7-20-2013

Reshape of the energy map and its implications in the shipping industry

Evangelos Fotiadis

WORLD MARITIME UNIVERSITY

Shanghai, China

RESHAPE OF THE ENERGY MAP AND ITS IMPLICATIONS IN THE SHIPPING INDUSTRY

By

EVANGELOS A. FOTIADES

Hellas

A research paper submitted to the World Maritime University in partial Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

INTERNATIONAL TRANSPORT AND LOGISTICS

2013

DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

Evangelos A. Fotiades

……

Supervised by

Professor Zhao Gang (赵刚)
Shanghai Maritime University

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my family for their support. This paper is dedicated to them.

ABSTRACT

Title of research paper: **Reshape of the energy map and its implications in the shipping industry**

Degree: **MSc**

The energy resources such as coal, oil and natural gas are key resources that are imported and exported to and from many countries. These resources are evenly dispersed in different regions of the world and the commercial vessels that are suitable for this kind of transportation are year after year increasing in size because of the economies of scale. The bigger the size, the more lower the transportation cost is. The lower the transportation cost is the more competitive ocean shipping transportation becomes.

With the appearance of emerging economies, the pre-existing trade routes for the energy resources change as well. Some trades such as coal become more Pacific intensive whereas LNG trade is more Atlantic intensive.

The result of this paper is to examine whether the global fleet structure of the above mentioned energy resources is going to increase as the findings and the theory of economies of scale are showing. The moving average method will be a sound indicator of this examination and the evaluation of the results will be performed using both mathematical and intuitive approach.

Keywords: coal, oil, natural gas, energy, moving average, resources, fleet structure

Table of Contents

List of Tables

List of Figures

List of Abbreviations

LNG	Liquefied Natural Gas
IEA	International Energy Agency
OPEC	Organization of the Petroleum Exporting Countries
CPP	Clean Petroleum Products
DPP	Dirty Petroleum Products
CNPC	China National Petroleum Corporation

Chapter 1. Introduction

1.1 Background of the research topic

The shipping industry, although being important because is influenced by the global trade, is also essential and vital for the global economy as a whole, in simpler words shipping is the lifeblood of a country's economy. Now, countries are dependent on numerous energy resources that are transported by specialized commercial ships, and mainly these energy resources that are going to be examined in this research topic are coal, oil and gas. The commercial ships which are suitable for the transportation of the previously mentioned energy resources are bulk carriers, oil tankers and LNG (liquefied natural gas) ships, respectively. Traditionally, these kinds of ships have been proven to be not only the most efficient means (in economical and environmental terms, at least) of transporting these important resources to another country which needs them, but also the mere fact that these energy resources are not evenly distributed around the world poses the necessity of the existence of having these kinds of vessels in our seas.

Moreover, as it is mentioned earlier, the three energy resources, coal, oil and natural

gas are unevenly dispersed around the world and are transported with ships in high volume quantities because they are the main fuels for most of the countries. Because of this uneven distribution, it is of paramount importance to point out that the existing energy map (in terms of the location of these resources) wasn't the same in the past 10 years, in comparison with what the present situation is. From the perspective of ship-owning companies mainly, but not only, what is intriguing is to assess the degree to which the energy map will be reshaped in the future. This is a generally accepted truth, since coal, oil and natural gas is loaded everyday 'on board' various commercial vessels and also oil is the fuel which allows the propulsion of the shipping industry per se. Hence, at an initial stage the thorough description and future projection of the three markets is essential.

1.2 Literature review

There is vast research going on about the energy reshape that is going to take place in the next years. International bodies, big corporations (like BP, Exxon, Gazprom to name a few) and scientific community are quite interested about the development in the energy frontier that will influence numerous industries and more predominantly the shipping industry.

First and foremost, researches in the future situation of the energy map have been made by the International Energy Agency (IEA) and by the Organization of the Petroleum Exporting Countries (OPEC). In the World Energy Outlook (2012), which

is an executive summary published on an annual basis by IEA, one can take a thorough view about the essential energy resources that are going to be explained in detail in the research paper. The World Energy Outlook (2012) covers all the energy resources that are going to be introduced by the research paper and those are the very recent developments in the coal industry, the oil and the natural gas industry, as well as for other resources of energy such as the renewables and the nuclear energy. Moreover, in OPEC's World Oil Outlook (2012), the reader can understand the degree of influence that oil generates to numerous industries like aviation, marine bunkers, rails etc. In IEA's Special Report: A Golden Age of Gas (2011), the characteristics of the natural gas market are explained in a holistic way. This includes an excessive description of the demand side and of the supply side of the market, a future projection of the demand for natural gas and some global supply trends. In BP's Statistical Review of World Energy (June 2012), there is a rich database collection of numerous categories for energy resources. These categories are coal, oil and natural gas reserves, consumption, production, trade movements and prices expressed in metric tones, million barrels and trillion cubic meters respectively.

Moreover, it is worth mentioning some research papers which aimed to include the crucial factor of the transportation cost to their research framework. In Moritz Paulus and Johannes Truby (2011) paper, the researchers aim to indicate that certain energy transport strategies affect the steam coal market which amounts for most of the transported hard coal on board ships. The researchers in their paper, they use a programming package called GAMS, applying a convex minimization problem with a non-empty set of feasible solutions called WCM[I]. In a paper submitted by C.

[I] Coal lumps vs electrons: How do Chinese bulk energy transport decisions affect the global steam coal market?

Haftendorn, F. Holz, C.v. Hirschhausen (2012), the researchers use the COALMOD-World which encompasses all global producers and consumers and models these domestic markets alongside with shipping trade to observe any interaction[I]. The modeling process commences analyzing the results from the starting year 2006 and finishes the research at the year 2030. At the same perspective, StefanLochner and DavidBothe (2009) use a different model to try to minimize the capital and operating costs of the production and transport of natural gas. The model that these researchers use is called MAGELAN which is an intertemporal and interregional cost minimization model[II]. In the paper of AleksandarZaklan, Astrid Cullmann, Anne Neumann, Christian von Hirschhausen(2011), the authors use Principal Component Analysis (PCA) based on the export, transport and import prices of steam coal which helps them, on a later stage, draw their conclusions based on three hypotheses produced by the PCA. These three hypotheses are, firstly the scenario that the steam coal price will be integrated, secondly that the oil market will affect the transportation of steam coal and thirdly that the global market will be integrated. In Don Maxwell and Zhen Zhu (2010) paper, the analysis method used is a unit root test also known in the bibliography as the conventional Dickey-Fuller test[III]. In addition to this, the VAR model is used to determine the potential developments of natural gas prices and LNG imports.

Admittedly, by all the above mentioned, there is a strong necessity for searching from the ship-owning perspective and examine the optimum way through which a fleet has to be readjusted in different trade routes so as to serve the existing and

[I]The end of cheap coal?A techno-economical analysis until 2030 using the COALMOD-World.

[II] The developments of natural gas supply costs to Europe, the United States and Japan in a globalizing gas market- Model-based analysis until 2030.

[III] Natural gas prices, LNG transport costs, and the dynamics of LNG imports.

future energy reserves. The above research papers, although tremendously valuable for the scientific community, do not focus on the fact that a fleet of ships is not going to follow the same trade patterns (as it used to follow until today) but the trade routes that a fleet follows will shortly be modified and new areas with sufficient reserves will emerge as core energy points or hubs. Therefore my research paper will be based upon this gap found between different past research papers and will target to bridge the changes in the energy map and the element of trade lines restructuring. In the near future and under the very realistic assumption, that some reserves will be extinct and others will be discovered, the fleet of, say 20 ships, will need to be optimally placed in trade routes and obtain the maximum employment per annum.

1.3 Purpose and methodology of the research

The research purpose of this research is two-folded. The first is to explain and analyze the historical facts that have happened so far in these three energy resources or markets (coal, oil and natural gas) and to form a future projection of the supply and demand alongside with the emergence of the new important players in these three markets. The second purpose is to point out the need for fleet readjustment from the behalf of the shipping companies due to the reshaped condition of the markets of coal, oil and gas in the future.

The methodology that is going to be followed for the indication of all the above mentioned points is: comparative analysis method will determine the separate distinction for certain time periods of the three markets of coal, oil and natural gas

respectively. In addition to this, for the fleet readjustment, moving average method will indicate the extent of the changed situation.

Chapter 2. Energy Map: Historical Overview and Analysis

2.1 Coal Market Explained: Basics, Major Players and Future Projections

2.1.1 Basic types of coal usage and seaborne transport

Generally speaking, coal is a widely used and widely dispersed fossil fuel, which is categorized in different groups for different usages in accordance with the moisture levels that contains. In other words, the moisture content of coal defines the 'rank' of coal, which is either low rank coal or hard coal[I]. Low levels of carbon and high levels of moisture characterize the former and that is why it can sometimes be found in zero or very few meters below the very surface of the earth. Of course, there are a lot of variations in this particular variety of coal 'rank', but the two main sub-categories that are profound are the lignite and the sub-bituminous fossils. The hard coal – which in terms of total available amount is slightly more than the soft

[I]As is depicted by the World Coal Association, the degree of the coal's carbon purity is expressed as a percentage and is known as 'rank'.

coal – is divided into bituminous coal and anthracites.

Now, seaborne transport is mainly focused in the transportation of bituminous coal. Thermal or steam coal and metallurgical or coking coal fall into this category and these two bituminous fossils have a wide range of functionalities. The thermal coal that is the cheapest fuel in the world is used from countries and more significantly by state-owned (or private) companies for power generation, for cement manufacturing and for general industrial use.

