# In Search of a Liquefied Natural Gas Trading Hub in Asia: Sri Lanka's Potential to Become a Candidate

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***Abstract:*** *Asian region's natural gas demand is growing fast but a lack of competitive national and regional markets creates high prices, and the region largely imports Liquefied Natural Gas (LNG). The LNG is one of the energy sources that diversifies Asia's energy mix while adding another source for energy security. Asia's economic powers like, China, India, Japan, and South Korea as well as many smaller countries like Sri Lanka largely depend on imported energy resources risking human security. As a matter of fact, this dependency is being controlled through diversification of energy sources. India has become fourth largest LNG importer in the world for electricity generation and for domestic cooking. The LNG prices in the region are higher than in any part of the world due to lack of distribution pipelines, regasification infrastructure, storage facilities and a trading hub. The International Energy Agency (IEA) identifies Singapore as the major LNG trading hub for South East Asian Region. In South Asia, by 2030, the India's growth in per capita income will enlarge the middle class society and its purchasing power, demanding higher standards of living, which will open new markets for LNG and renewable energy supplies. Singapore has a legacy for being the oil trade hub for long years and understands the market. But, when there is a lower demand for LNG, surplus tankers are idling in Singapore shores due to a lack of regasification and storage facilities, and incurring shipping cost to companies of which average cost $ 60,000 per day. In addition, proposed gas pipelines in South Asia: Turkmenistan-Afghanistan-Pakistan-India Gas Pipeline (TAPI), Iran-Pakistan-India Gas pipeline (IPI), and Myanmar-Bangladesh-India Gas pipelines largely depend on contemporary security challenges of involving countries. These challenges push Gas pipeline constructions beyond reality, in which increases dependence on sea commons to supply gas. Therefore, alternative LNG regasification and storage hubs should be in place to support export companies as well as to establish uninterrupted supply to the region. Being located in a major Sea Line of Communication (SLOC) and close proximity to Indian sub-continent increase Sri Lanka's potential to become another candidate in providing LNG regasification and storage facilities to the region. Kalpitiya, Mannar, Hambantota, and Trincomalee areas can be developed to have a LNG storage and terminal facility. This paper discusses Sri Lanka's potential to become an alternative LNG storage and regasification transit hub for Jurong Island LNG terminal, Singapore or an independent facility for the region, based on secondary sources.*

***Key words: Energy Security, Sea Line of Communication (SLOC), Human Security***

## I. INTRODUCTION

The energy sector can be divided into two categories, renewable and non-renewable energy resources, based on consumption tagged into relative natural regeneration. Non-renewable energy sources like coal, oil, and gas deposits deplete due to consumption but renewable resources like, sun light, wind and hydro-power are non-depleting resources and cleaner energy resources; however, the storage and consistency of supply would depend on seasons and are subject to various climatic changes. States look for sources of cleaner energy and a diversifying energy mix to maintain energy security have thus turned into liquefied natural gas (LNG). It is true that the Asian region's natural gas demand is growing fast but a lack of competitive national and regional markets create high prices, and the region largely imports liquefied natural gas (LNG) (Kate, Varro and Corbeau, 2013,p.6). LNG has become one of the energy sources that diversifies Asia's energy mix and adding another source for energy security (Heberg, 2015, p.4).

However, the LNG prices in the region are higher than in any part of the world because gas trading and retail prices are usually linked to the price of oil. Unlike other regions, LNG products have to compete with coal and oil products which are being used in the power, industrial, and transportation sectors. In addition, the lack of distribution pipelines, regasification infrastructure, storage facilities and a trading hub cause uncertainties in supply and demand affecting retail prices (Xunpeng, 2013). It is expected that in the next two decades, LNG imports to

Asia will rise due to China's and India's transitions from coal to renewable and cleaner energy resources. For example, Herberg (2013) identifies that growth in LNG demand will support the region's energy security and cleaner energy source.

To cater to this supply and demand, the International Energy Agency (IEA) report identifies that no adequate high-pressure pipelines to interconnect the consumers in the region and a trading hub for LNG market. Therefore, the IEA report identifies Singapore as the trading hub for the South East Asian Region (Kate, 2013,p.6). For a long time, Singapore has had a legacy for being the oil trading hub and understands the market realities. Nevertheless, in recent weeks, a lower demand for LNG created surplus tankers to idle in Singapore shores due to a lack of regasification and storage facilities, while adding shipping cost to companies (Maritime-executive.com (2015). Therefore, alternative LNG regasification and storage hubs should be in place to support export companies as well as to ensure an uninterrupted supply. This paper discusses Sri Lanka's potential to become an alternative LNG storage and regasification transit hub for Singapore or an independent facility for the region.

