The Role of Energy Economics in Sustainable Development

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Abstract: For a growing country, the most needed stimulus is energy. Without any access to adequate energy resources it is hard for a growing country to sustain economic development. Especially after the 1973 Oil Crisis, the importance of energy resources has been well understood. Most of the developed countries took measures to avoid the undesirable effects of reliance on these energy resources since then. This page of the history has contributed the most to the evolution of the modern day energy economics field. Thenceforth the developing and the developed world rang the changes to manage their energy policies effectively. Sustainable development on the other hand - most broadly - implies the effective use of resources aiming at development not just for present but also for future generations. As effective managing of the energy policy would entail reaping benefits in the long run, energy economics becomes a field with crucial role in sustainable development. Therefore, this paper promotes the effective use of energy resources for a growing country from both perspectives of energy economics and sustainable development.

Keywords: Energy Economics, Sustainable Development, Effective use of Energy Resources.

Energy Economics

For a growing country, the most needed stimulus is energy. Without any access to adequate energy resources it is hard for a growing country to sustain economic development. In this direction, most broadly, energy economics is the field that deals with efficient usage of the energy resources. As Sweeney states (2001, pp. 3-4), according to the energy economics standpoint, energy is neither created nor destroyed (except through nuclear reactions) but energy can be transformed among its various forms. Moreover, energy comes from the nature and ultimately is released back into the nature. Therefore, in Sweeney's own words (Sweeney, 2001, pp. 4-5) "energy economics is the field of human activities using energy resources from naturally available forms, through often complex conversion processes, to forms providing energy services".

Fossil fuels occupy a remarkable place in the energy economics field. Prior to the 1970s, particularly the oil market worked unilaterally to the benefit of some major Northern oil companies. Seven large oil companies known as the "Seven Sisters" dominated the world oil market. The oil-producing countries, especially those in the Middle East, should have been the rightful owners of their oil resources, but instead they found themselves almost entirely dependent upon the "Seven Sisters" for the revenues from their oil resources. This dependency stemmed from the fact that none of those oil-producing countries had the necessary skills, technology or marketing abilities to turn their resources into cash (Lairson and Skidmore, 1993; Van Suntum, 2005).

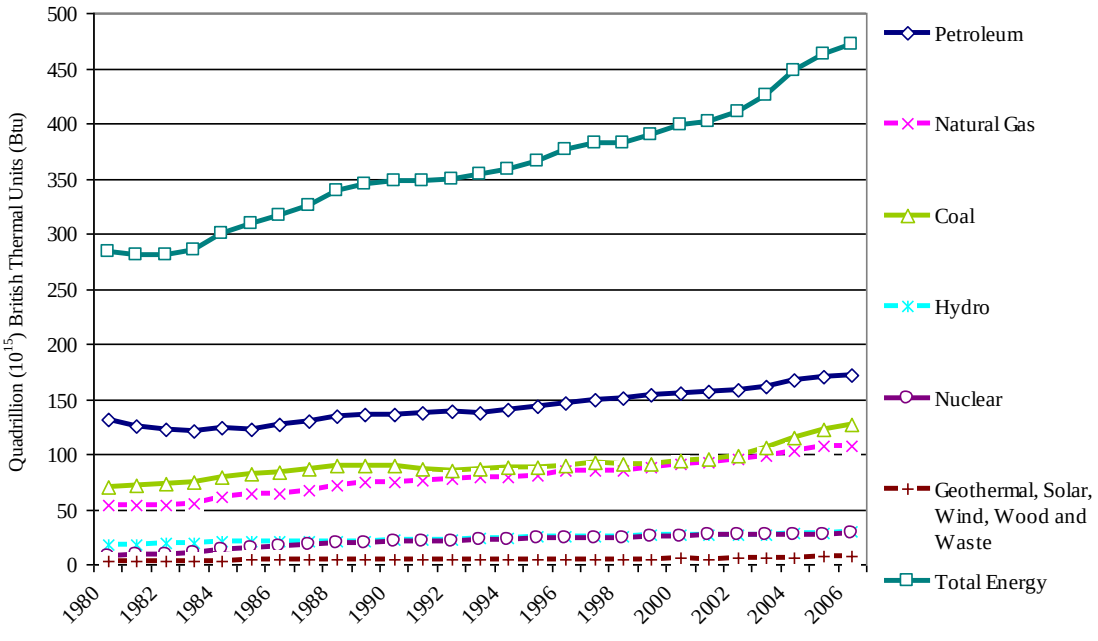
In the 1970s, however, the ownership rights of oil began to relay. Political situation in oil-producing areas of the world gave rise to a boost of economic power of Organization of Petroleum Exporting Countries (OPEC). In 1973, as a response to US and other Western support to Israel in Yom Kippur War against Egypt, the Arab members of OPEC cut oil production in remarkable portions and announced an embargo on oil deliveries to those countries. As a result of those actions, in a market with tight supply conditions namely tight worldwide oil production capacity, it was inevitable to face with sharp increases in the world price of oil. This was a major