In terms of volume, steam coal is transported to a bigger extent than the coking coal. This is happening especially if we imagine that almost all the power plants, in this world, need to burn steam coal in order to produce electricity. According to World Coal Association, the coal-fired plants generate 41% of the world's electricity (source: www.worldcoal.org). Needless to say, that the main factor which influences the demand for steam coal is for power generation purposes. Moreover, in a presentation done by a top executive of ABN Ambro Bank for the year 2011, it was shown that steam coal lies in the very core of the seaborne trade because is the second – after iron ore and always in terms of volume – most-frequently transported bulk commodity on board commercial ships. In the same presentation, coking coal was at the sixth position.

2.1.2 Major players and global reserves

In this sub-chapter, the most influential players of the market are going to be introduced both in the supply and demand side of the two different markets which affect the seaborne transportation. But before doing so, the crucial point of the location of the world reserves needs to be clarified. Which countries own the biggest proportion of the reserves? Are they self-consumers or do they export it?

Traditionally, USA, Russia, China and India have the biggest reserves which amount close to 66.1% of the global coal reserves[I].Globally speaking, there are close to 860 billion tonnes of proven coal reserves and according to the World Coal Association the reserves are enough to sustain a consumption– given the fact that the production levels are going to remain the same as today's - that can last for more than 100 years. This mere fact, in combination with its cheap price, constitutes coal as a very competitive fuel especially if we compare it with oil – which is characterized as price volatile fuel- or gas which with current production levels can last for 60 years.

Now, the fact that these countries have the biggest coal reserves doesn't necessarily mean that they export their coal as well. China and India not only consume all the coal they produce but also they are the two major importers in terms of volume. China alone consumes the astonishingly high percentage of close to 50% of world's total coal consumption; USA follows with 13.5% and India with close to 8% (BP, www.bp.com). To sum up, the major importers, until now, of steam coal are: European Union, Japan, China and South Korea whereas the major importers for coking coal, at the moment are: first Japan with double volume of imports from the second which is the European Union and the third biggest importer is South Korea.

[I] BP's rich data collection offers a wide range of information for the end of the year 2011.

On the other side, the major exporting countries of steam coal are: Indonesia, Australia, South Africa and Columbia whereas for coking coal the picture is slightly different with Australia and USA as the most dominant exporters.

2.1.3 Future projections and geography of the market

As the major influential players were described and the fact that the biggest reserve holders of this fuel are not necessarily exporters a sound future projection will follow. For the sake of scientific purposes, the projection will be as realistic as possible and therefore will be based upon the political decisions taken by key countries, which play a drastic role for the developments in the coal market and the subjective researches of well-known acknowledged institutions.

In terms of future projection of coal market, it should be clarified straight from the beginning that the changes that are going to take place in India, in the near future, are worth mentioning. Specific global institutions and conferences being held at the present moment inform us about this definite change, therefore is almost certain based on the above stated that on the one hand a rise in India's imports is going to take place on the other hand the amount of this rise remains ambiguous and will be the purpose of this paper to address it[I].

[I] General consensus expressed in the Coaltrans conference, held in India.

2.1.3.1 Importers: India

Let's take the events straight from the start. From figure 1 we can see that Indian imports showed from April 2012 to January 2013 an increase of 29% of the country's total imports, this is justifiably high due to the fact that the country set out a five year– from 2012 to 2017 - plan which aims to have a GDP increase of 9% per year. The consensus by different entities in the Coaltrans conference was that by the end of the 12th five-year plan, in 2017, the demand for coal will rise to 1.1 billion tones, as more and more people gain access to electricity, the household's coal consumption augments and according

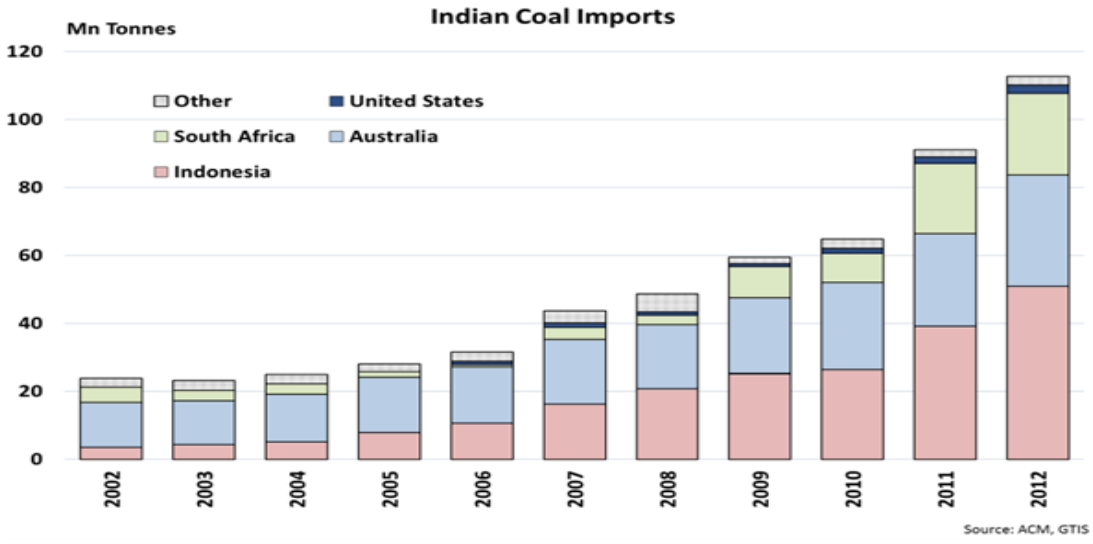

Figure 1: India Coal Imports

Source: ACM Shipping Ltd. Weekly Report March '13.

Moreover, not only thermal coal used in households is about to have an increase in India but also coking coal. By 2015, India has as a realistic target to almost double

the produced volumes of steel from its mills, from 70 million tones today to 130 million tones. By doing so, the country ought firstly to solve the problems related with its infrastructures. Coal-India which is the world's biggest coal producer alongside with the government will upgrade and restore three major railway lines to be able to transport the coal from the mines to the location of production[I]. These structural problems, though, cannot be solved overnight and the bureaucratic situation and regulatory bottlenecks prevailing in the country pose an additional burden. In the meanwhile, India will have to rely on the imported coal to satisfy domestic demand based on the given production.

The diagram in the previous page shows a table with India's coal providers and it won't be a surprise to see US coal and South African coal be imported more in the near future. This will take place for several reasons. Firstly, the coal from US is exported to the Chinese market and this trade is characterized by uncertainty[II]. Secondly, the revolution in shale gas has affected the US coal producers, domestically and thirdly the South African coal which until now serves the EU demand for coal, in the future will shift and might exclusively serve the Indian demand. The following snapshots are explaining exactly this shift.

[I]Coal-India is a state-owned company, which is responsible for the 80% of India's domestic production. (Source: Reuters)

[II]In China, at the moment, a shift is made to hydro power generation, although the country's coal consumption makes it number one globally (Source: Bloomberg)

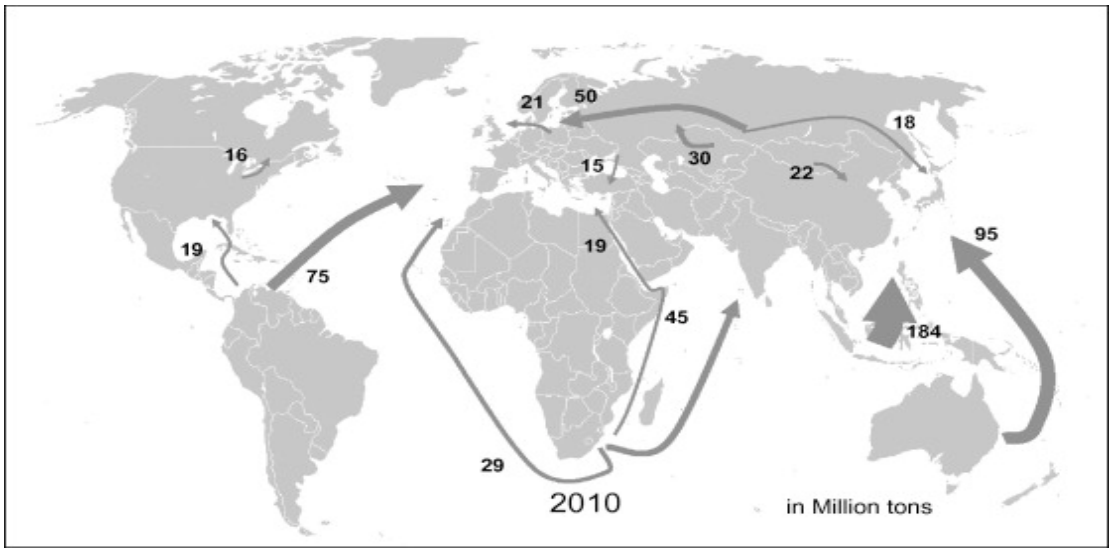

Figure 2: Coal sea trade routes for 2010

Source: C. Haftendorn, F. Holz, C.v. Hirschhausen, 2012, The end of cheap coal? A techno-economical analysis until 2030 using the COALMOD-World model, http://www.sciencedirect.com/

