ENERGY SECURITY INDEX OF COAL IN INDIA

DISSERTATION REPORT

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BONAFIDE CERTIFICATE

This is to certify that **Mr. Abhishek bhalla**, student of university of petroleum and energy studies, Dehradun, pursuing **MBA (Energy Trading)**, has successfully completed his Dissertation report. As a part of his curriculum, the project report entitled, **"ENERGY SECURITY INDEX OF COAL"** submitted by the student to the undersigned is an authentic record of his original work which he has carried out under my supervision and guidance.

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College of Management and Economics studies

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Certificate of Originality

This is to hereby state with the intention of this report is very original in every sense of the terms and conditions and it carries a sense of honour and belief and that no shortcuts have been taken and I remained both meticulous and caring during the prevalence of this research work. I have put in my point best to keep this work as informative and precise as possible.

It may be also stated here that during the preparation of this report some help has been taken from a scope of professionally shared information & knowledge, a comprehensive description of which has been mention in the references chapter of this report.

Dated: 17th April, 2014

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ABSTRACT

"Energy security aims at continuous supply of energy to a country at all times at competitive/affordable prices, where shocks and disruptions can be reasonably expected."

Energy is universally recognized as one of the most important inputs for economic growth and human development. India ranks fifth in the world in terms of primary energy consumption, accounting for about 4.6% of the world commercial energy demand. Despite the overall increase in energy demand, per capita energy consumption in India is still very low compared to other developing countries. Also, the growth in energy supply has not kept pace with increasing demand and, therefore, India continues to face serious energy shortages which have led to increased reliance on imports to meet the energy demand.

Currently India is at 13th largest consumer of Coal in the world.
There is a popular myth about Energy Security, which relies mainly on the imports and the possible security measures in case of a supply disruption.

There needs to be a holistic approach towards identifying the risks involved in the supply of energy to a country and finding out solutions to these risks which pose as threats towards the need for energy of a nation

The following risks have been identified as potential troublemakers for a nation Energy Security:

a) Global resource status
b) Geopolitics
c) Economic risks
d) Environmental risks
e) Logistical risks

These risks have been further classified into global and domestic risks where the risks at the global level have a direct relation with the domestic risks to supply security that a country faces.

Need for energy security

According to IEA, India is expected to overtake Japan and Russia to become the third largest consumer of energy by 2030.

- The demand for Coal has been ever increasing, but the indigenous production remains more or less the same.

- Also, the sourcing of Coal has been more or less the same for the past 2-3 decades which makes India all the more vulnerable to supply disruption and hence the need for energy security.

Energy security index

The Energy Security Index is a quantifiable number which help us gauge the current position of our country as to how secure the country is in terms of energy.

The Energy Security Index that is generated will be an oversimplification of the model that has been developed and concentrates on the supply side of Coal alone.

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"Energy security aims at continuous supply of energy to a country at all times at competitive/affordable prices, where shocks and disruptions can be reasonably expected."

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CHAPTER: 1
COMPANY OVERVIEW

Observer research foundation (ORF) is a not-for-profit, multidisciplinary public policy think tank engaged in developing and discussing policy alternatives on a wide range of issues of national and international significance. Some of ORF key Ares of research including international relationship, security affairs, political and governance, resources management and economy and development.

ORF was thus founded and subsequently supported by many of India's leading intellectuals, academics, public figures, social activists, business leaders and institutions of higher learning

ORF was established on 5 September 1990 as a private, not for profit, 'THINK TANK'' to influence public policy formulation. The Foundation brought together, for the first time, leading Indian economists and policymakers to present An Agenda for Economic Reforms in India. The idea was to help develop a consensus in favors of economic reforms. Since then ORF scholars have made significant contributions toward improving government policies.

VISION, MISSION & OBJECTIVES

ORF Mission: BUILDING PARTNERSHIPS FOR A GLOBAL INDIA
ORF Vision: India, in the next 25 years, will join the ranks of the world's great economic powers and transform significantly the quality of life of its one billion people.

- Aid and impact formulation of policies and evolve policy alternatives
- Create a climate conducive to effective implementation of these policies.
- Strengthen India's democratic institutions to enable coherent, reasoned and consistent policy-making.
- Provide reasoned and consensual inputs representing a broad section of opinion to improve governance, accelerate economic development, and ensure a better quality of life for all Indians.
- Work towards achieving international peace, harmony, and co-operation.
- Give direction to India's long-range foreign policy objectives
- Monitor strategic environment

ORF publications are distributed to government officials, legislators, business leaders, journalist and academics. With a objective of building relationship for a global India, ORF has been vigorously pursuing partnership with international think tank and research institutions .

ORF has collaborations with various think tanks and research organizations across the globe as a vital part ofits mandate. For international partners, ORF represents an institution that is able to generate real time and quality analysis on a diverse range of public policy issues. **ORF has more than 50 institutional partner across the world .**

Today, ORF is known among policy makers, both in India and abroad, as a place pulsating with fresh promises and ideas. Ideas are what shape public policy think tanks. Ideas are an expression of unfettered curiosity and an urge to explore ways and means to find solutions to vexed issues that affect us. At ORF, ideas are reflected in the projects and the programmes that are undertaken by various institutes and programmes. Young researchers are encouraged to take up challenges of organizing and leading projects which, in the years to come, would be symbols of pride for the Foundation.

CHAPTER:2
ENERGY SECTOR AT A GLANCE

2.1 Introduction

Energy is an essential building block of economic development

Energy is universally recognized as one of the most important inputs for economic growth and human development. There exists a strong relation between economic development and energy sources, but on the other hand, the level of economic development has been observed to be dependent on the demand for energy.

In recent years, India's energy consumption has been increasing at a great pace due to population growth and economic development. India ranks fourth in the world in terms of primary energy consumption, accounting for about 4.5%[1] of the world commercial consumption. Growth of any economy lies on the availability of cost-effective and environment friendly energy demand. Despite the overall increase in energy demand, per capita energy consumption in India is still very low compared to other developing countries.

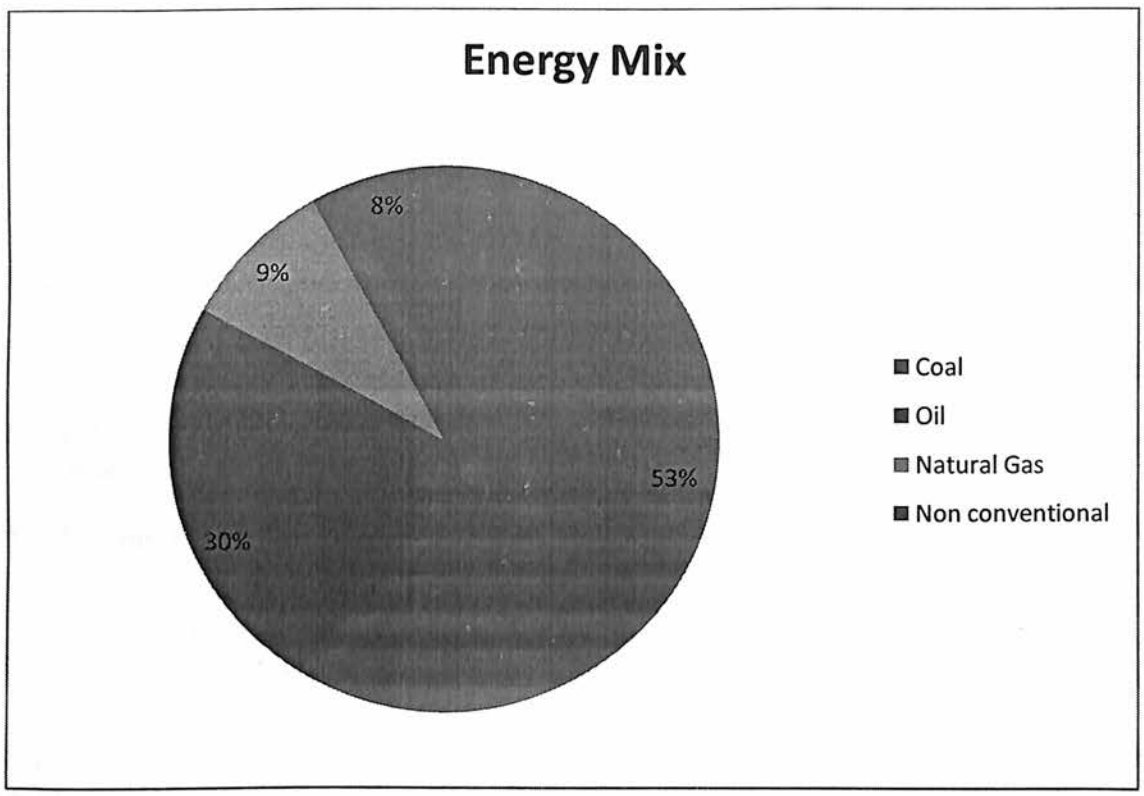
The use of energy has been a key in the development of the human society by helping it to control and adapt to the environment. Managing the use of energy is inevitable in any functional society. In the industrialized world the development of energy resources has become essential for agriculture, transportation, waste collection, information technology, communications that have become prerequisites of a developed society.

In an effort to meet the demands of a developing nation, the Indian energy sector has witnessed a rapid growth. Areas like the resource exploration and exploitation, capacity additions, and energy sector reforms have been revolutionized.

However, resource augmentation and growth in energy supply have failed to meet the ever increasing demands exerted by the multiplying population, rapid urbanization and progressing economy. Hence, serious energy shortages continue to plague India, forcing it to rely heavily on imports.

[1]Source - BP Statistical review of the world 2013

Figure 1[2] - Energy Mix of India In 2013



India's energy mix has been dominated by coal, accounting to more than half the share. It is followed by oil, which is almost a third of the country's energy mix. Since the report focuses on just the coal aspect, we would be looking at the consumption pattern of coal by various sectors, the demand and domestic production scenario, etc.

In 2012-13, Coal (53% of total Indian demand) remains the dominant source of demand and is the highest since 1996. Oil (30%) remains the second largest fuel used with Coal (9%) and non-fossil fuels (8%) far behind.

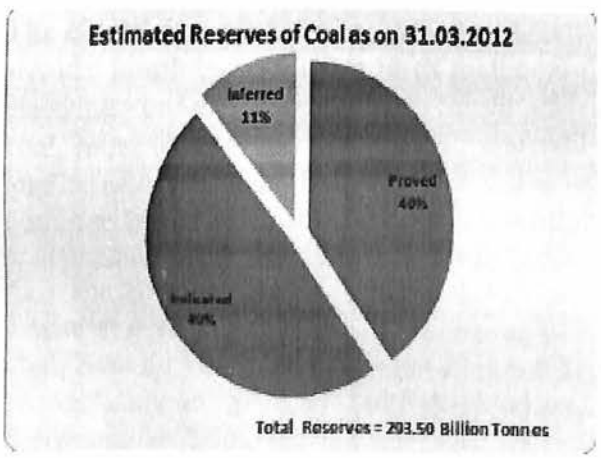
[2] Source - BP statistical review of the World 2013

COAL

Currently, India is 3rd largest consumer of Coal in the world. The Indian economy has experienced unprecedented economic growth over the last decade. Today, India is the ninth largest economy in the world, driven by a real GDP growth of 8.7% in the last 5 years (7.5% over the last 10 years). In 2010 itself, the real GDP growth of India was the 5th highest in the world. This high order of sustained economic growth is placing enormous demand on its energy resources. The demand and supply imbalance in energy is pervasive across all sources requiring serious efforts by Government of India to augment energy supplies as India faces possible severe energy supply constraints. In India, the Coal sector has been in prominence over decades. Coal has been the most economical energy option for energy mix and it is for our future energy needs. Coal has the emerged as a fuel of choice for many sections of Indian industries, particularly the Power sector. Since India need has huge power needs, it looks for cheap options, and no option is as cheap as Coal for power. Though Coal is not the cleanest option, it is most economical. Coal causes a number of environmental concerns – greenhouse Coal emissions, acid rain, smog, solid waste and water pollution.

Coal is the most important & abundant fossil fuel in India. It accounts for 55% of the County Energy need. The Countries Industrial heritage was would upon indigenous business coal. The increasing demand of India for energy for sustaining the economic growth will have to be met by a combination of renewable, nuclear and conventional sources of energy. Coal along with clean technologies forms an important role in India's increasing energy demand. To provide energy security to the country, guaranteed supply of coal with Better quality is a primary requirement. Even under the least coal dependence scenario, coal is expected to contribute 41% of the total preliminary energy demand in 2032 and about 40% of the total installed capacity in power in the country. Coal as an input in the manufacturing process of steel, cement, fertilizer and other industries.

Figure 2[3] – Estimated Reserves of Coal in India 2012-2013



[3] Source - Coal India Limited, CIL

2.2Sector wise Consumption of Coal

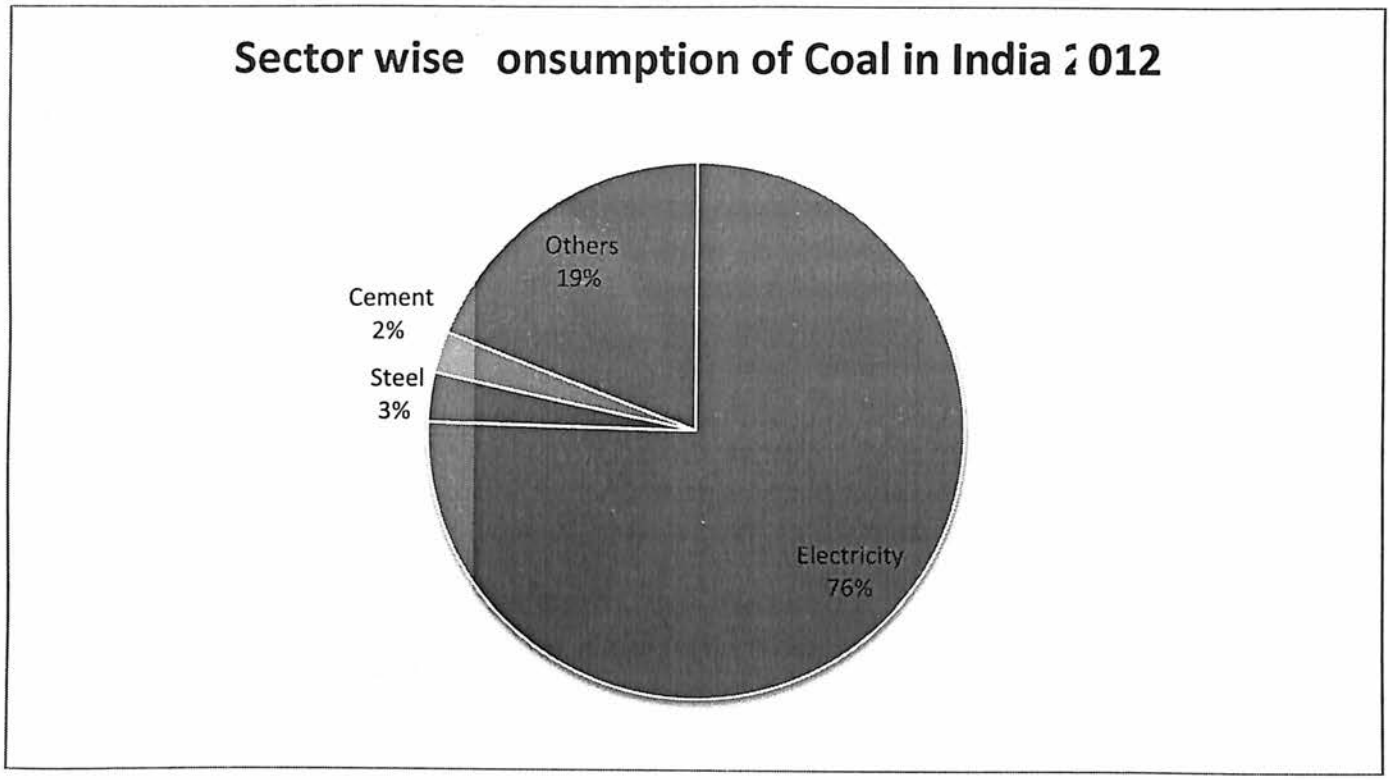


Figure 3[4]Sector wise Consumption of Coal in 2012

In India's energy sector, coal accounts for over 50% of primarycommercial energy supply. With the economy poised to growat the rate of 8–10% per annum, energy requirements will alsorise at a level of 6% (approx.). The consumption of coal lies mainly in the three sectors of Electricity, Cement Industry and Steel Industry.

