

Gauging the causes of energy insecurity economics essay

[Business](#), [Industries](#)



Introduction

Numerous energy literatures written by academic research workers, every bit good as statements made by representatives of oil consuming and oil bringing states have indicated that the construct of energy security is an elusive one. There has been varied definitions for energy security ranging from uninterrupted oil supplies at 'reasonable monetary values' to physical security of energy installations from break and really late an add-on to the definition is the ability to run into energy demands while equilibrating the environmental concerns of climate alteration extenuation.

The ensuing consequence of so many definitions of energy security is that the appraisal of energy security is not so straightforward. Different states depending on their own peculiar fortunes step energy security otherwise hence doing the construct 'self functioning'. Literature has nevertheless identified some generalized factors as being the constituents of energy security in any state. Factors including: diverseness of energy supplies, degree of imports; security of trade flows; energy geopolitics; portion of one peculiar fuel in the fuel mix; market/price volatility and energy dependability, have been identified as useful for understanding energy security in any state.

Energy insecurity no matter the cause consequences in welfare loss to society. Of all the causes of energy insecurity none is as politicized, relentless and permeant as fossil fuel resource concentration. The challenge

of fossil fuel concentration is obvious from geological facts that grounds the skewed spread of fossil fuel sedimentations in certain parts in the universe.

The of import inquiries that this paper seeks to reply are ;

What are the causes of Energy insecurity?

Can we divide the physical handiness and monetary value constituent of energy insecurity?

How does fossil fuel concentration affect each constituent above every bit good as the energy insecurity job in general?

How do we economically assess the public assistance deductions of energy insecurity due to fossil fuel concentration on an economic system?

A careful survey of the issues raised above has been undertaken and it is hoped that the replies supplied in this paper would supply a clear counsel for policy shaper 's on the energy security deduction of fossil fuel concentration.

Chapter one introduces the paper. Chapter two discusses the energy security challenge while concentrating on the unjust distribution of fossil fuels and the impact of menaces and Acts of the Apostless of terrorist act on energy security. Chapter three focal points on the measurings of fossil fuel concentration get downing with the methodological model of Herfindahl Hirshman Index (HHI) and ends with the more practical method suggested by Levefre. Chapter four focal points on the instance surveies get downing with why the pick of Japan and USA while so utilizing already calculated

indexes and IEA informations to measure the ESPI for each fuel and ESPAI for gas in the command to gauge the impact to energy security of dodo fuel resource concentration and a projection is made for these two indexes to 2030 based on IEA mention scenario. Finally, chapter five concludes the paper.

THE ENERGY SECURITY CHALLENGE

2. 1 WHAT CAUSES ENERGY INSECURITY?

In the twenty-first century universe, many economic systems depend extremely on energy to drive industrialization and power their economic systems. The demand for fossil fuels (oil, coal and natural gas) in the modern car industry, power coevals, agribusiness, fabrication and virtually all facets of human life has made the handiness and regular (uninterrupted) supply of energy at low-cost monetary values a really of import policy end for most authoritiess

[6]

. However, since all states do non possess the same sum of resource sedimentations with their boundary lines, many states have had to trust on imports for run intoing their energy demands hence exposing such states to the menace of break in supply of energy as a consequence of the exogenic nature of supply.

Furthermore, the menace of clime alteration and lifting temperature degrees has made the energy security challenge far more complex because it is no longer plenty pursue uninterrupted supply of energy but besides guarantee

that it is done in an environmentally sustainable mode. Besides, the asymmetric spread of fossil fuel sedimentations in the universe has proven to be rather of import in the finding of fossil fuel trade good monetary values and the oil market in peculiar is peculiarly volatile as a consequence of this. This un-equal distribution of natural resources with the boundary lines of each state of the universe has created a planetary trade good market for oil, gas and coal but besides caused energy insecurity

[7]

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As pervading as the geo-politics of oil is, there is small research on the economic appraisal of energy security deduction of fossil fuel resource concentration due to the qualitative nature of political instability which has proven really hard to mensurate. This paper seeks to bridge this spread by supplying indexes that will capture the impact of political instability on monetary value and physical handiness constituents of energy security

[8]

2. 2 THE INEQUITABLE DISTRIBUTION OF ENERGY RESOURCES

IEA (2009) reveals that fossil fuels together accounted for a sum of 81 % of the World primary energy demand in 2007. Oil demand is 33 % of entire and represents the largest portion with coal (27 %) and Gas (21 %) ranking 2nd and 3rd topographic point severally

[9]

. The inquiry now is what is the geographical distribution of these energy resources?