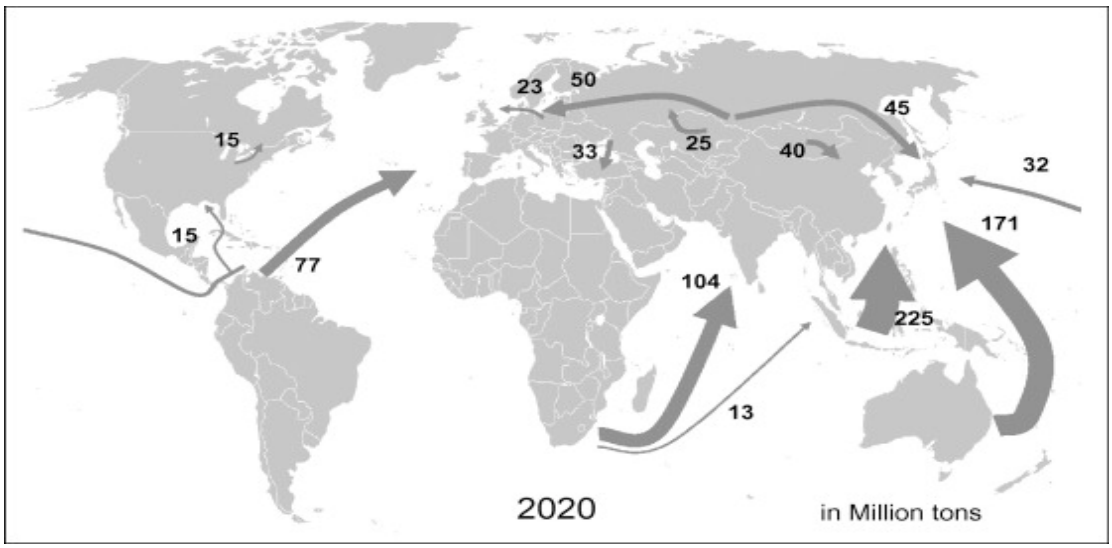

Figure 2: Coal sea trade routes for 2020

Source: C. Haftendorn, F. Holz, C.v. Hirschhausen, 2012, The end of cheap coal? A techno-economical analysis until 2030 using the COALMOD-World model, http://www.sciencedirect.com/

2.1.3.2 Importers: China and the Yellow Sea Region

Another and more crucial importer is non-other than China. China is the world's biggest coal consumer, as it was mentioned earlier. According to various researches, the imports of coal (mainly Indonesian, as we will see later on) will grow in the following years. What is important to point out here is that firstly, as it was mentioned previously the country have made a shift towards hydro power generation which apparently was risen to 24% this year as opposed to the power generation with the usage of thermal coal which was risen by only 1% and secondly the sentiment of the Chinese steel producers here is crucial. The steel producers in China are mainly afraid of the weak steel market situation and the fact that they didn't want to renew the contracts with the Mongolian Ovoot Tolgo imines undoubtedly poses a threat. The seaborne trade and more specifically the coal imports in China are affected by the above mentioned factors but they are definitely going to rise simply due to the fact that the consumption levels are globally high.

Generally speaking, there is a scenario produced by the numerous well-established institutions that if there is possibility of high demand for coal the region in the Yellow Sea will become the number one hub of coal imports. Japan and Korea will be even stronger importers. This will happen because in these two industrial countries the coal production is very low, and speaking of world's share of coal their production is almost zero, less than 0.05% of world's share, hence the imports will be greater.

2.1.3.3 Importers: European Union

European Union is a key importer as well, with core imports being made traditionally by countries like Spain and the United Kingdom, which have the lowest coal production in the region. As years are passing the imports are going to be intensified and the prices of the seaborne coal trade will have to compete with the large imports coming from Russia landwards to the Continent.

2.1.3.4Exporters: Indonesia

Indonesia is the number one thermal coal exporter and this fuel mainly feeds the power stations of China and India. As the figure 4 shows, based on data taken for the year 2010, domestic coal consumption in Indonesia accounts only for 28% of the coal produced and for the year 2012 this percentage was reduced to 20%. This means that the country is characterized as export-intensive as per the before-mentioned coal production. For the year 2012, the rest 80%, out of the total 357 million tones of coal produced, was exported and for this year the country aims to produce 391 million tones[I].

The exports of this country, for the year 2010, were increased by 15.22% from 230 million tones to 263 million in comparison of course with the previous year. For

[I]Data from Platts March 2013

2013, the exports are expected to rise up to 6.5% from the previous year, amounting to 330 million tones[1] whereas the forecasted coal produced will be 400 million tones for this year.

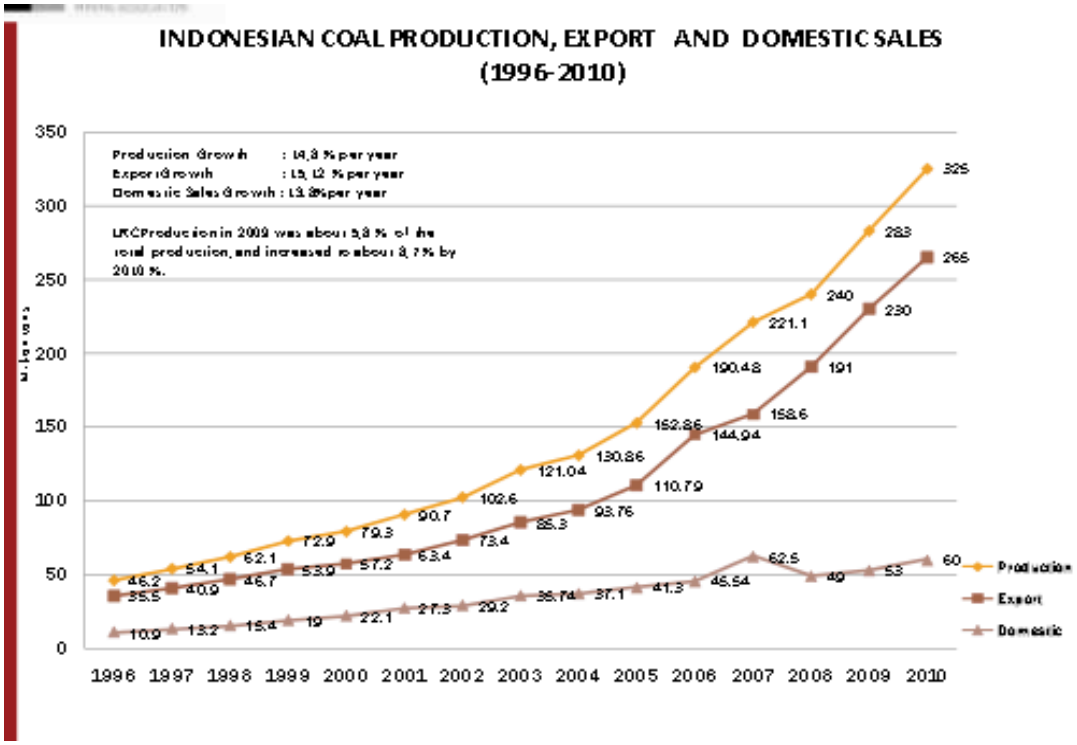

Figure 4: Indonesian Coal Production, Export and Domestics Sales (1996-2010)

Source: Coal Mining Association, Chairman's Presentation given in 2011.

Based on all the above mentioned, traditionally Indonesia is a key player for the exportation of this fuel and it is sound to say that apart from emerging market like China and India, other countries which prefer this coal are S. Korea and Taiwan. The geographical map, which follows, is quite indicative as per the coal map of the

[1]Combined data from Reuters and Coal Mining Association

country. Mainly, Indonesia has more low rank coal than high rank, constituting the country as export competitive since the pricing for this fuel play a dramatic role which affects the preferences of the importer.

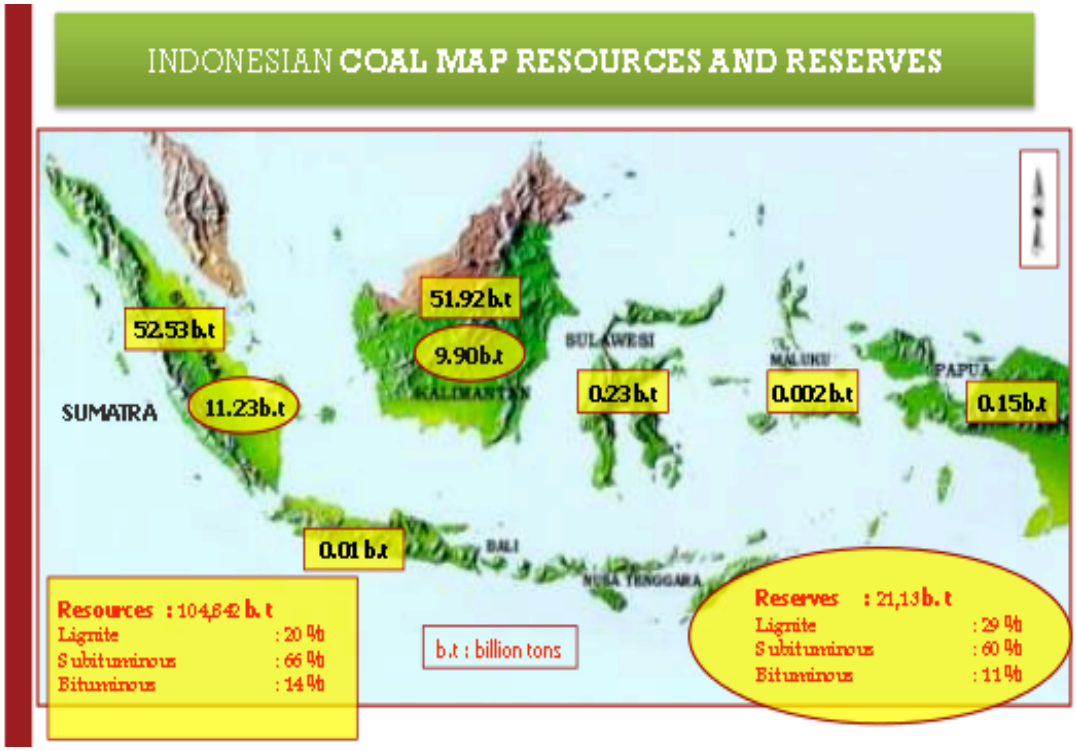

Figure 5: Indonesian Coal Map Resources and Reserves

Source: Coal Mining Association, Chairman's Presentation given in 2011

In the future, Indonesia will keep on setting targets and exporting bigger and bigger quantities of coal in the following years. Towards this direction the Indonesian government roads and railways are going to be upgraded from scratch and will expand the explorations portfolio since the country has all sorts of minerals apart from thermal coal, such as bauxite, alumina, nickel ore, to name a few.