The **electricity sector in India** had an installed capacity of 237.742 GW as of February 2014, the world's fourth largest. In terms of fuel, coal-fired plants account for 59% of India's installed electricity capacity, compared to South Africa's 92%; China's 77%; and Australia's 76%. After coal, renewable accounts for 17%, renewable energy for 12% and Coal for about %. Since the quality of Indian Coal is not that good due to high ash discharge and low calorific value, India is bound to import coal even though it has huge reserves of coal. In 2012, around 40 MT of Coal was used for Electricity Generation in India.

The next dominant sector of coal consumption is Steel. Globally, steel production is dependent on coal. Around 70% of total global steel production relies directly on Coal. In 2012, the global steel production was 1547 MT and India produced 78 MT which involved the use of 16.05 MT of coal consumption. Since the

Another dominant sector is Cement, where coal is highly consumed in India. In 2012 India consumed around 13 MT of coal in cement manufacturing Industry.

[4]Source - Energy Statistics of India 2013

Other sectors where coal is used are paper manufacturing Industry, Cotton industry , transportation and Domestic purposes

2.2 Literature Review

The study of undertaken to analyze the factors affecting Coal supply in India. With the help of these factors, the risks associated with the supply of Coal Security are brought forward. With the help of these factors, the energy security for Coal in India is evaluated, whether it is secure or insecure. An index is calculated which helps us in determining whether India lies in secure or insecure region. So the whole research analysis is done to find out that index number. It is obtained by deriving a uniform formula for Energy Security.

The result obtained at the end indicted the status of India how insecure it is in 2012 – 2013, in terms of Coal.

S.No'	THEME	AUTHOR & YEAR	REFERENCES	FINDINGS
1.	Energy Security	Jakrata, 2011	'Developing an Energy Security Index' in Koyama, K. (ed.), *Study on the Development of an Energy Security Index and an Assessment of Energy Security for East Asian Countries*	The definition of energy security changes depending on what the subject of energy security is ("what" is being protected), the threat to energy security ("against what" is it being protected), the measures to promote energy security ("who" "is doing what" to protect "with whom") and how these points are recognized. There is no universal definition that transcends time periods.
2.	Energy Security		(IEA, 2007)	***Energy security, defined in general terms, means adequate and reliable supplies of energy at affordable prices.***
3.	Risk Factors	Beatriz Munoz Delgado	UDAP 2001, Energy Security Index: Europe	**1. Economic-driven risk**: a country's energy risk derived from its economic characteristics, including its energy trade patterns (ie. energy intensity, income from energy,…) **2. Intrinsic energy risk**: energy risk emerging from a given energy resource base and energy imports concentration (ie. reserves-to-production ratios, HHI,…)

				3. Political-institutional risk: energy risk derived from institutional and political factors that may imply both internal and/or external political frictions (ie. institutional quality, political stability, prevalence of the rule of law) **4. Social risk**: risk emerging from social factors that usually imply internal turmoil (ie. social equity, social &labour conflict)
4	Energy Security Dimensions	Benjamin K, A. Brown January 2009	Research paper "Competing Dimensions of Energy Security"	we have created an Energy Security Index, utilizing ten metrics that encompass economic, social, political, and environmental aspects of energy security, and analyzed the status of energy conditions in 22 OECD countries from 1970 to 2007.
5	Energy Security Indicators	Bert Kruyal, D P Van Vuuren June 2009	Research paper on "Energy Policy"	The Four dimensions of energy security that relate to the availability, accessibility, affordability and acceptability of energy and classified indicators for energy security according to this taxonomy. There is no one ideal indicator, as the notion of energy security is highly context dependent. Rather, applying multiple indicators leads to a broader understanding. Incorporating these indicators in model-based scenario analysis showed accelerated depletion of currently known fossil resources due to increasing global demand.

The following risks have been identified as potential troublemakers for a nation Energy Security:

a) Global resource status
b) Geopolitics
c) Economic risks
d) Environmental risks
e) Logistical risks

These risks have been further classified into global and domestic risks where the risks at the global level have a direct relation with the domestic risks to supply security that a country faces.

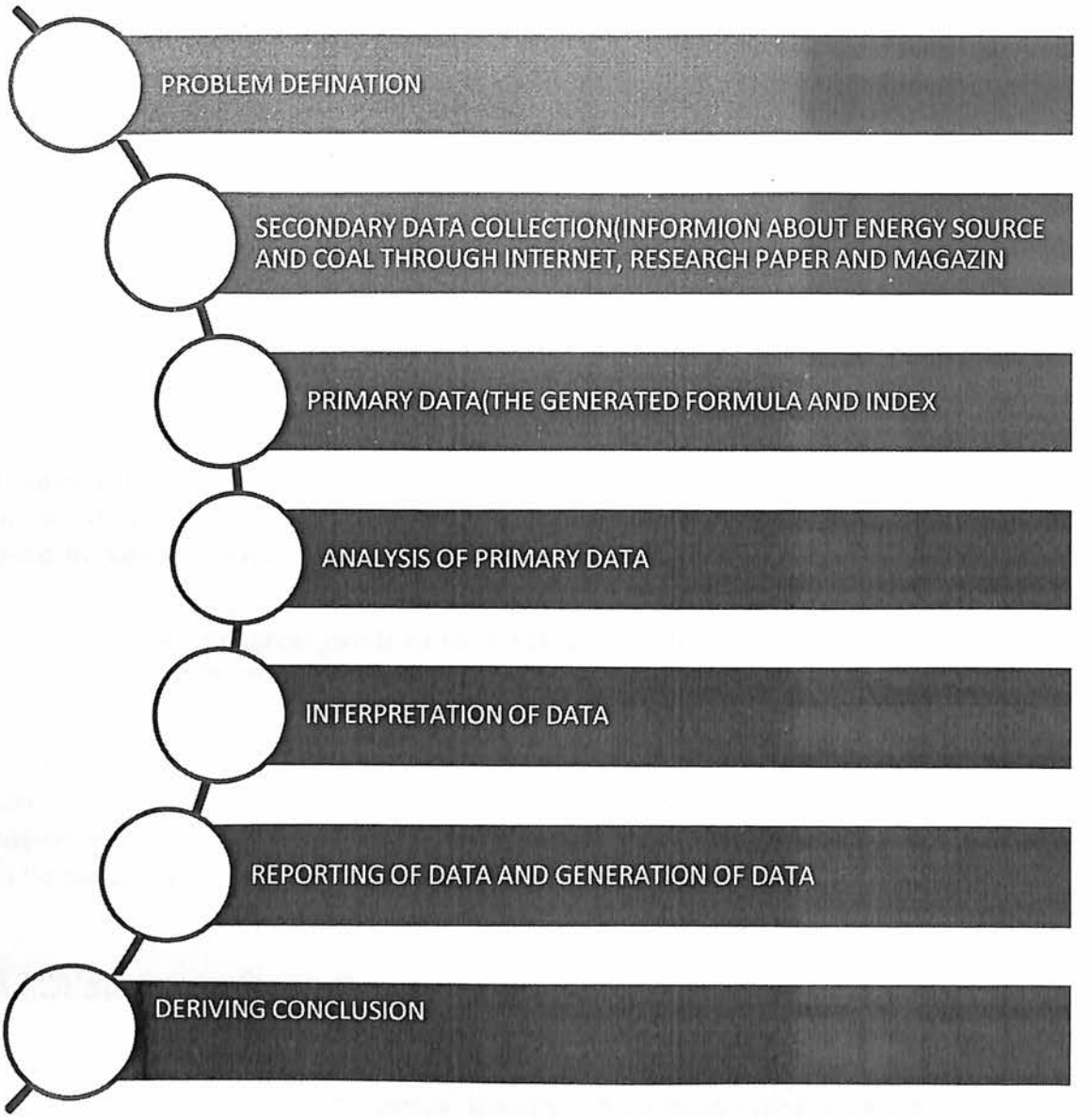
2.3 Research Objective

- To study the risks associated with the supply of Coal in India.
- To derive Energy Security Index for checking Energy Security of India in terms of Coal.

2.4 Limitations and Hypothesis

- The method followed in the study is a quantitative method., so like other quantitative model it also possess some limitations like –
- It is an over simplification of reality.
- It is non- linear in nature.
- Other factors remain constant.
- It is just a guide for the future telling whether we are heading in right direction or not, it cannot be used to predict the future.

2.5 Research Methodology



CHAPTER: 3
ENERGY SECURITY

3.1 Definition:

"Energy security aims at continuous supply of energy to a country at all times at competitive/affordable prices, where shocks and disruptions can be reasonably expected."

In order to ensure energy security at all times, shocks and disruptions must be easily anticipated. A nation must have the ability to withstand shocks and disruptions, which is a requisite for energy security.

However, there are certain factors which cannot be anticipated and one cannot guard against all possible shocks at affordable costs. Again, the surety of energy supply cannot be 100 percent. One can ensure supply only with a certain prescribed confidence level.

A nation for its progress needs to have continuous and uninterrupted supply of energy at all times as energy forms the major component as a driving force for any economy.

There exists a strong relation between economic development and energy consumption. Growth of any economy lies on the availability of cost-effective and environment friendly energy sources, but on the other hand, the level of economic development has been observed to be dependent on the demand for energy

3.2 "Myth versus Reality"

The Myth:

There is a popular myth about Energy Security, which relies mainly on the imports and the possible security measures in case of a supply disruption.

The current Energy Security Department lies with The Ministry of External Affairs which concentrates mainly on the import security of energy.

The Reality:

The focus needs to be on the price volatility and the overall impact of the absence of energy security on the economy as a whole.

There needs to be a holistic approach towards identifying the risks involved in the supply of energy to a country and finding out solutions to these risks which pose as threats towards the need for energy of a nation.

Augmentation of all the energy components (Coal, Crude Oil, Coal, Renewable sources), under one roof as the Ministry of Energy would probably come in handy while handling crucial and vital issues like Energy Security.

3.3 Need For Energy Security:

- According to IEA, India is expected to overtake Japan and Russia to become the third largest consumer of energy by 2030.
- According to BCG projections, India is going to face huge Energy deficit in the upcoming years.
- The major reason being the huge imports of Coal and crude oil over other energy fuels.
- Due to this substitution of Coal over other forms of energy, it will cause deficit since the production is unable to meet the required demand.
- The quality of Coal in India is Low, due to low calorific value and high ash content. For this reason India imports high quality coal from abroad.

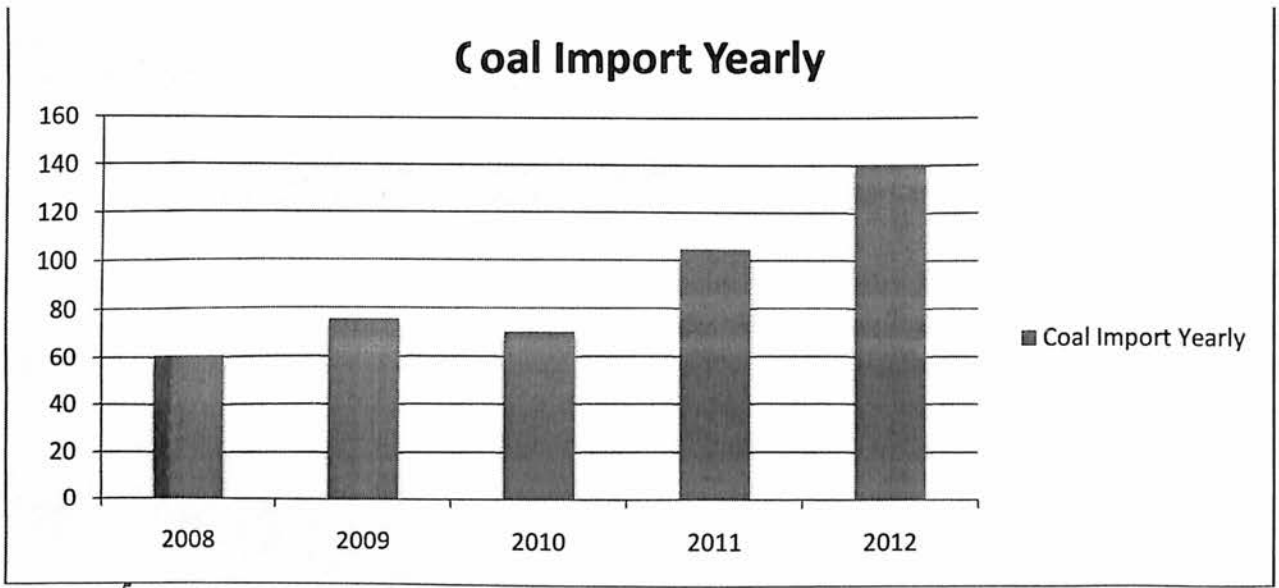


Figure 4[5]–Coal Imports in India over the years

- We can see that Import of Coal is India is increasing per year.
- From 2008, the import of Coal has more than doubled. In 2008, it was around 61 MT and in 2012 it crossed 140 MT[6].
- Another reason is the lack of technology for washing coal and increa ing its Calorific Value.
- The present capacities of Coal Washeries in India are 131.40 MT, which is very less.
- The largest supplier of Coal to India is Indonesia and South Africa, which exposes India to foreign coal prices fluctuations.