## II.STRATEGIC LOCATION


Figure one: Comparison of Time/Distance from East port Maine USA to Sri Lanka vs Singapore

Sri Lanka is located in the Indian Ocean and has one major port and some minor ports to handle the country's trade. International commercial sea lines connecting the east and west trades are twelve miles away from Sri Lanka. Gas and Oil tankers transporting LNG from Western countries pass Sri Lanka to reach Singapore's Jurong Island regasification facility. This takes an additional four days of travel time compared to a Sri Lankan port (Searates.com, 2016). For example, if a tanker departs from East port Maine, USA to Singapore's LNG terminal facility, it will take an additional four days to pass Sri Lanka and to reach Singapore as shown in Figure one.

Sri Lanka is situated 22 miles away from South of India. Southern India is home to over 72 million out of a total Indian population of 1.28 billion. By 2030, Asia's population is expected to grow by 500 million (Tsafos, 2013, p.9). The per capita income of Asia will increase by 90 percent. The growing LNG demand in Asia excluding India and China is expected to rise from 10 percent to 13 percent (Ibid). India uses coal as the major energy source in generating power; a product which is responsible for greenhouse gas emission. As a result, together with India, China too is risking each nation's human security due to polluted environmental conditions. When considering the recently concluded Paris Dialogue, states agreed to scale down greenhouse gas emission. This poses many challenges to India and China when it transforms from coal generated power plants to cleaner energy sources. Yet, human security concerns demand better health and equal access to energy resources. These concerns together with economic development attract LNG as one more cleaner energy source helping to achieve human security objectives because according to Sivaram (2016) "compared with burning coal or oil, burning natural gas releases significantly lower greenhouse gas emissions per unit of energy (provided that methane leakage from natural gas production and delivery is limited).

## III.GAS PIPELINES

LNG is usually transported through pipelines, which is very cost effective but it demands for a complex pipeline network infrastructure, to connect customer and supplier. The growing Indian demand for natural gas is expected to rise by 55% in 2016-2017 (The Hindu, 2016). Having identified this demand in the past, India has partnered with rival Pakistan to make the Turkmenistan, Afghanistan, Pakistan and India (TAPI) gas pipeline project into a reality. However, geopolitics, security conditions in Afghanistan, and stakeholder disagreement on profit sharing has been delaying this project. As of now, the Asian Development Bank (ADB) funds US $10 billion into this project but faces many challenges. For example, Central and West Asia Director General-ADB, Sean O'Sullivan states, "We're going through some of the toughest territory in Afghanistan." (The Economic times, 2016). Other proposed gas pipelines, Iran-Pakistan-India

Gas pipeline (IPI) and Myanmar-Bangladesh-India are also facing similar challenges. Though all these projects are becoming a reality, India lacks pipelines to connect the Southern and North Eastern Regions as shown in Figure Two. The likely reason is that India is operating nuclear power plants in these regions like Kudankulam, power plant in District: Tirunellveli-Kattabomman, Tamil Nadu State.

However, with all efforts, India's growing demand for LNG will remain high and supplies will fall far short of the demand. For example, the Hindu reports, "In 2021-22, LNG imports will outstrip domestic production with an estimated 188 mmscmd [million standard cubic meters a day ] being shipped into India. Together with production of 182 mmscmd from domestic fields and another 30 mmscmd coming from the TAPI pipeline, the total supplies will be 400 mmscmd, far less than 516.97 mmscmd demand"(The Hindu, 2016).

