on: April 6, 2013).

The Edge Malaysia, 2013. PETRONAS Gas: Pengerang LNG Re-Gas Plant Confirmed in the Edge. Retrieved from: www.theedgemalaysia.com. (Accessed on: March 1, 2013).

The Voice of Russia, 2012. Russia to Strengthen its Position on LNG Market 2012. Retrieved from: voiceofrussia.com. (Accessed on: June 10, 2013).

Tran, C., B. Cassidy, M. Pierce, X. Wang and M.J. Economides, 2012. International LNG prospects 2011 and beyond. Proceeding of the International Petroleum Technology Conference. Bangkok, Thailand, pp: 1-12.

US EIA Qatar (US Energy Information Administration), 2013a. Qatar Updated January 2013. Retrieved from: http://www.eia.gov/ dnav/ng/ng. (Accessed on: June 10, 2013).

US Energy Information Administration (US EIA), 2013b. US Natural Gas Export by Country. Retrieved from: http://www.eia.gov/dnav/ng/ng. (Accessed on: June 10, 2013).

Walker, A., 2013. Global LNG Market-a Look Back and a Look Forward. Retrieved from: http://www. bg-group.com. (Accessed on: May 9, 2013).