[5]Source - Ministry of Coal in India

[6] Source – Energy Statistics 2013, Ministry of Coal in India

- Many developed as well as developing economies, like China, have come up with Energy. Security strategies which will help them in case of shocks.

- In order to rightfully stake its claim as a superpower, India needs to have concrete plans to develop the concept and the need for it seems to be rising day by day.

3.4 Energy Security Index:

The Energy Security Index is a quantifiable number which help us gauge the current position of our country as to how secure the country is in terms of energy.

Steps need to be taken by the government by analyzing the gravity of the situation which can be judged from the index that is generated at the end of the report.

The Energy Security Index that is generated will be an oversimplification of the model that has been developed and concentrates on the supply side of Coal alone.

There is an allowance, or a share of uncertainty that has been kept aside from the actual index that has been generated, which allows scope for modifications in the future.

CHAPTER: 4
SUPPLY RISKS

Coal is most abundant source of energy in India and would be continues to be used as a major feedstock for Electricity production for at least next 30-40 years. Coal is the largest contributor of Energy accounting to 53% of all energy forms in India. According to the World Petro coal Congress, by 2030 70% of increased Coal will come from India and China for rest of the world. In 2012, the consumption of Coal in India was around 749 MT out of which around 140 MT was Imported. That is, around 19% of the consumed coal came through imports in 2012.

For our research we have identified the different types of Coal supply risks into five broad categories.

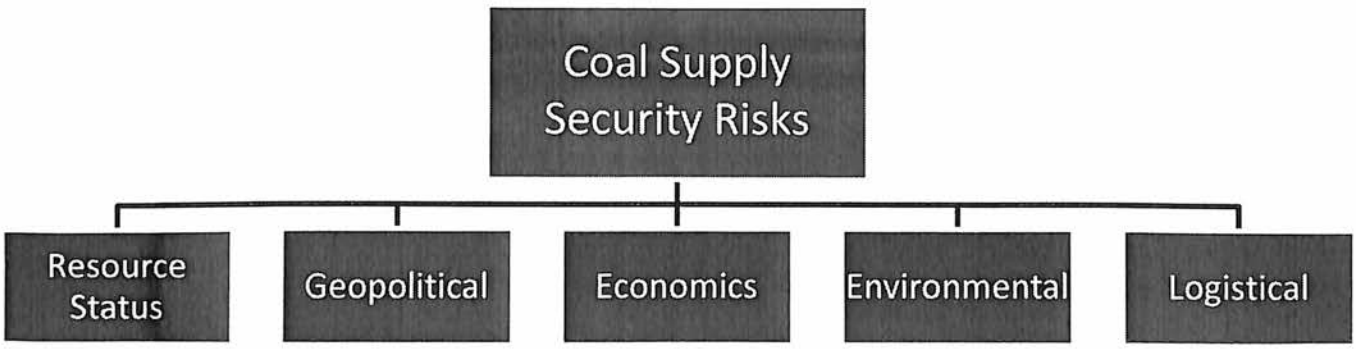


Figure 5 - Coal Supply Security Risks

These risks can further be broken down into two parts:

1. **Global Risks**
2. **Domestic Risks**

Global Risks: These are those risks which are influential in affecting the global economy as awhole and it directly affects the economies at an international level.

Domestic Risks: These are those risks which occur due to the impact of Global Risks, therefore,affecting any economy internally.

CHAPTER: 5
RESOURCE STATUS

Figure 6 – Resource Status

5.1 Global Resource Status (Global Risk)

5.1.1Introduction:

An important parameter to see the status of global Coal reserves present in the world. At international level the importance of Coal reserves is not that much concerning as the total proven Coal reserves present today are 60600 million tonnes up till 2012[7]. The R/P ratio of the Russia consumes theCoal at the same rate, Coal reserves would last for around 443 years. This is the highest RP ration y any country. The RP ratio of India is 100 by end of 2012.

R/P Ratio: The Reserves to production ratio (RPR or R/P) is the remaining amount of a non-renewable resource, expressed in years. While applicable to all natural resources, the RPR is most commonly applied to petroleum and Coal. The reserve portion (numerator) of the ratio is the amount of a resource known to exist in an area and to be economically recoverable (proved reserves). The production portion (denominator) of the ratio is the amount of resource used in one year at the current rate.

R/P Ratio = Amount of known reserves / Amount used per year

Therefore in terms of energy security, it can be explained as, for a country to be secured enough in terms of its reserves (proven as well as unproven) the RPRatio should he high. Countries like United States, Russia federation, Ukraine, Australia, India have their RPR's above 100. This means that these countries are the most secure in terms of the availability of Coal. India ranking 13th in the world with its RPR as 100 as per the data of 2012, which is at a safer end as countries like ChinaandCanada are way behind in terms of RPR.

5.1.2 Analysis:

Here to rank India in our research we have used the values of amount of Coal proven reserves present in India as share of the world Coal proven reserves. The table 4.1 shows the position of India with respect to other countries in the world. India ranks 5 with the current Coal reserves. It contains 7% of the total Coal reserves of the world. It can be seen that the reserves are increasing and more mining can increase India's proven Coal share. Yet it is not a issue of concern as RPR of India is significantly good. With changes in policies of mining (i.e. introduction of Foreign Investment in Mining of Coal) GOI is trying to boost the exploration in the country. As per our ranking methodology, India ranks 3th, that is the worst and has a high affinity towards the risk side. But as per the BP Statistical Review 2012, the proven Coal reserves' share has increased by 8%. This indicates that India is increasing its share of reserves, but not with that of the world.

[7] Source- BP Statistical review of the world 2013

Table 1 - Coal Proved Reserves around the world in 2012-13[8] (Million Tonnes)

Countries	Anthracite and bituminus	Sub-bituminous and lignite	Total	Share of Total	R/P ratio
US	108501	128794	237295	27.6%	257
Russian Federation	49088	107922	157010	18.2%	443
China	62200	52300	114500	13.3%	31
Australia	37100	39300	76400	8.9%	177
India	56100	4500	60600	7.0%	100
Germany	99	40600	40699	4.7%	207
Ukraine	15351	18522	33873	3.9%	384
Kazakhstan	21500	12100	33600	3.9%	289
South Africa	30156	-	30156	3.5%	116
Other Europe & Eurasia	1440	20735	22175	2.6%	234
Canada	3474	3108	6582	0.8%	98
Colombia	6366	380	6746	0.8%	76
Poland	4338	1371	5709	0.7%	40
Indonesia	1520	4009	5529	0.6%	14
Brazil	-	4559	4559	0.5%	*
Greece	-	3020	3020	0.4%	50
Other Asia Pacific	1583	2125	3708	0.4%	88
Bulgaria	2	2364	2366	0.3%	72
Turkey	529	1814	2343	0.3%	33
Hungary	13	1647	1660	0.2%	179
Pakistan	-	2070	2070	0.2%	*
Mexico	860	351	1211	0.1%	88
Venezuela	479	-	479	0.1%	292
Other S. & Cent. America	45	679	724	0.1%	*
Czech Republic	192	908	1100	0.1%	20
Spain	200	330	530	0.1%	85
Zimbabwe	502	-	502	0.1%	196
Other Africa	860	174	1034	0.1%	*
Middle East	1203	-	1203	0.1%	*
New Zealand	33	538	571	0.1%	115
North Korea	300	300	600	0.1%	19
Thailand	-	1239	1239	0.1%	68

Note: Only top 31 Countries with significant proven Coal reserves are ranked.

[8] Source – BP Statistical Review of the world 2013

#Figures are in Note: Only top 31 Countries with significant proven Coal reserves are ranked.

#Figures are in millionTonnes

5.1.3Ranking Methodology:

Proven Coal Share	Ranking
9% & above	1
8% ≤ SH < 9%	2
7% ≤ SH < 8%	3
6% ≤ SH < 7%	4
5% ≤ SH < 6%	5
4% ≤ SH < 5%	6
3% ≤ SH < 4%	7
2% ≤ SH < 3%	8
1% ≤ SH < 2%	9
1% & Below	10

Current Scenario Rank: 3.

Best Case is for the Countries like Russia Federation, China and US. Since the share is more than 10%.
For India the share of India's Coal reserve is 7% so ranking has been at 3 according to our methodology which is good.

5.2 India's Coal Import Share (Domestic Risk)

5.2.1 Introduction:

Supply of coal will not be an issue for India as we have abundant coal reserves. Most of the coal reserves are found in the states of Jharkhand, Orissa, West Bengal, Bihar, Chhattisgarh and Madhya Pradesh. The major issue is that we are short in production.Imports are increasing because many coal blocks are still not into operation stage due to various reasons. Coal quality is another issue forcing companies to import especially steel production where high quality of coal is required. A thrust has to be given for systematic exploitation of coking coal reserves from Jharia Coalfield. On account of the growing needs of the steel industry, a thrust had to be given on systematic exploitation of coking coal reserves in Jharia Coalfield. Though Private players are quite active in captive mining but still adequate capital is not coming from their end due to policy lacuna.

The consumption of Coal is satisfied by both imports as well as production. Currently in 2012, Coal imports of 140.63 MT[9] constitute roughly 23% of the total Coalproduction of India, which was 605.83 MT in 2012. Going forward, it is expected that the gap between Coal demand and domestic Coal production will increase to 192MT by 2014[10], indicating the potential for COAL imports. India is increasingly getting dependent on Coal imports for its Power Generation.

5.2.2 Analysis:

Table 2[11] – Import Share(IS) of Coal over the years by India (million tonnes)

		2008-09	2009-10	2010-11	2011-12	2012-13
COKING COAL		21.08	24.69	19.48	31.08	32.56
NON COKING COAL		37.92	48.56	49.43	71.05	105
COKE		1.88	2.35	1.49	2.36	3.07
TOTAL		60.88	75.6	70.4	104.49	140.63
IMPORT SHARE GROWTH			24%	-7%	48%	35%
PRODUCTION		515.9	556	573.83	570.1	605.84
CONSUMPTION		576.78	631.6	644.23	674.59	746.47
CONSUMPTION GROWTH			9.50%	2.00%	4.71%	10.66%
IS % of Consumption		**10.56%**	**12%**	**11%**	**15.49%**	**18.84%**

[9] Source – Ministry of Coal in India
[10] Source – World Energy Outlook 2013
[11] Source- Ministry of Coal in India

RANK	IMPORT SHARE VS CONSUMPTION
1	0≤IS<5
2	5≤IS<10
3	10≤IS<15
4	15≤IS<20
5	20≤IS<25
6	25≤IS<30
7	30≤IS<35
8	35≤IS<40
9	40≤IS<45
10	45≤IS<50

5.2.3 Import share ranking:

Ranking (Best Case):

The best scenario for Coalimports would be in the year 2008-2009 where the import share was 10.56% of the Coal consumption.
Rank - 3

Ranking (Worst Case) &Ranking (Current Scenario):

The worst scenario for Coalimport share would be in the year 2012-13where the import share was 18.84% of the Coalconsumption.
Rank - 4

The coal imports in India are increasing each year, particularly for the generation of Electricity. Eventually, this will increase India dependence on imported Coal in time to come.

5.3Difference between Domestic Production &(onsumption

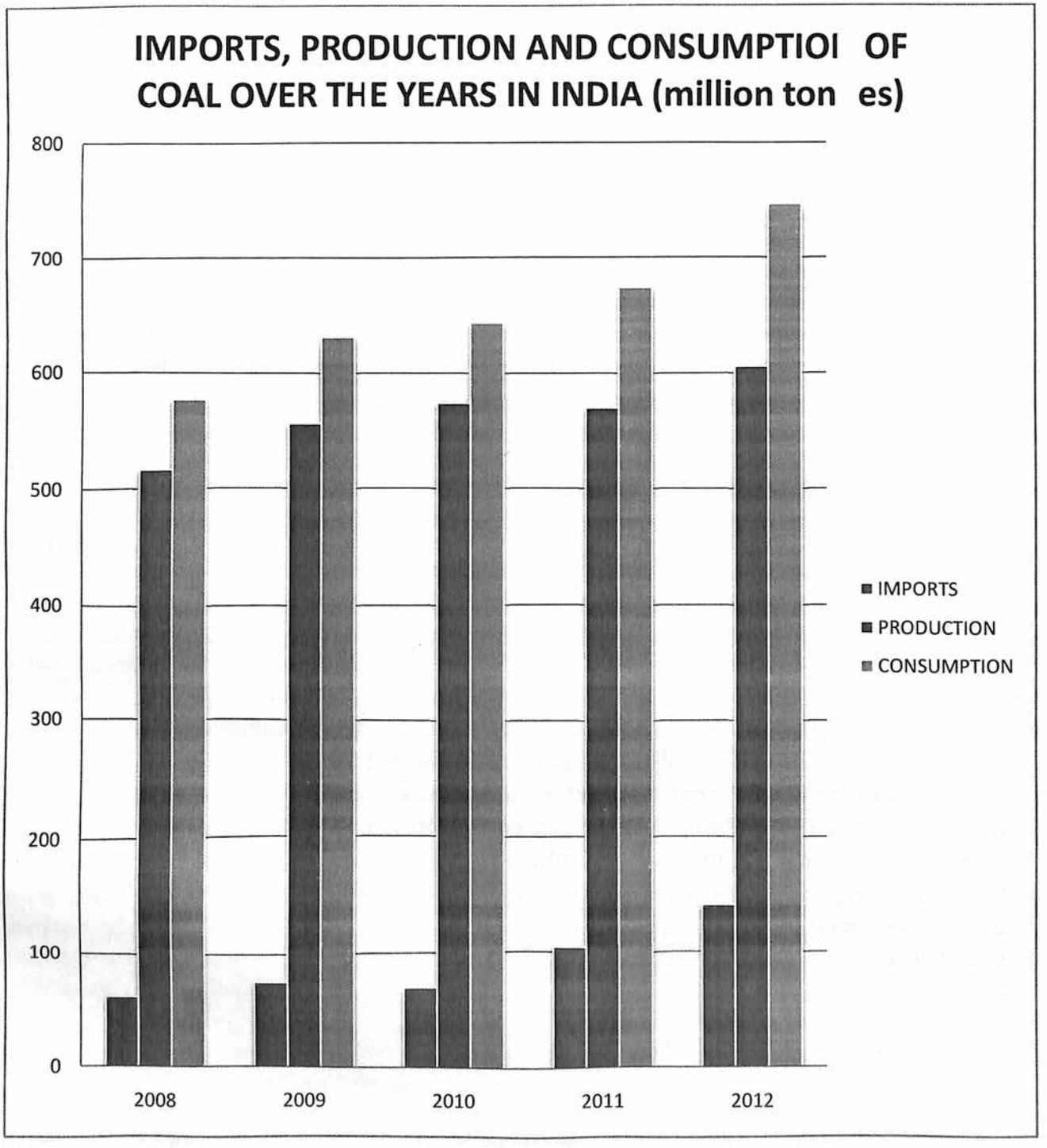


Figure7[12]The graph above shows the gap between the consumption and domestic production of India. The gap as can be seen is filled by the increasing imports of Coal.