2.1.3.5 Exporters: Australia

In the exporters' side, Australia is the second leading country, which is mainly focusing to supply coal in the Japanese market with a percentage of 39.3% of the total coal exports, or 115.3 million tones[I]. Other countries that Australia is supplying with coal are China (including Taiwan) and S. Korea. Together these countries absorb the astonishingly high 88% of the total coal exports of Australia.

The need for emerging players like India and China, which want to satisfy their needs in power generation and steel making, will force Australia to keep maintaining its leading role of exporter by producing and exporting more.

Other leading players like S. Africa and Colombia, which currently are supplying the European market, in the future they might need to shift towards the Yellow Sea Region due to the evident necessity of the region to import this cheap fuel. The obvious result of this change, will be the fact that ship-owners will need to shift their fleet towards unforeseen markets – based on the current standards and above all make their shipping business viable, economically speaking, by the selective picking of those new trade 'legs'.

[I]Data from Australian Coal Association.

2.2Oil Market Explained: Basics, Major Players and Future Projections

2.2.1 Basic types of oil transported with ships

Historically, oil is the most controversial of fuels that is due to the fact that in the past was directly linked with industrial production and the industrial revolution from the previous century onwards was closely dependent on this fuel. The significance of this fuel in seaborne trade is evident because not only the by-products of this fuel are carried on board tanker vessels from country A to country B, but also oil is used for the propulsion of the shipping industry per se. Hence, the fluctuation of prices, the accessibility to oil reserves and the liberalization of the market are determinant factors which influence the industry to a great extent especially if one bears in mind that bunker costs which amount to a great percentage of the operational expenses of running a vessel.

Now, the transported oil by-products are divided in two big categories, the clean and the dirty petroleum products (CPP and DPP). The DPP have occasionally black or dark brown color and they are characterized by high viscosity, since they are not purified. Heavy diesel, bitumen, fuel oil fall into this category and are black sticky stuff which is used to make roads, for instance. The CPP, on the other side, are purified products and these are the motor gas and the jet or aviation gas (as it is also

known). Kerosene, naphtha, paraffin and other light products belong to the clean category as well. There are also other chemicals which are by-products of the refining crude oil.

2.2.2 Major oil players and global reserves

To begin with the global reserves, it is important to be mentioned that the region, which encompasses the Middle Eastern countries, contains almost half of the proven global reserves of oil, 48.1% to be more precise[I]. In this area specifically, Saudi Arabia is the leading country with 16.1% of world's share. Iran and Iraq are following with 9.1% and 8.7% respectively and less powerful players of the region but important players in the global scheme are Kuwait and United Arab Emirates with a percentage close to 6%.

In terms of counties though, Saudi Arabia is not the first one in the list. Venezuela is the uprising star, in terms of global share of oil reserves, with 17.9% of world's total. Other countries that have to be mentioned here are Canada with 10.6%, Russia with 5.8%, Libya with 2.9% and Nigeria with 2.3%.

The absence of any country from the Asia Pacific region makes the explanation of the consumption of this fuel easier. In terms of regions, Asia Pacific area is the

[I]BP's statistics on World Fuel Report.www.bp.com

dominant player of the consumption side with 32.4% of world's total oil consumption. China consumes close to 11.8%, Japan 5%, India 4% and South Korea 2.6%. Speaking of countries though, USA is the most dominant always in terms of consumption with 20.5% share. In the European region, as BP informs us, the consumption of this fuel is more evenly distributed among countries with Russia, Germany, and France among the most leading ones with 3.4%, 2.7% and 2% respectively. It is important here to point out that in the demand side Middle Eastern countries, as a whole, consume only 9.1%, which means that the remaining oil is exported.

2.2.3 Future projections and geography of the market

The future projection of this fuel is the center of discussion for students, scholars and people in all sorts of professions. At the end of the day, however, it is the people of each country who need to have heating systems warming them in their houses and enough power in their cars. Oil is a necessity and as such the following projection will be treated delicately and above all impartially.

For the sake of keeping a cohesive structure the following subchapter will deal with the oil exploration in the Arctic Pole and then the future importers and exporters are going to be described. At this point, it is important to clarify the fact that the changes that will happen in the oil market, both crude and petroleum products are always a matter of change and this depiction is been made only for academic purposes.

2.2.3.1 The oil exploration in the Arctic Pole

Exxon Mobil characterized as:

"*The most promising and least explored regions for oil*"

The issue of oil exploration in the Arctic Pole becomes more and more intriguing as days are passing. In the past, the technological know-how and the extreme conditions that are prevailing in that region constituted the area as a difficult one for exploitation, since extreme coldness, powerful winds, low visibility and moving ice blocks was (and some of these problem still are) the case.

With the advancement of technology, with the existing oil resource isolation[I] and with the melting of ice[II]neighboring to the Pole countries are claiming their rights for further exploration in the region. A notable factor that makes the issue more interesting is that as the ice is melting – now at a faster rate than in the past – the cost for oil extraction decreases. A second important factor that will lead countries to start seeing the whole issue more seriously is the fact that close to 13% of world's undiscovered oil is located in the Arctic region. As it is depicted in the below graph, the countries that claim their share for undiscovered resources are Russia, Canada,

[I]It means that oil is concentrated in few regions in the world. Isolation in the sense that the oil reserves neither can be moved from one region to another nor are popping out on a daily basis. We know where they are and in that sense there is isolation because we cannot find more of this fuel anywhere else.

[II]There is an estimate that this issue is more important than before due to the fact that 28,000 sq. miles of ice are being vanished on an annual basis.

USA, Norway and Denmark.

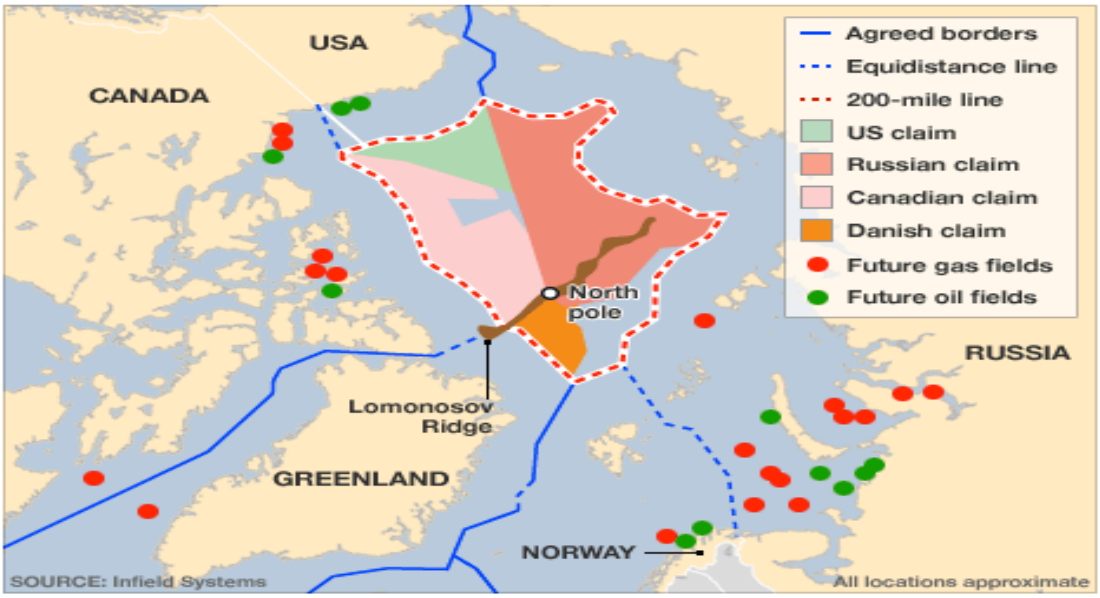

Figure 6: Arctic Pole oil claim reserves map

Source: BBC.co.uk

Based on the graph, it is evident that Russia takes the lion's share both in terms of oil and gas reserves and for that reason there is plenty of diplomatic battles going on but this is not going to be analyzed by this paper.

What is important for this paper to be mentioned is that Russia is quite active and is heading towards to become the world leader of energy resources. Towards this goal, the country aims to develop a massive exploratory project of the Arctic region which will be connected through a pipeline with China. The China-Russia exploratory project will add pipeline oil capacity between these two countries and the companies that are collaborating for this project are China National Petroleum Corporation

(CNPC) and Rosneft. The key point, here, that derives from this move is that by successfully implementing this project 12 VLCCs from West Africa or 8 VLCCs from the Arabian Gulf importing to China are going to be displaced. The reshaped status of the energy map which directly influences seaborne trade is profound.