[10]

(See figure 1 below)

Harmonizing to Energy Information Agency (EIA) in 2005

[11]

, the part that holds the universe 's largest proven militias of oil is the Middle East (Approximately about 800billion barrels of proved militias of oil) . In footings of proportion, over 65 % of the universes proven crude oil Militias are situated in the Middle East, approximately 78. 2 % are located in Organisation of Petroleum Exporting Countries (OPEC) , 25 % are located in Saudi Arabia entirely and the Russian Federation histories for 5. 7 % and is ranked as the following largest manufacturer outside OPEC (See figure 2 below)

A more recent survey carried out in 2010 by the Institute Francias du Petrole (IFP) reveals the proven, possible probable and possible militias of oil around the universe and the Middle East remains dominant accounting for approximately 58 % of the universe proven militias of oil

[12]

. (See figure 3 below)

A closer expression at the regional distribution of oil shows that 9 out of the 11 richest oil bring forthing states in the universe are located around the Caspian Sea Region a really volatile and conflict prone part marked by many wars and political instability

[13]

. The Chechenya struggle in Russia, the USA-Iraq invasion and the Niger delta agitation in Nigeria are some of the illustrations of such struggles to advert a few

[14]

. (See figure 4 below) .

Natural gas militias are besides unevenly distributed by geographic part worldwide. From the figure below, most dominant part is the Middle East accounting for approximately 45 % of universes proved militias

[15]

. Until late due to transit restraints, the majority of gas had to be traded within the major geographical parts that possessed this resource. With the coming of LNG (Liquefied Natural Gas) , universe economic systems have witnessed the development of a truly planetary gas market. (See figure 5 below)

The geographical distribution of coal militias nevertheless reveals a different image. Coal militias are reasonably equally distributed worldwide, but with a few dominant states Harmonizing to World Energy Council (WEC) study informations for about 70 states, One-third of coal militias is located in North America (29 %) , dominated by the United States ; one-third in Eurasia (34 %) , dominated by Russia, Ukraine, Kazakhstan and Serbia ; and one-third in Asia-Oceania (31 %) , where the militias in China entirely are equal to the amount of the militias in India and Australia. Africa represents less than 5 % of the sum, with the majority of the coal wealth to be found in South Africa and South America holds merely 2 % of universe militias

[16]

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Proven militias of coal at year-end 2008 stood at an estimated 826 billion dozenss (Gt) , stand foring about 122 old ages of production at the current rate

[17]

. Regional production of coal nevertheless reveals the laterality of the Asia-pacific part (61 %) with China and India playing a major function. North America produces 19 % ; Europe produces 14 % and the remainder of the universe (6 %)

[18]

. (See figure 6 below)

2. 3 THREATS AND ENERGY INSECURITY

The skewed distribution of dodo fuel militias (oil in specific) has led to a battalion of differences throughout clip and history. Today, about 30 % of current struggles (wars) have been straight linked to oil

[20]

. More late acts of terrorist act by Al-Qaeda and attached Jihadist group have been targeted at Middle East Oil

[21]

. In 2002, a Gallic oil oiler (Limbourg) off the Yemen Coast was attacked with asuicideboat filled with explosives.

Al-Qaeda besides attacked the Saudi port of Yanbu in 2003-2004, killing five applied scientists from the Western World. In 2006, a failed effort to assail the Abqaiq refinery took topographic point. The existent impact of these menaces asides its existent consequence on the monetary value of oil, is on the investor assurance in the degree of security, effectivity of jurisprudence enforcement establishments every bit good as the credibleness of political governments in topographic point in this states. The chief impacts with these Acts of the Apostless of force and sabotage on oil and gas installations are the attendant crisp monetary value swings that occur as a direct effect of decrease in capacity.

Measurements OF FOSSIL FUEL CONCENTRATION

Methodology

This starting point for measuring the fossil fuel concentration ratio among parts is to mention to the work by Orris Herfindahl and Albert O. Hirshman

[22]

on the measuring of the grade of market concentration in an industry.

3. 1. 1 THE HERFINDAHL HIRSHMAN INDEX

The Herfindahl Hirshman Index is usually known the grade of market concentration or a measuring of the size of a steadfast relation to the industry

[23]

. It provides indicant of the degree of competition between houses in an industry.