[12] Source – BP statistical Review of the world 2013

5.4 Demand-Supply Balance (Global Risk)

5.4.1 Introduction:

For the economy of any country, demand and internal production of crude oil, natural gas and Coal plays a vital role. If the demand exceeds the supply then the country needs to import it from the countries producing surplus to meet its demand. If the gap between demand and production is more, then the country depends on more of imports. Increase in imports leads to rise in import bill which reduces foreign exchange reserves affecting the GDP negatively, etc. Therefore in order to keep a check on the pattern of consumption and domestic production of Coal in our report, we take the difference between the two variables considered.

Demand Supply Balance = Supply –Demand

If the balance is positive i.e. it means that the country has surplus production of Coal. The country can easily satisfy its internal demand for Coal and the surplus amount can be sold in the foreign market.

If the domestic demand for Coal exceeds the domestic production the demand-supply balance becomes negative. This implies that country is deficit of Coal and will have to import Coal from other countries.

Ideally the demand-supply balance should be positive for a country to be secure in terms of energy. In other words, it can be said that if a country is producing more and good quality of Coal it is in better state with respect to energy security, for instance, US, Australian countries. More the balance (positive) better it is for a nation as it has not depend on the imports of Coal, so lesser is the import bill etc. This is the situation when other factors like import and export of other commodities; economic policies etc. are kept constant. Or we can say just in terms of supply of Coal, the best case is to have positive balance between demand and supply. Here in our research we have not considered the supply of Coal from other countries. Only domestic production is taken into account.

Here the table below shows the Coal production and consumption of different countries. Ranks have been given on the following basis:

- For consumption: more consumption lesser is the rank. (China ranks 1 with maximumCoal consumption of 1873.3 Million tonnes oil equivalentin 2012.
- For production: the country producing more is given the 1st rank (China leads the production chart with 1825.3 Milliontonnes oil equivalent in 2012).
- For overall balance (supply - demand): the country with most positive is given the

1st rank (Australia has the max. surplus production of 191.8 Million tonnes oil equivalent in 2012).

5.4.2 Analysis:

Therefore the country with the maximum rank has the maximum insecurity in terms of its demand-production balance. India ranks 32 out of the 34 countries as shown in the table. This shows that India has high insecurity of meeting its demand by its domestic production and incase supply disruptions occur India would be significantly affected. Irrespective of high reserves of Coal by India yet it ranks below.

The Balance table according to ranks is shown in the table below. The unit used is in million tonnesoil equivalent.

Table 3: Demand – supply balance of top 34 nations[13] (million tonnesoil equivalent)

Countries	Supply	Demand	Balance	Rank
(Mtoe)				
Australia	241.1	49.3	191.8	1
Indonesia	237.4	50.4	187.0	2
US	515.9	437.8	78.1	3
Russian Federation	168.1	93.9	74.2	4
South Africa	146.6	89.8	56.8	5
Colombia	58.0	4.0	54.0	6
Germany	45.7	17.9	27.8	7
Kazakhstan	58.8	35.0	23.8	8
Other Asia Pacific	40.0	21.6	18.4	9
Canada	35.2	21.9	13.3	10
Poland	58.8	54.0	4.8	11
Czech Republic	20.7	16.6	4.1	12
Bulgaria	5.4	3.0	2.4	13
Turkey	15.4	13.3	2.1	14
New Zealand	3.1	1.7	1.4	15
Ukraine	45.9	44.6	1.3	16
Venezuela	1.2	0.2	1.0	17
Greece	7.9	7.5	0.4	18
Romania	6.4	6.7	-0.3	19
Other Europe & Eurasia	21.2	22.2	-1.0	20
Hungary	1.9	3.0	-1.1	21
Other S. & Cent. America	0.5	2.0	-1.5	22

[13]Source- BP Statistical Review of the world 2013

Pakistan	1.2	4.3	-3.1	23
Other Africa	1.1	6.6	-5.5	24
Total Middle East	0.7	9.9	-9.2	25
Thailand	5.1	16.0	-10.9	26
Brazil	2.2	13.5	-11.3	27
France	0.1	11.4	-11.3	28
Spain	2.4	19.3	-16.9	29
Vietnam	23.5	49.9	-26.4	30
China	1825.0	1873.3	-48.3	31
India	228.8	298.3	-69.5	32
South Korea	0.9	81.8	-80.9	33
apan	0.7	124.4	-123.7	34

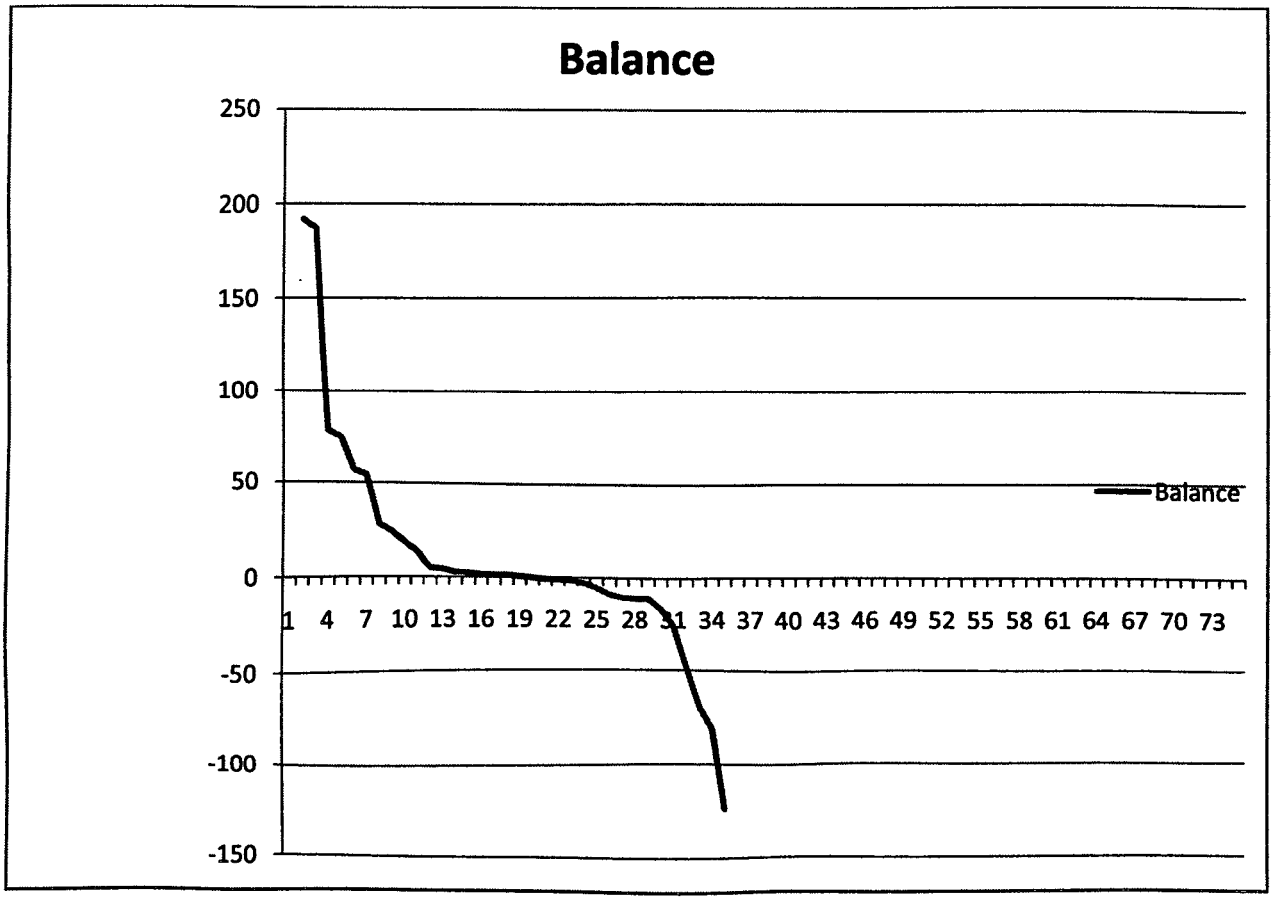


Figure 8[14] - Demand Supply Balance of Coal

[14] Source – BP Statistical Review of the World 2013

5.4.3Ranking Methodology:

BALANCE (Production-Consumption)	Ranking
BAL> 150	1
150 ≤ BAL < 125	2
100 ≤ BAL < 125	3
75 ≤ BAL < 100	4
50 ≤ BAL < 75	5
25 ≤ BAL < 50	6
0 ≤ BAL < 25	7
-25 ≤ BAL < 0	8
-50 ≤ BAL < -25	9
-50 & Below	10

For the year 2012, Ranking for India is 10^{th}.

5.5 Investment in Energy (Global Risk)

5.5.1 Introduction:

Energy-Supply infrastructure involves the complete chain of delivering the Energy products to the end consumer. Itcan be broken into the following stages as:

- Mining
- Transportation of Coal

Of these stages, mining sector requires high funding/investment, as mining involves geographical surveys, exploration, production etc.

But talking about Coal specifically, it requires maximum investment in transportation. Transportation plays a very important role. India only imports Coal because of lack of technology of clean washries of Coal and the low quality of coal produced in India.

This parameter tells us about where India stands in terms of investment in the development of petroleum infrastructure. It is not very easy for any country to invest on infrastructure development for petroleum products as it involves huge investments and the returns come over a long time period. As it involves huge investments which makes it tough for the developing countries like India to have huge investments. Thus, growing economies like India lacks behind in terms of financial investments with respect to developed economies like U.S. In order to sustain its growing demand for petroleum products, India needs to invest in the sector continuously. Therefore significant analysis has to be done as to how much to invest in the sector. According to World Energy Outlook 2011, India invested around 8.458 billion USD (almost 2% of the total world's investment into this sector).

The importance of this factor comes when a decision has to be made about how much to be invested as the returns would be coming over a time period. Thus investment decisions are to be taken in conditions of great uncertainty. But then country has to maintain its place in the world such that it does not stay behind in its production (domestic). Because if the domestic production is not increased then the imports will increase which eventually increase the import dependency and the import bill making the nation insecure in terms of demand-supply balance. Thus to secure proper investments are required from the government side and after all financial analysis this should be done. As investments are high therefore if any of the decision goes wrong there will huge loss of money.

5.5.2Analysis:

India for the last 5 years has increased its overall investment in the development of infrastructure. In 2007 it was 7.042 billion USD to 8.458 billion USD showing a growth of around 4.023%. Though the growth is not that significant but out of the top 9 nations (continents also) India ranks 7th above China with growth in investment of -1.35% and Middle East with growth of 1.17%. as can be seen from the table that Latin American countries have the highest growth in investment since 2006 of 71% approx. with Africa on second position with a growth of 43%.

Table 4 – Investment in energy sector year – wise in India

Expenditure	In Energy	Supply	Infrastructure				
	2008	2009	2010	2011	2012	Growth	Rank
Country					Amount	Since 2008	
					USD Billion	Percentage%	
Latin America	18.000	33.696	29.545	61.960	82.125	71.250	1
Africa	20.583	37.739	46.273	52.520	64.875	43.036	2
Europe	10.292	13.217	13.318	14.920	21.292	21.377	3
Americas	42.625	44.478	40.091	54.320	87.500	21.056	4
Eurasia	32.042	46.913	45.500	50.800	58.250	16.359	5
Russia	23.667	23.652	23.682	27.040	32.792	7.711	6
India	7.042	7.783	7.727	8.280	8.458	4.024	7
Middle East	44.750	43.348	41.045	38.600	47.375	1.173	8
China	22.792	22.391	21.909	19.000	21.250	-1.353	9
Total (World)	223.333	273.739	269.045	322.120	416.542	17.302	

Data Source: World Energy Outlook (2007, 08, 09, 10, 11,12).

5.5.3Ranking Methodology:

For this risk, the ranking of nations is based on the growth in their investments in E & P. More he growth the better will be the rank.

Ranking(Current Scenario):7.

5.6 Investment in Mining (Domestic Risk)

5.6.1 Introduction

Coal India Limited (CIL) is an Indian state-controlled coal mining company headquartered in Kolkata, West Bengal, India. It is the largest coal producer company in the world and contributes around 81% of the coal production in India. It produced 452 million tonnes of coal during FY 2012–13[15] and earned a revenue of INR 882.81 billion from sale of coal in the same financial year. Union Government of India owns 61% of the shares in CIL and controls the operations of CIL through Ministry of Coal. In April 2011, CIL was conferred the Maharatna status by the Union Government of India.On 31 March 2013, its market capitalisation was INR 1.952 trillion (US $35.9 billion) making it India's 5th most valuable company by market value.

Here we need to analyze investment been done in mining sector over the years. The data for this analysis consists of expenditure done by CIL, SSCL, NLC, etc

Based on the total expenditure over the years we have done our ranking for Coal, based on growth in expenditure in Coal sector.

5.6.2 Analysis:

EXPENDITURE IN COAL(IN CRORE)[16]

YEAR	CAPITAL EXPENDITURE OF CIL	CAPITAL EXPENDITURE OF SCCL	CAPITAL EXPENDITURE OF NLC	S&T/RE/EMSED.D/VRS#	TOTAL	Growth Percent	Growth since 2008 (g%)
2008	2033.51	573.79	1766.71	279.8	4653.81		-
2009	2507.17	650.44	1559.41	197.47	4914.49	5.60%	5.60%
2010	2809.99	888.67	1363.1	237.29	5299.05	7.83%	13.86%
2011	2539.72	643.81	1444.65	218	4846.18	-8.55%	4.13%
2012	3727.17	1070.56	1684.38	327.57	6809.68	40.52%	46.32%

5.6.3 Research Methodology

RANK	IMPORT SHARE VS CONSUMPTION
1	**g%> 100**
2	**90≤ g%>80**
3	**80≤ g%>70**
4	**70≤ g%>60**
5	**60≤ g%>50**

[15] Source- Ministry of Coal in India
[16] Source – Ministry of Coal in India

6	50≤ g%>40
7	40≤ g%>30
8	30≤ g%>20
9	20≤ g%>10
10	10≤ g%>0

Best Rank& Current Rank –

The best rank is in year 2012 ie the latest year, the growth has been over 40% in this year.
So, rank of 6.

