Innovative Energy & Research

Khan and Saleem, Innov Ener Res 2016, 5:1

Mini Review Open Access

Mini Review for Formulating Energy Policies for Feasible Energy Planning

Abdul Qayyum Khan* **and Naima Saleem**

Management Sciences Department, COMSATS Institute of Information Technology, Wah Campus, Pakistan

***Corresponding author:** Abdul Qayyum Khan, Management Sciences Department, COMSATS Institute of Information Technology, Wah Campus, Pakistan, Tel: +92-300-5275614; E-mail: qayyum72@ciitwah.edu.pk

Rec Date: Feb 05, 2016; **Acc Date:** Feb 20, 2016; **Pub Date:** Feb 25, 2016

Introduction

Energy is a hot debated issue for the researcher as it is an essential production factor like capital and labor. Energy plays a pivotal role as an input to virtually all other consumptions and production processes. Energy consumption is essential for human being survival and it is one of the basic indicators of economic development and growth. It is generally believed by the researchers' that energy plays an indispensable role in the process of economic and social development and enhanced quality of life both in developed and in developing economies. Today world in general and developing and underdeveloped world in particular is engulfing by energy challenges and all the concern researchers want to see the developing and under developed world being acknowledged as a major energy reformer in the world. The researchers wish to see the complete harmony in demand and supply side energy policies. These are not unjustifiable target, as we know that every achievement begins with a clear vision of the future. Energy consumption has significant and long run relationship to economic growth for ASEAN countries. In ASEAN developing and under developing countries, energy consumption has progressively increased over the past few decades due to the population growth and industrial expansion [1,2].

The International Energy Agency's (IEA) (2013) report on South East Asia has shown that the Southeast Asia region is particularly a diverse set of countries with considerable differences in the scale and patterns of energy use and energy resource endowments. The energy demand in the region increased in the last three decades and thus, energy demand would increase by over 80 percent between today and 2035. During 2012 in Southeast Asia the fossil-fuel subsidies are estimated to be US$ 51 billion. Though, some reform efforts were made particularly in Indonesia, Malaysia and Thailand, subsidies remain the most important factor distorting energy markets. It consequences includes wasteful energy consumption, burden on government budgets, and discouraged investment in energy infrastructure and efficient technologies. In South Asia above 130 million populations have no access to electricity. Apparently, there are very high levels of access to electricity in Brunei Darussalam, Malaysia, Thailand and Singapore, while, the levels are below 75 percent in the case of Indonesia and the Philippines. The majority of the region's population still uses traditional biomass for cooking, which contributes to pollution. The report of IEA [3] also reveals that for the region, it is necessary to devise sound policies in order to enhance investment, which is significant for improving energy security, affordability and sustainability. For this purpose, almost US$ 1.7 trillion of cumulative investment in energy-supply infrastructure to 2035 is needed in Southeast Asia, with almost 60 percent of the total in the power sector. Energy demand increases due to incoming FDI, an increase in the real GDP growth, more opened economies and gradual population moves from rural areas to urban areas.

Indonesia is the largest energy consumer in Southeast Asia at 36 percent of the region's total primary consumption in 2011. Though, Indonesia is a net importer of oil, but it is the world's top exporter of steam coal along with key supplier of LNG. Indonesia's population is expected to increase from 242 million to 302 million, where it's per capita consumption to rise by 46 percent from 0.8 tons in 2011 to 1.2 tons in 2035. Thailand has the 2nd largest primary energy demand in ASEAN, at 118 million tons in 2011. Thailand is highly dependent on energy imports because of its scarce indigenous resources. Its per capita energy consumption continues to rise, approaching 3 tons in 2035. Similarly, the 3rd largest energy consumer in the ASEAN region is Malaysia, largely the net exporter of oil and natural gas. It is estimated that Malaysia's population will grow at an average yearly pace of 1.2 percent between 2011 and 2035, reaching 39 million. As GDP of Malaysia increases at 4 percent per year, which is the important factor helping to drive an increase in Malaysian primary energy demand by 71 percent in 2011-2035. Currently Malaysia's per capita energy use is quite high for the region. Malaysian electricity demand is expected to double by 2030 and then increase further to just over 300 TWh in 2035. This calls for an expansion of installed power generation capacity from 29 GW in 2011 to 67 GW in 2035. In the Philippines, electricity demand is estimated to grow at 4.6 percent per year on average, to over 200 TWh in 2035 (Table 1).