Let us presume, S_i is the market portion of an i th house, and so the Index is estimated by:

Where S_i = market portion of an ' i th ' house (normally expressed as a per centum

N = the figure of houses in the market

The HHI recognises both the comparative size of the house every bit good as the figure of houses in the market. The utility of HHI to gauge fossil fuel

concentration, lies in the fact that in an industry the figure is known and a weight commensurate to the market portion house is attached to each house to the i th house which when substituted into the expression gives an indicant of the degree of fight of the industry. The maximal value for HHI is 10000 reflecting a monopoly state of affairs and the lowest value is zero (0) as the market moves towards a perfect completion state of affairs

[24]

. (See Figure 7 below)

3. 2. MEASURING THE PRICE IMPLICATION OF RESOURCE CONCENTRATION

[25]

The monetary value deductions of fossil fuel resource concentration can be broken into two constituents. The first portion is the Energy Security Market Concentration (ESMC) which is the grade of market concentration in each planetary dodo fuel market. The ESMC gives an indicant of the 'price hazard' consequent to fossil fuel resource concentration. The 2nd portion is incorporated into an Energy Security Price Index (ESPI) that provides an appraisal of any given state 's degree of exposure to these monetary value hazards. The ESMC relies to a great extent on the work by Herfindhal Hirschman Index (HHI) , which is derived as the amount of the square of each market portion of all houses.

Although, the planetary market for oil, coal, and gas market are considered individually, the providers (market participants) are assumed to be states

instead than private houses. The ground for the focal point on states is because the authorities have control of the development of natural resources within their boundary lines. The inquiry of what the step of market portion should be used is besides really of import. Since unequal distribution of resources created the planetary market, the step of market portion of fossil fuels on 'resources ' would be inappropriate. Market portion should non be based on production or exports but that excessively depends on monetary values and physical exports capacity.

However, market portion based on net export seems good suited as it takes history of physical restrictions and the issue of whether states monetary value exports otherwise from domestic ingestion or non

[26]

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The ESMC for each dodo fuel type would hence be calculated utilizing the expression similar to the HHI and is given below:

$$ESMC = \sum_{i=1}^n S_i^2 / n$$

(eqn 1)

I

Where S_i is the leaden portion of an single provider I in the planetary market for fuel degree Fahrenheit defined by its cyberspace export potency (S_i varies from 0 to 100) . Values of ESMC vary from between 0, which

suggests a close perfect competition state of affairs to 10, 000 for a pure monopoly state of affairs. A fuel with a higher ESMC value implies a higher insecurity. Therefore since monetary value hazard is reflected in ESMC, the 'price hazard calculated would be the same for any state. As a consequence, any state in the universe including Japan and the USA would confront the same monetary value hazards associated with resource concentration.

In order to acquire a more accurate ESPI, some alterations has to be made on the ESMC to account for political instability. This is because political instability is important because fossil fuels as frequently geographically concentrated in politically sensitive parts like the Caspian Sea part for case which has been prone to many affraies. To account for political instability, the step of ESMC can be defined as ;

$$ESMC_{pol} = a^i (r_i * S_{2if})$$

$$a^i = \frac{1}{1 + R_i} \quad (\text{eqn 2})$$

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Where Rhode Island is the political evaluation for the state 'i ' which in this survey is the World Banks administration index on political instability

[27]

. ESMC_{pol} therefore scopes from 0 to 30, 000 where 0 indicates a perfect competition among states with the highest degree of political stableness and 30, 000 indicates a pure monopoly of a state with the worst degree of political stableness

[28]

. ESMCpol for coal, oil and gas that would be used to cipher ESPI in the instance surveies presented in chapter 4 will be adopted for Levefre 's (2009) work.

ENERGY SECURITY PRICE INDEX (ESPI)

After deducing the ESMC, the ESPI must so be estimated. The ESPI reflects the exposure of a given state to the monetary value hazards linked with resource concentration. The part of the state 's entire concluding primary energy supply exposed to each ESMCpol value must be calculated. The ESPI is hence calculated as

$$ESPI = \sum (ESMC_{pol-f} * E_f / TPES)$$

$$\sum (ESMC_{pol-f} * E_f / TPES) \quad (\text{eqn 3})$$

F

Where ESMCpol-f is the ESMCpol value for peculiar dodo fuel degree Fahrenheit, E_f is the state 's supply exposed to the 'price hazard ' of fuel degree Fahrenheit, and TPES is the state 's Entire Primary Energy Supply

[29]

. ESPI 's values ranges from 0 to 15000

[30]

MEASURING PHYSICAL AVAILABILITY IMPLICATIONS OF RESOURCE CONCENTRATION ENERGY SECURITY PHYSICAL AVAILABILITY INDEX (ESPAI)

The ESPAI is an Index which is relevant merely the gas market. In a state of affairs where the gas market is regulated, gas monetary values are non affected by the forces of demand and supply. Physical handiness hence becomes an of import security concern because demand is likely to transcend supply in a regulated government

[31]

. This is normally the instance in the European Union every bit good as Japan. In such state of affairss the flexibleness of gas substructures to suit strong on-peak demand determines the physical handiness hazard.