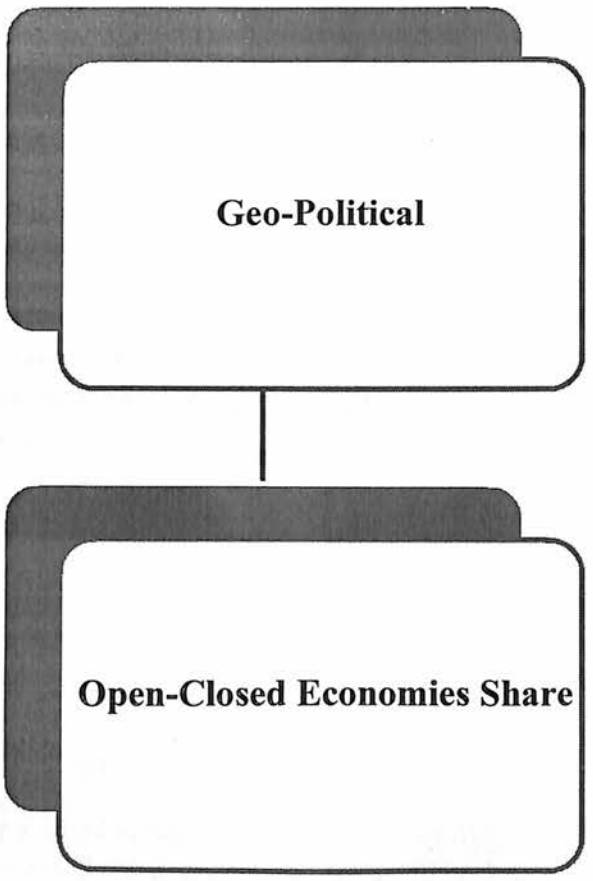
Worst Rank -

In starting years of mining and investment in mining sector, worst case was in 2011 around 4%.
So, rank of 10.

Expenditure in this sector will increase with time to come.

CHAPTER: 6
GEO-POLITICAL RISK

Figure 9



6.1 Open Economies/Closed Economies Share(Global Risk)

6.1.1Introduction

Another important parameter which is to be considered for supply of Coal is the share of Coal that comes from a closed or partial economy. The exporting nation's economy plays an important role as closed or partial economies restrict their Coal production and even does not like private investments within their countries. Therefore, for a country like India which imports almost 19% of Coal consumption (23.2% of production) has to consider such factor as a risk to its supply.

Closed Economy: closed economy is the quality of being self-sufficient. Usually the term is applied to politicalstates or their economic systems. The latter are called closed economies. Closed Economy exists whenever an entity can survive or continue its activities without external assistance or international support. A closed economy is self-sufficient. It is one in which no imports are brought in and no exports are sent out. The goal is to provide consumers with everything that they need from within the economy's borders. It is not open to other economies of the world.

Closed economies are less developed if the lack resources to serve the nation like raw materials such as oil, gas and coal. Due the presence of international trade in the present era, closed economies are rarely seen.

Open Economies – An open economies is a one in which the nation trades with other economies of the world. Its economic activities are open to outside world. Trade can be of different forms, it can be managerial exchange, technology transfer and all kind of goods and services.

Risk: For a country importing an adequate amount of Coal from closed economy like the countries from middle east, if the demandof the nation grows abruptly and there is a sudden requirement of Coal in the consuming country (for any reason). In that case, the question arises that whether the closed economy nation will increase their supply of Coal to meet the demand of the consuming country? The answer to this question is NO, as these economies will not be increasing their production. So the consuming nation will not be able to meet its Coal demand (in case of majority of imports are from closed economies). Thus, this will increase the insecurity of Coal supply. Therefore we need to consider the share of Coal import (from closed/open economy) as a risk.

6.1.2Index of Economic Freedom:

The Index of Economic Freedom is a series of 10 economic measurements created by The Heritage Foundation and The Wall Street Journal. Its objective is to measure the degree of economic freedom in the world's nations.

The index scores nations on 10 broad factors of economic freedom:

1. Business Freedom: Business freedom is a quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation as well as the efficiency of government in the regulatory process.
2. Trade Freedom: Trade freedom is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services.
3. Monetary Freedom: Monetary freedom combines a measure of price stability with anassessment of price controls. Both inflation and price controls distort market activity. Price stability without microeconomic intervention is the ideal state for the free market.
4. Government Size/Spending: This component considers the level of governmentexpenditures as a percentage of GDP. Government expenditures, including consumption and transfers, account for the entire score.
5. Fiscal Freedom: Fiscal freedom is a measure of the tax burden imposed by government.
6. Property Rights: The property rights component is an assessment of the ability ofindividuals to accumulate private property, secured by clear laws that are fully enforced by the state.
7. Investment Freedom: In an economically free country, there would be no constraints on theflow of investment capital. Individuals and firms would be allowed to move their resources into and out of specific activities internally and across the country's borders without restriction.
8. Financial Freedom: Financial freedom is a measure of banking efficiency as well as ameasure of independence from government control and interference in the financial sector.
9. Freedom from Corruption: Corruption erodes economic freedom by introducing insecurityand uncertainty into economic relationships. The higher the level of corruption, the lower the level of overall economic freedom and the lower a country's score.

Labor Freedom: The labor freedom component is a quantitative measure that looks intoaspects of the legal and regulatory framework of a country's labor market.

In our study we have classified an economy according to the international distinctions and values given to them[17]
Note: In our study we have taken partial open as closed only for simplification of our Analysis:

Table 5[18]

- Units are in Million Tonnes.

6.1.3 Analysis (Imports in 2012)

[17] Source : World heritage (http://www.heritage.org)
[18] Source : International Coal Reports 2009, 2010, 2011,2012

Table 5 – Imports of Coal from Open and closed economies

Country/Year	Quantity (Tonne)	Percentage Imported	INDEX OF ECONOMIC FREEDOM	Economy Type
Indonesia	29.004	57.4792%	58.5	Partially Open
Russia	0.634	1.2564%	51.9	Partially Open
China PRP	0.347	0.6877%	52.5	Partially Open
Vietnam, SOC REP	0.034	0.0674%	50.8	Partially Open
Nigeria	0.023	0.0456%	54.3	Partially Open
Benin	0.008	0.0159%	56	Partially Open
Mozambique	0.005	0.0099%	55	Partially Open
Philippines	0.005	0.0099%	60	Partially Open
Morocco	0.002	0.0040%	58	Partially Open
Egypta RP	0.002	0.0040%	52.9	Partially Open
Total	30.064	**59.5799%**		**Partially Open**
Ukraine	0.233	0.4618%	49.9	Closed
Iran	0.056	0.1110%	40.3	Closed
Total	0.289	**0.5727%**		**Closed**
Australia	12.099	23.9774%	82	Open
South Africa	5.02	9.9485%	62.5	Open
United State of America	1.252	2.4812%	75.5	Open
New Zealand	0.247	0.4895%	81	Open
Canada	0.14	0.2774%	82	Open
Austria	0.066	0.1308%	72.4	Open
Isreal	0.06	0.1189%	68.4	Open
Netherlands	0.05	0.0991%	74.2	Open
Germany	0.049	0.0971%	73.4	Open
Malaysia	0.037	0.0733%	69.6	Open
Japan	0.027	0.0535%	72.4	Open
Maxico	0.016	0.0317%	66.8	Open
Ireland	0.01	0.0198%	76.2	Open
Turkey	0.008	0.0159%	64.9	Open
Czech Republic	0.007	0.0139%	72.2	Open
Portugal	0.005	0.0099%	63.5	Open
France	0.003	0.0059%	63.5	Open
Saudia Arab	0.003	0.0059%	62.2	Open
Singapore	0.003	0.0059%	89	Open
Italy	0.002	0.0040%	61	Open
United Kingdom	0.001	0.0020%	74.9	Open
Total	19.105	**37.8617%**		**Open**

6.1.4 Ranking Methodology:

% share (Closed + Partial Open)	Rank
SH <= 10%	1 (Best Case)
10% < SH <= 20%	2
20% < SH <= 30%	3
30% < SH <= 40%	4
40% < SH <= 50%	5
50% < SH <= 60%	6
60% < SH <= 70%	7
70% < SH <= 80%	8
80% < SH <= 90%	9
Above 90%	10 (Worst Case)

***SH stands for Share of Coal.**

India's Case: (Current Scenario)

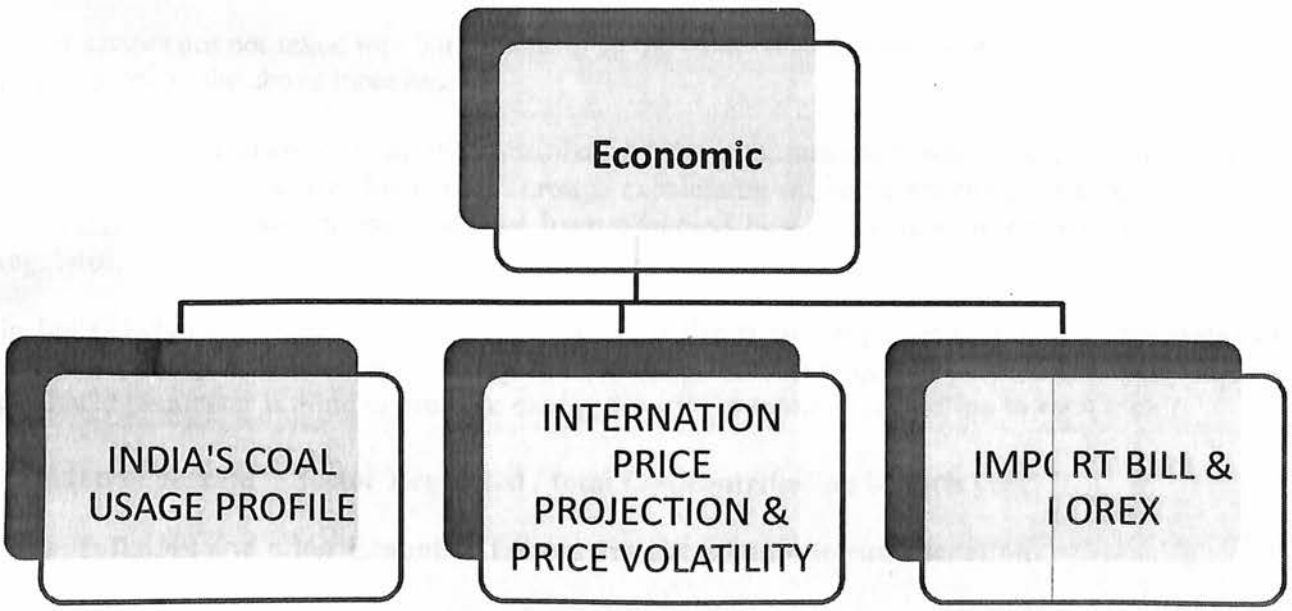
Economy Type	Percentage Share (as per imports in 2012)
Closed	0.573
Partial Open	59.58
Total Closed	60
Open	37.86
Rank	6

India's Ranking is 6.

As it can be seen that India imports only around 60% of Coalof its total Coal imports from closed economies it is ranked 6th, where 10 is the worst case. This is not a very goodcondition; India will have trouble with the Coalsupply as imports, in case of disruptions. The problem that seems to be here is that the imports done in Coal are used in power sector and power is the wheel of industries in India. Since COAL has huge applications, it dependence on other foreign countries should be minimized. India should look for other options in Open economies and domestic arena for COAL.

CHAPTER:7
ECONOMIC RISK

Figure 10



7.1India's Coal profile use and share in Regulated Sector (Domestic factor)

7.1.1Introduction:

This parameter is considered to see how efficiently Coal in different sectors is being utilized. Different end uses of Coal are Transportation, Industries, fertilizers, domestic uses, Power Generation and Others. These are the main classification under which Coal is consumed.

In our study we will consider three broad categories:

- Power Generation
- Cement
- Steel Industries and domestic uses

Other sectors are not taken into consideration as the Coal consumption in other sectors is very less as compared to the above three sectors.

The power and steel sector is mostly subsidized by the government of India. It is highly subsidized due to the political reasons behind it. Through subsidizing oil and Coal the government hails for votes during elections. In our study we have observed how much this sector is subsidized and regulated.

In India, 76% Coal consumed for the generation of Electricity in power sector. So, regulations in power sector do not encourage mining of coal for private and foreign players.The study in this particular parameter is done to estimate energy security in terms of regulation to each sector.

Regulation percent = Sector Regulated / total Coalcontribution in each year.

Note: Inflation and other Economic factors are not taken into consideration.

7.1.2Analysis:

Table 6 – Share of Regulated and non-Regulated sector trends (million cubic metres)

Industry	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12*
Power Generation	12099	11878	11963	12037	12603	21365	27415	20333
Fertilisers	8173	7762	8497	9823	9082	13168	13429	11330
Total by regulated sector	20272	19640	20460	21860	21685	34533	40844	31663
Grand Total	30775	31025	31368	30579	32989	46506	51429	45905
% to Regulated Sector	65.87%	63.30%	65.23%	71.49%	65.73%	74.25%	79.42%	68.98%

Sources[19]

[19] Source - MOPNG and Planning Commission of India

7.1.3Ranking Methodology:

% of Regulation in Sector	Ranking
100= Rank >90	10
90>= Rank .80	9
80>= Rank >70	8
70>= Rank >60	7
60>= Rank >50	6
50>= Rank >40	5
40>= Rank >30	4
30>= Rank >20	3
20>= Rank >10	2
Rank <= 10%	1

Best Case: It is when the sector is less regulated here year 2005-2006, where ranking is 7 where 1 is best rank. Regulation in Coal sector is more of political stunt to hail for elections.

Worst Casescenario was in the year 2010-2011, where the rank is 8 regulated at almost 80%.

Current case scenario in 2012 is ranked as 7, which is regulated at almost 68%.