2.2.3.2Crucial oil exporters in the future

Traditionally, Russia is focusing on the onshore oil extraction and by signing the bilateral contract with China's pipelines; the country makes the seaborne oil imports, in terms of prices, even more competitive. Russia's commitment to become world leader doesn't stop there. There is an estimate in Lloyd's magazine which depicts that by the year 2030 Russian oil will be shipped directly to Europe but the bigger volumes will be shipped to China and to the other Asian countries in that region.

A crucial player for the oil market is Venezuela, especially with the recent development of the death of Chavez. Some enthusiasts believe that after this incident the liberalization of the oil market will be realized, others are of the view that the whole issue with oil needs more time to be developed and fully exploited. The reality is that the Chavez regime didn't enable foreign investments in the region so far and as a result the oil production has been kept on hold. The company, which is mainly responsible for the oil exploitation, is PDVSA. Venezuela produced 2.72 million barrels/day for the year 2011 and PDVSA claims that this number can be increased exponentially for the upcoming years with 5 million b/d and 6.5 million b/d for the

years 2015 and 2020 respectively. There are those who say that by the year 2020, with the changing environment in the energy map on a global level, the whole production can reach up to 10 million b/d, especially if the proper platform has been built for the attraction of private investments[I].

The region which is the most vibrant in terms of density of countries that own and exploit oil resources is no other than the Middle East and the biggest, as we mentioned earlier oil producer is Saudi Arabia. A projection[II] explains that in the future the crude oil from S. Arabia, and generally from the regions of the Middle East Gulf and Black Sea, in the next 17 years will increase and will head east of the Suez Canal passing the Indian Ocean. China and other Asian countries will dominate the imported crude demand at that time. This shift of trade will boost the demand for VLCC vessels – long-haul voyages will increase as well – and as a consequent smaller tankers and Suezmaxes, which until very recently transferred crude to USA, now will be displaced. The same direction is projected to be followed by countries in the African Continent, like Nigeria, which will no longer service the North American market and will shift their exports towards the Asian counties.

2.2.3.3Crucial oil importers in the future

[I]Auctioning oilfield is one type that currently is being discussed.

[II]It was made by Lloyd's Register but International Energy Agency publicizes similar reports which justify the statements of the given projection.

To begin with the biggest importer, at the present levels, USA for 2011 imported approximately 8.4 million b/d[I] and the top sources for US crude net imports were Canada with 29%, Saudi Arabia with 14%, Venezuela with 11%, Nigeria with 10% and Mexico with 8%. The fact now is that these numbers of imports are not representative of the recent developments in the energy frontier in the North American region. The domestic developments show that the onshore oil production, which is supported by the shale gas of North Dakota and Texas, is expected to increase less than the offshore oil production beyond the year 2020[II].More specifically the US government has signed a lease agreement for a 5 year plan in order to achieve an expansion of oil and gas platform in the Gulf of Mexico. All these facts drive the rest of the world to the conclusion that USA has already begun to make steps towards its energy independence with the view that in the future will be less prone to imports from foreign countries. Towards this direction, the Alaskan crude oil, which, in simplistic terms, is the 'back-up' crude inventory for USA, amounts for almost 10% of the whole American production for the year 2011 and exclusively serves the domestic North American market. What is important here to mention for the significance of the Alaskan crude is that from 2004 until 2012 the Alaskan oil wasn't exported to foreign countries and primarily focused upon domestic refineries such as those in California, Hawaii and Washington to name a few. To sum up all the above, although for the first months of 2013 US imports increased up to 294,000 b/d, as opposed to the average of the previous year which was at 170,000 p/d[III], the US imports especially those from West Africa are going to be decreased because of the shale gas developments and generally the energy

[I]Source IEA, net value, the gross was 11.4 minus the exports for that year equals 8.4 millions b/d.

[II]Source UPI.

[III]This is merely justifiable by the reaction of the US oil industry due to refinery maintenance purposes.

independence policy, mentioned above, and a natural reaction to the seaborne trade is that this cargo will head towards China and India[I].

The role of China in the following years will be very crucial for the oil market. In a report of Lloyd's magazine for the year 2030, China will increase the seaborne trade for oil to 24 million tones from 9 million, which is the current level. This can be justified if one bares in mind the fact that there is a shift in Chinese people lives. Chinese people, while seeking better standards of life, tend to migrate in urban areas – mainly coastal cities within China – and accepting more and more the Western lifestyle. By doing so, the levels of oil consumption are pushing the limits only upwards. Not only the people of China, but the government as well implements strategies to attract bigger quantities of crude oil. The first pipeline that described earlier which is a collaboration between China and Russia is followed by another project which aims to bring 22 million tones of crude in China through a second pipeline passing through Myanmar starting from the Indian Ocean. This measure of course is performed because the Chinese elite do not want to be heavily dependent on seaborne transport in its imports of crude. Therefore although the upward trajectory of crude oil imports by sea is a fact, for the sake of analysis one needs to bare in mind the potential competitors that will slow down the mere seaborne trade. In simpler words, the fleet discharging oil in Chinese ports will rise drastically but will have a point where this upward slope will be stabilized. Now, traditionally the crude oil is coming from countries in the Arabian Gulf and to be more specific for the year 2013 the Iranian crude exports to China's Sinopec are close to 60,000 b/d. The important observation here is that the exports from West African crude oil to China has increased lately. It is important because this is a derived shift from the US

[I]Lloyd's Magazine, Hal Brown

shale gas development strategies that displace the West African crude. All in all, one can say that the 'port of refugee' for the Western African crude is no other than the coastal China.

2.3Natural Gas Market Explained: Basics, Major Players and Future Projections

2.3.1 Natural Gasbasics, usage and seaborne transport

Natural Gas is the world's cleanest fossil fuel and the usage of this fuel varies. It can be used for power generation in the households – as this is the case of the US households, in the manufacturing industry and in the transport industry –although numerous vehicles in certain regions of the world burn this fuel; its usage is not widely practiced. Natural Gas is widespread in nature and is mainly composed by methane (70-90%) or other hydrocarbons like butane, propane and ethane (0%-20%)[I].

In order to transport natural gas with LNG ships, it needs to be transformed from gas to liquid. This transformation is been done in designated facilities where the fuel freezes to -160 degrees of Celsius and obtains its liquid form. By doing so, the fuel,

[I]See www.naturalgas.org

which now is called ‘liquefied natural gas’ becomes 600 times smaller and is more easily to be managed and loaded on board the refrigerating - insulated holds of a LNG ship.

The whole process from exploration and extraction to transportation, storing and pushing it into the market is a costly business; hence the transformation from gas to liquid is proven not only to be a necessity but also is safer because the possibility of ignition decreases drastically constituting the fuel, apart from clean, as a safe one.

Focusing in the transportation side of the fuel, there are two ways to transport it, the first one was mentioned above via LNG carriers and the second is through pipelines. Now, at the moment, as it is clear from the chart in the following page, the pipelines as a means of transporting are more famous than carrying the fuel across oceans. This is reasonable because on the one hand the pipelines traditionally decrease the cost for transportation very much and on the other hand the pipeline can be understood as a bilateral agreement between two countries which simply implies that the trade is characterized by continuity and stability, viz. it will not seize to exist overnight.

More specifically, in the chart, which follows, we can spot out the imports and exports of natural gas both with pipelines and with LNG ships for the year 2011 and 2012 respectively. Apart from the conclusion that most of trade is conducted with pipelines passing through mainly 2 and sometimes 3 or more countries, another important component is the exact geographical points where imports and exports are

taking place. Most notably – in the following chapter we will see this in depth – the key LNG exports are coming from Qatar, Indonesia and Trinidad & Tobago and Asian countries like Japan and South Korea as well as in the European continent by Spain and United Kingdom conduct the imports.

	Pipeline imports	LNG imports	Pipeline exports	LNG exports	Pipeline imports	LNG imports	Pipeline exports	LNG exports
US	93.3	12.2	30.3	1.6	88.1	10.0	40.7	2.0
Canada	20.9	2.1	92.4	-	26.6	3.3	88.0	-
Mexico	9.4	5.7	0.9	-	14.1	4.0	0.1	-
Trinidad & Tobago	-	-	-	20.4	-	-	-	18.9
Other S. & Cent. America	14.3	9.2	14.3	1.8	15.6	10.9	15.6	5.1
France	34.6	14.2	1.5	-	32.3	14.6	2.2	-
Germany	91.7	-	14.9	-	84.0	-	11.7	-
Italy	65.8	9.1	0.1	-	60.8	8.7	0.1	-
Nerterlands	16.8	-	53.3	-	13.6	0.8	50.4	-
Norway	-	-	96.3	4.71	-	-	92.8	4.0
Spain	8.9	27.9	0.5	-	12.5	24.2	0.5	0.7
Turkey	28.4	8.0	0.7	-	35.6	6.2	0.7	-
United Kingdom	35.0	18.7	15.7	-	28.1	25.3	16.3	-
Other Europe	98.9	10.6	11.3	0.6	101.8	10.9	6.2	0.6
Russian Federation	32.7	-	189.5	13.4	30.1	-	207.0	14.4
Ukraine	33.0	-	-	-	40.5	-	-	-
Other Former Soviet Union	32.2	-	51.5	-	30.4	-	62.5	-
Qatar	-	-	19.2	76.1	-	-	19.2	102.6
Other Middle East	31.5	2.9	8.4	25.3	31.6	4.6	9.1	27.8
Algeria	-	-	37.0	19.3	-	-	34.4	17.1
Other Africa	4.9	-	18.0	39.5	5.7	-	8.3	39.8
Japan	-	95.1	-	-	-	107.0	-	-
Indonesia	-	-	9.9	31.8	-	-	8.7	29.2
South Korea	-	44.4	-	-	-	49.3	-	-
Other Asia Pacific	33.4	40.4	19.9	66.1	43.2	51.0	20.3	68.6
Total World	**685.5**	**300.6**	**685.5**	**300.6**	**694.6**	**330.8**	**694.6**	**330.8**

Source: I cludes data from Cedigaz, CISStat, IGNL, Pote , Waterborne.