During the winter months in early 2009, some parts of Europe experienced break in gas supply from Russia as a consequence of the Transit grapevine issue between Russia and Ukrain

[32]

. This is what happens when a state relies on merely one import grapevine for its domestic demands. Due to the comparative inflexibleness of grapevines, the physical handiness concerns are normally grapevine based imports of gas instead than LNG beginnings. The attack of measuring the ESPAI therefore is to gauge the portion of the state 's entire demand met by

grapevine based gas imports procured through long term understandings as the ESPAI. The ESPAI can hence be expressed as ;

ESPAI=

Gasimp-pipe-regulated/TPES... .. (eqn 4)

Where Gasimp-pipe-regulated is the supply of gas that is imported by grapevine based regulated contracts. ESPAI value ranges from 0 to 100. 0 is a state of affairs where there are no grapevine based imports (LNG based imports) or all purchases are made on competitory footings and 100 where the state is self sufficient in gas in the conjectural instance. The overall attack in this work with the inclusion of ESPAI is to mensurate the energy security deductions of fossil fuel concentration can be summarized as shown in Figure 8 below.

WHY USA AND JAPAN?

Oil is the lifeblood of the U. S. economic system

[34]

. America imports about 60 % of the oil it consumes, and harmonizing to 2005 estimations, approximately \$ 680million is spent on oil imports per twenty-four hours

[35]

. Oil and natural gas monetary value additions in recent old ages has had a profound impact on U. S. concerns every bit good as on consumers in signifier of higher monetary values for goods

[36]

. However, since the U. S has the largest coal militias in the universe for any individual state, we shall non gauge and the ESPI for coal

[37]

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Japan is the 3rd largest consumer of fossil fuels in the universe but has its ain alone challenges. It is resource hapless and has to depend on imports for virtually all of it fossil fuel demands

[38]

. Figure 9 below shows Japans dependance on Middle East oil has grown from 73. 2 % in 1973 to 86. 4 % in 2007 with an all clip high of 89. 9 % in 2006.

Harmonizing to IEA, both states dependance on imported energy beginnings are really high. Japan 's energy imports rose from 81 % in 2005 to 96 % in 2006, an highly vulnerable energy supply construction

[39]

. America 's energy imports on the other manus rose from 29 % to 38 % between the same periods, a potentially vulnerable state of affairs.

Beginning: IEA, Key Energy Statistics (2008)

Development OF ESMC (2004 - 2030)

In this subdivision, the attack detailed supra is applied to two OECD states, Japan and The United States of America (U. S. A) to measure the development of ESPI overtime. Country level informations gathered from IEA (2008) and projections from the World Economic Outlook (2008) mention scenario are used in the analysis

[40]

. ESMC

[41]

in the international oil market as estimated by Levefre is about 3700 in 2004 (See Figure 12) , in the 2004 to 2010, ESMC drops somewhat before shiping on a uninterrupted rise to about 4800 in the 2004 to 2030 period stand foring an a 30 % addition between the 2004 to 2030 period

[42]

. 2030. The ESMCpol is about 8700 in 2004, and increases to about 11, 400 by 2030.

In the coal market, ESMC is about 1900 in 2004 and rises to 2300 by 2030 stand foring a 22 % growing (See figure 13 below) . ESMCpol is about 3000 in 2004, and rises to about 3700 in 2030, 62 % higher than ESMC.

In the gas Market, the ESMC is about 2200 in a regionally constrained grapevine based gas market but when the displacement to a planetary gas market occurred, there was a drop in ESMC value to about 1000 in 2010 and later increases to about 1100 by 2020 before making a further fall to 900 in 2030. (See figure 13) ESMCpol is nevertheless 4800 in 2004, fell to 1700 in 2030.