indication of relaying ownership rights of oil in favor of oil-producing countries (Lairson and Skidmore, 1993; Van Suntum, 2005).

It was 1973 Oil Crisis that marked a milestone in the pages of the history. It was that date the economic system as we know today has been founded. The 1973 crisis was a major cause of the end of the previous economic system of Bretton Woods. It changed the level of world price of oil and the prices remained in high levels well after the crisis. Especially after the 1973 Oil Crisis, the importance of energy resources and therefore, energy economics has been well understood. Most of the developed countries took measures to avoid the undesirable effects of reliance on these energy resources since then. This page of the history has contributed the most to the evolution of the modern day energy economics field. Thenceforth the developing and the developed world rang the changes to manage their energy policies effectively. After this first crisis, particularly US had realized how dependent she was to the imported oil. Then US decided to carry out policies to lessen the effects of this dependency (Sweeney, 2001). Accordingly US approached to Kingdom of Saudi Arabia as a new strategic partner. The importance of this act solely lies in the fact that Saudi Arabia is one of the co-founders of OPEC and is the largest oil exporter. This partnership with Saudi Arabia led US to secure its oil importing future free from any other embargos - at least not from Saudi Arabia, given that Saudi oil reserves would have met US oil demands at that time. These developments after the first oil crisis are very crucial to understand the role the energy economics played in shaping the new world order.

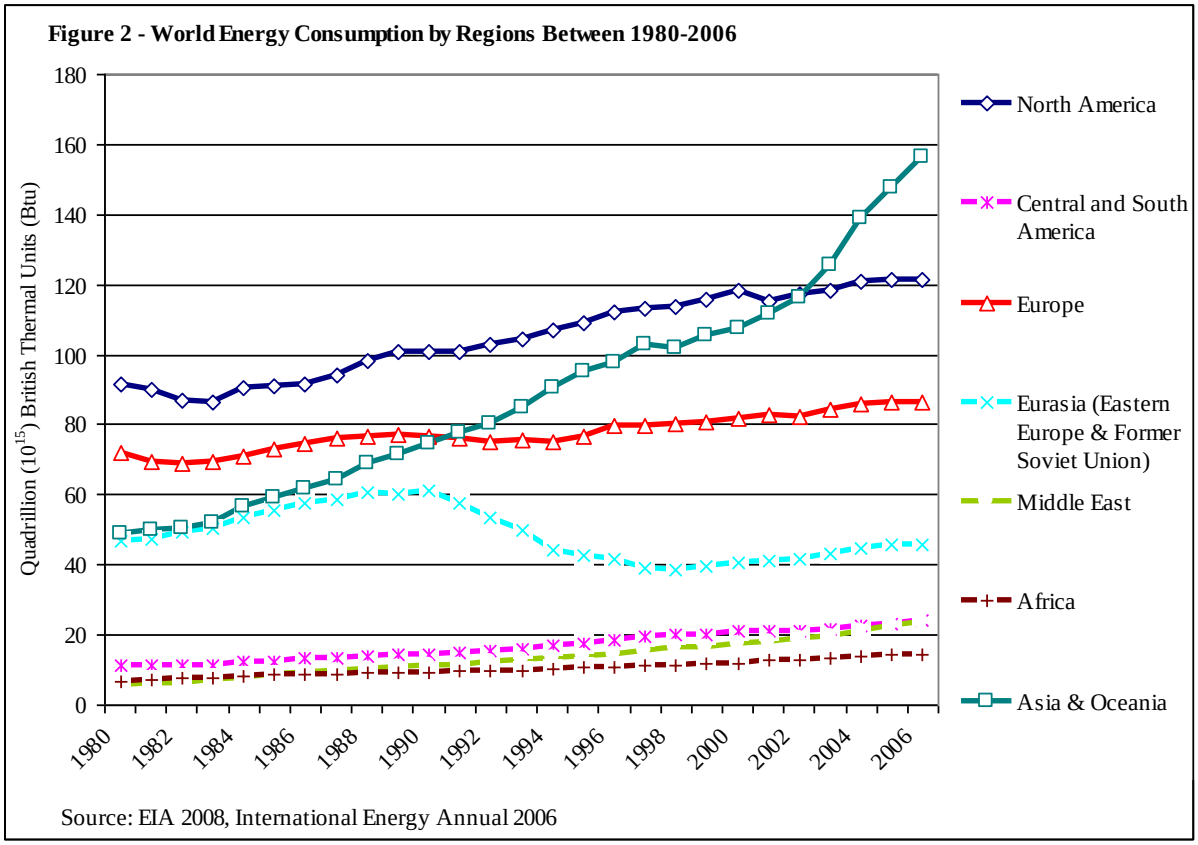
Today, energy economics is somehow underlies nearly every international political issue. Even though those issues would seem to be political at the first glance, the energy needs are the motivating factor for almost all of them. The First Iraq War (The Gulf War) and the ensuing Iraq invasion by US and the dangerous political game that US plays with Iran nowadays are all point out the fact that depicted above. Even though the fight for energy resources left its mark on the last century, it has been sharply intensified in the latest decades. As shown in Figure 1 below world total energy consumption has continued to rise in the last three decades. Moreover fossil fuels' share in world total energy consumption remains at top for the same period and gives us the strong indication that they will remain as the primary energy resource for the next century. If world's energy demand will continue to rise as it did in the last century - last three decades in particular - then this is going to be a clear indication of increasing importance of energy economics field. Thus, Figure 1 particularly suggests that energy economics gains importance within last three decades.