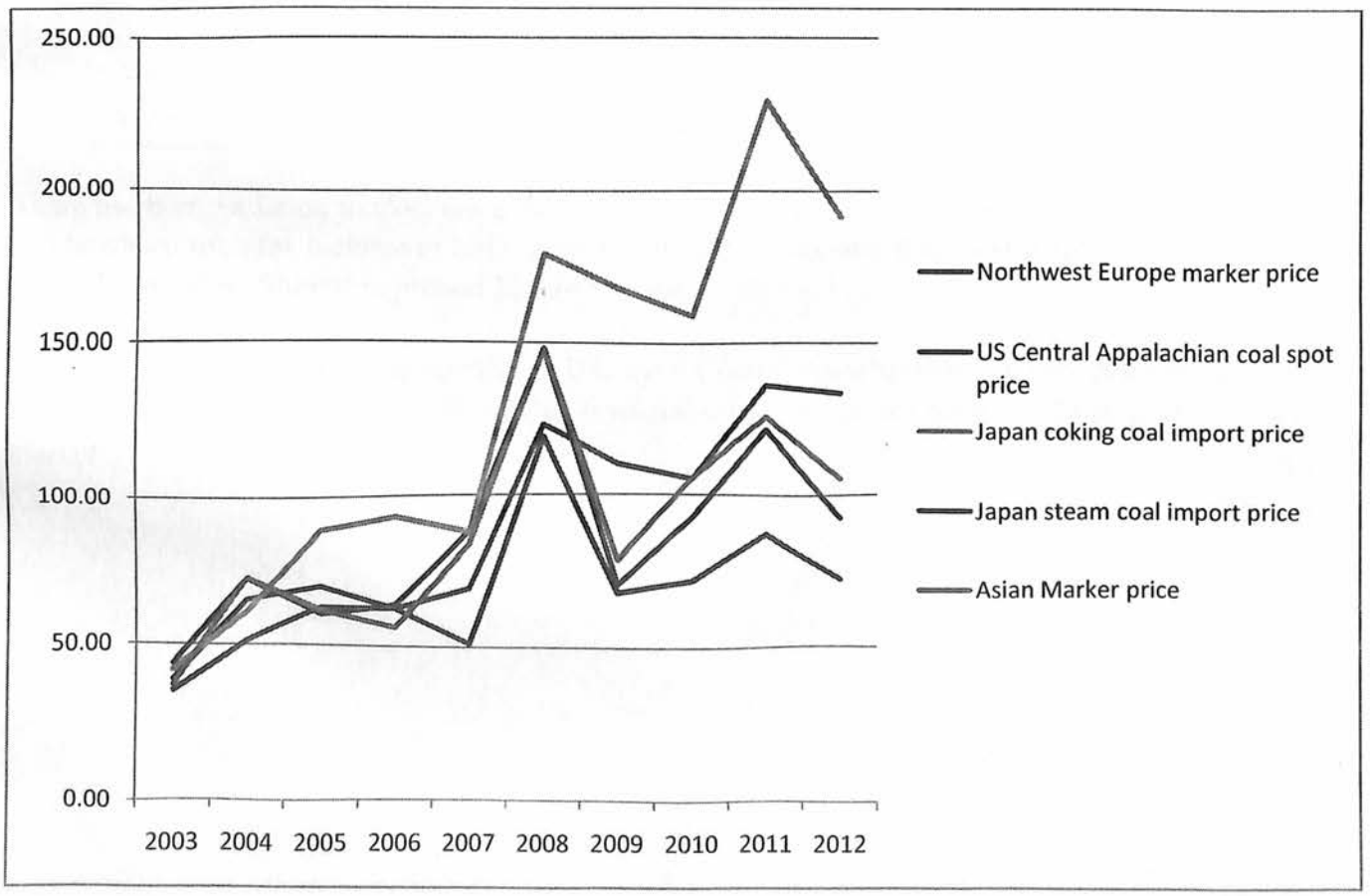
7.2 International CoalPrice Projections and Price Volatility (Global Risk)

7.2.1 Introduction:

With the ever increased use of Coal in the 21st century, Coal forms a major component with regards to energy. Coal prices fluctuate either directly or indirectly due to the affects of global economy. An increase in price affects almost various sectors of the country like power, steel, manufacturing industry, etc on which in turn affects the country's progress.

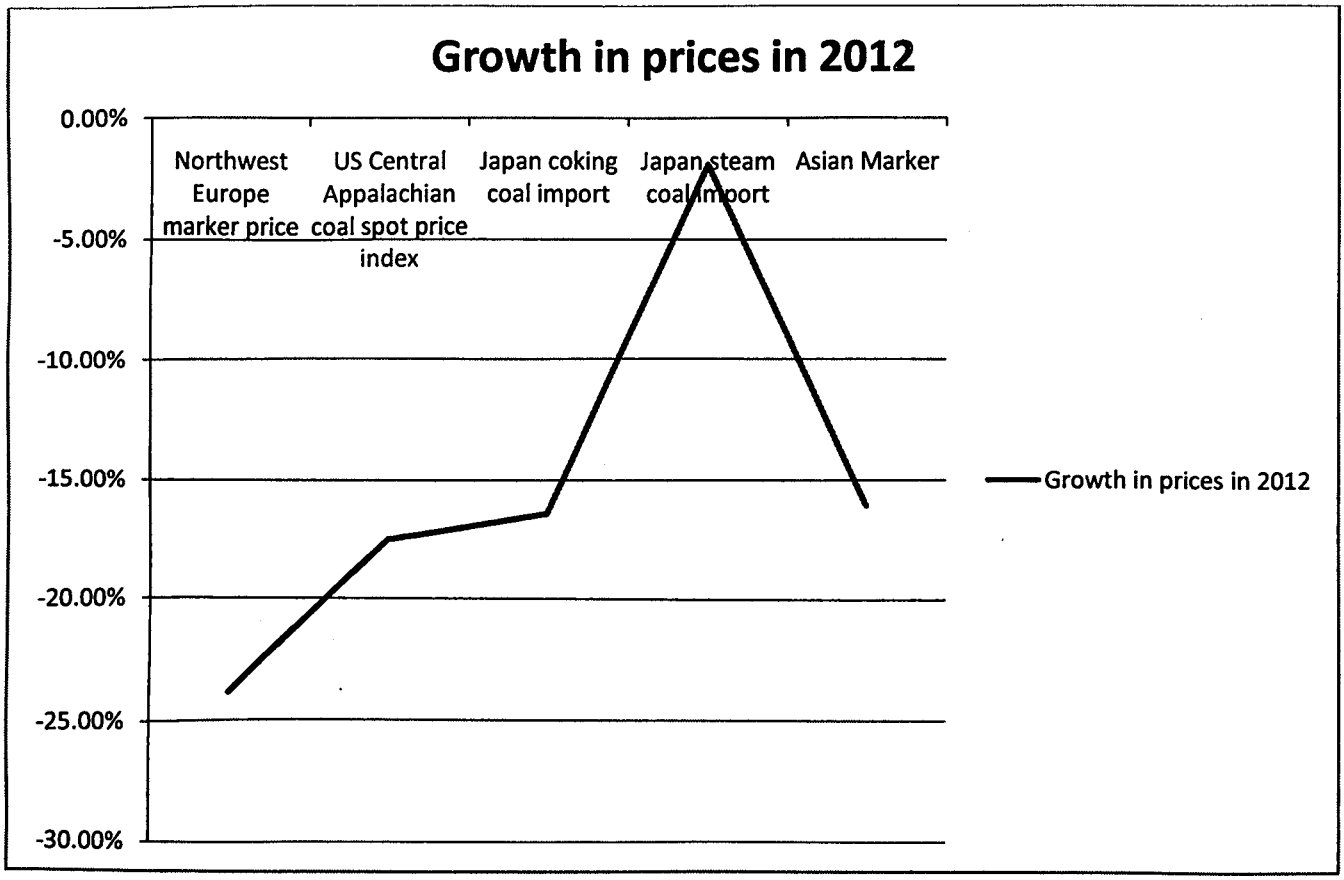
An important point that comes under geo-politics is the effect on prices of Coal due to the various disasters or mis-happenings around the globe. Coal market is a bit different from the crude oil market. There are five pricing agencies of Coal market around the world. They are Northwest Europe marker price, US Central Appalachian coal spot price,Japan coking coal import, Japan steam coal import and Asian Marker price. The Indian coal market is affected by the Asian Marker price agency.

Figure 11[20]- Prices of Coal in 2012-13in Different Markets (in US $/tonne)



[20] Source – BP Statistical Review of the World 2013

Figure 12[21]- Growth in Coal prices in 2012 over 2011 in Different Markets (in percentage)



There has been variation in Coal price due to occurrence of any event or any accident. The effects can be traced from the incident in 2011, after the Fukushimadisaster there was a abrupt rise in Coal prices from 105.43 $/tonne to around 125.74 $/tonne.

Similarly, in 2005 after Katrina incident in US, the S Central Appalachian coal spot price increased from 64 $/ton to 70 $/ton. In 2008, due to financial crisis, the prices were sky high in al he five markets.

[21] Source – BP Statistical Review of the World 2013

7.2.2Analysis

Table 7 – Prices of imported Coal over the years[22]

US $ per tonne	Asian arker price †	Price Growth	INCIDENTS
2005	61.84	-14.61%	No incidents
2006	56.47	-8.68%	Hurricane Katrina
2007	84.57	49.74%	No incidents
2008	148.06	75.08%	Ukraine Russia Coal dispute, Lehman shock
2009	78.81	-46.77%	Recovery period
2010	105.43	33.78%	Bit stabilized, no incident
2011	125.74	19.26%	Fukushima daiichi nuclear plant problem
2012	105.50	-16.09%	No incidents

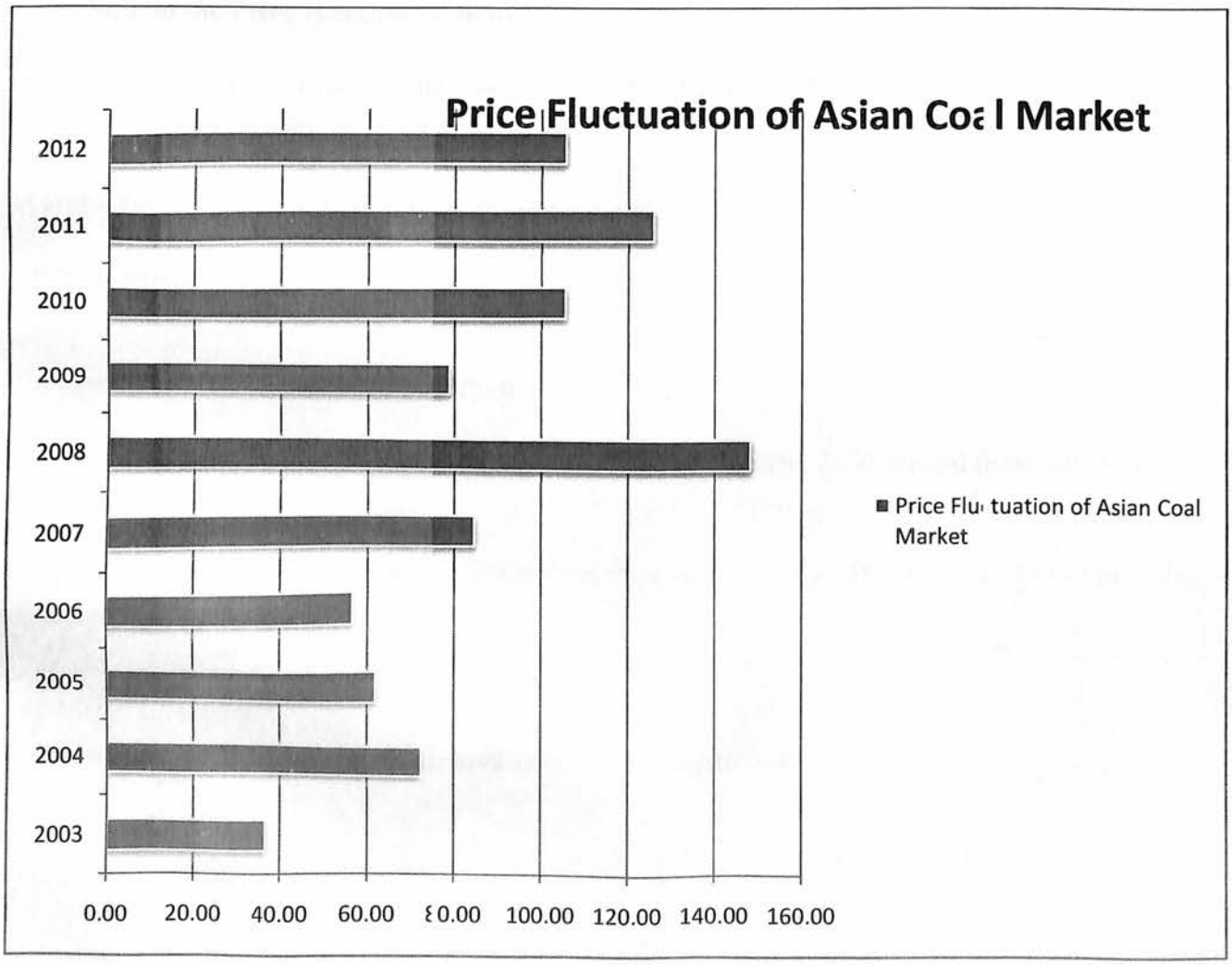


Figure 13 – Coal Price Fluctuation over the Years

[22] Source – World Energy Outlook 2013, eia

7.2.3Ranking Methodology:

Percentage PRICE GROWTH (PG)	Prices	Rank
PG Below 0 %	0 ≤ P < 20	1
0 ≤ PG < 10%	20≤ PG < 40	2
10% ≤ PG < 20%	40≤ PG < 60	3
20% ≤ PG < 30%	60≤ PG < 80	4
30% ≤ PG < 40%	80 ≤ PG < 100	5
40% ≤ PG < 50%	100 ≤ PG < 120	6
50% ≤ PG < 60%	120≤ PG < 140	7
60% ≤ PG < 70%	140≤PG < 160	8
70% ≤PG < 80%	160≤ PG < 180	9
PG above 80%	180≤ PG <200	10

According to the Price Increase method:

Best case for India was in 2009 when the prices dipped by almost 46%. 2009 ranked one according to prices increase ranking.

Worst Case is year 2008 after which the price were seen to rise by 75%. 2008 is ranked 9.

Current case 2012 is ranked 1 according to our methodology.

According to the Price Ranking Method:

Best case for India was in 2006 when the prices were 56 $/tonne. 2006 ranked three according to prices increase ranking.

Worst Case is year 2008 after which the price were seen to rise by 75% and were 148$/ton. 2008 is ranked 8.

Current case 2012 is ranked 6th according to our methodology.

7.3Impact of Import of Coal on Foreign Exchange Reserves

7.3.1Introduction:

This parameter gauges the effect of the increase in Coal import bill and the subsequent effect on the FOREX reserves.

Import bill refers to the value of imports that a country incurs with respect to a particular product.

Foreign-exchange reserves (also called**forex reserves** or **FX reserves**) in a strict sense are theforeign currency deposits and bonds held by central banks and monetary authorities.

It is a common fact that when a country imports something, it needs to pay foreign exchange in order to import the goods. As a result, as the import of a country increase, there is a decrease in the amount of foreign reserves, and vice versa.

7.3.2Analysis–

Table 8 – Import Bill VsForex(In US dollars)

Year	Import Bill in Rs	Growth in Import Bill (IB)	Forex in $	Growth in Forex	RsVs $	Forex in Rs	IPP	IB AS % OF FOREX
2004-05	12534.8		135571		43.3	5870224.3	8.4	0.21%
2005-06	16348.7	30.43%	145108	7.03%	44.9	6515349.2	8	0.25%
2006-07	20529.9	25.58%	191924	32.26%	44.15	8473444.6	11.9	0.24%
2007-08	25862.2	25.97%	299230	55.91%	39.4	11789662	8.7	0.22%
2008-09	45948	77.66%	241426	-19.32%	48.5	11709161	3.2	0.39%
2009-10	41702.1	-9.24%	254685	5.49%	46.5	11842852.5	10.5	0.35%
2010-11	41136.1	-1.36%	274330	7.71%	44.7	12262551	7.8	0.34%
2011-12	79394.1	93.00%	260069	-5.20%	53.1	13809663.9	4	0.57%
2012-13	86092.3	8.44%	293843	12.99%	55.05	16176057.2	3.7	0.53%

During the 2012, India's Import Bill for COAL rose by almost 8.44% in due to the rising huge imports of Coal this year.