Development OF ESPI JAPAN AND USA (2004 TO 2030)

From figure 15 below, the development of Japan 's fuel mix from 1990 - 2030 shows the dominant function of fossil fuels in the energy mix. By 2030, atomic portion would increase while fossil fuel portion would somewhat cut down. However, by 2030, Japan would still depend on fossil fuels for 80 % of its energy demands

[43]

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The fuel mix for the USA is similar to that of Japan bespeaking approximately 90 % dependence on fossil fuels in 2004 and falling to approximately 80 % in 2030 (See figure 16 below)

[44]

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Consequences for the development of ESPI in Japan is presented in table 1 below. The ESI and the ESPAI are both based on informations collected from the IEA every bit good as assumed ESMCpol values from Levefre (2009)

[45]

The get downing point was to gauge E_f for 2004 in Japan for all fuels ; it was found that Japan is extremely dependance on imports for its energy demands. The base old ages E_f was calculated and approximated so this computation was used to gauge an false E_f for the subsequent periods. For simpleness we would presume that 100 % of demand for oil is met through oil-indexed long-run contracts thereby exposing the entire oil demand to the oil market. Besides, we would presume 100 % exposure of coal to the market because it imports more coal than it presently domestically produces. While, it is 85 % exposed to the gas market due to the high dependance on LNG imports. For coal and oil, ESPI grew from 4133. 51 to 6785. 71 and 2640 to 3458 between the 2004 to 2030 period. Gas ESPI nevertheless fell from 4872 to 1433 could be due to a rapid development of the planetary market for gas.

Due to the high dependance on oil in the USA, the E_f is besides calculated utilizing similar methods with Japan and for simpleness the false E_f is that the 100 % of demand for oil is met through oil-indexed long-run contracts thereby exposing the entire oil demand to the oil market. Besides, we would presume 5 % exposure of coal to the market because the USA has one of the largest coal militias in the universe. While, it is 20 % of gas demand is

exposed to the gas market due to the LNG imports. For coal and oil, ESPI grew from 943 to 1293 and 27 to 87 between the 2004 to 2030 period. Like Japan, Gas ESPI besides fell from 118. 40 to 93 in the period (See table 2 above) .

Summarily, the ESPI fell from 11645 in 2004 to 9924 in 2015 and rose once more to 11678 in 2030 reflecting Japan is extremely vulnerable to Price hazards as a consequence of dodo fuel concentration. The ESPI for USA besides followed the same form although lower than that of Japan doing the USA besides vulnerable but in a better place than Japan. The value for ESPI ranges from 0 to 15000. The 2004-2030 period depicts a common tendency demoing the comparative importance of oil market hazard on energy security. The instance is more marked for Japan due to its energy hapless province. However the autumn in ESPI for gas reflects the demand to quickly heighten the development of the gas market. (See figure 17 for the comparisons between Japan and USA 's ESPI)

ESPAI IN JAPAN AND USA (2004)

Japan is the big natural gas consumer and must trust on imports for virtually all of its natural gas demands because its deficiencies international grapevine connexion. Today Japan is the largest importer of liquified natural gas (LNG) in the universe and presently histories for about 40 per centum of planetary LNG imports

[47]

. This makes it un-necessary to gauge the ESPAI because it has no grapevine contracts. (See figure 18 below for top LNG importers in the universe)

The USA besides has limited trust on imports for its gas demands. In 2004, ESPAI is 0. 1 picturing really low exposure to physical handiness of gas. (See figure 19)

Restriction OF THIS RESEARCH

The WEO projections in the mention scenario is simply a projection of the hereafter and like any prognosis, it is capable to fluctuations therefore it must be noted that it is non an accurate prognosis of the hereafter. The major purpose of this work was to show how the attack detailed in subdivision 3 may work. However, for more formal analysis, a more accurate informations set should be used and a scenario based attack which would bring forth a sensitiveness analysis must besides be undertaken, which was non include in this survey

Decision

CAN ENERGY INSECURITY DUE TO FOSSIL FUEL CONCENTRATION BE REDUCED?

The energy security challenge would go on to be a topical issue in economic, political and scientific arguments in the universe over. From the findings in this paper, the USA and Japan are presently in a vulnerable place with regard to energy security. They must therefore actively pursue policies that will better their current place. Although, fossil fuels concentration in surely creates exposure of to monetary value and physical handiness hazards, it is

still unrealistic to propose an straight-out boycott of the planetary market. However, the current energy security state of affairs can still be improved in the average term every bit good as long term end by actively prosecuting variegation of their fuel blend off from fossil fuels to renewable energies that can be domestically produced

[48]

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