Figure 1 - World Energy Consumption Between 1980-2006



Source: EIA 2008, International Energy Annual 2006

In addition, energy economics is also related with the levels of development of the countries. As the level of development of a country increases, her energy need will also increase accordingly. Figure 2 below shows world energy consumption by regions. We can observe from the figure that in relatively more developed regions such as North America, Europe, Asia and Oceania the energy demand is far more beyond than the need of relatively less developed - or developing – regions such as Africa or the Middle East.



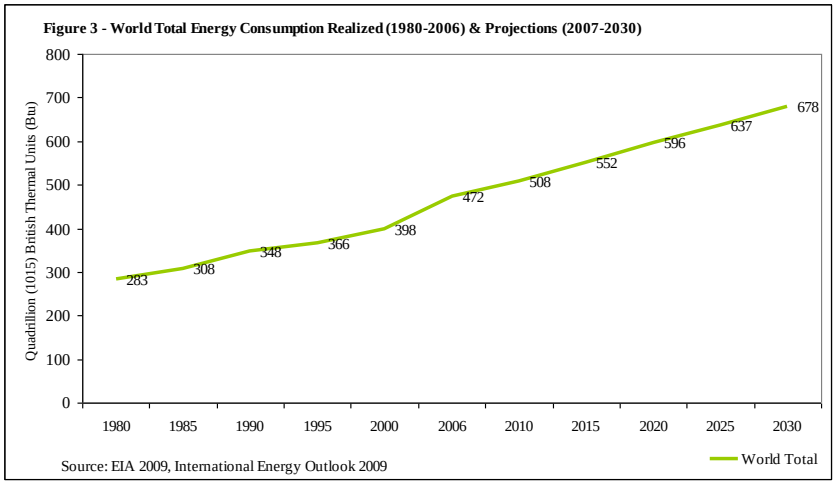
Therefore, the effective use of energy economics whets developed countries' appetite on one hand, and on the other hand, is of vital importance for developing countries in the long road of development. The new technologies that developed for seeking new fossil fuel reserves, efforts to make existing resources more efficient and investments in alternative energy resources are all indicators that shows us how dynamic the energy economics field is. As effective managing of the energy policy would entail reaping benefits in the long run, energy economics becomes a field with crucial role in sustainable development.

Sustainable Development Perspective

United Nations World Commission on Environment and Development in their famous Brundtland Report (1987, p. 43) defines sustainable development as follows: "Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In line with this definition sustainable development implies the effective use of finite resources aiming at development not just for present but also for future generations.