The following are the major factors influencing the Indian import bill:

1. INR value appreciation/depreciation
2. IIP(Index of Industrial Production) Growth

- Exchange rate, IIP index and import bill as % of forex reserves, are closely linked and hence hold a close relation.
- The value of currency and IIP thus emerge as detrimental factors in the increase or decrease of import bill which has a direct impact on the forex reserves.

7.3.3Ranking Methodology:

Ranks	Import Bill as a % ofForex Reserves(IB)	Rupee vs Dollar (Re$)	IIP Growth (IIP)
1	$0 \leq IB < 5$	$35 \leq Re\$ < 37.5$	$IIP > 10$
2	$5 \leq IB < 10$	$37.5 \leq Re\$ < 40$	$9 \leq IIP < 10$
3	$10 \leq IB < 15$	$40 \leq Re\$ < 42.5$	$8 \leq IIP < 9$
4	$15 \leq IB < 20$	$42.5 \leq Re\$ < 45$	$7 \leq IIP < 8$
5	$20 \leq IB < 25$	$45 \leq Re\$ < 47.5$	$6 \leq IIP < 7$
6	$25 \leq IB < 30$	$47.5 \leq Re\$ < 50$	$5 \leq IIP < 6$
7	$30 \leq IB < 35$	$50 \leq Re\$ < 52.5$	$4 \leq IIP < 5$
8	$35 \leq IB < 40$	$52.5 \leq Re\$ < 55$	$3 \leq IIP < 4$
9	$40 \leq IB < 45$	$55 \leq Re\$ < 57.5$	$2 \leq IIP < 3$
10	$45 \leq IB < 50$	$57.5 \leq Re\$ \leq 60$	$1 \leq IIP < 2$

Best case:

The best case for the Indian natural imports would be the FY'2007-08 & 2008-09, which saw the growth in import bill for Coal the least.

Reasons:
2006- 07

- Value of import bill as % of Forex reserves=0.24%
- INR value appreciation(1$=Rs 44.15)
- IIP Index of the country rose by 11.9%

2007- 08

- Value of import bill as % of Forex reserves=0.22%
- INR value appreciation(1$=Rs39.15)
- IIP Index of the country rose by 8.7%

Rankings (Best case):

Best case ranking = (1+4+1)/3 = 2

Worst & Current Case:

The worst case for the COAL imports would be the FY'2012-13, which saw the growth in COAL import bill increase by almost 9%.

Reasons:

- Demand for COAL increasedsharply.
- Value of import bill as % of Forex reserves= 0.53%
- IIP index rose by 3.7%
- INR value depreciation(1$=Rs55.05)

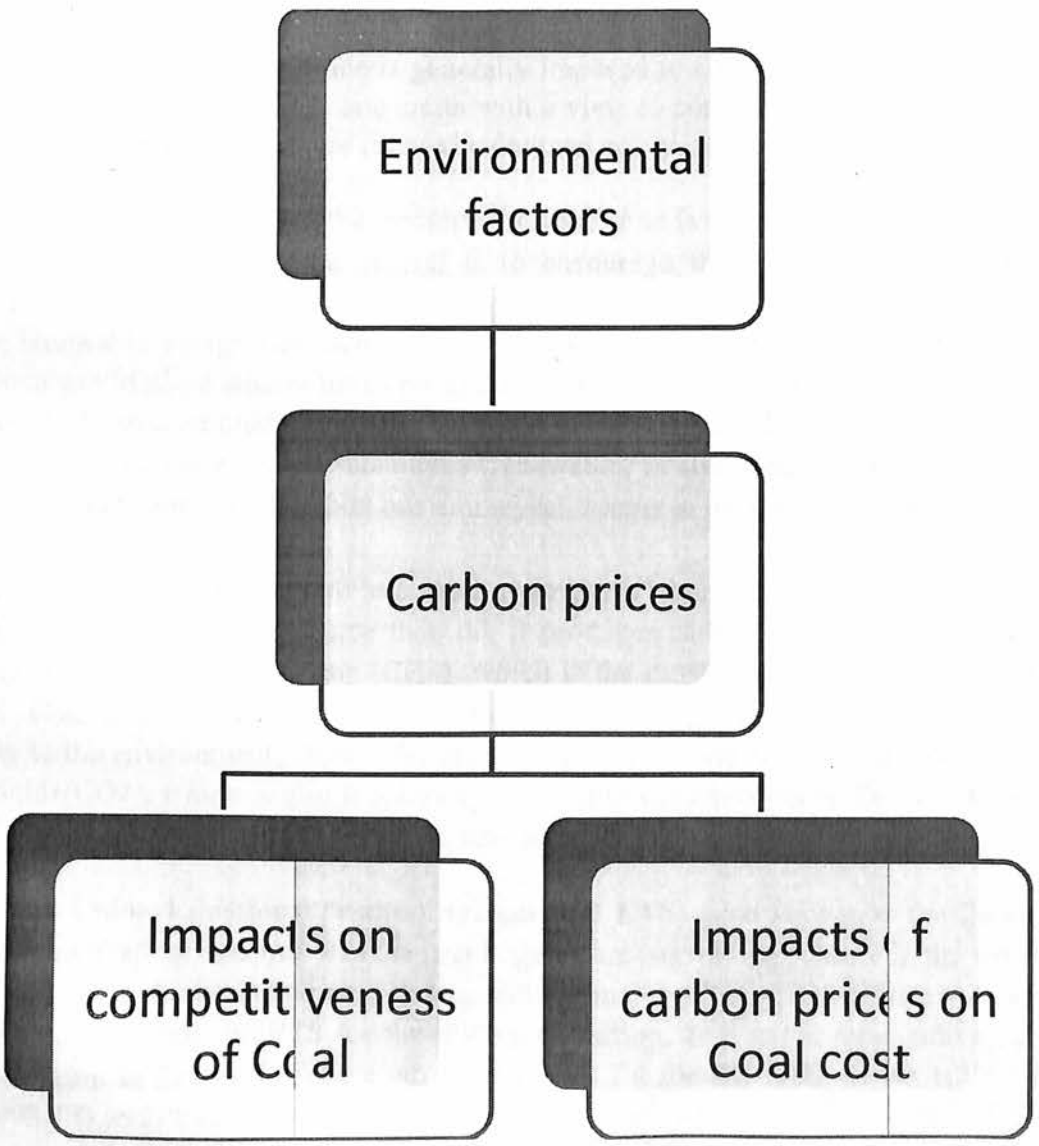
Rankings (Current Scenario):

Factor	Value of bill as a % of Forex(0.53%)	Rupee vsDollar(55.05)	IIP Growth(3.7)
Ranking	1	9	8

Current Scenario Rank = (1+9+8)/3 = 6

CHAPTER: 8
ENVIROMENTAL RISK

Figure 14



An important factor that accounts for Coal is Carbon Prices. The carbon prices have impacts in the form for checking its competitiveness from other fuel forms and its effects on prices of Coal. In this study, we take each of them one by one as under.

8.1Impact of Carbon Prices on International Coal Cost (Global Risk)

8.1.1Introduction:

Carbon price or carbon emission price is generally imposed to control pollution by placing a price on the amount of carbon/CO2 one emits with a view to control global warming. Due to this carbon pricing, greenhouse Gases cannot be dumped easily into the environment.

There are two main goals towards the pricing of carbon: one is to discourage the emitting of carbon due to combustion and the second is to encourage the use of renewable energy resources. However, one needs to come up with more feasible measures with respect to developing renewable energy resources. Thus, we would concentrate more on cap-and-trade system, which would place stricter limits on fossil fuel use or impose tax, which places a price on the amount of carbon emission per year. Limiting the use of fossil fuels is not ideal in the current scenario as efficient use of substitutes (renewable) is still nascent stage. As a result, imposing a tax on the amount of carbon one emits/year, seems to be a better option.

Natural gas is better than coal and oil as an energy source when its effects on environment are considered. Yet being a cleaner source than oil, it produces carbon emissions that harm the environment. Coal is mostly Methane (CH4), which is the most dangerous among the green housegases. Coal liberated directly into the atmosphere during exploration from wells is a huge danger to the environment. During the processing of Coal and at end uses also it librates Carbon dioxide(CO2), which is also a polluting element to the atmosphere. So to observe the impacts of Coal world carbon prices are taken into considerations.

The **European Union Emissions Trading System (EU ETS)**, also known as the European Union Emissions Trading Scheme, was the first large emissions trading scheme in the world. It was launched in 2005 to combat climate change and is a major pillar of EU climate policy. We would therefore follow the EUETS for the pricing of carbon, as it is the most active carbon pricing mechanism in the world. There are three phases for the EU ETS: Phase 1(2005-07), Phase 2 (2008-12) and Phase 3 (2012-2020).

8.1.2 Analysis:

Table 9[23] - Carbon prices over the years in EU ETS

Year	€/ton
2005	7.2
2006	20
2007	0.65
2008	21
2009	13
2010	15
2011	12
2012	6.6

Each country has two options, either to improve infrastructure which will help reducing carbon emissions or pay more for excess carbon emissions. Either ways, the cost will be recovered from the consumers.

When the carbon price increases, it is more or less imposed on the end user as the combustion of fossil fuels by large comes from the end use sector. This increase in carbon price does not have direct relation with the Coal but it directly affects the economic growth of a country.

8.1.3Ranking Methodology:

Rank	Carbon Price (CP)
1	$0 \leq CP < 4$
2	$4 \leq CP < 7$
3	$7 \leq CP < 10$
4	$10 \leq CP < 13$
5	$13 \leq CP < 16$
6	$16 \leq CP < 19$
7	$19 \leq CP < 22$
8	$22 \leq CP < 25$
9	$25 \leq CP < 28$
10	$28 \leq CP$

Ranking (Best case):

The best case would be in the year 2007, where the carbon price was almost close to zero, i.e. 0.65€/ton of carbon emitted. The reason behind such a low price on carbon emission was an oversupply of emissions allowances for EU ETS Phase I. Hence, the **best case ranking would be 1.**

Ranking (Worst case):

[23]Source: emissierechten.nl, www.wikipedia.org

The worst case would be in the year 2008, where the carbon price was around 21€/ton of carbon emitted. This was mainly due to the fact that in 2007, three non-EU members, Norway, Iceland, and Liechtenstein joined the scheme. Hence, **the worst case ranking would be 7.**

Ranking (Current Scenario):

If we consider the current scenario, where the carbon price was around 6.6€/ton of carbon emitted, **the ranking assigned would be 2.**

8.2The Impac of Carbon Prices on Coal&Its Con petitiveness (Glob l Factor)

8.2.1 Introduction

In our study, we are basically concerned with Coal in power sector because it is Coal finds great importance for electricity production these days throughout the world. We have not talked about Coal in fertilizer sector since fertilizer sector is not for energy concerns.

Coal is not that complicated and threatening as oil sector but the former can be replaced by other energy fuels. Oil finds it very difficult to be substituted by any other fuels in all sectors. In power sector too, if Coal becomes costly or it is unavailable then it can always be replaced by coal, which is a cheap source of energy.

We can relate this carbon price concept and substitution together to check the competitiveness of the fuel. Carbon prices have huge impact on the price of the Coal. If the carbon prices are more than a certain level then it is preferred to be replaced by different energy fuel. There are different power plants made for both coal as well as gas, so which ever fuel is cheaper is used in it overnight. There was a study done by MIT, to bring on a consensus on what trade-mark should be kept for carbon prices for substitution

.8.2.2 Analysis–

Table 1: Costs of Electric Generation Alternatives

			LCOE		
	Overnight Cost	Fuel Cost	Base Case	w/ carbon charge $25/ tCO_2	w/ same cost of capital
	$/kW	$/mmBtu	¢/kWh	¢/kWh	¢/kWh
	[A]	[B]	[C]	[D]	[E]
MIT (2003)					
$2002					
[1] Nuclear	2,000	0.47	6.7		5.5
[2] Coal	1,300	1.20	4.3	6.4	
[3] Gas	500	3.50	4.1	5.1	

Update					
$2007					
[4] Nuclear	4,000	0.67	8.4		6.6
[5] Coal	2,300	2.60	6.2	8.3	
[6] Gas	850	7.00	6.5	7.4	

Table 10[24] - Competitiveness of Coal when compared to nuclear energy.

According to the report of MIT, the best and worst cases can be determined.

8.2.3 Ranking Methodology-

Ranking

Best Case-

The best case will be the one when the cost of electricity generation with carbon prices from diff sources is the minimum at a given fuel cost. For coal when the fuel cost is 1.20 then the cost of electricity generation is 6.4€/kwh, which is least at this standard when other sources of energy like oil and gas are considered. So this is the best case with rank 1.

Worst Case –

The worst case will be the one when the cost of electricity generation with carbon prices from different sources is minimum at a given fuel cost. For coal it is 9.6 €/kwh.

So from the table above we can say in the worst scenario, the prices of power from nuclear is less with carbon prices. So it is preferal le to replace it with nuclear. Hence nuclear is giving high competition to Coal.Given rank 10 for it.