Energy	Brunei Darussalam	Indonesia	Malaysia	Philippines	Thailand	Singapore
Electricity production	3.723 billion kWh[d]	183.4 billion kWh[d]	118 billion kWh[e]	67.45 billion kWh[d]	173.3 billion kWh[e]	44.41 billion kWh[d]
Electricity consumption	3.391 billion kWh[d]	158 billion kWh[d]	112 billion kWh[e]	56.84 billion kWh[c]	169.4 billion kWh[e]	40.62 billion kWh[c]
Oil production	141,000 bbl/day[e]	912,100 bbl/day[d]	603,400 bbl/day[d]	25,240 bbl/day[e]	213,000 bbl/day[d]	20,170 bbl/day[e]
Oil proved reserves	1.1 billion bbl[f]	4 billion bbl[f]	2.9 billion bbl[f]	138.5 million bbl[f]	442 million bbl[e]	0 bbl[f]

Natural gas proved reserves	390.8 billion cu mf	3.994 trillion cu m[e]	2.35 trillion cu m[e]	98.54 billion cu m[f]	299.8 billion cu m[e]	0 cu m[f]
Natural gas production	12.44 billion cu m[d]	82.8 billion cu m[c]	66.5 billion cu m[c]	3.91 billion cu m[e]	28.21 billion cu m[d]	0 cu m[d]
Natural gas consumption	2.97 billion cu m[c]	41.35 billion cu m[c]	35.7 billion cu m[c]	2.86 billion cu m[c]	45.08 billion cu m[c]	8.778 billion cu m[d]
Electricity installed generating capacity	759,000 kW[d]	39.9 million kW[d]	25.24 million kW[b]	16.36 million kW[c]	32.6 million kW[e]	10.25 million kW[c]
Refined petroleum products production	13,500 bbl/day[d]	935,300 bbl/day[d]	649,700 bbl/day[a]	181,300 bbl/day[d]	913,600 bbl/day[d]	1.357 million bbl/day[d]
Refined petroleum products consumption	14,640 bbl/day[d]	1.322 million bbl/day[d]	542,900 bbl/day[d]	315,600 bbl/day[d]	721,100 bbl/day[d]	1.25 million bbl/day[d]
CO_2 emissions from energy consumption	8.656 million Mt[d]	402.1 million Mt[d]	181.9 million Mt[c]	81.15 million Mt[d]	278.5 million Mt[c]	212.4 million Mt[d]

Table 1: Energy consumption and production: a comparison. Source: Central Intelligence Agency (CIA) (2014), the World Bank Factbook. a. 2008 estimated b. 2009 estimated c.2010 estimated d. 2011 estimated e. 2012 estimated f. 2013 estimated.

As far as European country the Greece is concerned, it has developed a high income economy, however the fiscal crisis of Greece in 2009 turned quickly into an outstanding debt crisis, which eventually changed into a complete recession. It has observed that as results, the social cost of the Greek crisis has been recorded unreasonably high. Where, Greece's national income has decreased by roughly a quarter. The gap in living standards relative to the rest of Western Europe has been increased. The Greece country report (2013), the National Energy Efficiency Action Plans (NEEAPs) and experts' survey reveals that Greece has neither striving nor an innovative energy efficiency policy. It is also recorded that energy has been saved due to the economic recession, which hit Greece severely during the reporting year (i.e., 2010). The study of Katsivelis notes that four European Union (EU) (i.e., Germany = 19.1%, France = 15.3%, Italy = 10%, UK = 12.1%) out of 27 EU countries use around 56.5% of the EU energy consumption. Where, Greece consumes a very small amount of energy which is almost 1.6% of the total EU consumed energy of 56.5%. Greece energy import dependency is nearby 65.3% due to which Greece raking 8th out of 27 EU countries. Similarly, Greece consumes almost 19 million tons of oil. This corresponds to nearly Euro 9 billion turnovers, equivalent to 5% of the GDP and evidently employs 50000 employees, which is 1% of the total labor force. Moreover, the data, statistics demonstrates that energy consumption fall down from 21.9 million tons in 2007 to 15.1 million tons in 2012. The total gross energy demand is covered largely by oil and petroleum products, solid fuels, natural gas and renewable energy of 53.2%, 27.8%, 11.4%, and 7.6% in 2010 respectively. Likewise, the electric power account for 27% of the country's final energy demand, where, fossil fuel (i.e., oil and gas) 69%. A brief comparative analysis of energy consumption and production of Greece economy with China, EU and World consumption and production is reported in Table 2 [4,5].