Figure 7: Gas Trade flows

2.3.2 Major natural gas players and global reserves

Again, the region with a strong presence in terms of natural gas reserves is the Middle East. Close to 40% of the world's reserves are concentrated in certain countries of this region. Most notably, Iran owns the biggest percentage of the reserves in the region with 15.9%, next in the list is Qatar with 12%. These are the giants of natural gas reserves and two other important countries are following Saudi Arabia and United Arab Emirates with 3.9% and 2.9% respectively[I].

Among all countries in the world, admittedly, Russia is the biggest leader with reserves per country ratio higher than any other country. Russia with a world share of 21.4% is the major supplier of the fuel between two different continents Asia and Europe. In Europe via pipelines the fuel is transported in Finland and countries in the Baltic region and in Asia with the same means the fuel is mainly transported to China. Apart from supplying multiple countries with its clean fossil fuel, Russia plays a leading role in all the neighboring countries politics which are revolving around the issue of natural gas, since the bargaining power is in its favor. One of the neighboring countries with huge reserves is Turkmenistan with 11.7% of world's share.

Another country with strong presence in the reserves spectrum is USA with 4%. Venezuela, Nigeria, Libya, Papua New Guinea and generally the majority of the

[I]See, BP data

countries in the Middle East have reserves, which can last for more than 100 years with today's production[I]. These countries will play a dramatic role in the future developments of natural gas especially pairwise with the emerging importers.

Natural Gas: Trade moveme Billion cubic metres To	Total imports
United States	10.01
Canada	3.30
Mexico	4.05
North America	17.35
Argentina	4.38
Brazil	1.05
Chile	3.86
Dominican Republic	0.91
Puerto Rico	0.74
S. & Cent. America	10.94
Belgium	6.57
France	14.57
Greece	1.29
Italy	8.75
Netherlands	0.78
Portugal	3.01
Spain	24.16
Turkey	6.23
United Kingdom	25.31
Europe and Eurasia	90.67
Kuwait	3.18
United Arab Emirates	1.43
Middle East	4.60
China	16.62
India	17.10
Japan	106.95
South Korea	49.31
Taiwan	16.31
Thailand	0.98
Asia Pacific	207.26

Figure 8: Major LNG Importers for 2012

The above figure 8 shows the major LNG importers for the year 2012[II]. Starting from the Asian region, the major importer is Japan which receives liquified natural gas from Malaysia (20.35 bcm), Australia (19.01 bcm), Qatar (15.78 bcm) and Indonesia

[I]See, same

[II]See, BP datas

(12.6 bcm). The second biggest is South Korea with biggest imports from Qatar (11.09 bcm) and Indonesia (10.76 bcm). The remaining regions in Asia such as China, India and Taiwan are the silent giants in terms of imports which mainly will be discussed in the following chapter where it would be indicated that the imports will start increasing to respective levels in the near future.

In the European region, the biggest imports are been made by countries which, for mainly geographical reasons, do not have access to the pipelines coming from Russia. Therefore, United Kingdom[I], France and Spain have the biggest volumes of LNG imports in proportion to the rest of the European countries. A characteristic of the imports of France and Spain which differs them from the UK imports is that they mainly import from African countries.

In the American continent, USA is the dominant player. The imports are coming from Trinidad & Tobago (3.77 bcm) and from Qatar (2.58 bcm). USA has an aggressive domectic program of production for natural gas in order to become entirely independent in the future. This domestic program lies on the exploration of shale gas and the implementation of new methods[II] for extracting it are seriously tested.

The top 6 exporters of the fuel are Qatar, Malaysia, Indonesia, Australia, Nigeria and Trinidad & Tobago.

[I]UK imported exclusively from Qatar 21.9 billion cubic meters the previous year.
[II]Hydraulic fracturing, horizontal drilling etc.

2.3.3 Future projections of liquefied natural gas

2.3.3.1 USA, Canada & Mexico

The future projections of natural gas in the United States, according to the International Energy Agency, have a common factor as a basis. This common factor is the price of fuel will follow an upward trajectory. This is mainly caused because of the reason that USA's production of natural gas is foreseen to grow 6 times faster than any other fossil fuel for energy purposes of course. The natural gas is the future in the country's energy mix and the domestic production and above all the consumption of the fuel will be a determining factor of whether the country will be a gas exporter or its imports will rise. That being said, it is projected that the shale gas production will rise from 610 billion cubic meters in 2010 to 820 billion cubic meters in 2035[I]. If this becomes a reality then the exports with LNG carrier will reach up to 40 billions cubic meters in 2035 including together the exports from Canada.

Now, production in Canada rises from 160 billion in 2010 to 180, but the picture here is slightly different since the increase in domestic consumption drops the exports from 65 billion cubic meters in 2010 to 25 billions in 2035.

In Mexico, the national oil company Pemex has started evaluating 175 wells until 2015 in order to assess the quantity of the reserves underneath the soil. The production here is expected to rise by the year 2035, and in addition to this Mexico is

[I]See, Golden Rules for a Golden Age of Gas, World Energy Outlook 2012 (IEA)

a promising area for the fuel and the seaborne trade since has 19 trillion cubic meters in shale gas.

2.3.3.2 Asian region and Australia

Australia is the ideal country for seaborne transportation of the fuel because it combines two crucial characteristics. The first is the low demand for the fuel and the second is its massive exports of the fuel. As an exports country, Australia has big projects to install LNG receptive equipment in three already existing major ports and be ready to forward the fuel from the regions of extraction towards the holds of LNG carriers. Mainly Australia is exporting to the Asian market with China and Japan being the key importers. To meet with the needs of these developments, the production will increase from 60 billion cubic meters in 2010 to 110 billion cubic meters. Australia and Qatar will be the main exporters of the fuel until 2035.

For China, now, although at the moment is not so necessitated, natural gas will be the fuel of the future. As it was mentioned before, the Sino-Russian pipelines and also the pipelines coming from Indian Ocean are strong indicators which show that China is heading towards a shift in its energy mix. It is said that in 2030, the LNG seaborne trade will rise to 500 metric tones from 200 mt in 2010 and China alongside with Japan and India will be the key countries of this increase. Of course, there are the enthusiasts who claim that 500 metric tones by then is a modest increase and a rise

up to 600 metric tones is more realistic[I]. Although the country, today invests in shale gas projects in North America in order to learn the technology, the significant change will start taking place at the end of this decade.

Japan and China together will globally account for the biggest amount of imports in the future. On top of that, Malaysia and Indonesia, which currently export LNG to Japan mainly, will face the issue of not having sufficient reserves to satisfy domestic consumption as years are passing.

[I]See, Lloyd's Register

Chapter 3. The future structure of the fleet of energy carriers to match the reshaped energy map

3.1 Fleet Deployment Structure: Coal carriers' fleet structure

Based on the below figure 9 and figure 10 published by Drewry, there is an upward tendency of the seaborne trade of coal for the upcoming years expressed in tonnemiles which basically means that the total trade carried by the total dry bulk fleet. Not only the below figures, but also the previously mentioned statements of the future projections in the previous chapter indicate that the world fleet deployed for the coal trade will increase with a lot more ships coming to China.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Coal	830.2	784.1	884.7	896.3	1,011.1	1,045.4	1,085.1	1,128.2	1,173.3	1,221.1
% growth	-0.4%	-5.6%	12.8%	1.3%	12.8%	3.4%	3.8%	4.0%	4.0%	4.1%

Figure 9: Coal projections in tonnes

Source: Drewry 3Q2012, Million tonnes

Coal	4,566	4,101	4,954	5,095	5,833	6,122	6,449	6,806	7,185	7,590
% growth	1.0%	-10.2%	20.8%	2.8%	14.5%	4.9%	5.4%	5.5%	5.6%	5.6%

Figure 10: Coal projections in tonnemiles

Source: Drewry 3Q2012, Billion tonnemiles

In this chapter the research methodology is going to take place and more specifically the moving average method of forecasting is going to indicate the future tendencies of the fleet structure. The moving average method of forecasting is the simplest and most commonly used method. One important element here is to clarify that the quality of the research is highly determined by the tools of the researcher which enable him to do his job. The outcome of the implementation of the moving average method will constitute the scientific outcome of the research topic. On the other side of the pendulum, however, is the intuitive outcome of the researcher which as we will notice later on can contradict the scientific one. That being said, below table 1 excel sheet shows the different size categories of ships, the total amount of them which are at present time in our waters and finally in red is the future value of the amount of ships in our waters for each category.