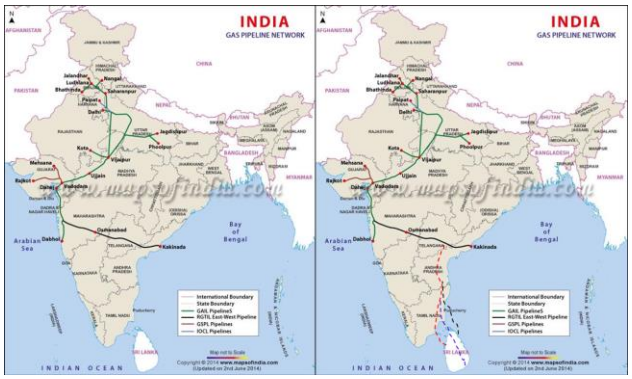


Figure Two: Indian Pipelines and Dotted Connecting Pipelines Suggested by the Writer

Sri Lanka's geographical location in the Indian Ocean naturally provides easy access to the Indian sub-continent, from West via Mannar Island and from North via Jaffna Peninsula. If Sri Lanka can convert an existing Sri Lankan Harbor and adjoining zone or an onshore or a close proximity offshore location to India as a LNG regasification, storage, and trading hub, through such facility, Sri Lanka can connect into India's major gas pipelines as shown in the Figure Two. If Sri Lanka is able to materialize such a project, then it would contribute to expand the global LNG trade along with an affordable cost. In addition, such a project can help to capture the developing Indian LNG market. Nevertheless, LNG exporting countries like, US, Canada, Qatar, and Australia will surely seek developing a regasification and storage facility along the shortest routes to mitigate the LNG transport cost, when traveling into the Indian market and Bay of Bengal from West and East.

## IV.POTENTIAL LOCATIONS IN SRI LANKA

Capitalizing on geographically advantageous locations to increase sustainable development projects are a factor that is effectively contributing to secure a nation. In achieving sustainable economic goals, a nation cannot separate environmental issues, values, and human security. However, when energy security is concerned, there can be instances where tradeoffs being needed on environmental issues and values of a nation because energy security compromise a nations human security. Sri Lanka too needs to optimize the use of potential locations by converting those into economic and energy hubs. Having considered the safety and security issues related to oil, gas, and chemical products, Kalpitiya, Mannar, Hambantota, and Trincomalee areas can be developed to set-up a LNG storage and terminal facility. The four suggested locations have different advantages and disadvantages. According to Cairn Lanka (2013), locations off the shores of Kalpitiya and Mannar have been identified as potential oil and gas deposit areas, and the initial exploration data has confirmed rich oil and hydrocarbon deposits in this general area. On the other hand, government of Sri Lanka has identified Kalpitiya as a tourist destination and plans are underway to develop 14 islands in this region as part of the Kalpitiya Integrated Resort Project (Al Jazeera, 2016). Though the government has not identified to develop Kalpitiya area as LNG terminal facility, its isolated nature and thinly populated reasons are increasing chances of converting some isles into LNG terminal facilities.

Despite tourism development, Norocholai, which is situated in the south of Kalpitiya peninsula, falling under Puttalm District has been used to establish Sri Lanka's largest coal power plant. People living in and around this area are now experiencing environmental issues such as ash-falls due to this plant.

Moreover, the government is developing Norocholai, for energy related industries. It is interesting to note that a LNG project is also in the pipeline, which is cleaner and more environment friendly compared to coal. For example, the report of Ministry of Power and Energy (2015, p.54), Sri Lanka has indicated the establishment of natural gas processing facility in Norocholai, as a future project. Yet, the same report does not indicate any estimated cost or year of completion for LNG plant but

other oil related projects are being indicated to be completed in 2020-2025 with estimated costs. It indicates that the LNG related energy sector developments are unlikely to come in the near future.

The geographic condition like the shallow sea water in this region demands costly infrastructure for berthing facility, but with new modifications like Floating Oil/LNG Processing and Storage Offshore Platforms can be used to overcome the berthing issues. Further, it is interesting to note that Jurong Island in Singapore was manmade, which has been dedicated for oil, gas and chemical industry. Similarly, one of the thinly populated islands in Kalpitiya peninsula or adjoining region can be converted into LNG terminal, regasification or strategic reserve stock maintaining port with the help of a LNG exporting country or a company.

Trincomalee has a deep harbor and small isles that can be developed to set up LNG storage and terminal. This location has the potential than Kalpitiya, Mannar and Hambantota to link with an Indian pipeline network. As identified by Janaka Ratnasiri (2015), "A pipeline from Trincomalee will be cheaper to build than building one from Myanmar which is about 900 km over Bangladesh. The distance from Trincomalee to the northern coast overland is about 175 km, while the sea straight is only about 75 km, making the total distance 250 km to the Indian coast."