Energy	Greece	China	European Union	World
Electricity production	56,200,000,000[c] kWh	5,398,000,000,000[d] kWh	3,255,000,000,000[b] kWh	56.2 billion[c] kWh
Electricity consumption	56,400,000,000[a] kWh	5,322,000,000,000[d] kWh	3,037,000,000,000[a] kWh	56.4 billion[a] kWh
Natural gas proved reserves	991,100,000[d] cu m	3,100,000,000,000[d] cu m	1,811,000,000,000[c] cu m	991.1[c] million cu m
Natural gas production	6,000,000[b] cu m	117,100,000,000[d] cu m	162,800,000,000[c] cu m	6[b] million cu m
Electricity installed generating capacity	15,120,000[a] kW	1,247,000,000[d] kW	867,600,000[a] kW	15.12[a] million kW
Electricity from fossil fuels	69.5[a]	69.1[d]	-	69.5%[a] of total installed capacity

Electricity from hydroelectric plants	16.2[a]	22.5[d]	-	16.2%[a] of total installed capacity
Electricity from other renewable sources	10.5[a]	7.2[d]	-	10.5%[a] of total installed capacity
Natural gas consumption	4,200,000,000[c] cu m	150,000,000,000[d] cu m	443,900,000,000[c] cu m	4.2[c] billion cu m
Refined petroleum products production	462,000[a] BBL/day	9,371,000[c] BBL/day	12,050,000[c] BBL/day	462,000[a] BBL/day
Refined petroleum products consumption	343,400[b] BBL/day	9,790,000[b] BBL/day	12,800,000[c] BBL/day	343,400[b] BBL/day
CO_2 emissions from energy consumption	991,100,000[d]	3,100,000,000,000[d]	1,811,000,000,000[c] cu m	85.6[c] million Mt

Table 2: Comparative analysis of energy consumption and production. Source: Central Intelligence Agency (CIA) (2014), the World Bank Factbook. a. 2010 estimated b. 2011 estimated c. 2012 estimated d. 2013 estimated.

Previous Literature

A vast body of existing literature explained the various factors explaining energy consumption function. They used different econometric techniques with different set of data for different countries. For example, Kraft and Kraft [6] examined for causality between energy consumption and GNP in USA over the period 1947-1974 by utilizing Sims methodology. The findings revealed uni-directional causality running from GNP to energy consumption. In a study Hwang and Gum found bi-directional causality between GNP and energy consumption in Taiwan. Yu and Choi observed that there exists a causal linkage between GNP and energy consumption in South Korea and Philippines. Similarly, the study of Masih and Masih used six Asian countries- India, Indonesia, Philippines, Pakistan, Malaysia and Singapore to examine the causality between energy consumption and income. The study revealed that energy consumption and income to be co-integrated for India, Pakistan and Indonesia, where, energy consumption is causing income in India, income is causing energy consumption in Indonesia and bi-directional causality exist in Pakistan. However, finding portrayed no causality for Philippines, Malaysia and Singapore. In another study, Masih and Masih discovered bi-directional causality in Korea and Taiwan supports Hwang and Gum findings for Taiwan.

The study of Grant [7] has shown that electricity prices will continue to upsurge during the year due to higher liquefied natural gas (LNG) prices in Thailand. Similarly, average electricity prices have increased about 5 percent in the mid of current year in Vietnam. In Indonesia, electricity prices increased by almost 15 percent last year and the report further extended that they are probably to be augmented "dramatically"- by up to 65 percent. Kottari [8] focusses on the significance renewable energy source which plays an ever more key role in Greece's energy production profile. The study reveals that the existent investment framework needs a prominent expansion in production from wind, solar, geothermal, and biomass / biofuels, which are likely to help progressively as a transport fuel. Greece's also expected in the coming future to generate electrical energy from renewable energy source at a 40% part of the total electrical power by 2020, due to the development of solar power plant in Greece, within the context of the debt crisis, solar power plant development and particularly the HELIOS project needs to enhance more foreign investments, helps to create job opportunities and it will largely stimulate economic growth of Greece. Table 3 briefly presents most relevant previous studies:

Author (s)	Methodology, sample, country	Outcomes
Stern [9]	VAR, 1947-1990, USA	No relationship
Glasure and Lee [10]	Cointegration, ECM 1961-1990, South Korea, Singapore	No causal relationship for South Korea, while, uni-directional causal relationship for Singapore.
Fatai et al. [11]	Toda and Yamamoto approach, 1960-1999, New Zealand, India, Australia, Indonesia, the Philippine and Thailand	Uni-directional causality runs from GDP to energy consumption for Australia. No relationship for India, Indonesia, the Philippine and Thailand
Chiou-Wei et al. [12]	VAR, 1954-2006, Taiwan, South Korea, Singapore, Hong Kong, Indonesia, Malaysia, Philippines and Thailand,	Empirical evidence on the Philippines and Singapore reveals a uni-directional causality running from economic growth to energy consumption while energy consumption may have affected economic growth for Taiwan, Hong Kong, Malaysia and Indonesia
Nanthakumar and Subramaniam [13]	ARDL, 1971-2008, Malaysia	Bi-directional causal relationship
Ozturk et al. [14]	Panel causality 51 countries, Low income Lower middle income Upper middle income	Uni-directional relationship runs from Growth to energy Bi-directional causal relationship

		No relationship
Asghar and Rahat [15]	Graph Theoretic Approach,1971-2005, Pakistan	One-way causality runs from energy consumption to economic growth.
Bekle et al. [16]	VAR, 1981-2007, 25 OECD Countries	Bi-directional causal relationship
Kaplan et al. [17]	VECM, 1971-2006, Turkey	Bi-directional causal relationship
Lau et al. [2]	FMOLS, 1980-2006, 17 Asian countries	Causality runs from energy consumption to GDP in the short-run, however, causal relation exists from GDP to energy consumption in the long-run
Belaida and Abderrahmani [18]	1971-2010, VECM, Algeria	bi-directional causal relationship
Ouedraogo [19]	VAR, 1980-2008, 15 African countries,	The causality runs from GDP to energy consumption in the short-run, and from energy consumption to GDP in the long-run
Ahmed et al. [20]	VAR, 1975-2009, Pakistan	Bi-directional causality between the electricity consumption per capita and economic growth

Table 3: Compact prior empirical studies on energy consumption and economic growth nexus. Source: Authors compilation -Comprehensive detail information on the causal relationship between energy consumption and growth are given in the studies of Ozturk [14], Kalyoncu et al. [21] and Ajmi et al. [22].

Policy Implication

In order to meet the energy demand, ASEAN countries should have to devise some plans for sustainable development in their region. These plans may consist of the following: (a) There is a need to focus on some other energy sources in the region, as there is an abundance of oil, gas, coal, hydro, geothermal and biomass in Indonesia, while there are oil, gas and coal reserves in Malaysia and Thailand. (b) ASEAN countries need an explicit and countrywide adapted climate policy, where technology, energy, population and economic policy have different weights and contents. As the consequence, rising energy efficiency would provide foremost energy security, economic and environmental benefits

Each ASEAN country should prioritize energy management at the national level to meet future demand. Each country should have an energy development program to shift from fossil oil to other non-renewable energy resources based on efficiency and technology. A comprehensive investment framework for renewable energy should also be developed to encourage the participation of independent players/investors, besides maintaining adequate national energy inventory. In order to have an effective energy policy, each government should develop their institutions and capacity related to energy management policymaking and monitors their implementation and progress. The electrification program should also be enhanced to meet the expanding needs of the urban and rural societies in each country. At the regional level, the ASEAN member countries should strengthen their cooperation in sharing best practices and experiences in the utilization of energy resources and energy management and development.

Renewable technologies are significantly contributing to global energy needs. Developing countries have set a modest renewable energy target in short and medium terms. Preference to rightly suited technologies is essential to meet these targets. Determination of suitable utility scale technologies is central for developing countries. Preference to these technologies at the national level shall quicken and economize their deployment. It may save time and national resources necessary for development of renewable energies. These utilities scale technologies are necessary to meet national renewable targets; overcome prevailing energy shortages and meet future energy needs.

Policy makers in Greece need to create an investment-friendly environment in order to enhance more FDI inflows into the country. Moreover, gradual population transfers from rural areas to urban area (urbanization) and infrastructure development is also of paramount importance as all these factors expand energy demand. More importantly, in order to fulfill the energy demand in the country, the policy option is that energy policy should to be adjusted in favor of enlarging the supply of energy to give a boost to economic growth and development.