Table 1: Number of Bulk carriers

Year / Size (in dwt)	40k-60k	60k-80k	80k-200k
2011	2643	1494	1921
2012	2857	1595	2153
2013	3070	1760	2358
2014	2856.67	1616.33	2144.00
2015	2927.89	1657.11	2218.33
2016	2951.52	1677.81	2240.11
2017	2912.02	1650.42	2200.81
2018	2930.48	1661.78	2219.75

Source: The numbers in black color where borrowed from Drewry report whereas the numbers in red are the future forecast.

In order to use the moving average method properly first and foremost we need to select a span, in our example the span being used is a total of 3 years. When it comes to calculate the future amount of ships for Panamax vessels (60k-80k dwt, as the chart shows), the span helps us in the calculation because we take the total amount of the ship in the previous 3 years and we divide it by 3, hence for 2014 we have an average of 1616 Panamax vessels. In the excel sheet, now, we use a function called "Average" and we basically insert inside this function the values of the previous years which is our span. The table 2 below shows exactly the before mentioned way for calculating future values.

Table 2: Number of Bulk Carriers (2)

Year / Size (in dwt)	40k-60k	60k-80k	80k-200k
2011	2643	1494	1921
2012	2857	1595	2153
2013	3070	1760	2358
2014	=AVERAGE(C2:C4)		
2015	2927.89	AVERAGE(number1, [number2], ...)	
2016	2951.52	1677.81	2240.11
2017	2912.02	1650.42	2200.81
2018	2930.48	1661.78	2219.75

Source: The numbers in black color where borrowed from Drewry report whereas the numbers in red are the future forecast.

Based on the above, a conclusion can be drawn. The numbers of ship that carry coal worldwide according to the Moving Average method are going to decrease in numbers. This can be quite justifiable since, as we all know, the present levels of the freight rate are low and the demolition activity is in high levels in comparison with other years, therefore for a period of time there will be a decrease in the global bulk fleet which is mirrored in the excel sheet for the year 2014 and 2015. Going forward up to the year 2018, based on the method above one notices that the bulk fleet in all three categories is trying to regain 2013's levels of ship in water. There is where the intuitive approach, based on the findings of the previous chapter kicks in.

There are certain aspects that need very delicate consideration because their gravity is important in terms of influence of the number of the global bulk fleet and these aspects are not easy to be transferred in a mathematical formula. For instance, we ought to bare in mind India. If the Indian government will stick to and successfully

execute the targets of the five-year program, then the moving average method will prove to be wrong and as a matter of fact Supramax and Panamax vessels especially will have to increase in number before the end of the year 2017 which is the end of the five-year plan. Supramax and Panamax vessels will be influenced more significantly since the formers are primarily employed in the Asian coal trade and the latters are focused in the thermal coal exports from Indonesia. Another entity which reinforced the previous statement is China, which not only influences the before mentioned ship categories but also the Capesize vessels, where coal trade steadily increased as opposed to other bulk cargo carried in these kinds of ships.

In general terms, the findings of this research topic are more of the tendency that the fleet of bulk carriers will certainly increase in number and the trade 'legs' and especially the destination point of them will be more Pacific-centered. The below figure 11 is indicative of this belief.

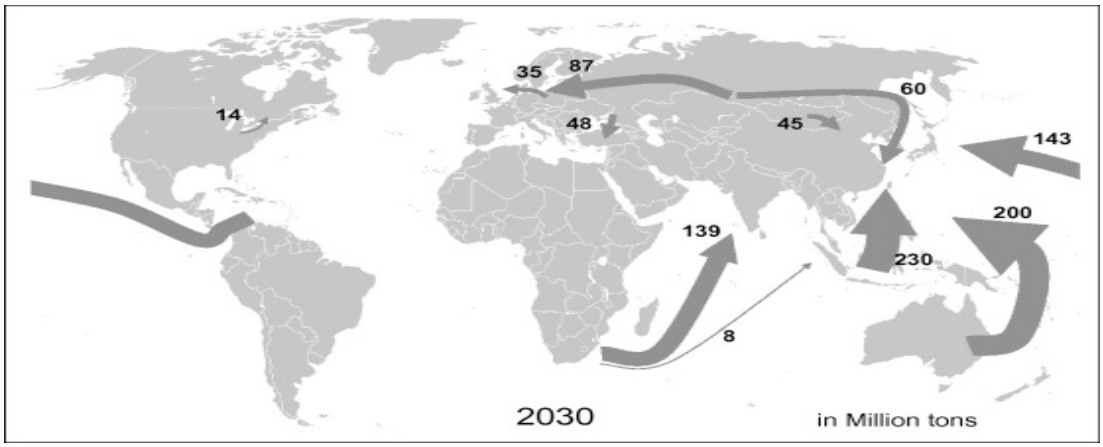

Figure 11: Coal sea trade routes for 2030

Source: C. Haftendorn, F. Holz, C.v. Hirschhausen, 2012, The end of cheap coal? A techno-economical analysis until 2030 using the COALMOD-World model, http://www.sciencedirect.com/

3.2Fleet Deployment Structure: Oil carriers' fleet structure

The same formula is applied in the oil sector as well. Table 3 below shows the future tendencies in the four different segments of tanker ships.

Table 3: Number of Tankers

Year / Size (in dwt)	50k - 80k	80k - 120k	120k - 200k	200k - 320k
2011	437	902	462	600
2012	454	923	489	629
2013	499	949	543	673
2014	463	925	498	634
2015	472	932	510	645
2016	478	935	517	651
2017	471	931	508	643
2018	474	933	512	646

Source: The numbers in black color where borrowed from Drewry report whereas the numbers in red are the future forecast.

The notable observation about the implementation of the formula is that although in the year 2013 a major demolition activity took place in all segments, as years are passing the fleet is growing gradually in number.

Although the formula identifies one major issue of today's industry which is non other than demolition, the concrete fact is that at the moment a sound number of

tankers going towards USA for discharging they will have to shift (especially Aframaxes and Suezmaxes). Not only the recent North American policies for domestic consumption and exploitation of shale gas but also dramatic changes are taking place in the Asian region. More and more people are having access to 'Western comforts' if I may, having a car for instance, and these comforts will lead countries like India and China in the future to monopolize the entire market, due to the fact that they will be the destination of where oil will end up. Moreover, the Lloyd's Report in its recent projection about tankers that China, up until the year 2030, might be the owner of 25% of the global tanker fleet. All the above indicate the significance of the region and the shift of future trade legs.

3.3Fleet Deployment Structure: Natural Gas carriers fleet structure

370 vessels represent the world fleet of LNGs. The rapid changes in the sector of natural gas will push the fleet up numerically; therefore there are some attempts to show this rapid development of the sector. The most predominant one is of Lloyd's Register, which stipulates that the number of the current fleet will be tripled by the year 2030, in order to satisfy the growing demand for this particular type of transportation. The future projections of the previous chapter will point towards this direction.

Below table 4 shows the usage of the Moving Average method, it is quite clear that by using the method, the total number of LNG vessels is declining from the 2013's

levels.

The findings depict something different though. Mitsui OSK Lines, among others, predicted in 2004 that the global LNG fleet will be around 353 vessels for the year 2015 and according to the American Association of Port Authorities another evident of increase in the fleet has risen. For the years 2011 to 2016 there will be around 388 ships in total. Recent development in the Mediterranean Sea (cooperation between Cyprus – Israel) and based on the infancy of the sector (in terms of ways of exploitation and management of the fuel) a potential rise of the fleet is eminent. Another factor, which contributes to this phenomenon, lies on the immediate competitor of LNG ships, and that is the pipelines as ways that a country can import natural gas. The pipelines, by their very construction, as opposed to LNG ships are able to transport a limited or standard quantity of natural gas to a specific destination hub for further distribution. This poses the threat of having regions that will be characterized by over-demand of the fuel, but the quantities being transported by the pipeline will only satisfy the demand of the big consuming hubs. On the other side, LNG ships are evolving. The modern LNG ships have grown into size especially if one makes the comparison with the LNGs in the 70-80s and are more flexible in delivering the fuel, in the sense that have numerous ports of call or destination hubs. To conclude with, the distinction between the features of pipeline and LNG ships is obvious. From the ship-owning's point of view, as soon as the charterparties of transporting natural gas pass their infant stage and become more sophisticated, then immediately will be an intriguing endeavor to think about it more realistically.

Table 4: Number of LNG vessels

Year	LNG (in total)
2011	337
2012	361
2013	370
2014	356
2015	362
2016	363
2017	360
2018	362

Source: The numbers in black color where borrowed from Drewry report whereas the numbers in red are the future forecast.

Chapter 4.Parallel energy developments as fleet's influence factors and bunkering

4.1 Alternative energy resources and its influence in the structure of the fleet: renewables and nuclear power

The changes in the field of energy resources allocation are unprecedented. Based on a report of International Energy Agency, in the previous years, the price of the implementation of solar systems for power generation purposes have decreased significantly. The technological costs have dramatically been decreased and generally solar energies the fastest growing fuel which will see an augmentation in the near future. To the same direction, wind power gains similar ground. With the world population being increased steadily, people will need to feel warm and protected; wind alongside with solar power will have a bright future usage. Generally, the price will be the number one determinant of the winner of this competition. So, if the price for coal, for example, keeps persisting to increase in the future renewables will be the fuel of choice. The result of this situation is obvious. Ships carrying energy resources will face the push from the competition and the worst-case scenario will be to be demolished or converted to satisfy different trades. The summation of

the above mentioned might be futuristic but is at least a potential one, therefore prudent shipping companies put an eye on the developments of these resources.