Hambantota has a newly built deep harbor and an earmarked zone for industrialization projects (Sri Lanka Ports Authority, 2015). It is expected that these projects will be powered by LNG plants. In addition, there is an ongoing Chinese project connected to the Hambantota Port. LNG World Shipping reports, "China Huanqiu Contracting and Construction is building the US$ 80 million terminal at Magampura Mahinda Rajapaksa Port. The terminal will be South Asia's largest LPG import-export terminal, storing an initial 30,000 tonnes when it opens in 2018" (Lloyds Shipping, 2016). This terminal and its surrounding open land mass provide further expansion opportunities for LNG suppliers, as a strategic reserve storage point.

Out of the four locations, Trincomalee is the most suitable for a LNG terminal and regasification facility considering deep harbor, which is a prerequisite for berthing large LNG tankers. In addition, the government has identified Sampur in Trincomalee to be developed as an industrial zone. Nevertheless, this place had been identified to establish a 500 Megawatt coal powered plant with the help of the Indian Government but this move was strongly criticized by environmentalists; as of now, the government is negotiating with the counterpart to convert the proposed coal power plant into a LNG power plant (Colombo Page, 2016). However, it has not been considered to develop as an area for a LNG regasification, strategic reserve storing facility or re-exporting terminal. If Sampur in Trincomalee can be converted into an LNG trading hub, then such a project would be able to link with the Indian market and will surely attract LNG investors.

Kalpitiya and Mannar also have open land mass with shallow waters, which mean it requires more infrastructure development when compared to other two locations. However, in the future, when gas deposits and oil drilling commence, these two areas will contribute to the oil and gas markets. Yet connecting Hambantota and North through a pipeline to connect with the Indian LNG market will increase capital cost. Therefore, when evaluating the potential of suggested locations for a LNG facility, the list of priority can be as follows: first, Trincomalee is far ahead of every other location because it has a deep natural harbor and offshore and onshore potential to establish a LNG facility; second, Kalpitiya and Mannar do not have operating harbors but are ideal places to set-up floating terminal facilities due to shallow water; in addition, for safety and security, offshore facilities can offer more advantages than an onshore terminal facility; third, physical distance from Hambantota to the Indian onshore plants and land reclamation challenges for a pipeline are the factors which place Hambantota at the end of list. On the other hand, Hambantota also can be placed at the top of the potential priority list. Hambantota is situated approximately 12 nautical miles away from major sea lines of communication. As of now, projects are underway for a LPG bulk break storage and transit facility (Lloyds Shipping, 2016). Besides that Western, Middle Eastern, and African countries exporting LNG would look to establish a similar LNG project focusing South Asian, Chinese and Japanese markets, because energy security and the human security nexus of China and Japan largely depend on imported energy sources from these regions.

## V.REGIONAL COOPERATION

Lack of pipelines, infrastructure, and pricing market to facilitate LNG imports and exports, will lead to more bilateral agreements between countries rather than unifying for a regional market. For example, Brunei

exports a large stock of LNG to Japan and approximately 40 percent of her other imports come from Qatar and Malaysia. Another 20 percent of LNG imports come from Australia and Indonesia. United Arab Emirates exports 10 percent to meet Japan's demand. Japan imports LNG from Russia and its share is 30 percent of imported LNG (Tsafos, 2013, p.17).

These relationships with the countries create an economic interdependence between exporter and importer states which eventually support world peace and increase the energy security of the importer. Australia is the major LNG export partner for Eastern region countries like Japan to date. Tasafos indicates (2013, p.16) "Australia's share of the market grew so big because there were no alternatives: an Asian LNG buyer in 2009–11 looking for a new long-term contract after 2015 had few options except Australia." As no adequate LNG supply pipelines exists in the region supplying towards the west from Australia, countries importing LNG from Australia and Indonesia westwards may use Sri Lanka as one of the LNG storage and regasification transit center to connect with India and rest of the few pipeline networks. In addition, those importing LNG from the west like Canada and in the future from the USA can use Sri Lanka as a storage facility. This can facilitate western LNG tankers to bulk- break for Eastern countries like China and Japan. Eastern tankers will be able to pick up their LNG supply and minimize the shipping costs ensuring an uninterrupted supply chain.