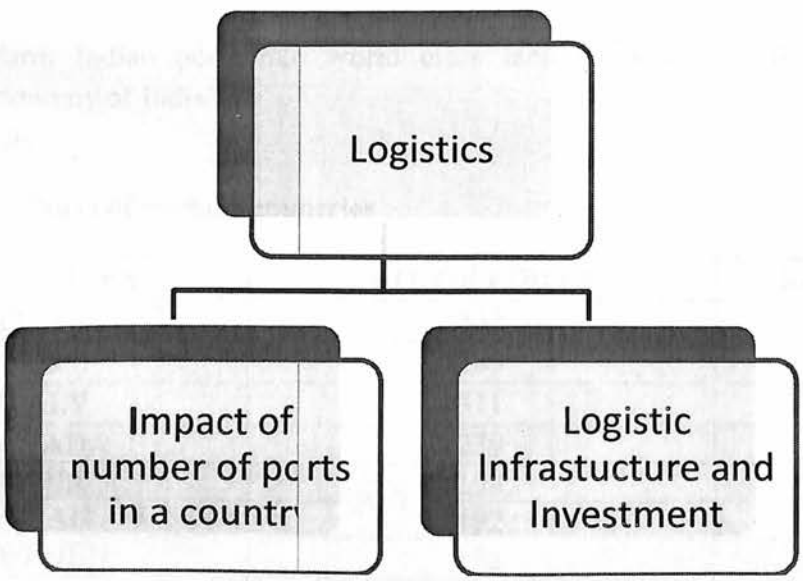
Current Case –

The current scenario is the breakeven point where the price of Coal fuel 2.60€/kw h and the cost of generation with carbon prices is 8.3 where nuclear is 6.6€/kwh. **So it can be taken as rank 6.**

[24] Source – The future of Nuclear Fuel Cycle 2013 MIT

CHAPTER: 9
LOGISTICAL RISK

Figure 15



9.1 Impact of Ports in various Countries (Domestic Risk)

9.1.1Introduction

The national economic development of India requires a well-functioning seaport system. India has 13 major seaports and 185 minor seaports along a coastline of over 7.000 km. The 13 Major Ports handle some 75% of the total Indian port traffic. Due to the foreseen national economic development in the coming decades, a strong further growth of the Indian port sector is expected. To be able to cope with the above, the Government of India not only decided to improve the seaport and hinterland infrastructure but also the institutional and organizational structure of the port sector. The overall goal of the development of Business Plans for the 13 Major Ports was:

"To transform Indian ports into world class facilities suited to the requirements of the future"."""economy of India"

9.1.2Analysis:

Table 11[25] – Ports of various countries

COUNTRIES	NO. OF PORTS	Ranks
UNITED STATES	532	1
UK	389	2
ITALY	311	3
CANADA	239	4
INDIA	198	5
JAPAN	192	6
SWEDEN	182	7
CHINA	172	8
FRANCE	159	9
DENMARK	159	10
INDONASIA	154	11
AUSTRALIA	106	12
RUSSIA	105	13/
SPAIN	105	14
GREECE	103	15
GERMANY	98	16
PHILIPPILES	62	17
URGENTINA	55	18
TURKEY	50	19

[25]Source – World Port Source, World Shipping Association.

IRELAND	49	20
CHILE	46	21
PERU	33	22
PORTUGAL	29	23
NEWZELAND	25	24
NETHERLAND	24	25

In our study we have taken top 25 countries with healthy number of ports. That is with ports more than 24. In the table, India ranks around 5th position. The best situation is for United States with 532 ports. Less number of ports in the country possesses threat of moving the Coal from one part of the nation to another. Hence, in India due to less number of ports the cost of transportation of Coal increases.

9.1.2Ranking methodology:

Rank	DENSITY
1	Ports> 450
2	400≤ Ports <450
3	350≤ Ports < 400
4	300≤ Ports <350
5	250≤ Ports < 300
6	200≤ Ports <250
7	150≤ Ports < 200
8	100≤ Ports <150
9	50≤ Ports < 100
10	0≤ Ports < 50

Best Case:

The best case is the one where the number of ports in a country is more than 450. In the above table, the best case is for United States. The **rank will be 1.**

Worst Ranking:

The worst condition is for the nation with less than 50 ports. In the above analyzed data the world case is for Netherlands with 24 ports. India's situation is not far off to it. The **worst case rank is 10.**

Current Ranking :

The **current ranking for India is 7**. It has just 198 ports. The situation of India is and India needs to develop its port infrastructure to import more of coal.

9.2Logistics Infrastructure and Investment (Global Risk)

9.2.1 Introduction

Coal is readily available from a wide variety of sources in a well-supplied worldwide market. Coal can be transported to demand centres quickly, safely and easily by ship and rail. A large number of suppliers are active in the international coal market, ensuring a competitive and efficient market.

COAL TRANSPORTATION

The way that coal is transported to where it will be used depends on the distance to be covered. Coal transportation is generally carried out by conveyor or truck over short distances. Trains and barges are used for longer distances within domestic markets, or alternatively coal can be mixed with water to form a coal slurry and transported through a port.

Ships are commonly used for international transportation, in sizes ranging from:

- Handysize - 40-45,000 DWT
- Panamax - about 60-80,000 DWT
- Capesize vessels - about 80,000 DWT

9.2.2 Analysis

COAL TRADE

Coal is traded all over the world, with coal shipped huge distances by sea to reach markets. Over the last twenty years:

- seaborne trade in steam coal has increased on average by about 7% each year
- seaborne coking coal trade has increased by 1.6% a year.

Overall international trade in coal reached 1142Mt in 2011; while this is a significant amount of coal it still only accounts for about 15% of total coal consumed. Most coal is used in the country in which it is produced.

Transportation costs account for a large share of the total delivered price of coal, therefore international trade in steam coal is effectively divided into two regional markets

- The Atlantic market, made up of importing countries in Western Europe, notably the UK, Germany and Spain.
- The Pacific market, which consists of developing and OECD Asian importers, notably Japan, Korea and Chinese Taipei. The Pacific market currently accounts for about 57% of world seaborne steam coal trade.

Indonesia has overtaken Australia as world's largest coal exporter. It exported over 300Mt of coal in 2011.

Australia remains the world's largest supplier of coking coal, accounting for roughly 50% of world exports.

	2010		2020		2035		2010-35
	Mtce	Share of demand*	Mtce	Share of demand*	Mtce	Share of demand*	Delta Mtce
OECD	-119	9%	-79	6%	78	7%	197
Americas	59	8%	58	8%	61	9%	2
United States	53	7%	54	8%	56	9%	3
Europe	-184	61%	-214	77%	-162	84%	22
Asia Oceania	6	2%	78	19%	179	41%	173
Australia	272	86%	340	85%	382	88%	111
Japan	-164	100%	-147	100%	-131	100%	33
Non-OECD	140	4%	79	2%	-78	2%	-218
E. Europe/Eurasia	107	32%	109	32%	65	20%	-42
Russia	101	46%	104	46%	70	34%	-31
Asia	-51	2%	-147	4%	-272	6%	-221
China	-145	6%	-167	6%	-77	3%	68
India	-60	15%	-190	31%	-315	34%	-255
Indonesia	223	84%	337	79%	347	71%	125
Middle East	-2	70%	-3	73%	-5	80%	-2
Africa	43	20%	66	27%	80	29%	36
South Africa	50	24%	66	29%	67	28%	17
Latin America	44	59%	54	53%	55	53%	11
Colombia	64	93%	90	94%	89	92%	24
World**	833	17%	1 095	20%	1 122	19%	289
European Union	-158	58%	-187	76%	-130	84%	28

Figure 16 – COALtrade around the world[26]

If the investment in this sector is done properly such that the trading of Coal becomes as easy as crude oil then the limitations to logistics part will be minimum. According to BP statistical review 2013, world traded around 30.65 % of natural gas as compared to 64.84% of crude oil and 29% of coal in 2012. If proper infrastructure in terms of ports is available then Coal will reach the point where crude oil is traded.

From Indian perspective, India uses around 53% of coal when compared to oil which is around 23%. If proper infrastructure is available then it will reach world class standards. Based on these observations, the best and worst case can be established.

[26] Source- World Energy Outlook 2012

9.2.3 Ranking Methodology

Best Case:

Best case is when Coal reaches over the oil mark of 64.84% trade in the world. At this time it will be given a **rank 1.**

Worst Case:

Worst case is when it dips down to less than 10%. It will be ranked worst. **Rank is 10.**

Current Case:

Current situation is moderate. The **current ranking is taken4 for India.**

CHAPTER 10
CONCLUSION: THE INDEX GENERATION

10.1 FORMULA

The formula used in our study is just an over simplification of the model. The results obtained by using this formula are not the exact results. It just gives a value which gets affected by the global risk ranks and domestic risk ranks. The weight assigned to each category of risk is a subjective method.

Here we have used Quantitative Research Methodology in our study. In quantitative methodology we have followed probabilistic approach.

Every risk whether domestic or global, the ranks given are on a scale of 1 to 10 with 1 being the best and 10 being the worst. This brings the measure of risk in terms of a scale of 10.

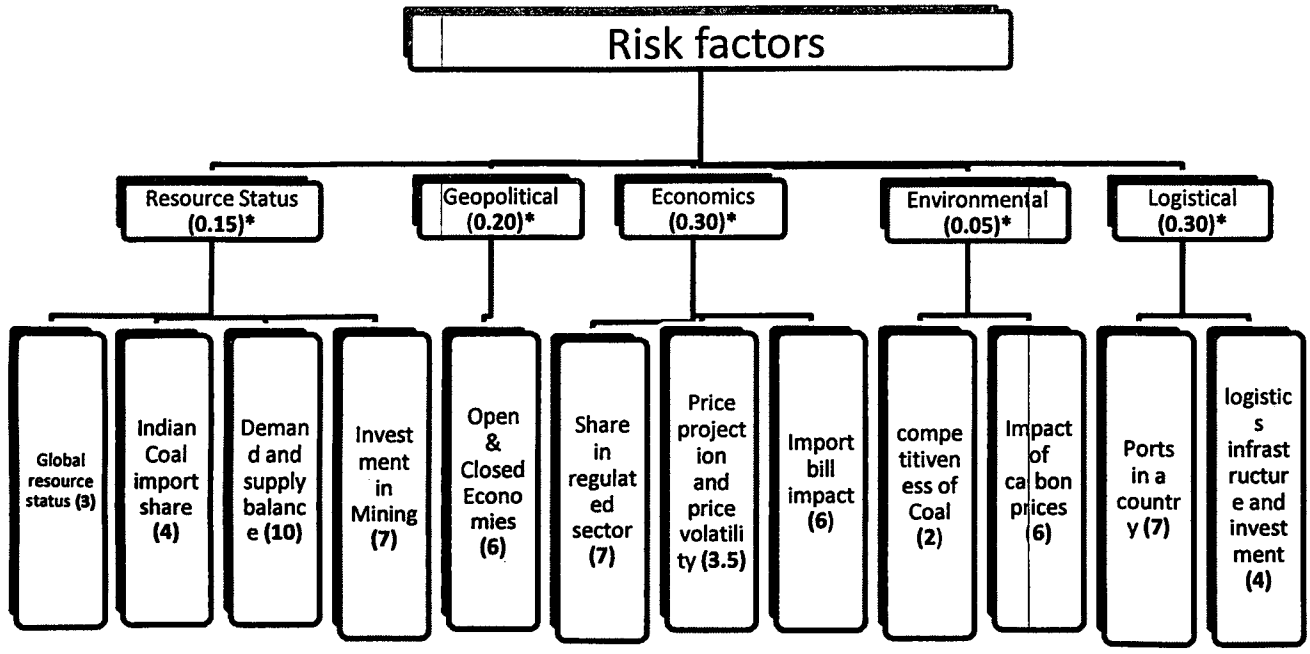
Weights are given on a scale of 0 to 1 (probability), so that, the index thus generated ranges from 1 to 10.

From each category of risks, we have taken 10% of the weight for uncertainty. Uncertainty here means other factors can also be added.

The formula that we have derived is given as below:

Index = Σ (Σ (Average of factor * Weight applied to that factor))

Figure 16 – Weighted Risk Factors



Note - * denotes the weights assigned.
Rest values are ranks allotted to various factors.

10.2 Calculations

For Example:

Average of Resource status = (Rank of Global Resource Status+ Indian Import Share + Demand and supply balance + Investment in E&P)/4

$$=(3+5+10+7+7)/5 = \mathbf{6.4}$$

Similarly average for all factors can be calculated.

Weight of resource status = 0.30

Similarly, we have given weights to all the other factors.

Average of resource status * weight of resource status = 6.40* 0.30 = **1.92**

Similarly we calculate the product and sum them to find out the final index.

Table 12 - This obtained index is the Energy Security Index. The Energy Security index can be classified as:

Index Value	Risk Classification7	Security
0 < Index Value ≤ 1	Low Risk	Highly Secure
1 < Index Value ≤ 2	Low Risk	Highly Secure
2 < Index Value ≤ 3	Low Risk	Moderately Secure
3 < Index Value ≤ 4	Medium Risk	Secure
4 < Index Value ≤ 5	Medium Risk	Partially Secure
5 < Index Value ≤ 6	Medium Risk	Partially Insecure
6 < Index Value ≤ 7	Medium Risk	Insecure
7 < Index Value ≤ 8	High Risk	Moderately Insecure
8 < Index Value ≤ 9	High Risk	Highly Insecure
9 < Index Value ≤ 10	High Risk	Highly Insecure

10.3The Index

For India the index that we generated after using the formula mentioned above is 5.3

It shows that India as per current scenario lies in the almost secure region. But it is heading toward insecure zone with the increasing coal imports in the country.

India is having partial security of energy security because of the following reasons:

- Though the coal reverse in India form 7% of total world share, lack of mining companies is a reason due to which domestic production is not picking up.
- Another reason for high risk is the geo political situation of India. India imported almost 60% of coal from closed economies, which is a threat in time to come. India must look fo some more options.
- The coal prices of Asian market are highest and prone to fluctuations.
- The presence of subsidized pricing for domestic power sector where coal is most used is another constraint which restricts huge investments in this sector.
- India has only 198 ports when compared to 532 in United States, increasing imports of coal demand for development in infrastructure.

Therefore we see India on a moderately securer nation in terms of coal supply but then it is only for the financial year 2012- 2013.

CHAPTER: 11
SOME OF THE RECOMMENDATIONS AND SUGGESTIONS

Recommendations

1. We can see that Indian share in terms of Coal reserves is quite high almost 7% when compared to the world. A serious concern should be given on finding of the new reserves.An investment plan should be there that could help in a consistent flow of money in exploration & production of Coal.

2. The Indian Coal sector is highly regulated, the single company that is doing mining in India is Coal India Limited. When compared to other countries this sector is deregulated, will increase the opportunity of investments and competitive in this sector. This leads to high production of coal in other countries.

3. Proper coal policy needs to be set up and it should be implemented as soon as possible encouraging foreign direct investment in mining sector in India. It would result in increase in Coal share of India along with proper utilization of reserves and also result in decrease in import share.

4. A lot of domestic coal energy is wasted in terms of ash content. Due to lack of clean coal washeries capacity in India(which is 131.24 MT[27] in 2012) the high domestic production is not well utilized. Hence India needs to spend more investment in developing the coal cleaning capacity.

5. Trade with open economies instead of close economies: Most of the Coal in India is coming from partially closed economy that is not a good sign. In coming years, India should continue to focus on imports from open economies.

[27] Source – Ministry of Coal in India

Suggestions

For this research projects there some viewpoints that could be included in the next step to refine the index which are:

- There are not just five broad categories of risks, other risks could be involved.
- Risks could be added on domestic as well as on global level.
- The risks at both the levels can be classified as

CONTROLLABE & UNCONTROLLABE risks: Or we can say that the parameters can be first broken into their trigger points (trigger points means the points that majorly affects the parameter) and then these trigger points can be analyzed on their extent of controllability by the government. For example government cannot control the international crude oil prices thus it comes under uncontrollable. Category & FDI can be controlled by government. Thus the extent of controllability can be examined and then one can find the index for energy security.
above

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