4.2 The issue of bunkering

In general terms, bunkering is the procedure, which is responsible for the propulsion of ships to distant ports. In the recent years, a persistent rise in bunkering costs is influencing more and more the decision-making processes conducted by the ship-owners, in a global level. The future projections explained in this paper is a direct influential factor for the bunkering of vessels, and in the recent years ship-owners have seen a dramatic push in the prices for the bunker oil. The bunkering issue not only poses a great dilemma to the decision making process of the ship-owner but also harms the environment. It is a common knowledge that the amount of carbon dioxide emissions produced by ships is one of the lowest in comparison with other means of transporting cargo but the fact is that this leads certain international institutions to pose strict regulations to the shipping transportation. The shipping transportation of the future will guarantee a cleaner transportation of cargo ensuring that the engines of ships will burn other fuels (such as gas) friendlier to the environment and the society as a whole.

Chapter 5.Conclusion and Recommendations

5.1 Author's Recommendations

The energy map change is a hotly debated topic of discussion. The fast pace of changes will always constitute it as a contemporary, complex yet problem among all sorts of cycles. The political arena, the economic players involved, the necessities of different societies in different eras, the scarcity of certain fuels will very much influence the developments of the reshape of the energy map. Due to this dynamic mix of entities, the fast changes will accelerate to even faster ones.

The moral of the above research is that Shipping companies which are the direct receivers of the results of these kinds of changes ought to always keep an eye on the energy sector because it can be said that shipping is the art of carrying energy resources with the help of energy resources to balance the global resources in different regions of the world.

Reference

[1] International Energy Agency, 2012, Executive Summary: World Energy Outlook, http://www.iea.org/

[2] BP (British Petroleum), 2012, BP Statistical Review of World Energy June 2012, http://www.bp.com/

[3] International Energy Agency, 2011, Are we entering a golden age of gas? World Energy Outlook 2011, http://www.iea.org/

[4] International Energy Agency, 2012, Golden Rules for Gas: Entering a golden age of gas, www.iea.org

[5] International Energy Agency, 2011, Coal: Medium-Term Market Report 2011, Market Trends and Projections to 2016, http://www.iea.org/

[6] OPEC, 2012, World Oil Outlook, http://www.opec.org/

[7] Moritz Paulus and Johannes Truby, 2011, Coal lumps vs electrons: How do Chinese bulk energy transport decisions affect the global steam coal market?,http://www.sciencedirect.com/

[8] C. Haftendorn, F. Holz, C.v. Hirschhausen, 2012, The end of cheap coal? A techno-economical analysis until 2030 using the COALMOD-World model, http://www.sciencedirect.com/

[9] Stefan Lochner and David Bothe, 2009, The developments of natural gas supply costs to Europe, the United States and Japan in a globalizing gas market-Model-based analysis until 2030, http://www.sciencedirect.com/

[10]AleksandarZaklan, Astrid Cullmann, Anne Neumann, Christian von Hirschhausen, 2011, The globalization of steam coal markets and the role of logistics: An empirical analysis, http://www.sciencedirect.com/

[11] Don Maxwell, Zhen Zhu, 2010, Natural Gas prices, LNG transport cost, and the dynamics of LNG imports, http://www.sciencedirect.com/

World Coal Association, 2012, The coal in the global energy supply,

www.worldcoal.org

[12] World Coal Association, 2012, Global Availability of coal, www.worldcoal.org

[13] World Coal Association, 2009, Section One: What is coal?,www.worldcoal.org

[14] Jean Hevre-Jenn, 2012, Bunker Supply & Procurement: The competitive edge, www.bunkerworld.com

[15]Samantha Cacnio, 2012, Embracing Change: Fujairah Evolving Landscape, www.bunkerworld.com

[16] Julian McQueen, 2012, A passage to prosperity?,www.bunkerworld.com

[17] Lars Moller, 2013, New year same issues, www.bunkerworld.com

[18] Ada Taib, 2013, Top ten corporate moments in the bunkering industry, www.bunkerworld.com

[19]Daniel Kein, 2013, What lies beneath, www.bunkerworld.com

[20] Robert DiNardo, 2012, Colombia's El Cerrejon coal mine to produce 32.5 MT this year, www.platts.com

[21] Hal Brown, 2013, Let's get China addicted to Gas, www.lloydslist.com

[22] Liz McCarthy, 2013, A changeover in Caracas fuels new oil supply fears, www.lloydslist.com

[23] Tito Summa Siahaan, 2013, Iraq willing to supply 'Unlimited Quantity' of crude oil to Indonesia, www.thejakartaglobe.com

[24] UtpalBhaskar, 2013, Oil production in South Soudan to resume this month, www.livemint.com

[25] PIB, 2013, India Coal demand to touch 980 mn tons by 2016-17, www.commodityonline.com

[26] Lawrence Williams, 2013, Gloomy price outlook for iron ore and met coal – MMHK, www.mineweb.com

[27] DeepaVijiyasingam, 2013, Indonesia aims to produce 391 mil mt of coal in 2013, up 1% on year, www.platts.com

[28] Gerard MacCormick, 2013, US Imports Of Saudi Crude Oil Up Nearly 300,000 bpd Last Week, www.reuters.com

[29] FitriWulandari and William Mellor, 2013, Indonesia to Import LNG by 2018 as Demand Rises, Migas Says, www.bloomberg.com

[30] Stephen Jewkes and Giancarlo Navach, 2013, Eni opens up Mozambique gas riches to China, www.reuters.com

[31] Royal Dutch Shell plc, 2013, Shell launches first LNG barge, www.shell.com

[32] Melissa Akin, 2013, Russia, China find compromise on gas deal after 15 yearstandoff, www.reuters.com

[33] Hal Brown, 2013, Shell looks to bolster its position in gas sector, www.lloydslist.com

[34] Hal Brown, 2013, Hedging its bets, www.lloydslist.com

[35] Hal Brown, 2013, Shell calls for energy and shipping to intergrate, www.lloydslist.com

[36] Max Tingyao Lin and Jing Yang, 2013, China Shipping Development to book 10 large LNG carriers this year, www.lloydslist.com

[37] Hal Brown, 2013, Newbuildings fuel concern over China moves to control LNG supply chain, www.lloydslist.com

[38] Hal Brown, 2013, Gazprom forges ahead with new LNG export project, www.lloydslist.com

[39] Hal Brown, 2013, Shell's 105 steps to greater efficiency, www.lloydslist.com

[40] Claire Wright, 2013, A good vintage, www.lloydslist.com

[41] Hal Brown, 2013, Green means go, www.lloydslist.com

[42] Mark Renton, 2013, False spring for LNG, www.lloydslist.com

[43]Hal Brown, 2013, Singapore to invest 800$ million in LNG, www.lloydslist.com

[44] Hal Brown, 2013, Global Marine Trends 2030: suezmaxes to suffer as VLCCs get an Asian boost, www.lloydslist.com

[45] Platts, 2013，U.S. crude inventories climb to nine-month high, gasoline stocks drop, www.platts.com

[46] Michael Place, 2013, Brazil oil output to rise 214% by 2020, says ANP, www.bnamericas.com

[47] DambisaMoyo, 2013, Why Oil Prices Will Hover at $120 for Next Decade, www.themoscowtimes.com

[48] Barclays, 2013, Crude Oil prices likely to gravitate back towards $111/bbl, www.thecommodityonline.com

[49] Barclays, 2013, Predicting Brent Crude Oil: The special, magnetic $111 mark, www.thecommodityonline.com

[50] Hal Brown, 2013, VLCCs can look forward to rising spot rates, www.lloydslist.com

[51] Colin Lamb, 2013, Is Colombia mortgaging its future?, www.lloydslist.com

[52] Jason O'Connell, 2013, China blow for tankers, www.tradewinds.com

[53] Hal Brown, 2013, Owners and charterers must work together to cut VLCC costs, www.lloydslist.com

[54] Aviezer Tucker, 2012, The New Power Map, Published by the Council on Foreign Affairs

[55] International Energy Agency, 2012, Renewable Energy: Coming of Age, www.iea.org

[56] Keith Burnard and Sankar Bhattacharya, 2011, Power Generation from Coal:

Ongoing Developments and Outlook, www.iea.org

[57] International Energy Agency, 2012, Oil Market Report (November of 2012), www.iea.org

[58] International Energy Agency, 2012, Oil Market Report (December of 2012), www.iea.org

[59] Obindah N. Wagbara, 2006, How would the gas exporting countries forum influence gas trade?, www.sciencedirect.com

[60] Yeongsok Ha, Keunjon Chung and JungsooSeo, 2012, Estimation on Oil Tanker Fleet Capacity in Korea's Crude Oil Market, www.sciencedirect.com

[61] Clyde Russell, 2013, India not quite the shining knight for coal miners, www.reuters.com

[62] Minister--, 2013, India hopes to complete three key coal rail links in 2017, www.reuters.com

[63] DeepaVijiyasingam, 2013, Indonesia aims to produce 391 mil mt of coal in 2013, up 1% a year, www.platts.com

[64] Bank of America Merrill Lynch, 2013, Atlantic Thermal Coal market could fare worse than Newcastle FOB, www.commodityonline.com

[65] Platts, 2013, Mongolian SouthGobi's 2012 coal output falls 71% to 1.34 mil mt on mining suspension, www.platts.com

[66] Jonathan Fox, 2013, ASIA THERMAL COAL: Traders in China switch to Indonesian low cv coal, www.platts.com