The efficient utilization of a nation's available energy resources is undeniably of great significance to the improvement of the welfare of human-being and the entire growth of the economy. On the other hand, environmental degradation is caused by the some factors like industrialization, population, poverty, transportation, soil erosion, traffic and exploitation of open access resource because of weak defined property rights. Pollution free environment is essential for sustainable economic growth and development. Energy consumption [23] and trade openness are found seemingly having an undesirable impact on the environment, but these two factors are usually considered the key factors plays an important role in the process of economic development and poverty alleviation. Each country should systemize energy consumption and formulate environment friendly trade policy at the national level to meet future demand and mitigate environment degradation in order to achieve the ultimate goal of sustainable economic growth and development.

References

1. Energy Information Administration (2008) International Energy Outlook 2008. Washington.
2. Lau E, Chye XH, Choong CK (2011) Energy-growth causality: panel analysis. International Conference on Applied Economics-ICOAE, pp: 355-361.
3. Energy Information Administration (2013) International Energy Outlook 2013. Washington.

4. Matsaganis M (2013) The Greek Crisis: Social Impact and Policy Responses.
5. Annual Energy Outlook (2014) Annual Energy Outlook prepared by the U.S. Energy Information Administration.
6. Kraft J, Kraft A (1978) On the relationship between energy and GNP. Journal of Energy and Development 3: 401-403.
7. Grant (2014) ASEAN: electricity shock coming. The Financial Times Ltd 2014.
8. Kottari M (2014) Energy brains-energy fact sheet, Greece.
9. Stern DI (1993) Energy and economic growth in the USA: a multivariate approach. Energy Economics 15: 137-150.
10. Glasure YU, Lee AR (1998) Cointegration, error-correction and the relationship between GDP and energy: The case of South Korea and Singapore. Resource and Energy Economics 20: 17-25.
11. Fatai K, Oxley L, Scrimgeour F (2004) Modelling the causal relationship between energy consumption and GDP in New Zealand, Australia, India, Indonesia, the Philippines and Thailand. Mathematics and Computers in Simulation 64: 431-445.
12. Chiou-Wei SZ, Chen CF, Zhu Z (2008) Economic growth and energy consumption revisited-Evidence from linear and nonlinear Granger causality. Energy Economics 30: 3063-3076.
13. Nanthakumar L, Subramaniam T (2010) Dynamic Cointegration Link between Energy Consumption and Economic Performance: Empirical Evidence from Malaysia. IJTEF 1: 261.
14. Ozturk I (2010) A literature survey on energy-growth nexus. Energy Policy 38: 340-349.
15. Asghar Z, Rahat T (2011) Energy-GDP causal relationship for Pakistan: a graph theoretic approach. Applied Econometrics and International Development 11: 207-214.
16. Belke A, Dobnik F, Dreger C (2011) Energy consumption and economic growth: New insights into the cointegration relationship. Energy Economics 33: 782-789.
17. Kaplan M, Ozturk I, Kalyoncu H (2011) Energy consumption and economic growth in Turkey: cointegration and causality analysis. Romanian Journal of Economic Forecasting 2: 31-41.
18. Belaid F, Abderrahmani F (2013) Electricity consumption and economic growth in Algeria: A multivariate causality analysis in the presence of structural change. Energy Policy 55: 286-295.
19. Ouedraogo NS (2013) Energy consumption and economic growth: Evidence from the economic community of West African States. Energy Economics 36: 637-647.
20. Ahmed W, Zaman K, Taj S, Rustam R, Waseem M, et al. (2013) Economic growth and energy consumption Nexus in Pakistan. South Asian Journal of Global Business Research 2: 251-275.
21. Kalyoncu H, Gursoy F, Gocen H (2013) Causality relationship between GDP and energy consumption in Georgia, Azerbaijan and Armenia. International Journal of Energy Economics and Policy 3: 111-117.
22. Ajmi AN, Montasser GE, Nguyen DK (2013) Testing the relationships between energy consumption and income in G7 countries with nonlinear causality tests. Economic Modelling 35: 126-133.
23. Payne JE (2009) On the dynamics of energy consumption and output in the US. Applied Energy 86: 575-577.