Contrary to general conception, major part of the energy economics field particularly concerned with fossil fuels or nuclear energy, when proposes procedures to improve the efficiency of their usage in a cleaner and safer way, can make a remarkable contribution to sustainable development field.

As the countries continue to develop, their energy needs tend to increase directly proportional to their level of development and to their population. World's total energy need is depicted below in Figure 3. According to International Energy Outlook 2009 projections (EIA, 2009), world's energy demand will increase substantially in the near future. However, as our primary energy resources are limited, how we will meet these energy needs is a question of effective usage of energy economics in a sustainable development perspective.



At this point, with the help of Table 1 and Table 2 below, we can have an idea about the remaining lifetime of our primary fossil fuels, oil and natural gas respectively. If we keep our present levels of oil production also in the future, then we can observe from Table 1 that on average remaining oil reserve lifetime will be around 58 years.

Table 1: World's Top 15 Oil Reserves

Countries	Oil - Proved reserves bbl (2009 est.)	Oil Production bbl/day (2008 est.)	Oil Production bbl annual	Reserve Life in Years*
Saudi Arabia	266,700,000,000	10,780,000	3,934,700,000	68
Canada	178,100,000,000	3,350,000	1,222,750,000	146
Iran	137,600,000,000	3,707,000	1,353,055,000	102
Iraq	115,000,000,000	2,420,000	883,300,000	130
Kuwait	101,500,000,000	2,274,000	830,010,000	122
Venezuela	99,380,000,000	2,643,000	964,695,000	103
United Arab Emirates	97,800,000,000	3,046,000	1,111,790,000	88
Russia	79,000,000,000	9,810,000	3,580,650,000	22
Libya	43,660,000,000	1,875,000	684,375,000	64
Nigeria	36,220,000,000	2,169,000	791,685,000	46
Kazakhstan	30,000,000,000	1,528,000	557,720,000	54
United States	21,320,000,000	8,514,000	3,107,610,000	7
China	15,550,000,000	3,795,000	1,385,175,000	11
Qatar	15,210,000,000	797,000	290,905,000	52
Brazil	12,620,000,000	2,422,000	884,030,000	14
Total	**1,249,660,000,000**	**59,130,000**	**21,582,450,000**	**58**

* Proved Reserves / Annual Production ratio gives the estimated remaining reserve lifetime, given that production remains constant.

Source: All values have been taken from CIA, the World Factbook (2010).

With same conditions in effect 62 years will be the approximate reserve lifetime for natural gas as shown in Table 2. Thus, keeping present levels of energy production from limited resources becomes more difficult each day. Consequently, more efficient, alternative solutions are urgently needed in the field of energy economics.

Table 2: World's Top 20 Natural Gas Reserves

Countries	Natural Gas - Proved Reserves cubic meters (2009 est.)	Natural Gas Production cubic meters (2008 est.)	Reserve Life in Years*
Russia	43,300,000,000,000	662,200,000,000	65
Iran	29,610,000,000,000	116,300,000,000	255
Qatar	25,260,000,000,000	76,980,000,000	328
Turkmenistan	7,940,000,000,000	34,000,000,000	234
Saudi Arabia	7,319,000,000,000	80,440,000,000	91
United States	6,731,000,000,000	582,200,000,000	12
United Arab Emirates	6,071,000,000,000	50,240,000,000	121
Nigeria	5,215,000,000,000	32,820,000,000	159
Venezuela	4,840,000,000,000	24,010,000,000	202
Algeria	4,502,000,000,000	86,500,000,000	52
EU	3,605,000,000,000	286,590,000,000	13
Iraq	3,170,000,000,000	1,880,000,000	1686
Indonesia	3,001,000,000,000	70,000,000,000	43
China	2,460,000,000,000	76,100,000,000	32
Kazakhstan	2,407,000,000,000	35,610,000,000	68
Malaysia	2,350,000,000,000	57,300,000,000	41
Norway	2,313,000,000,000	99,200,000,000	23
Egypt	2,190,000,000,000	62,700,000,000	35
Uzbekistan	1,841,000,000,000	67,600,000,000	27
Canada	1,640,000,000,000	170,900,000,000	10
Total	**165,765,000,000,000**	**2,673,570,000,000**	**62**

* Proved Reserves / Annual Production ratio gives the estimated remaining reserve lifetime, given that production remains constant.

Source: All values have been taken from CIA, the World Factbook (2010).