However, Tasafos (2013, p.17), indicates that new market opportunities are booming in this region but cannot predict ideal locations to set-up hubs. Therefore he insists that such infrastructure facilities should meet the short term and long-term demands and says: "In other words, one should think about the Asian market as a balanced market with limited scope for a sharp reduction in prices but with choice about how to meet future demand." Australia, Indonesia, Malaysia, and central Asia are the LNG exporters in the region, and for the consumers in the west of Asia and South Asia like India and Sri Lanka can operate a joint LNG terminal facility in Sri Lanka. Through such facility Sri Lanka can become the hub for LNG marketing in the South Asian region, unifying all eastern and western LNG exporters like Canada and in the future with the USA. Eventually, it will contribute to increase energy security in the region.

Moreover, cross-border cooperation in the power sector is booming in the South Asian region. For example, India - Bhutan and India - Nepal are engaged in discussions to develop cross-border exchanges of electricity (Singh, 2016, p. 6). India and Sri Lanka are examining possibilities of exchanging electricity. According to South Asia Regional Workshop held on March 19, 2014, it is expected to link

Sri Lanka through a submarine cable to the Indian major power gridline [see Figure Three]. Similarly, it should be


feasible to connect with India through a submerged or submarine LNG gas pipeline running from LNG terminals in Kalpitiya and Mannar.

Figure Three: Electricity Line Route Identified through Feasibility Studies (Jayasekera, 2014

## VI.SINGAPORE VS SRI LANKA

Singapore's potential to become the LNG trading hub in East Asia is proven without doubt. It has the technology and professional teams to operate their 40-hectare LNG terminal at Jurong Island. The country's sound economy and stable political status will bring about the LNG regional leadership and cooperation. Its regasification facility has three storage tanks which have capacity of 540,000 m3 and the jetty is designed to berth LNG tankers carrying a maximum load of 265,000 m3. Singapore has the advantage of using its domestic LNG pipelines which are connecting mainly to power electricity generation. Singapore largely depends on LNG for electricity and almost 80 percent of its electricity needs are generated by LNG (hydrocarbons-technology.com, 2015). The feeding pipelines run from Jurong Island LNG terminal to

distribution points that extend from east to west of the country.

The Trans Asian Pipeline is expected to connect the Asian region. India and south Asian countries will be requiring another pipeline to link up with this region, through these pipeline. As of now, South Asia's LNG demand is lower than that of East Asian countries, but in 2030, it is expected that Asian region's per capita income will increase by 90 percent. As a result, the middle class purchasing power also will rise demanding cleaner, efficient, and low price energy source.

According to Asian Tribune (2015) Sri Lanka is expected to utilize LNG as one third of their energy by 2020. LNG suppliers like Qatar has shown their interest in building an LNG terminal in Sri Lanka (Highbeam.com, 2015). The first LNG operated Sri Lankan plant is located in the Kerawalapitya area (Ministry of Power and Energy, 2016). Sri Lanka does not have a domestic pipeline network as compared to Singapore. By 2020, India's and Sri Lanka's electricity demand will rise by seven percent (Singh, 2016, p.12). India will use coal as its primary source for electricity generation but for cooking and transport sector will demand more clean energy source like LNG. Because, by 2030, India's growth in per capita income will boost the purchasing power and for standard living middle class, and their demand for LNG and renewable energy supplies will open-up new markets. Sri Lanka can operate as an LNG hub for the Indian subcontinent. Unlike Singapore, the LNG investors and companies can utilize the advantage of location as well as the cheap labor for infrastructure building. Singaporean labor is costlier than Sri Lankan labor.

Singapore has spent approximately US$ 1.11 million to build the LNG terminal, which consists of three LNG tanks and a jetty to berth tankers (Singapore LNG, 2016). The government undertook the investment for this project and subsequently major five banks have invested in this project. Naturally LNG terminals and regasification facilities are costly affairs. To attract LNG markets, the terminals and regasification facilities have to be commissioned according to the free market regulations and other policies. LNG companies invest in long-term contracts expecting future markets and attractive returns. Therefore, hands-off government policies are expected in this LNG business (Singapore LNG, 2016). Singapore's LNG facility is a government owned subsidiary corporation but Singapore has a long steady record of protecting investors and consumers through institutionalism and regulatory means. This confidence, experience in the market and the quality standards maintained in the Jurong facility are challenges for other competitors who expect to build their own LNG terminals and regasification facilities.