In this context the problem of fair allocation of energy resources among nations, within nations and most importantly among generations arises. If we leave the first two to international and domestic politics, then sustainable development is the field to deal with the problem of fair allocation of energy resources among generations. As Van Suntum (2005, p.133) indicates from a sustainable development standpoint, it should be expected that all future generations should have the opportunity to access the energy resources that we use today. But fair allocation of a depletable energy resource among generations is not easy as it sounds. Since depletable energy resources - let say oil - are limited, even if the present generation consumes a little oil, it will nevertheless consume some share of the future generation. Thus, Van Suntum (2005, p. 133) argues that only optimal consumption of oil for the present generation to achieve sustainable development would be zero. However, he also adds, zero-consumption would not generate any benefit for any generation. Therefore, as a theoretical answer to the sustainable development question we can rule out the solutions based on absolute re-allocation of energy resources among generations. Instead the solution lies in either promoting the usage of alternative non-depletable energy resources or making the usage of existing fossil fuels more efficient.

Making "It" More Efficient

The problem with alternative clean energy resources is that they are either too expensive or inefficient. However, making widely used fossil fuel based energy resources much cleaner and improving safety regulations on nuclear energy usage would definitely yield far more efficient results in energy economics.

Moreover, most processes of production and consumption of energy cost environmental damages. Among those damages, most widely known and most notable one is the combustion of fossil fuels which causes the release of greenhouse gases - in particular carbon dioxide - into the air. However, those environmental costs

are generally not reflected to the prices of energy consumption which in return generates unconscious consumption of energy (Sweeney, 2001). As Sweeney suggests (2001, pp. 20-21), one solution could be assigning monetary values of those costs and therefore, limit the unconscious consumption of energy.

From a sustainable development standpoint, as Bertel and Morrison (2001) state nuclear energy - as it embodies long term commitments from decision makers - could also offer an attractive alternative way to approach efficiently to energy economics field. Although investments on nuclear energy is expensive, once ready to use they have low input and operating costs, which will enable them to amortize their initial investment - generally more than two decades (Bertel and Morrison, 2001, p. 14). According to Bertel and Morrison (2001, p. 14), the technical lifetimes of nuclear plants can reach more than 60 years which is in fact in line with sustainable development perspective of decision makers. Moreover, production of nuclear energy process needs limited amounts of resources due to effective energy output of nuclear energy. Natural resources that are inputs for the production of nuclear energy process - mainly uranium and thorium - are relatively cost efficient, easily accessible and are generally only able to be used in the process of nuclear energy production. Easy access to those resources and the opportunity to store nuclear energy for years enable us to overcome any potential supply shortages in the near future. In addition, retrieval of energy from those resources - otherwise would be useless - would entail decline in the demand for other energy resources that could inherent environmental damages and thus, contribute more to sustainable development (Bertel and Morrison, 2001, p. 15).

Cogeneration process, on the other hand, can offer an effective way in energy use. In this process, energy production is focused on simultaneously generate both thermal and electrical energy. The major advantage of this process is that less input energy is needed to produce the same energy levels than in separate processes (Rosen, 1996, p. 24). Additionally, by using less energy this process releases less waste to the nature, which makes it more economical and safe (Rosen, 1996, p. 24). In his case study for Ontario, Canada, Rosen (1996, pp. 24-26) finds evidence to support the energy efficiency of cogeneration process. He concluded that by using cogeneration in Ontario, Canada, energy-utilization efficiency levels have increased more than they do in independent processes. Due to cogeneration process, energy requirements to satisfy energy demands in the province in question have significantly reduced and thus environmental emissions have reduced accordingly (Rosen, 2001, p. 25).

Another viable option to use energy resources can be found in producing energy from coal waste. Prior to this process, coal waste had no value and was stored in the coal mines as piles. High levels of sulfur are inherent in these piles, thus when these piles come into contact with water, they generate acid rains. Today technological advancements allow us to burn this coal waste without creating acid rains or any other environmental damages and generate electrical energy.

To sum up, in the long road of attaining sustainable development, using alternative and cleaner ways to produce and consume fossil fuels and applying nuclear energy with improved safety regulations and skilled labor force would be valuable assets. Additionally, sound governmental institutions that will back up the efficient energy economics policies in the long-run and altruistic politicians that will not decide policies based on whether or not they will be re-elected in the next term, would be remarkably important to achieve sustainable development.

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