Despite the fact that Sri Lanka does not have experience, regulatory and a strong institutionalize mechanism compared to Singapore; Sri Lanka has a long history in engaging in free trade market. Its Board of Investment regulations have safeguarded and protected investors introducing many tax free concessions for their projects. Therefore, building a LNG terminal in Sri Lanka will not be costly as compared to Singapore. In addition, multi-national companies operating in Sri Lanka enjoy governments' "hands –off" policy. Similarly, investors for LNG projects would be welcomed by the government.

Due to LNG demand fluctuations, low oil prices, and slower economic growth in the regions affect LNG market. In the recent past, LNG tankers had been lying idle for weeks in Singapore causing economic downturns to LNG exporters. The Reuters reports, "According to shipping data on Thomson Reuters, seven tankers have been sitting idle off the east coast of Johor, Malaysia, for over two weeks, and another two ships have been anchored south of Batam, Indonesia, for several months. Half a dozen LNG tankers are in Singaporean docks." (Gloystein and Vukmanovic, 2016). These situations clearly indicating that there has to be more emergency storage facilities en-route to these destinations. Had there been another LNG facility in the region, these ships would have been directed to such a port. Sri Lanka is five voyage days away from Jurong Island, Singapore; considering the fact, Sri Lanka has the potential to become an alternative LNG storage or regasification facility for Singapore.

## VII.CONCLUSION

The low price of oil has created an impact on LNG short-term demand cycle because large LNG importers in the region - China, Japan and Korea's economic growths have slowed down during the past two years. Oil and coal are still priced low in this region as compared to LNG but world leaders agreed upon the mitigation of carbon emission through more renewable and low emission energy sources like LNG. In that context, the demand for LNG will be consistent in this region compared to that of coal and oil. Smaller countries with high economic growths will transform their present inefficient energy mix with more efficient and clean energy sources.

Sri Lanka can develop a LNG trading hub in either of locations of Kalpitiya, Mannar, Hambantota, and Trincomalee for LNG onshore or offshore LNG regasification, storage, and trading hub or strategic reserve management for the region. All of these locations have the advantage of accesses to major SLOCs. It is not only Sri Lanka's LNG terminal would be able access to Indian market but also for Japan, China and other eastern countries as well. Sri Lanka's potential for establishing a LNG storage hub can contribute to the energy security and diversifying of supply chains in the region.

REFERENCE

Anon (2016 ) "Sri Lanka to Provide One Third of Energy Demand With LNG By 2020." (2011). [Online]. *Asian Tribune*. Available from: http://www.asiantribune.com/news/2011/02/20/sri-lanka-provide-one-third-energy-demand-lng-2020. [Accessed: 14 June 2016].

Anon (2016). Sri Lanka's tropical beaches: A development trap?. *Aljazeera.*[online] Available at: http://www.aljazeera.com/indepth/opinion/2013/10/sri-lanka-tropical-beaches-a-development-trap-201310610855158222.html. [Accessed 10 August 2016].

Bradshaw, M., Herberg, M.E., Jaffe, A.M., Ma, D. and Tsafos, N., (2013). *Asia's Uncertain LNG Future* (Vol. 44). [pdf] Seattle, Washington: Report of National Bureau of Asian Research. Available at http://www.amymyersjaffe.com/content/pdf/sr44.pdf. [Accessed 13 June , 2015).

Economic Times, (2016). India's Gas Demand to Jump 55% By 2016-17[Online]. Available at: http://economictimes.indiatimes.com/news/international/business/tapi-gas-pipeline-through-afghanistan-doable-asian-development-bank-official/articleshow/51745189.cms. [Accessed: 6 August 2016].

Geo Expro.com. Cairn Discovers Gas Offshore Sri Lanka.[online] Available at: http://www.geoexpro.com/articles?q=cairn+discovers+gas+offshore+sri+lanka. [Accessed June 14, 2015]

Gloystein, H. & Vukmanovic, O. (2015). LNG tankers lie unused around Singapore as gas downturn turns to crisis. [Online].*Reuters*. Available at: http://www.reuters.com/article/us-singapore-lng-tankers-idUSKBN0LH17Q20150213. [Accessed 29 August 2016].

Gunaratna, G. (2015). Sri Lanka: Sri Lanka may shelve Sampur coal power plant project - report. [Online]. *Colombopage.com*. Available at: http://www.colombopage.com/archive_16A/May15_1463287810CH.php. [Accessed 23 August 2016].

Highbeam.com. (2015). Qatar plans LNG plant in Lanka. [Online]. Available at: https://www.highbeam.com/doc/1P3-3686945261.html. [Accessed 6 June 2016].

HydrocarbonsTechnology.com. (2015) "Singapore LNG Terminal, Jurong Island." [Online]. Available at: http://www.hydrocarbons-technology.com/projects/singaporelngterminal/. [Accessed 14 June 2016].

Infolanka.asia.com (2015). Establishing an energy hub in Trincomalee –II [online] Available at: http://www.infolanka.asia/science-and-environment/energy/establishing-an-energy-hub-in-trincomalee-ii/all-pages. [Accessed 14 June 2016].

Jayasekera, K. (2014). "Status of Sri Lanka Cross Border Interconnection with India & Expected Benefits."[pdf] *South Asia Regional Workshop on Competitive Electricity Market*. [online] Available at: https://www.usea.org/sites/default/files/event-/Ceylon%20Electricity%20Board.pdf. [Accessed 6 August 2016].

Lngworldshipping.com (2016). Lloyd's Register supervises safety at Sri Lanka LPG hub. [Online]. Available at:http://www.lngworldshipping.com/news/view,lloyds-register-supervises-safety-at-sri-lanka-lpg-hub_41620.htm. [Accessed 4 August 2016].

Maritime-executive.com (2015). *Asia's LNG Demand Crashes*.[online] Available at: http://www.maritime-executive.com/article/asias-lng-demand-crashes. [Accessed 13 June 2015].

Ministry of Power and Energy, (2015). *Sri Lanka Energy Sector Development Plan For A Knowledge-Based Economy 2015 – 2025* p 54 [pdf] Available at: http://powermin.gov.lk/sinhala/wpcontent/uploads/2015/03/ENERGY_EMPOWERED_NATION_2015_2025.pdf. [Accessed 4 August 2016].

Searates.com (2015) *Sea Rates Calculations*. [online] Available at: http://www.searates.com/reference/portdistance. [Accessed 13 June 2015].

Singapore LNG Cooperation, (2016). [Online]. Available at: http://www.slng.com.sg/newsroom-press-release-20141127.html. [Accessed: 4 August 2016].

Singh, A. (2013) "Prospects for Regional Cooperation on Cross-Border Electricity Trade in South Asia," [pdf] *Integrated Research and Action for Development Energy*. Page 6.[online] Available at: http://www.irade.org/Background%20Paper%20revised,%20Write%20Media,%20Oct18.pdf.

Sivaram, V. (2016). *What Will It Take to Turn Natural Gas Around in India?*.[Blog] Council on Foreign Relations. [Online]. Available at: http://blogs.cfr.org/levi/2016/08/02/what-will-it-take-to-turn-natural-gas-around-in-india/. [Accessed 3 August 2016].

Sri Lankan Port Authority (2015). http://www.slpa.lk/port-colombo/mrmr

Ten Kate, W., Varro, L. and Corbeau, A.S., (2013) *Developing a Natural Gas Trading Hub in Asia: Obstacles and Opportunities.* [pdf] France: International Energy Agency. Available at http://www.iea.org/publications/freepublications/publication/AsianGasHub_FINAL_WEB.pdf [Accessed 15 June 2016].

The Hindu, (2016). India's Gas Demand To Jump 55% By 2016-17. [Online]. Available at: http://www.thehindu.com/business/Industry/indias-gas-demand-to-jump-55-by-201617/article5944066.ece.

Tsafos, N., Bradshaw, M., Herberg, M.E., Jaffe, A.M., and Ma, D. (2013). "The New Geography of Asian LNG,"*Asia's Uncertain LNG Future* (Vol. 44). [pdf] Seattle, Washington: Report of National Bureau of Asian Research. Available at http://www.amymyersjaffe.com/content/pdf/sr44.pdf. [Accessed 13 June , 2015).

Xunpeng, S (2016). *The Impact of Low Oil Prices on Natural Gas and the Implications for the Asia-Pacific*, *working paper*, Pacific Energy Summit. Available at: http://pacificenergysummit.org/2016/06/22/the-impact-of-low-oil-prices-on-natural-gas-and-the-implications-for-the-asia-pacific/. [Accessed 01 August 2016].

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